



## **TECHNICAL ~ VOCATIONAL LANGUAGE LEARNING**

### **Exploiting the Earth**

Β' ΕΠΑ.Λ. - ΤΟΜΕΑΣ ΓΕΩΠΟΝΙΑΣ, ΤΡΟΦΙΜΩΝ ΚΑΙ ΠΕΡΙΒΑΛΛΟΝΤΟΣ

ΙΝΣΤΙΤΟΥΤΟ ΤΕΧΝΟΛΟΓΙΑΣ ΥΠΟΛΟΓΙΣΤΩΝ ΚΑΙ ΕΚΔΟΣΕΩΝ  
«ΔΙΟΦΑΝΤΟΣ»

# **Exploiting the earth**

**ΣΤΟΙΧΕΙΑ ΑΡΧΙΚΗΣ ΕΚΔΟΣΗΣ**

**ΟΜΑΔΑ ΣΥΓΓΡΑΦΗΣ ΑΓΓΛΙΚΩΝ ΕΙΔΙΚΟΤΗΤΑΣ ΓΙΑ ΤΑ ΤΕΕ**

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Η επανέκδοση του παρόντος βιβλίου πραγματοποιήθηκε από το Ινστιτούτο Τεχνολογίας Υπολογιστών & Εκδόσεων «Διόφαντος» μέσω ψηφιακής μακέτας.

ΥΠΟΥΡΓΕΙΟ ΠΑΙΔΕΙΑΣ ΚΑΙ ΘΡΗΣΚΕΥΜΑΤΩΝ  
ΙΝΣΤΙΤΟΥΤΟ ΕΚΠΑΙΔΕΥΤΙΚΗΣ ΠΟΛΙΤΙΚΗΣ

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ΜΗΧΑΝΙΚΟΥ ΓΑΡΥΦΑΛΛΙΑ

ΒΑΣΣΑΛΟΥ ΕΛΕΝΗ  
ΜΩΡΑΪΤΑΚΗ ΜΑΡΙΑ

Η συγγραφή και η επιστημονική επιμέλεια του βιβλίου πραγματοποιήθηκε  
υπό την αιγίδα του Παιδαγωγικού Ινστιτούτου

# Exploiting the earth

Students' book

Teaching material for students of vocational and technical schools

**Β' ΕΠΑ.Λ.**



**ΤΟΜΕΑΣ ΓΕΩΠΟΝΙΑΣ, ΤΡΟΦΙΜΩΝ  
ΚΑΙ ΠΕΡΙΒΑΛΛΟΝΤΟΣ**

ΙΝΣΤΙΤΟΥΤΟ ΤΕΧΝΟΛΟΓΙΑΣ ΥΠΟΛΟΓΙΣΤΩΝ ΚΑΙ ΕΚΔΟΣΕΩΝ «ΔΙΟΦΑΝΤΟΣ»

Το βιβλίο αυτό διαμορφώθηκε με βάση τα αντίστοιχα βιβλία του ΤΕΛ: “Today’s Agriculture”, “English for Chemistry and Metallurgy”, “Building Materials and structures” και “Mechanical Engineering Technicians” της Β’ Φάσης συγγραφής.

Στο “Today’s Agriculture” υπεύθυνος ύλης-πληροφοριών ειδικότητας ήταν ο κ. Κιούσης Γεώργιος του Κλ. Π.Ε. 14.

## ΠΡΟΛΟΓΟΣ

Το διδακτικό αυτό υλικό προορίζεται για τους μαθητές των Τεχνικών Επαγγελματικών Εκπαιδευτηρίων που έχουν επιλέξει τις Γεωτεχνικές και Μεταλλευτικές ειδικότητες. Σκοπός του βιβλίου είναι να βοηθήσει τους μαθητές:

- α.** να εξοικειωθούν με την Αγγλική ορολογία που αφορά την ειδικότητά τους,
- β.** να εμπεδώσουν γλωσσικά φαινόμενα (λεξιλογικά, γραμματικά και συντακτικά) μέσα από ανάλογα κείμενα και ασκήσεις,
- γ.** να βελτιώσουν την ικανότητά τους για προφορική και γραπτή επικοινωνία κατά την άσκηση του επαγγέλματός τους.

Για την επίτευξη των παραπάνω στόχων, θεωρήθηκε σκόπιμο να επιλεγούν θέματα που περιλαμβάνουν ορολογία ανάλογη με τα ελληνικά μαθήματα και των δυο προαναφερθέντων ειδικοτήτων. Έτσι, το πρώτο μέρος του βιβλίου αποτελείται από 18 ενότητες που περιέχουν βασικό εξειδικευμένο λεξιλόγιο που αφορά τις ειδικότητες φυτικής και ζωικής παραγωγής και το δεύτερο μέρος του βιβλίου αποτελείται από 14 ενότητες που περιέχουν επίσης βασικό εξειδικευμένο λεξιλόγιο που αφορά τις ειδικότητες χημικών βιομηχανιών και μεταλλείων. Και στα δυο μέρη ακολουθούν – μετά από τα κείμενα – ασκήσεις που αποβλέπουν κατά κύριο λόγο στην εμπέδωση της ορολογίας, αλλά και γλωσσικών φαινομένων, η γνώση των οποίων θεωρείται απαραίτητη για την κατανόηση και σωστή χρήση της αγγλικής γλώσσας όσον αφορά τις παραπάνω ειδικότητες.

Προς διευκόλυνση των μαθητών, στο τέλος του βιβλίου, περιλαμβάνεται – κατ' αλφαβητική σειρά – γενικό λεξιλόγιο με την ερμηνεία των λέξεων στα ελληνικά, όπως αυτές ερμηνεύονται στα υπάρχοντα κείμενα.

Η ομάδα εργασίας



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## Part 1

Unit	Skills/Functions	Structures/Activities
<p><b>1. Planting</b></p>	<p>Reading: Giving information Acquiring vocabulary</p> <p>Dealing with the gerund and infinitive Reporting statements</p>	<ul style="list-style-type: none"> <li>• Answering questions</li> <li>• Identifying words with their definition</li> <li>• Matching words to form phrases</li> <li>• Completing sentences with words</li> <li>• Completing sentences with derivatives</li> <li>• Putting verbs in their correct form</li> <li>• Turning direct into indirect speech</li> </ul>
<p><b>2. Transplanting procedures</b></p>	<p>Reading: Describing procedures~ Giving advice~ Giving instructions</p> <p>Acquiring vocabulary</p> <p>Dealing with adverbs and prepositions Giving advice and/or instructions</p>	<ul style="list-style-type: none"> <li>• Answering questions</li> <li>• Imperative</li> <li>• Temporal and conditional clauses</li> <li>• Completing a guided dialogue</li> <li>• Matching parts of sentences</li> <li>• Identifying words with their definitions</li> <li>• Matching synonymous items</li> <li>• Completing sentences with derivatives</li> <li>• Completing sentences with adverbs and prepositions</li> <li>• Forming sentences using imperative / You should / You'd better / Why don't you / What about + -ing</li> </ul>
<p><b>3. Formation, composition and capacity of the soil to hold water</b></p>	<p>Reading: Explaining terms~ Describing types~ Giving information</p> <p>Acquiring Vocabulary</p> <p>Dealing with prepositions</p>	<ul style="list-style-type: none"> <li>• Answering questions</li> <li>• Identifying True-False statements</li> <li>• Identifying words with their definitions</li> <li>• Matching synonyms</li> <li>• Forming derivatives (nouns-adjectives)</li> <li>• Completing sentences with prepositions</li> </ul>

Unit	Skills/Functions	Structures/Activities
4. Soil texture and structure	<p>Reading: Giving information~ Describing types</p> <p>Acquiring vocabulary</p> <p>Revising Tenses</p>	<ul style="list-style-type: none"> <li>• Answering questions</li> <li>• Multiple choice</li> <li>• Completing sentences with information given in the text</li> <li>• Forming derivatives</li> <li>• Completing sentences with the suitable words (soil types)</li> <li>• Matching synonyms</li> <li>• Completing sentences with the correct Tense</li> </ul>
5. Soil water and tensiometers	<p>Reading: Describing features, uses and purpose~ Giving Information~ Expressing purpose</p> <p>Acquiring Vocabulary</p> <p>Dealing with prepositions</p> <p>Revising Tenses</p> <p>Emphasizing the doer</p>	<ul style="list-style-type: none"> <li>• Answering questions</li> <li>• To + infinitive</li> <li>• Identifying words with their definitions</li> <li>• Matching synonymous items</li> <li>• Forming verbs</li> <li>• Completing sentences with prepositions</li> <li>• Completing sentences with the correct Tense</li> <li>• Rewriting sentences in the active voice</li> </ul>
6. Irrigation	<p>Reading: Giving Information~ Describing processes~ Describing facts</p> <p>Acquiring Vocabulary</p> <p>Describing features</p> <p>Describing a logical sequence of facts</p>	<ul style="list-style-type: none"> <li>• Answering questions</li> <li>• Identifying True - False statements</li> <li>• Identifying words with their definitions</li> <li>• Completing sentences with appropriate words</li> <li>• Forming derivatives</li> <li>• Completing sentences with the appropriate term</li> <li>• Joining pairs of sentences using <i>after</i> or <i>before</i></li> </ul>

<b>Unit</b>	<b>Skills/Functions</b>	<b>Structures/Activities</b>
<b>7. The basic anatomy of the tree</b>	<p>Reading: Describing parts~ Describing functions</p> <p>Acquiring vocabulary</p> <p>Revising Tenses</p>	<ul style="list-style-type: none"> <li>• Answering questions</li> <li>• Identifying True - False statements</li> <li>• Forming derivatives (nouns)</li> <li>• Solving a puzzle</li> <li>• Matching synonyms</li> <li>• Completing sentences with the suitable words</li> <li>• Putting verbs in their correct form</li> </ul>
<b>8. Working out garden designs</b>	<p>Reading: Giving information~ Giving instructions~ Describing features and processes</p> <p>Acquiring vocabulary</p> <p>Hypothesising</p> <p>Emphasizing results</p>	<ul style="list-style-type: none"> <li>• Answering questions</li> <li>• Imperative form, 1st conditional, should</li> <li>• Matching synonyms</li> <li>• Identifying words with their definitions</li> <li>• Forming meaningful expressions</li> <li>• Solving a puzzle</li> <li>• Completing sentences with the suitable words</li> <li>• 1st, 2nd, 3rd conditional</li> <li>• Turning from active to passive voice</li> </ul>
<b>9. Insects and other enemies of plants</b>	<p>Reading: Giving information~ Describing injuries and diseases~ Describing methods of fighting a disease</p> <p>Acquiring vocabulary</p> <p>Dealing with prepositions</p>	<ul style="list-style-type: none"> <li>• Answering questions</li> <li>• Identifying True - False statements</li> <li>• Identifying words with their definitions</li> <li>• Matching synonyms</li> <li>• Forming derivatives (verbs-nouns-adjectives)</li> <li>• Completing sentences with prepositions</li> </ul>

Unit	Skills/Functions	Structures/Activities
<p><b>10.</b> Field crops: the basic source of food</p>	<p>Reading: Describing features, characteristics, uses and properties</p> <p>Acquiring vocabulary</p> <p>Revising Tenses</p>	<ul style="list-style-type: none"> <li>• Answering questions</li> <li>• Identifying True - False statements</li> <li>• Completing paragraphs with information given in the text</li> <li>• Multiple choice</li> <li>• Matching synonyms</li> <li>• Forming derivatives (nouns)</li> <li>• Adding the suitable prefix or suffix to form opposite meanings</li> <li>• Putting verbs in their correct form</li> </ul>
<p><b>11.</b> Ag machines preparing the soil for cultivation</p>	<p>Reading: Giving information~ Describing features and processes</p> <p>Acquiring vocabulary</p>	<ul style="list-style-type: none"> <li>• Answering questions</li> <li>• Multiple choice</li> <li>• Identifying True - False statements</li> <li>• Identifying words with their definitions</li> <li>• Matching synonyms</li> <li>• Forming derivatives (nouns)</li> <li>• Completing sentences with words related to the text</li> </ul>
<p><b>12.</b> A short reference to harvesting and tying pick-up machines</p>	<p>Reading: Describing features, processes and functions</p> <p>Acquiring vocabulary</p> <p>Structuring sentences</p>	<ul style="list-style-type: none"> <li>• Answering questions</li> <li>• Identifying True - False statements</li> <li>• Matching operations and tasks with their equivalent item/term</li> <li>• Forming derivatives</li> <li>• Matching synonyms</li> <li>• Completing sentences with adjectives drawing information from the text</li> <li>• Putting words in their correct order</li> </ul>

Unit	Skills/Functions	Structures/Activities
<b>13. Breeding animals</b>	Reading: Describing features and processes~ Referring to symptoms  Acquiring vocabulary  Emphasizing facts	<ul style="list-style-type: none"> <li>• Answering questions</li> <li>• Completing sentences drawing information from the text</li> <li>• Matching synonyms</li> <li>• Forming derivatives (verbs, nouns)</li> <li>• Matching words to form meaningful expressions</li> <li>• Distinguishing nouns, adjectives, verbs</li> <li>• Turning sentences from active into the passive voice</li> </ul>
<b>14. Dairy production- Milking systems and techniques</b>	Reading: Describing systems and techniques~ Describing items  Acquiring vocabulary  Structuring sentences  Emphasizing the doer	<ul style="list-style-type: none"> <li>• Answering questions</li> <li>• Completing sentences (definitions) with their terms/words</li> <li>• Identifying words with their definitions</li> <li>• Matching synonyms</li> <li>• Forming sentences by putting words in their correct order</li> <li>• Turning sentences from passive into the active voice</li> </ul>
<b>15. Photosynthesis: storing energy</b>	Reading: Describing a process  Acquiring vocabulary	<ul style="list-style-type: none"> <li>• Answering questions</li> <li>• Identifying True - False statements</li> <li>• Multiple choice</li> <li>• Forming derivatives (verbs, nouns, adjectives)</li> <li>• Matching synonyms</li> <li>• Solving a puzzle</li> <li>• Completing sentences with the proper words</li> <li>• Identifying words with their definitions</li> </ul>

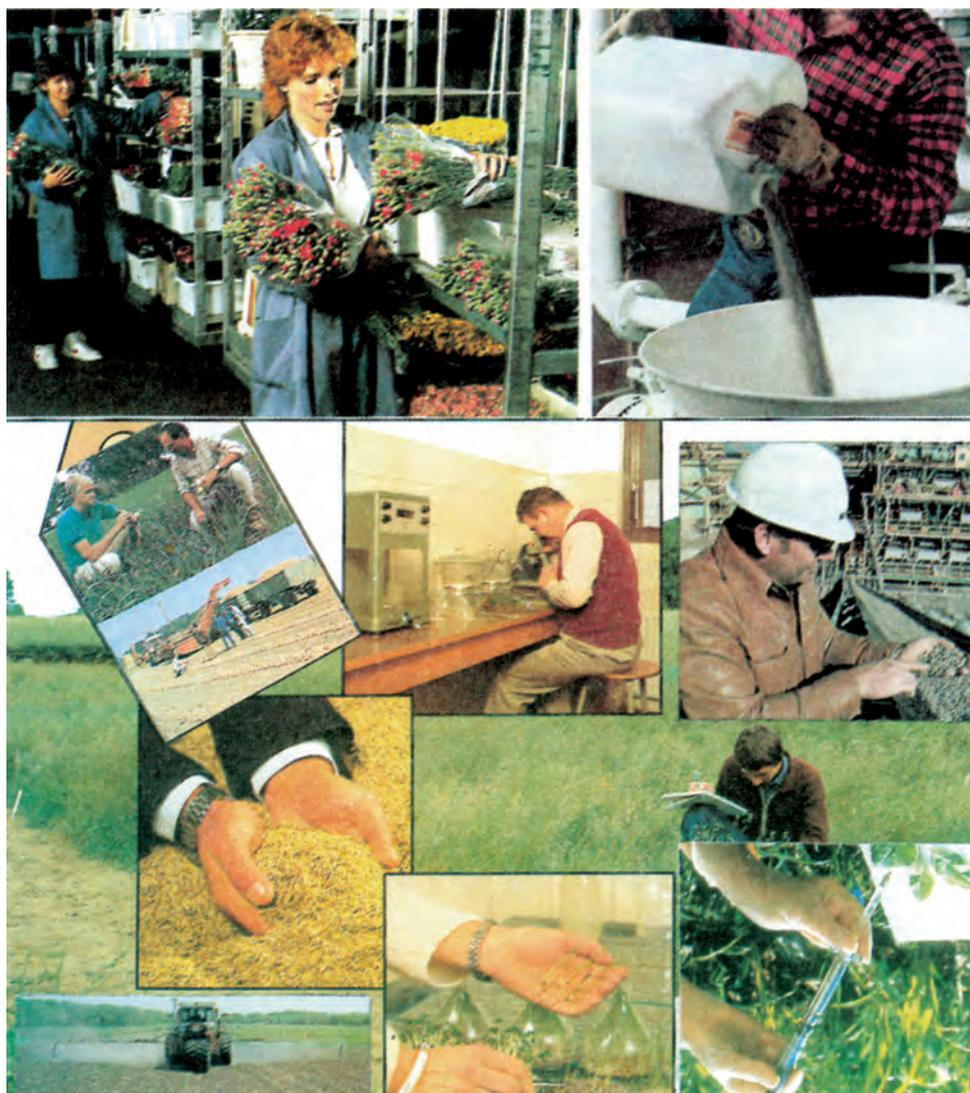
Unit	Skills/Functions	Structures/Activities
<p><b>16. Greenhouses:</b>  <b>a.</b> Materials and equipment necessary for their construction</p> <p><b>b.</b> Types of greenhouses</p>	<p>Reading: Describing features, properties, constructions and uses</p> <p>Reading: Describing types, properties and functions</p> <p>Acquiring vocabulary</p> <p>Structuring sentences</p> <p>Revising Tenses</p>	<ul style="list-style-type: none"> <li>• Answering questions</li> <li>• Identifying True-False statements</li>   <li>• Answering questions</li>   <li>• Matching synonyms</li> <li>• Replacing synonymous items in sentences</li> <li>• Forming derivatives (nouns, verbs)</li>   <li>• Forming meaningful statements by putting words/phrases in their correct order</li>   <li>• Completing sentences with the proper form of verbs</li> </ul>
<p><b>17. Cooperatives -</b>  What are they?</p>	<p>Reading: Describing types, principles and business organizations</p> <p>Acquiring vocabulary</p> <p>Revising Tenses</p> <p>Speaking: Connecting subsequent information with earlier information</p>	<ul style="list-style-type: none"> <li>• Answering questions</li> <li>• Identifying True-False statements</li>   <li>• Matching words with synonymous items</li> <li>• Forming derivatives (verbs, nouns, adjectives)</li> <li>• Completing sentences with derivatives</li> <li>• Completing sentences with proper words</li>   <li>• Completing sentences with the correct form of verbs</li>   <li>• Describing statements and principles by using sequencing connectors</li> </ul>

Unit	Skills/Functions	Structures/Activities
<p><b>18. Farm management</b></p>	<p>Reading: Describing skills and tasks~Expressing obligation</p> <p>Acquiring vocabulary</p> <p>Giving advice and instructions</p> <p>Emphasizing facts and the usefulness of items</p> <p>Expressing purpose</p>	<ul style="list-style-type: none"> <li>• Answering questions</li> <li>• Identifying True-False statements</li>   <li>• Identifying words with their definitions</li> <li>• Completing sentences with the appropriate words</li> <li>• Identifying jobs with tasks and practices</li>   <li>• Why don't you, You'd better, I suggest you (should), Wouldn't it be a good idea to</li>   <li>• Turning from active into passive voice</li>   <li>• to + infinitive, so that</li> </ul>



# Part one

## Elements of agricultural subjects



# Planting

Planting a seed, bulb, shrub, or a tree in the ground is an important event. It has been said that you cannot plant a garden without being an optimist. Many positive thoughts are affirmed on a planting day; the desire for a more beautiful environment, the anticipation of flowers, shade, fruit, privacy, and the recognition that you will enjoy the future rewards, season after season.

For proper growth, plants need air in the soil, available moisture (but not standing water), and a supply of mineral nutrients. If the soil has plenty of clay, it holds onto nutrients. However, the small clay particles that cling closely together hold water, and leave little room for air. As a result, water penetration is slow. Drainage is the main problem in clay soils, the lack of which often causes suffocation to plant roots. You know that you have a clay soil, if it's rock hard when dry, or if it's gummy when wet.

Sandy soils have a lot lot of room for air, but moisture and nutrients disappear quickly. Water sinks right into sandy soil without spreading, and dries up in just a few days after watering. When sandy soils are squeezed into a ball, they quickly fall apart when the ball is released.

One of the best soil types for plant growth is the loam soil. It contains a combination of clay, silt, and sand, which retains nutrients and water, while it still allows sufficient room for air.

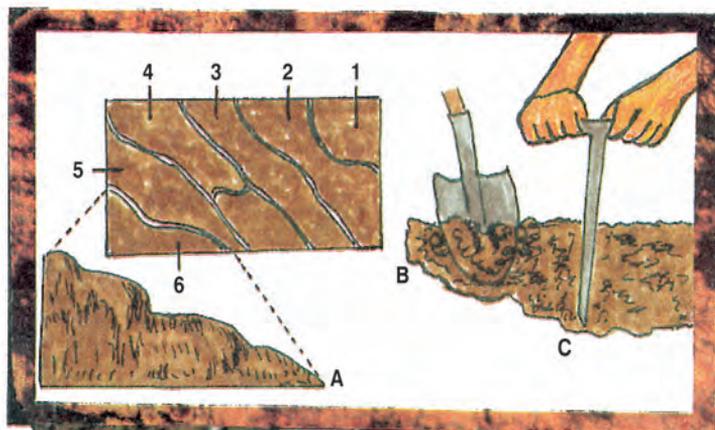
Before deciding on the area you are going to plant, a soil test is always advisable.

## **Typical questions for taking a soil test are:**

- How large is the sample area?
- Has fertilizer or lime ever been added?
- To what degree does the land slope?

To collect the soil, you will need a clean non-metal bucket or container, a soil sampler, a garden trowel or a spade and a mailable container that will hold about a pint of soil. The process of taking a soil test is shown in the pictures that follow.

## How to take a soil test



1. steep knoll
2. no lime
3. clay
4. old sod
5. sandy soil
6. low area



- A. Test individual areas separately. The above areas are examples of the soil differences a lawn can have; most areas usually have only one or two different soil types.
- B. 1/2 inch slice from center.
- C. Using a spade or sampling tube, take separate samples of individual areas at a 6 to 7 inch depth.
- D. Mix soil well. (Do not mix soil from separate sampling areas). Place about one pint of this soil into labelled container. Repeat process for each specific area.

## A. Questions

1. Which are a gardener's positive thoughts on a planting day?
2. What do plants need for proper growth?
3. What is the main problem in clay soils?
4. Which are the disadvantages of sandy soils?
5. Which type of soil is the best for plant growth?
6. What does it consist of?



## B. Exercises

1. Find the words in the text meaning the following:
  - a. a low bush with several woody stems
  - b. soil; earth
  - c. a person who thinks that whatever happens will be good
  - d. declared again, or in answer to a question or doubt

- e. water, or other liquids, in small quantities or in the form of steam or mist
- f. heavy firm earth that is soft when wet, but becomes hard when baked at a high temperature, from which bricks, pots, etc. are made
- g. retains; keeps
- h. hold tightly; stick firmly
- i. the act or process of entering or forcing a way through
- j. the act of causing to die because of lack of air
- k. sticky
- l. set free; let go
- m. the sand, mud, etc. carried by moving water
- n. a small round hill
- o. a garden tool like a small spade with a curved blade, for digging small holes, lifting up plants, etc.

**2. Match each word from list A with a word from list B to form phrases found in the text.**

List A	List B
plant	soil
clay	area
soil	roots
sufficient	trowel
sample	types
non-metal	bucket
garden	room
steep	knoll

**3. Fill in the blanks choosing one of the following words: container, seed, trowel, particles, bulb, moisture.**

- a. A \_\_\_\_\_ is the part, usually small and hard, of some plants that may grow into a new plant of the same kind.
- b. A \_\_\_\_\_ is a round root of certain plants.
- c. When we say \_\_\_\_\_, we mean water in small quantities or in the form of steam or mist
- d. \_\_\_\_\_ are very small pieces of something.
- e. A \_\_\_\_\_ is anything such as a box, metal barrel, bottle, etc. used for holding something or in which goods are packed.
- f. A \_\_\_\_\_ is a garden tool with a curved blade for digging small holes, lifting up plants, etc.

**4. Form the suitable word that derives from the words in capitals at the end of each sentence to complete the blanks.**

- a. Negroes worked as slaves in cotton \_\_\_\_\_ in N. America. PLANT
- b. The supply of mineral nutrients is necessary for the natural \_\_\_\_\_ of plants. GROW
- c. Water \_\_\_\_\_ is slow in clay soils. PENETRATE
- d. Lack of \_\_\_\_\_ results in suffocation of plant roots. DRAIN
- e. A soil test eliminates guessing the amounts of \_\_\_\_\_ and lime that must be added. NUTRITION

**5. Fill in the blanks, using the *infinitive* or the *-ing form* of the verbs in brackets.**

- a. \_\_\_\_\_ (plant) a seed in the ground is an important event.
- b. \_\_\_\_\_ (collect) the soil, you will need a clean bucket.
- c. \_\_\_\_\_ (use) a spade, take separate samples of individual areas at a 6 to 7 inch depth.
- d. Water sinks right into sandy soils without \_\_\_\_\_ (spread).
- e. He'd like to know how \_\_\_\_\_ (take) a soil test.

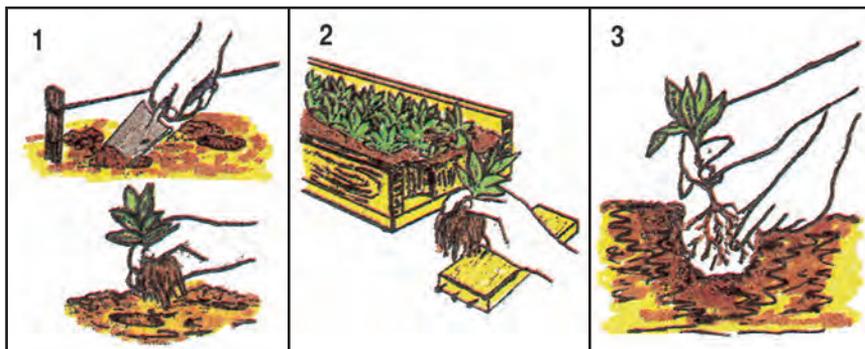
**6. Study the following examples:**

- 1. Does water dry up in a few days after watering?  
• **He asked** if water dried/dries up in a few days after watering.
- 2. Have you mixed clay with silt soil?  
**He asked me** If I had mixed clay with silt soil.

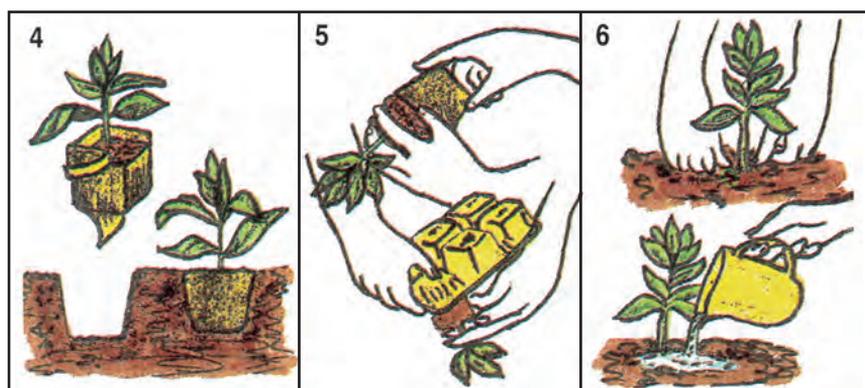
**Based on the examples already given, rewrite the three questions mentioned in the paragraph "Typical questions for taking a soil test". Begin as follows:**

- a. The agriculturist asked .....
- b. He also asked .....
- c. Finally, he wanted to know .....

## Transplanting procedures



1. If you are planting in a straight line, stretch a string between two stakes to guide you. Figure carefully how far apart to dig the planting holes. Dig holes slightly larger than the rootball and water them an hour before planting.
2. When many plants are grown together in a single flat, their roots intermingle. The individual plants will be damaged less, if you pull them apart with your hands rather than using a knife or other sharp instruments.
3. When planting the transplants, fill in the hole around the roots carefully. Firm the soil slightly with the heel of your hand, and then water. If the soil settles after watering, add loose dry soil.



4. If transplants are growing in peat pots, tear off the edges of the pot down to the soil line to prevent drying. It's also a good idea to tear off the bottom of the pot to promote root growth. Plant them at the same level as they were in the pots.
5. For transplants grown in individual plastic pots, tip the pot and tap the plant into your hand; don't pull it out. Plants in six packs should be turned over and pushed out from the bottom with your thumb. Hold the soil in its place with your other hand.
6. After planting, firm the soil slightly with your hands to remove any air pockets. Don't wait for the newly planted annuals to show signs of wilt before watering again. A little extra attention in the first few days after planting will ensure healthy plants.

## A. Questions

1. What do you have to use if you plant in a straight line?
2. What should you figure carefully?
3. How large should the holes be?
4. What must you do to avoid damaging individual plants when pulling them apart?
5. What must you do when planting the transplants?
6. Why must you tear off the edges and the bottom of the peat pots down to the soil line when transplanting a transplant?
7. What procedure must be followed when planting transplants grown in individual plastic pots?
8. When must extra attention be paid to the newly planted transplants?

## B. Exercises

### 1. Find the words in the text meaning the following:

- a. without a bend or a curve
- b. a pointed length of wood or metal hit into the ground as a post or a support (for sth, e.g. plants)
- c. an opening or empty place in a solid thing
- d. intermix; mix sth with sth else
- e. the parts of a plant in the ground
- f. the upper layer of earth in which plants grow
- g. a container for liquids or solids
- h. the process of growing or developing
- i. to a small extent
- j. plants that live for one year or less

### 2. Match the words in the 1st list with their meanings in the 2nd list.

- |               |  |
|---------------|--|
| a. damage     | 1. one of the fingers set opposite and apart from the others |
| b. tear off   | 2. harm  |
| c. individual | 3. take away   |
| d. pull out   | 4. more  |
| e. bottom     | 5. single; particular  |
| f. thumb      | 6. remove or pull apart or into pieces by force              |
| g. remove     | 7. remove by drawing out                                     |
| h. extra      | 8. the lowest part   |

**3. Based on the text, fill in the gaps with the right prepositions or adverbs.**

- a. If you plant \_\_\_\_\_ a straight line, you must stretch a string between two stakes \_\_\_\_\_ guide you.
- b. You will damage the individual plants \_\_\_\_\_, if you pull them \_\_\_\_\_ your hands.
- c. Fill \_\_\_\_\_ the hole \_\_\_\_\_ the roots carefully.
- d. If the soil settles \_\_\_\_\_ watering, fill in \_\_\_\_\_ loose dry soil.
- e. It's a good idea to tear \_\_\_\_\_ the bottom \_\_\_\_\_ the pot \_\_\_\_\_ promote root growth.
- f. For transplants grown \_\_\_\_\_ plastic pots, tip the pot and tap the plant \_\_\_\_\_ your hand but don't pull it \_\_\_\_\_.
- g. Don't wait \_\_\_\_\_ the newly planted annuals \_\_\_\_\_ show signs of wilt before watering again.

**4. Fill in the blanks using words deriving from the words at the end of each sentence.**

- a. A \_\_\_\_\_ is someone who owns, or is in charge of a \_\_\_\_\_. (PLANT)
- b. Firm the soil \_\_\_\_\_ with the heel of your hand. (SLIGHT)
- c. After \_\_\_\_\_, fill in with loose dry soil. (WATER)
- d. Tear off the edges of the pot down to the soil line to prevent \_\_\_\_\_. (DRY)
- e. Tear off the bottom of the pot to promote root \_\_\_\_\_. (GROW)
- f. Extra attention in the first days after planting will ensure \_\_\_\_\_ plants. (HEALTH)

**5. Match the two parts of the sentences.**

- |  |                                       |
|--|---------------------------------------|
| a. When planting transplants                                     | 1. into your hand; don't pull it.     |
| b. If the soil settles after watering                            | 2. will ensure healthy plants.        |
| c. Plant the transplants in the same                             | 3. fill in the hole around the roots. |
| d. Tip the pot and tap the plant                                 | 4. level as they were in the pots.    |
| e. A little extra attention in the first few days after planting | 5. add loose dry soil.                |

**6. Peter is transplanting some plants and Liza is watching him. Complete the dialogue between them, following the stages of transplanting shown in the pictures 1-6.**

**Liza:** No matter how hard I try, I'm sure I'll never manage to be a good gardener. Well, what are you doing there? You look so busy.

**Peter:** .....

**Liza:** Oh, I see. What is this string for?

**Peter:** .....

**Liza:** How big must a planting hole be?

**Peter:** .....

**Liza:** And why don't you use a knife to pull the plants apart?

**Peter:** .....

**Liza:** Now that you have placed the plants in the holes, what comes next?

**Peter:** .....

**Liza:** And now, why are you tearing off the edges and the bottom of these peat pots?

**Peter:** .....

**Liza:** And how will you manage with the plastic pots?

**Peter:** .....

**Liza:** How beautiful they look! Do they need watering every day?

**Peter:** .....

**Liza:** Well, what about some coffee for a rest now? I'm going to make some.

**7. Give advice and/or instructions to someone about how:**

- a. to dig a hole
- b. to fill in the hole around the roots
- c. to plant the flowers at the same level
- d. to hold the soil in its place with his other hand.

**Example**

- a. **Dig** the hole slightly larger than the rootball.  
**You should dig** the hole slightly larger than the rootball.  
**You'd better dig** the hole slightly larger than the rootball.  
**Why don't you dig** the hole slightly larger than the rootball?  
**What about digging** the hole slightly larger than the rootball?

## Formation, composition and capacity of the soil to hold water

The surface of the earth consists of complex natural formations which are what is known to us as *soils*. The variety of soils mainly depends on the various types of rocks which they are composed of. Furthermore, topography, life of animals or plants, the age of the material of the soil, farming operations, as well as climatic conditions are some of the factors which affect soils.

We can have an opinion of how the soil is formed by examining its profile. To obtain a soil profile we can either dig a trench down to the parent rock or take out soil samples from different depths with the help of a *soil auger*. The soil profile indicates the various types of layers which are formed by the breakdown of rocks and are known as *horizons*. These layers are usually classified as follows:

- a. The *surface soil* or *topsoil* which is the upper –of few inches– layer, in which beneficial bacteria, worms, naturally accumulating humus as well as the most of the plant roots can be found.
- b. The *subsoil* which is the layer lying under the topsoil and receives materials washed out of the topsoil.
- c. The (unweathered) *parent rock*, which is the lower layer of soil in the earth surface.

Soils vary enormously in composition. However, they are basically composed of:

- *Solids* which are principally formed by a) mineral or inorganic matter, such as stones, silt, clay, sand, etc. and b) organic matter, such as plants and animals' parts that are left in the soil.
- *Liquids* which are mostly formed by soil water.
- *Living organisms* which are micro-organisms, such as earthworms, small soil animals, fungi, bacteria, etc.
- *Gases* –that is to say soil air– which, along with water, fill in the spaces among the soil particles.

Soils capacity to hold water varies, depending on the following factors:

1. The *pore space* which is a network of channels formed by the soil particles. When the soil particles are large (e.g. sand) then the spaces between the

particles are large, too; when they are small (e.g. clay) the spaces are small. Therefore, the spaces are large in sandy soils, while the spaces in clay soils –of the same volume– are smaller. The property of sandy soils to have a larger pore space than clay soils makes it clear that sandy soils can hold less water than clay soils.

2. The *surface area* of the particles. Water is held as a thin film around the soil particles; if the particles are larger, the attractive forces which hold the water are weaker. If the particles are smaller, the surface area per unit volume is greater.

3. The *amount of humus*, which is the organic matter remained in the soil, also contributes to the capacity of the soil to hold water.

The capacity of the soil to hold water is known to farmers as the *field capacity* or *moisture-holding capacity*. It depends on the structure and texture of the soil, and it is expressed in mm (e.g. a clay soil may have a field capacity of 4 mm/cm in depth).

## A. Questions

1. What does the variety of soils depend on?
2. How can we obtain a soil profile?
3. Name the three layers of the soil.
4. What can be found in the topsoil?
5. What are soils basically composed of?
6. Give examples of inorganic and organic matter of the soil solids.
7. How do gases contribute to the composition of soils?
8. Are the spaces equally large between the particles of sandy and clay soils?
9. What is the water held around the soil particles like?
10. What is known as humus?
11. What is the capacity of the soil to hold water called?
12. What is it expressed in? (Give an example).

## B. Exercises

1. Find the words in the text which mean the following:

- a. the top covering of the earth in which plants grow
- b. stones forming the major part of the earth's crust

- c. all the surface features, natural and artificial, of a particular place
- d. works; activities
- e. a section taken through the soil down to the parent rock
- f. a tool used for boring holes in the ground
- g. coatings of one or more substances lying upon or under one or more other substances
- h. original rock
- i. substances that have little or no tendency to flow
- j. having the physical structure characteristic of living organisms
- k. a chain of channels formed by the soil particles
- l. an amount of space occupied by a substance, liquid or gas
- m. the organic part of soil, formed by the decomposition of plants or animals
- n. water (or other liquids) in small quantities or in the form of steam or mist

**2. Match the two columns below.**

- |                |  |
|----------------|--|
| a. soil        | 1. being located                               |
| b. complicated | 2. cultivating                                 |
| c. farming     | 3. consisting of                               |
| d. conditions  | 4. complex                                     |
| e. affect      | 5. decomposition/disintegration                |
| f. breakdown   | 6. circumstances                               |
| g. lying       | 7. influence                                   |
| h. composed of | 8. the upper layers of earth where plants grow |

**3. Fill in the blanks in the 2nd list below.**

<b>Verb</b>	<b>Noun</b>
a. surface	.....
b. form	.....
c. vary	.....
d. live	.....
e. operate	.....
f. examine	.....
g. differ	.....
h. accumulate	.....
i. lay	.....
j. compose	.....

**4. Which of the words in the text have the same meaning as the words/ phrases below.**

- |   |  |
|---|--|
| a. belief/idea  | f. complete                                |
| b. ditch  | g. very small pieces of sth                |
| c. a thickness of material over a surface or forming one division / layer | h. ability (to hold sth)                   |
| d. immensely  | i. membrane                                |
| e. mainly   | j. the way in which parts are put together |

**5. Give the adjectives deriving from the following nouns.**

- a. rock .....
- b. earth .....
- c. nature .....
- d. material .....
- e. climate .....
- f. parent .....
- g. clay .....
- h. sand .....
- i. space .....
- j. force .....

**6. Fill in the blanks below with the appropriate preposition.**

- The variety \_\_\_\_\_<sup>(1)</sup> soils basically depends \_\_\_\_\_<sup>(2)</sup> the different kinds \_\_\_\_\_<sup>(3)</sup> rocks which they come \_\_\_\_\_<sup>(4)</sup>. We can learn \_\_\_\_\_<sup>(5)</sup> soil formation \_\_\_\_\_<sup>(6)</sup> examining a soil profile. We can dig a ditch down \_\_\_\_\_<sup>(7)</sup> the original rock or take \_\_\_\_\_<sup>(8)</sup> soil samples \_\_\_\_\_<sup>(9)</sup> various depths \_\_\_\_\_<sup>(10)</sup> the help of a soil auger.
- Soils also vary \_\_\_\_\_<sup>(11)</sup> their capacity \_\_\_\_\_<sup>(12)</sup> hold water. This capacity depends \_\_\_\_\_<sup>(13)</sup> various factors; the pore space, the surface area and the amount \_\_\_\_\_<sup>(14)</sup> the humus remained \_\_\_\_\_<sup>(15)</sup> the soil.
- The moisture-holding capacity of the soil is expressed \_\_\_\_\_<sup>(16)</sup> mm.

**7. Say whether the following statements are True or False. If they are false, explain why.**

- a. The surface of the earth consists of complex natural formations, known as soils.
- b. The variety of soils is irrelevant to the types of rocks from which they are made.

- c. The soil profile indicates the various types of layers which are formed by the breakdown of rocks.
- d. We cannot form an opinion about the formation of soil by examining a soil profile.
- e. The subsoil is a layer which lies under the topsoil.



# Soil texture and structure

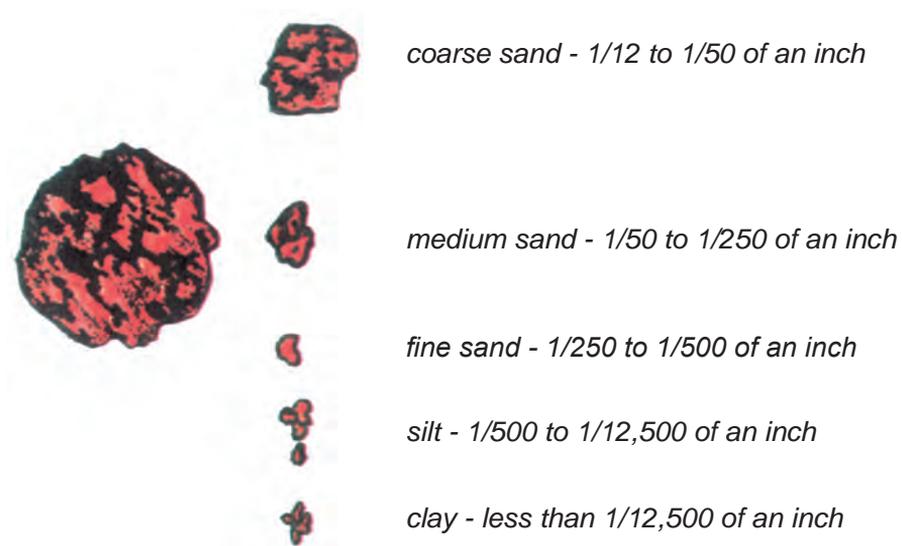
Most soils provide a suitable rooting medium which holds moisture and allows proper aeration with little or no amending. Loam soils are a mixture of various soil particle sizes of acceptable structure.

Soils that are extremely sandy or clayey can be improved by adding organic matter (peat, compost, nutrified bark, or well-decomposed sawdust) to the backfill, at a rate of 2 parts soil to 1 part organic matter. Sandy soils usually drain well and have good aeration but they do not retain much water. To some degree, organic matter will increase the moisture.

Clay soils hold a lot of water but may drain poorly and have inadequate aeration. Organic matter will help clay soils improve drainage and aeration by separating some of the particles to provide paths for water and air.

There is an easy way to find out what kind of soil you have. Pick up a handful of soil and squeeze. A ball of clay will remain in a tight, ridged lump. Loam will hold its shape, but will crumble if you poke it. Sandy soil will begin to fall apart as you open your hand.

## Soil texture



## Soil structure



**Compacted soil:** The particles are packed with little space for air and water.

**Crumbly soil:** Organic matter aggregates particles into porous crumbs.

**Saturated soil:** If water doesn't drain through the soil, the plants may drown.

**Moist soil:** There is a film of water between soil particles with air in the larger pores.

## A. Questions

1. How can extremely sandy soils be improved?
2. What is the advantage and the disadvantage of sandy soils?
3. What can you say about clay soils as far as water is concerned?
4. How can organic matter help clay soils improve drainage and aeration?
5. Is there a way of finding out what kind of soil you have?

## B. Exercises

### 1. Refer back to the text and complete the sentences.

- a. Organic matter usually consists of.....
- b. Loam soils are .....
- c. Most soils provide a suitable rooting medium which .....
- d. Sandy soils usually drain well and have good aeration but .....

**2. Fill in the blanks with the missing items.**

<b>noun</b>	<b>verb</b>
mixture	_____
_____	add
_____	provide
_____	improve
drainage	_____
beginning	_____
aeration	_____
_____	amend
_____	allow
_____	retain

**3. Fill in the blanks with the appropriate name of each soil type.**

- a. In \_\_\_\_\_ soils the particles are packed with little space for air or water.
- b. \_\_\_\_\_ soils hold a lot of water but may drain poorly and have inadequate aeration.
- c. In \_\_\_\_\_ soils organic matter aggregates particles into porous crumbs.
- d. \_\_\_\_\_ soils usually drain well and have good aeration, but they do not retain much water.
- e. In \_\_\_\_\_ soils there is a film of water between soil particles with air in the larger pores.
- f. If water does not drain through the \_\_\_\_\_ soil, the plants may drown.

**4. Which words in the text mean the following?**

- a. supply .....
- b. appropriate .....
- c. retains .....
- d. permits .....
- e. improving .....
- f. stuff .....
- g. extent .....
- h. insufficient .....
- i. discover .....
- j. a little .....

## 5. Fill in the blanks choosing the suitable items.

- a. Extremely sandy or clayey soils can be improved by adding ..... to the backfill.  
1. coarse sand 2. organic matter 3. silt
- b. Sandy soils have .....  
1. good aeration 2. inadequate aeration 3. bad aeration
- c. If you squeeze a handful of soil, and it still holds its shape, but crumbles if you poke it, you know that it is .....  
1. clay soil 2. sandy soil 3. loam soil
- d. Organic matter helps clay soils improve drainage, and aeration by .....  
1. keeping the soil dry 2. crumbling the soil 3. separating some of the soil's particles
- e. A mixture of various soil particle sizes of acceptable structure is the .....  
1. sandy soil 2. loam soil 3. clay soil

## Soil water and tensiometers

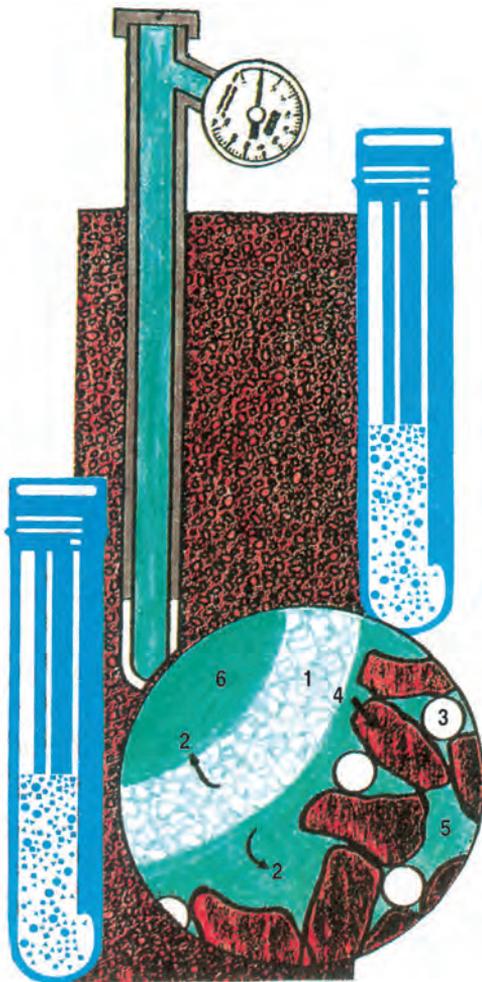
### Soil water

The amount of water which is retained by the soil is called *the moisture - holding capacity* or *field capacity*. It varies according to the texture and structure of the soil. Water tends to hold the particles of the soil together. If the soils have very

small pores and channels, some of the water can move through the soil by means of capillary forces.

Water management should be viewed as a priority in agricultural production and development; water wastage through evaporation and drainage must be reduced to a minimum. The underlying principle of irrigation scheduling is to add only sufficient water to the soil to meet the daily requirements of a growing crop. Excess of water becomes wasted through evaporation from the soil surface or through drainage. The usual range includes equipment for the following determinations:

- hydraulic conductivity
- permeability
- infiltration capacity
- soil moisture tension
- soil moisture content
- soil bulk-density



**Tensiometers** are used to measure soil tension, which is directly related to the amount of soil moisture available for plants. Capillarity is established between the waterfilled tensiometers and the soil water via a ceramic cup or tip. As soil water tension increases, water is drawn by suction from the tensiometer and the negative pressure created (which is representative of soil tension) may be read from a vacuum gauge.

1. Ceramic tensiometer tip causing capillarity between tensiometer / soil water.
2. Movement of water in and out of the tensiometer in "balance" with soil suction.
3. Air in soil pore space.
4. Soil particle.
5. Water in soil pore space.
6. Water in tensiometer body.

### Why should we measure soil-water tension?

- To get to know when to water and how much.
- To produce significant yield increases.
- To save on water and fertilizer costs.
- To increase profitability.

### A. Questions

1. What is the amount of water retained by the soil called?
2. Does water tend to split the soil particles?
3. How can water move through the soils which have very small pores?
4. What must be reduced to a minimum as far as water management is concerned?
5. What's the underlying principle of irrigation scheduling?
6. Which determinations does a usual range of equipment include?
7. What's the use of tensiometers?
8. How is capillarity established?
9. What is the result of soil water tension increase?
10. Why do we measure the soil-water tension?

### B. Exercises

1. Match the words in column A with the words or expressions in column

**B.**

**A**

1. vary
2. priority
3. agricultural
4. wastage
5. reduced
6. sufficient
7. meet
8. crop

**B**

- a. cultivation
- b. having to do with farming
- c. become different
- d. enough
- e. loss
- f. of primary importance
- g. becoming less
- h. satisfy

**2. Find the words in the text which mean the following:**

- a. an apparatus which is used to measure soil tension and moisture
- b. a very small or the smallest quantity of something
- c. a very fine hairlike tube with very narrow width
- d. concerning or moved by the pressure of water or other liquids
- e. an instrument for measuring size, amount, etc.
- f. a preparation containing the elements essential to plant growth

**3. Complete the verbs corresponding to the nouns.**

Verb	Noun
a. _____	moisture
b. _____	structure
c. _____	management
d. _____	production
e. _____	wastage
f. _____	drainage
g. _____	evaporation
h. _____	equipment
i. _____	suction
j. _____	cost

**4. Fill in the blanks with the appropriate prepositions.**

- a. Water management should be viewed as a priority \_\_\_\_\_ agricultural development.
- b. Water wastage must be reduced \_\_\_\_\_ a minimum.
- c. Excess \_\_\_\_\_ water becomes wasted \_\_\_\_\_ evaporation \_\_\_\_\_ the soil surface.
- d. Soil tension is directly related \_\_\_\_\_ the amount \_\_\_\_\_ soil moisture available \_\_\_\_\_ plants.
- e. Capillarity is established \_\_\_\_\_ the waterfilled tensiometer and the soil water \_\_\_\_\_ a ceramic cup or tip.
- f. Water is drawn \_\_\_\_\_ suction \_\_\_\_\_ the tensiometer.
- g. The negative pressure created may be read \_\_\_\_\_ a vacuum gauge.
- h. There are air and water \_\_\_\_\_ soil pore space.

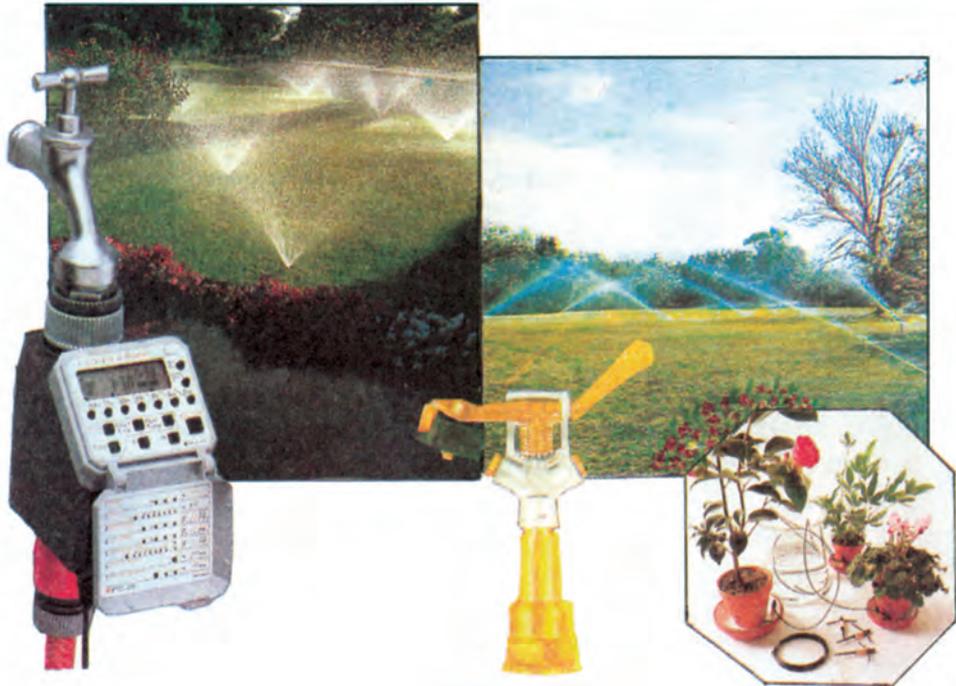
**5. Give the appropriate form of the verbs in brackets.**

- The amount of water \_\_\_\_\_ (**retain**) by the soil is called field capacity. Water tends \_\_\_\_\_ (**hold**) the particles of the soil together.
- The underlying principle of irrigation scheduling \_\_\_\_\_ (**be**) \_\_\_\_\_ (**add**) only sufficient water to the soil \_\_\_\_\_ (**meet**) the daily requirements of a growing crop, without \_\_\_\_\_ (**add**) excess water which \_\_\_\_\_ (**become**) wasted through evaporation from the soil surface or through drainage.

**6. Rewrite the sentences using the new prompts.**

- a. Water management should be viewed as a priority in agricultural production.  
The local authorities .....
- b. Water wastage must be reduced to a minimum.  
Farmers .....
- c. Sufficient water is added to the soil to meet the daily requirements of a growing crop.  
Agricultural producers .....
- d. Tensiometers are used for measuring soil tension.  
Agriculturists .....
- e. The negative pressure may be read from a vacuum gauge.  
We .....

# Irrigation

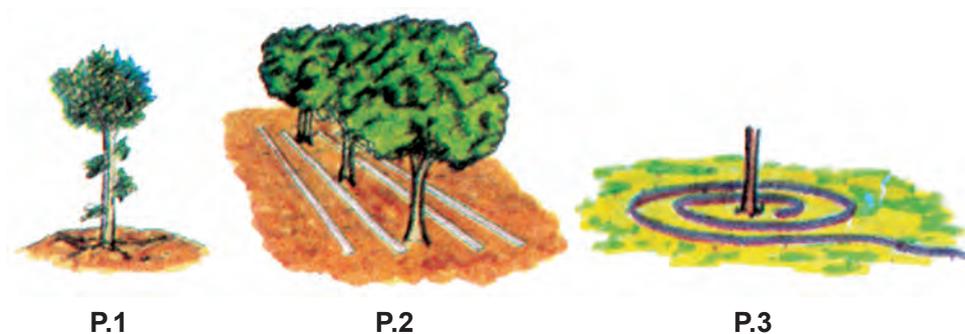


*In the middle of the picture there is a low-capacity sprinkler for strong wind conditions and variable water pressures. Reduced discharge permits close spacing of sprinklers without undue addition of water. One and two nozzles. Dual-action brass hammer drive. Stainless steel axle.*

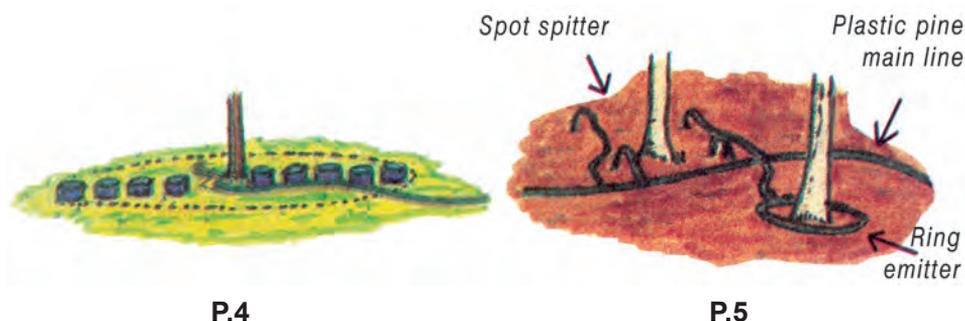
All plants require water for growth. They get water from the soil and lose most of it through their leaves by evaporation (transpiration). Plants receive water from either rain or irrigation. How much water is available for a plant depends on the depth and spread of the roots. Most roots are located within three feet of the surface. When there is sufficient water, most of it is supplied from the top, and reaches a 3 to 4 feet depth into the soil. In dry periods, deep-rooted plants can draw water from lower roots.

During dry periods, or in areas where irrigation is a necessity, a farmer must keep a close eye on his trees to determine when they need water. Signs of water stress include wilting, a change in leaf color (from shiny to dull, or from dark green to gray green), and premature leaf fall.

There are numerous ways to water efficiently: basins, furrows, sprinklers, soakers, or drip systems. The most important goals are to eliminate run-off, to confine water inside the drip line of branches, and to apply water uniformly. The purpose is to make as much of the applied water available for the tree as possible.



- P.1 Basin:** A shallow basin is an efficient way to hold water for a young, newly planted tree.
- P.2 Furrows:** Rows of trees are easily irrigated using parallel furrows on either of the sides of the trees.
- P.3 Soaker hose:** A couple of turns around a tree distributes water evenly.



- P.4 Sprinkler:** A big advantage is that you can measure the amount of water you put on by measuring its depth in an array of coffee cans. This also gives you a check on distribution evenness.
- P.5 Drip / trickle:** To keep trees evenly moist with little water wasted, use one of the drip / trickle systems available at your garden center.

## A. Questions

1. According to the text, what do plants need water for?
2. Where do plants receive water from?
3. What does the quantity of water which is available for a plant depend on?
4. Which plants can draw water from lower roots in dry periods?
5. What are the signs of water stress?
6. Which are the ways of watering efficiently?
7. What are the most important goals of irrigation?
8. When are shallow basins an efficient method of irrigation?
9. What's the advantage of the sprinklers?
10. What is the benefit of the drip systems?

## B. Exercises

### 1. Find the words in the text which mean the following:

- a. a mechanical pump which distributes water by an overhead device using a rotating pipe with a series of holes
- b. the artificial increase of water supply to help the growing of crops
- c. a short tube fitted to the end of a hose, pipe, etc. to direct and control the stream of liquid coming out
- d. a long narrow track cut by a plough in the earth
- e. a thin, slow flow (of liquid) falling in drops

### 2. Fill in each blank with one of the following words: available, located, draw, irrigation, roots, surface, supply, reach, depth, deep-rooted.

Plants receive water from either rain or \_\_\_\_\_<sup>1</sup>. The quantity of water \_\_\_\_\_<sup>2</sup> for plants depend on the \_\_\_\_\_<sup>3</sup> and spread of the \_\_\_\_\_<sup>4</sup>. Most roots are \_\_\_\_\_<sup>5</sup> within 3 feet under the \_\_\_\_\_<sup>6</sup> of the soil, where water can \_\_\_\_\_<sup>7</sup> when there is sufficient water \_\_\_\_\_<sup>8</sup> from the top. In dry periods, \_\_\_\_\_<sup>9</sup> plants can \_\_\_\_\_<sup>10</sup> water from lower roots.

### 3. Find the nouns deriving from the following verbs and then use them in sentences of your own:

1. require .....  
2. grow .....  
3. evaporate .....

- 4. irrigate .....
- 5. locate .....
- 6. determine .....
- 7. distribute .....
- 8. measure .....

**4. Fill in the blanks with the suitable words.**

- a. The supply of water provided to the plants with manmade streams, canals, etc. is called \_\_\_\_\_ .
- b. A \_\_\_\_\_ is an apparatus used for scattering drops of water.
- c. A \_\_\_\_\_ is a short tube fitted to the end of a hose, pipe, etc. to direct and control the stream of liquid coming out.
- d. The \_\_\_\_\_ leaves look less fresh and start to die.
- e. A round hollow space on the surface of the ground for holding water is a \_\_\_\_\_
- f. A \_\_\_\_\_ is a long narrow track esp. one cut by a plough in farming land.
- g. A circular line of plastic pipe, round a tree, etc. used to send out water, is a \_\_\_\_\_  
\_\_\_\_\_ .

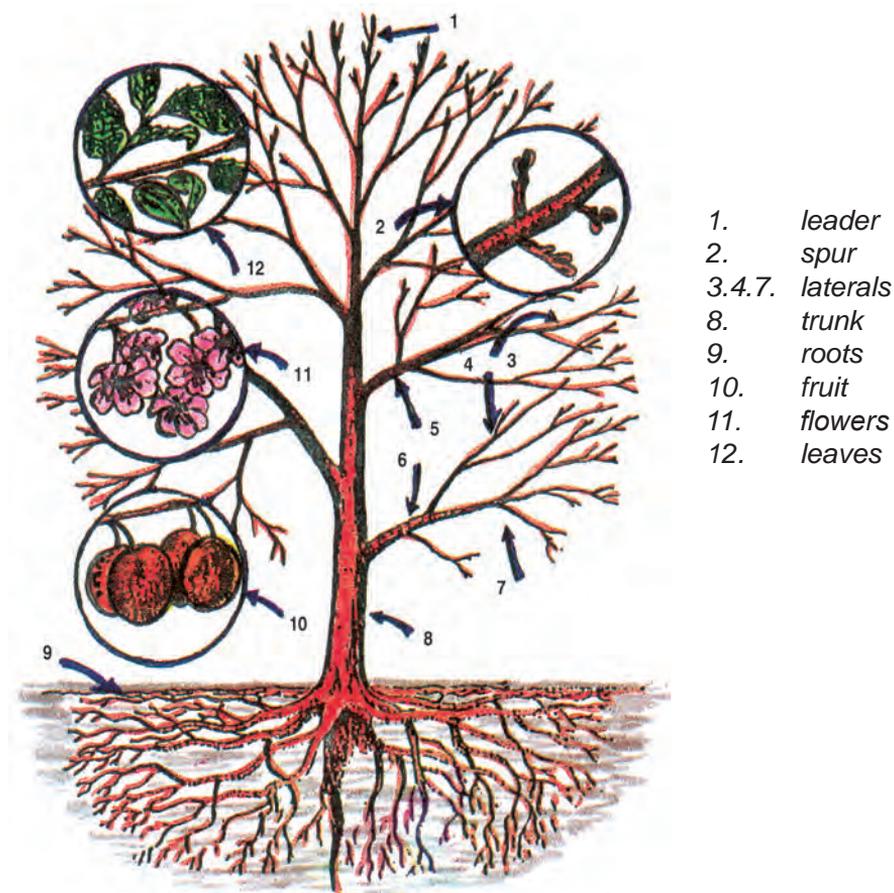
**5. Say whether the following statements are True or False. If false, explain why.**

- a. All plants require water for growth.
- b. Plants receive water only from rain.
- c. They loose most of the water through their leaves by transpiration.
- d. There is only one way to water plant efficiently.
- e. Rows of trees are easily irrigated if we make parallel furrows on either of the sides of the trees.
- f. With a couple of turns of a soaker hose around a tree water is distributed evenly.

**6. Based on the text join the pairs of sentences using the words in the parentheses.**

- e.g. Keep a close eye on your trees. Then determine when they need water, **(after)**  
After keeping a close eye on your trees, determine when they need water.
- a. Make a shallow basin around the tree. Then supply with sufficient water. **(before)**
- b. Dig parallel furrows on either of the sides of the trees. Then irrigate them. **(after)**
- c. Put some fertilizer on the grass. After that provide it with water. **(before)**
- d. Consider your plants' needs. Then determine the best type of sprinkler and nozzles for your particular irrigation requirements. **(after)**

## The basic anatomy of the tree



The parts of all plants are the same, even though they don't always look alike, and the main of them are:

**Roots:** They serve two major purposes; they anchor the plant and they absorb water and necessary nutrients.

**Stem or Trunk:** You can think of this part of the plant as a pair of plumbing pipes, one inside the other, wrapped in bark. The **inner** pipe carries water and minerals from the roots up to the branches, leaves, flowers and fruit. The **outer** pipe carries food down from the leaves to the rest of the plant. Another function of the stem is obviously the support of branches, leaves, flowers and fruit.

**Branches:** They serve as a framework for the leaves and are named according to their position on the trunk. The **leader** is the central, highest branch; a continuation of the trunk itself. **Scaffold** branches are the main side branches. **Lateral** branches emerge horizontally from scaffold limbs. **Hangers** are lateral fruit-tree branches that drop after bearing the weight of the previous year's crop. **Spurs** are the short twigs or branchlets that bear flowers and fruit. **Suckers** are leafy shoots that sprout at a tree's crown or from its roots. Because they may rob the plant of nutrients and water, they normally should be removed. **Water sprouts** are shoots that grow above the pruned parts of a tree.

**Leaves:** Food is manufactured mainly in the leaves by the sun. The process of photosynthesis creates carbohydrates through the action of chlorophyll in the leaves combined with the energy of the sun.

**Flowers and fruits:** Flowers are the sexual portion of plants that produce seeds for reproduction.

## A. Questions

1. What are the main parts of a tree?
2. Which two major purposes do the roots serve?
3. Refer to the three functions of the stem.
4. "Branches serve as a framework for the leaves". What does the word "framework" imply?
5. Name the kinds of branches and give their basic functions in the tree.
6. Leaves are "the food factory" of the tree. Explain the process.

## B. Exercises

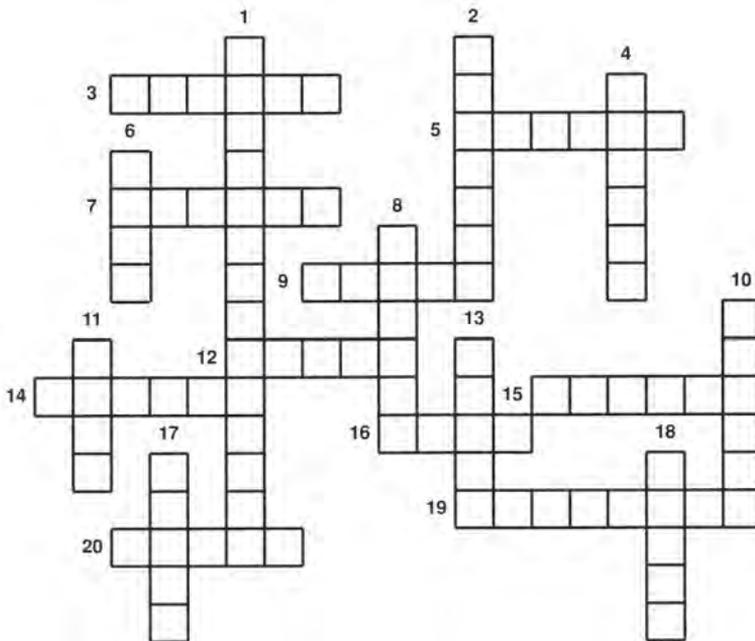
1. Complete the table below:

verb	noun
serve	.....
anchor	.....
function	.....
support	.....
weigh	.....
rob	.....
remove	.....
combine	.....

**2. Match the words in column A with their meaning in column B.**

- | A              | B               |
|----------------|-----------------|
| a. even though | 1. aim / target |
| b. main        | 2. support      |
| c. purpose     | 3. although     |
| d. anchor      | 4. cover        |
| e. absorb      | 5. basic        |
| f. wrap        | 6. suck in      |

**3. Solve the puzzle.**



1. the production of special sugar-based substances that keep plants alive, caused by the action of sunlight on the green matter (chlorophyll) in leaves
2. to act together
3. to (cause to) be fixed firmly
4. the part of a plant, often beautiful and coloured, that produces seeds or fruit
5. chiefly; basically
6. the strong outer covering of a tree
7. to take or suck in liquids
8. leafy shoot that sprouts at a tree's crown or from its roots

9. to cut off or shorten some of the branches of (a tree or bush) in order to improve the shape, growth, production of flowers or fruit
10. to (cause to) grow or come out
11. to allow to / make sth to fall
12. the thick main stem of a tree
13. the top of a tree
14. an armlike stem growing from the trunk of a tree
15. the central, highest branch of a tree
16. the part of the plant that grows down into the soil in search of water and necessary nutrients
17. that part of a plant or tree that contains the seeds and is used as food (e.g. apples, bananas)
18. covered with many leaves
19. a chemical or food providing what is needed for life and growth
20. to (cause to) break suddenly, esp. by pressure from within; (of a flower, leaf) to open suddenly

**4. Say whether the following sentences are True or False. If false, explain why.**

- a. The parts of all plants are the same, even though they don't always look alike.
- b. The trunk anchors the plant and absorbs water and necessary nutrients.
- c. The roots support the branches, leaves, flowers and fruit.
- d. The stem of a plant works as a pair of plumbing pipes, one inside the other, wrapped in bark.
- e. Spurs are leafy shoots at a tree's crown or at its roots.
- f. Lateral branches are the main side branches.
- g. The process of photosynthesis creates carbohydrates through the action of chlorophyll in the leaves combined with the energy of the sun.

**5. Fill in the blanks using one of the following words: carbohydrates, bearing, laterals, sprout, scaffold, roots, combined.**

- a. \_\_\_\_\_ support the plant and they absorb water and necessary mineral nutrients.
- b. The basic framework of a tree consists of the trunk and the \_\_\_\_\_, that is to say, the main side branches.
- c. \_\_\_\_\_ are secondary side branches, mainly horizontal.
- d. Hangers drop after \_\_\_\_\_ the weight of the previous year's crop.
- e. Suckers are leafy shoots that \_\_\_\_\_ at a tree's crown or from its roots.
- f. The photosynthesis creates \_\_\_\_\_ through the action of the chlorophyll in the leaves \_\_\_\_\_ with the energy of the sun.

## 6. Put the verbs in brackets in their suitable form.

- a. Before leaves and new stems \_\_\_\_\_ (**appear**), they \_\_\_\_\_ (**exist**) in small swellings on the stems and branches \_\_\_\_\_ (**call**) "buds". In spring, buds \_\_\_\_\_ (**swell**) and \_\_\_\_\_ (**lengthen**) into stems, \_\_\_\_\_ (**unfurl**) into leaves and \_\_\_\_\_ (**burst**) into flowers. After the flowers \_\_\_\_\_ (**produce**) fruit and the fruit \_\_\_\_\_ (**be**) almost ripe, seeds \_\_\_\_\_ (**form**) and the growth in most plants \_\_\_\_\_ (**stop**).
- b. Although branches go on \_\_\_\_\_ (**thicken**) and fruit \_\_\_\_\_ (**sweeten**) and drops, no more leaves, flowers or fruit \_\_\_\_\_ (**appear**) until next spring. Soon, leaves \_\_\_\_\_ (**fall**) from deciduous plants, and evergreen plants will become dormant.
- c. If you \_\_\_\_\_ (**look**) closely at buds, you \_\_\_\_\_ (**see**) that there are three main kinds: terminal, lateral and flower.

## Working out garden designs

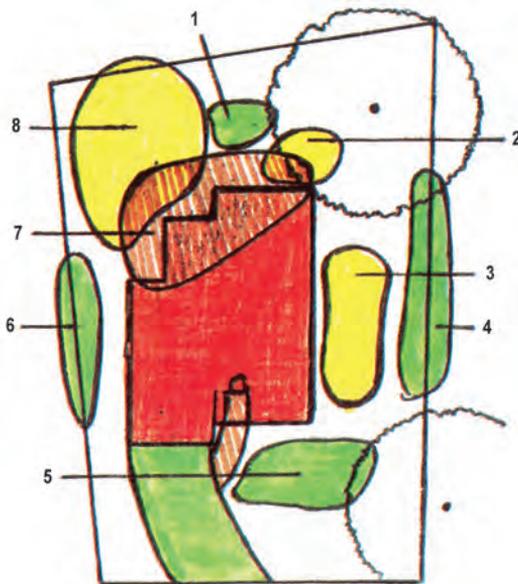
You can always find places and plants that will suit your fancy. The same garden visited at different seasons will show entirely different faces and moods, teaching new lessons and providing new delights. The people who tend gardens are always adding plants they've never grown before and chucking out others they've been tired of. Where there had been strictly perennials, there can also be annuals. The vegetable garden can change in size and shape and grass walks can become pavings. In short, the garden is expanding at every turn, as new plants and new planting ideas are introduced. With all these alterations, the garden lacks some of the fullness that will come in a year or so, but it shows the vitality of a landscape where people have worked hard.

Most gardens show their best in spring and early summer, seasons during which you may come across the best blooming varieties of plants.

No matter what kinds of plants you grow in your garden, the designing for its construction is essential. Some people can make designs easily, but most people need time to find a good answer to a design problem. Fortunately, tracing paper is as cheap as it is necessary. Don't give form to your sites before working out several conceptual designs. If you use tracing paper as a base plan, you can easily change your mind or refine your plan and select actual materials and dimensions. But if you try to give form to any landscape without having decided which plan to follow, there is a high possibility of difficulty or failure.

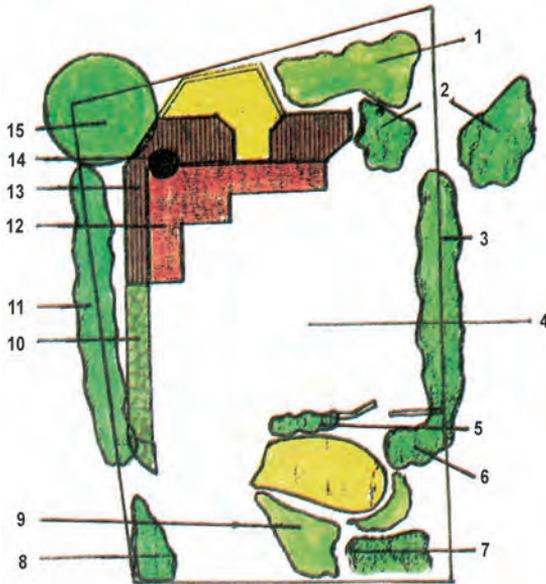
Here follow two samples of plans you can use, or choose one, or make a combination.

### **Bubble plan**



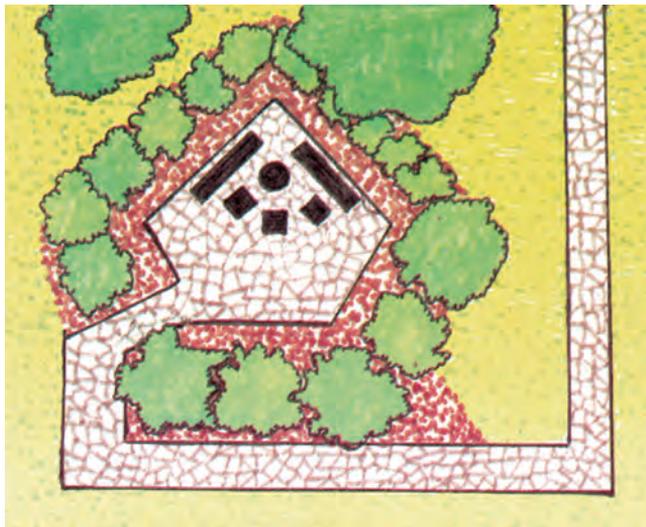
1. *Lawn*
2. *Small deck*
3. *Play area*
4. *Screen planting*
5. *Lawn and flower beds*
6. *Screen planting*
7. *Sunscreen*
8. *Deck and hot tub*

The first step in making a concept drawing is to do several “bubble” plans on tracing paper laid over your base plan. With nothing more than sketchy circles – bubbles– indicate the specific areas you want to include in your final landscape (lawn areas, decks, play areas, etc.) and how you want them situated.



1. Ground cover
2. Mixed shrubs
3. Shrub screen
4. Play area
5. Evergreen shrubs
6. Tall flowering shrubs
7. Deciduous shrubs
8. Mixed shrubs
9. Ground cover
10. Rock path
11. Shrub screen
12. Wood overhead
13. Wood deck
14. Hot tub
15. Conifer tree

After using the bubble plans to determine the size of the basic space and the way the plans and the space should be combined, refine the ideas with concept drawings. At the concept stage, however, you should still feel free to change your mind as often as you like. The final concept drawing should be fairly specific and accurate, containing the type of detailed information shown in the plan.



*Final concept drawing*

## A. Questions

1. Does a garden appear the same throughout the year?
2. How, do you think, can a garden change shape?
3. What does the expression “vitality of a landscape” imply?
4. When and why do most gardens show their best?
5. What is essential for the proper construction of your garden?
6. Can most people easily find a good answer to a design problem?
7. Which paper is suitable for conceptual designs?
8. Why is this paper useful?
9. When is there a high possibility of difficulty or failure?
10. What is the first step in making a concept drawing?
11. What do “bubbles” indicate?
12. What's the difference between the concept stage and the final concept drawing?

## B. Exercises

1. Match the synonymous meanings from columns A and B.

A	B
1. design	a. drawing paper
2. tracing paper	b. plan
3. landscape	c. improve
4. refine	d. creative idea
5. bubbles	e. site
6. concept	f. pattern
7. sample	g. protecting from the sun
8. sunscreen	h. sketchy circles

2. Find the words in the text meaning the following:

- a. A piece of land, often near a house, on which flowers and vegetables may grow.
- b. Living organisms that have leaves and roots and grow usually in earth, especially the kinds which are smaller than trees.
- c. Plants which live for more than two years.
- d. Plants which live for only one year or season.
- e. Completeness.
- f. Paths of grass for walking.
- g. Being flowered.

**3. Based on the text, match the following to give meaningful expressions.**

conceptual	paper
tracing	plan
base	design
actual	materials
high	circles
sketchy	possibility
detailed	shrubs
deciduous	decks
wood	information
conifer	trees

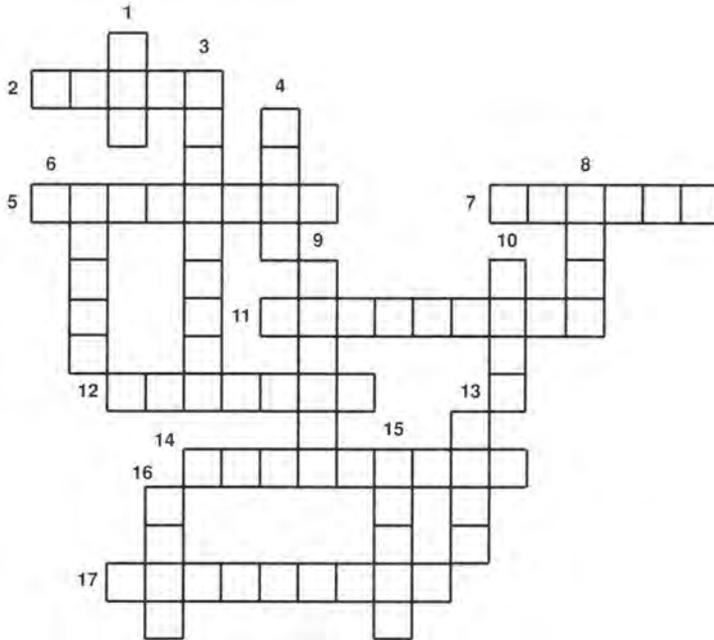
**4. Complete the sentences with one of the following words:**

deciduous, shrubs, evergreen, lawn, conifer, drawing, tracing, plan, trees, bushes, landscape

- a. Who is going to cut the \_\_\_\_\_, while we are on holidays?
- b. \_\_\_\_\_ papers are useful for a base \_\_\_\_\_.
- c. Most of the \_\_\_\_\_ trees keep their leaves in winter.
- d. \_\_\_\_\_ are usually low bushes with several woody stems.
- e. The leaves of \_\_\_\_\_ usually fall off seasonally.
- f. \_\_\_\_\_ trees and most of the \_\_\_\_\_ do not lose their leaves in winter.
- g. Do not try to give form to any \_\_\_\_\_, without having decided which plan to follow.
- h. Your final \_\_\_\_\_ should be specific.

**5. Solve the puzzle.**

1. put sth on/over sth
2. a measurable interval or distance between two or more objects
3. (a tree or bush) that does not lose its leaves in winter
4. a way made by people walking over the ground
5. free of mistakes; exactly correct
6. costing little
7. a drawing (usu. showing how something is to be made)
8. place; a piece of ground for building on
9. example; specimen
10. an area of grass cut short and smooth
11. natural surroundings in a particular area



- 12. a creative idea or thought
- 13. shape; appearance; figure
- 14. a measurement in any one direction
- 15. plant with woody stem, lower than a tree and (usu.) with several separate stems from the root
- 16. an act, esp. in a set of actions, which should produce a certain result
- 17. (of plants) losing their leaves regularly, esp. in autumn

**6. Fill in the gaps with the proper form of the verbs in brackets.**

- a. Unless you \_\_\_\_\_ (work out) several conceptual designs you \_\_\_\_\_ (not give) form to your sites.
- b. If you \_\_\_\_\_ (use) tracing paper as a base plan, you can easily change your mind.
- c. If you \_\_\_\_\_ (use) tracing paper as a base plan, you could easily change your mind.
- d. If you \_\_\_\_\_ (use) tracing paper as a base plan, you could have easily changed your mind.
- e. If you tried to give form to any landscape without having decided which plan to follow, there \_\_\_\_\_ (be) a high possibility of failure.

**7. Rewrite the sentences using the prompts given.**

- a. You can always find places and plants that will suit your fancy.  
Places and plants that will suit your fancy.....
- b. The same garden visited at different seasons will show entirely different faces and moods.  
Entirely different faces and moods of the same garden.....
- c. The people who tend gardens are always adding new plants.  
New plants .....
- d. Gardeners must chuck out some old plants.  
Some old plants .....
- e. During spring or early summer, you may meet the best blooming varieties of plants.  
The best blooming varieties of plants .....
- f. Indicate the specific areas you want to include in your final landscape.  
The specific areas .....

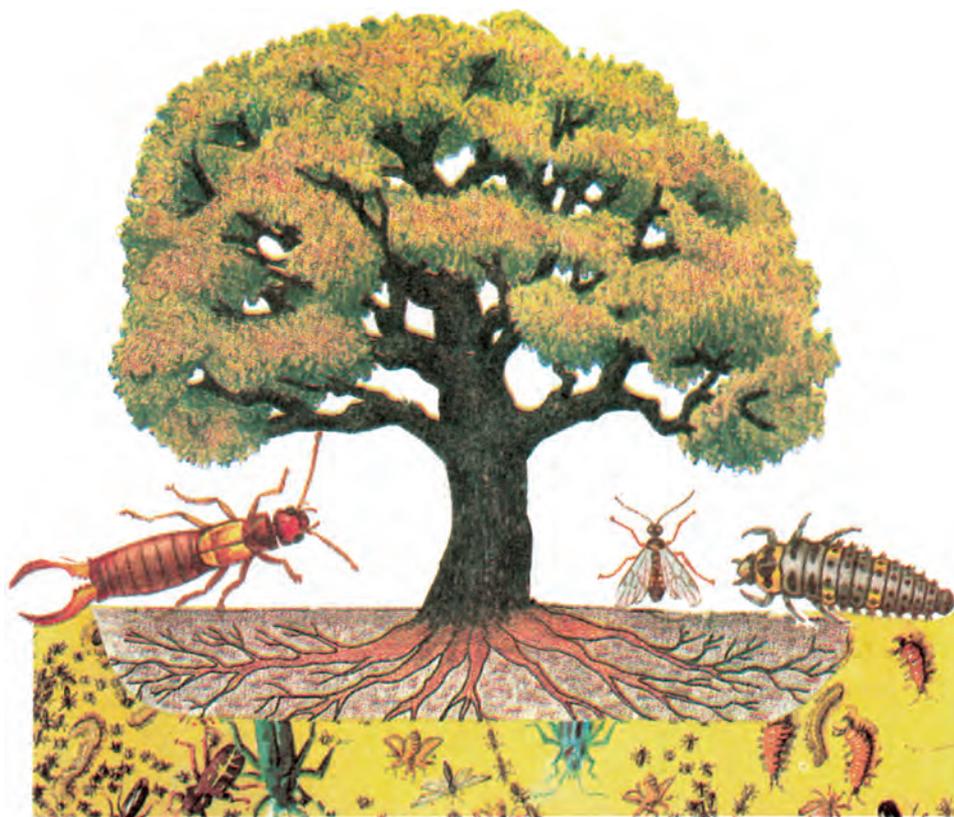
**Insects and other enemies of plants**

Insects are the largest group of living creatures. More than 1,000,000 species are known up to now. They are mainly adapted to life on land but some live in an aquatic or semiaquatic environment.

With the exception of some insects useful to man (bee, silkworm, cochineal insect, etc.) and some others helpful in agriculture as they are fed on noxious insects (staphylinus, coccinella and some hymenoptera or diptera), almost all other insects are harmful. Some species (liparis, phylloxera, polichrosis botrana, mediterranean fly, etc.) can multiply easily and are serious enemies of different plants. All these noxious insects can be attacked either

biologically (used as food for insect-fed vertebrates and insects) or chemically (by the use of pesticides).

*Dacus oleae* is the most threatening insect for olive-trees which are widely cultivated in our country.



**Injury:** The olives are covered with light-brown to blackish-brown spots (decay), which are usually slightly sunken. Mature fruits affected by these symptoms nearly always drop. On cutting open an infested olive, galleries of irregular shape containing whitish larvae and their brown excrements will be found inside the fruit. The distribution of the olive fruit fly is confined to the Mediterranean zone, and it is the chief enemy of olive cultivation. *Dacus oleae* very greatly reduces the yields of olive fruits and oil, sometimes by as much as 80-90%.

**Control:** *Dacus oleae* can be successfully controlled by using the proper insecticides. The first spray applications on table olives should be carried out as soon as the flies begin to lay eggs on the fruits. Olives grown for oil production should be treated a little later. The treatment should be repeated at intervals of 20 days.



***Dacus oleae***

**1)** *D. oleae*; top: magnified, bottom: natural size, **2)** Different forms of damage caused on olives, **3)** Larva (magnified), **4)** Pupa (magnified), **5)** Green fruit with pupa of summer generation, **6)** Ripe fruit with larva.

Other enemies of trees and plants are:



**FUNGUS DISEASES**

*(Including powdery mildew and rust.) Spread by wind and splashing water and overwinter on plant debris.*



**APHIDS**

*Soft-bodied, green, brown, or reddish insects that suck plant juices.*



**BEETLES**

*Beetle larvae eat plant roots.*



**MITES**

*Minute pests that suck juices from underside of foliage.*



**BOTRYTIS BLIGHT**

*(Gray Mold) A fungus disease that overwinters on infected plant parts.*



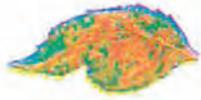
**CATERPILLARS**

*Larvae of moths and butterflies that feed on foliage, buds, and flowers.*



**WHITE FLIES**

*Nymphs are scalelike flat, oval, pale green, brown, or black, depending on the species.*



### **VIRUS DISEASES**

*Spread by propagation of infected plants, aphids, and sometimes leafhoppers.*



### **THRIPS**

*Tiny, brownish-yellow, winged insects.*

Last but not least, there exist the **weeds** which belong to another group of plants' enemies, as they prevent plants from proper growth. They are undesirable plants growing wild, especially on cultivated grounds to the disadvantage of a crop, lawn, or a flower-bed.

To prevent plants from all the above mentioned enemies an application of insecticides, fungicides or herbicides is the solution.

## **A. Questions**

1. Do all insects live on land?
2. Refer to some insects useful to man or in agriculture.
3. How can the noxious insects be attacked?
4. How do olives appear when they have been attacked by *dacus oleae*?
5. Why is the olive fruit fly considered to be the chief enemy of olive cultivation?
6. How can *dacus oleae* be successfully controlled?
7. When should the first spray applications on olives be carried out?
8. How often should the treatment be repeated?
9. How do the beetle larvae harm a tree?
10. What do caterpillars feed on?
11. What do white flies' nymphs look like?
12. How are virus diseases spread?
13. Which insects, among the ones mentioned in the text, suck plants juices?
14. What kinds of cultivations do weeds harm?

## **B. Exercises**

### **1. Find the words in the text which mean the following:**

- a. small creatures with no bones and a hard covering, having 6 legs, and a body divided

into 3 parts, such as ants and flies

- b. groups of plants or animals that are of the same kind and which can produce young of the same kind
- c. taking place in or on water
- d. animals, birds, fish, etc. which have a back bone
- e. chemical substances used for destroying pests
- f. harm; damage to a living organism
- g. changes which show disease or disorder
- h. an insect in the first stage of its development after coming out of its egg
- i. unwanted wild plants growing in ground that is under cultivation
- j. selective weed killers

**2. Match the words in the first column with the appropriate words or explanations in the second one.**

**A**

- a. noxious
- b. be attacked
- c. mature
- d. affected
- e. gallery
- f. yield
- g. oil
- h. foliage

**B**

- 1. be fought
- 2. the amount that is produced, as of fruit
- 3. attacked (by a disease)
- 4. harmful
- 5. fatty liquid extracted from olive fruits, used for cooking
- 6. fully grown and developed
- 7. all the leaves of a tree
- 8. a covered passage, partly opened at one side

**3. Fill in the table below.**

	verb	noun	adjective
a.	live	_____	_____
b.	_____	_____	useful
c.	_____	_____	helpful
d.	_____	_____	harmful
e.	_____	distribution	_____
f.	_____	cultivation	_____
g.	_____	production	_____
h.	repeat	_____	_____
i.	_____	_____	different
j.	_____	wind	_____
k.	prevent	_____	_____
l.	grow	_____	_____
m.	_____	application	_____

**4. Can you guess what the following descriptions refer to? The first one is done for you as an example.**

They are the largest group of living creatures.

Do you mean the **insects**?

- a. They are insects, which make sweet honey, live in groups, can sting painfully and are supposed to be very busy.
- b. It's the most threatening insect for olive-tree cultivation.
- c. They are soft-bodied, green, brown or reddish insects that suck plants juices.
- d. They are larvae of moths and butterflies that feed on foliage, buds and flowers.
- e. They are unwanted wild plants which prevent crops or garden flowers from growing properly.

**5. Fill in the blanks with the missing words.**

	<b>Positive</b>	<b>Comparative</b>	<b>Superlative</b>
a.	_____	_____	largest
b.	useful	_____	_____
c.	helpful	_____	_____
d.	serious	_____	_____
e.	light	_____	_____
f.	_____	_____	most important
g.	little	_____	_____
h.	soft	_____	_____
i.	wild	_____	_____

**6. Fill In the blanks with the appropriate prepositions.**

- a. Most insects are adapted \_\_\_\_\_ land, but some live \_\_\_\_\_ an aquatic or semiaquatic environment.
- b. The insects which are fed \_\_\_\_\_ noxious insects are helpful \_\_\_\_\_ agriculture.
- c. Noxious insects can be attacked chemically \_\_\_\_\_ the use \_\_\_\_\_ pesticides.
- d. *Dacus oleae* is a serious enemy \_\_\_\_\_ the olive trees.
- e. The olives are covered \_\_\_\_\_ light-brown \_\_\_\_\_ blackish-brown spots.
- f. The first spray applications \_\_\_\_\_ table olives should be carried \_\_\_\_\_ when the flies lay eggs \_\_\_\_\_ the fruits.
- g. The treatment should be repeated \_\_\_\_\_ intervals \_\_\_\_\_ 20 days.
- h. Fungus diseases are spread \_\_\_\_\_ wind and splashing water.

- i. Mites are minute pests that suck juice \_\_\_\_\_ underside \_\_\_\_\_ foliage.
- j. Farmers use insecticides, fungicides or herbicides to prevent plants \_\_\_\_\_ their enemies.

**7. True or False? If false, explain why.**

- a. Insects are the smallest group of living creatures.
- b. All insects are harmful in agriculture.
- c. *Dacus oleae* is a fertilizer.
- d. The distribution of the olive fruit fly is spread to the whole of Europe.
- e. *Dacus oleae* increases the yields of olive fruits and oil, sometimes by as much as 80-90%.
- f. The first spray applications on table olives should be carried out when the flies begin to lay eggs on the fruits.
- g. The treatment for *dacus oleae* should be repeated every week.
- h. Beetles larvae eat plant roots.



## Field crops: the basic source of food



The basic kinds of food have remained the same in the last two thousand years. It can be said that all of our food comes from plants because most animals eat plants.

**Cereals** or **grains** belong to the most important categories of food items and they require almost half of the world's cropland. *Wheat, barley, rye, oats,* and *corn* (parts of which are used as forage or as a source of sugar, starch and whisky production) are among the most widely cultivated cereals. Cereals may be cooked in their natural state or they may be processed into breads, pastas or beverages. Grains offer a balanced diet as they contain carbohydrates, proteins, minerals, vitamins, and a little fat. Grain crops are annuals while pasture grasses in open meadows are perennials. Another widespread essential food is the **rice**. Rice, unlike other cereals, grows in water for part of its life cycle, and its thousands of varieties are mainly developed in southeastern Asia.

**Legumes**, another important group of food, are the main source of proteins. Legumes are deep-rooting and they are resistant to drought. *Beans, peas, soybeans, lentils* and *chickpeas* are some of the most important legumes. Legumes can enrich the soil and they help the growth of other crops.

**Cotton** and **tobacco** are two crops which are widely cultivated in Greece. Cotton is an annual and it is sown on well-tilled land. Careful weeding and irrigation, as well as the application of the appropriate fertilizers and insecticides are necessary. Tobacco is a perennial as a wild plant, but when cultivated it is an annual.

**Potatoes** are edible tubers of cultivated plants which grow in any fertile soil except heavy clayey or wet, undrained land. They are one of the easiest crops to raise and they are expected to be of high quality as long as the soil is fertilized with phosphate and potash. They are very nutritious because they contain carbohydrates, proteins and minerals.

**Onions, garlic, leeks** —which are biennials— belong to the bulb plants. They are an essential kind of food as they assist in the functioning of the blood circulation.

**Tomatoes** are plants bearing pulpy berries which —when ripe— are eaten raw or cooked as vegetables. They are annuals and they need rich soil and a lot of water to produce a nutritious, high in sugar and vitamins vegetable. In our country we have tomato produce all the year round, as tomatoes are cultivated in greenhouses.

Some other common **vegetables** grown in our country are *carrots, lettuces, cabbages, pumpkins, marrows, cauliflowers, broccoli, radishes, eggplants* and *okras*. They are easily cultivated in all types of soil and are highly nutritious because they contain a lot of protein and fiber which is utterly necessary to fight against digestive disorders.

Except for the above mentioned field crops, different kinds of **fruit** are also very useful to humans or animals, thanks to their high nutritive value. *Apples, cherries* and *pears* are common garden **tree fruits**, usually grown in warm lowlands. They need good soil, little summer rain and a lot of sunshine. **Citrus fruits** such as *lemons, oranges, citrons* and *mandarins* need abundant sunshine and frost-free conditions. The **grapevine** needs a warm and sunny climate. Apart from the grapes, the wine produced reinforces the cheerful and warm-hearted nature of people.

## A. Questions

1. Which category of food items requires half of the world cropland?
2. Refer to some well known cereals.
3. What are some of the corn's uses?
4. Are the cereals cooked only in their natural state?
5. Why do the grains offer a balanced diet?
6. Are grain crops and pasture grasses annuals or perennials?
7. Where does rice grow?
8. Why are legumes an important group of food?
9. Which are some of the most common legumes?
10. What information about cotton do you get from the text?
11. Can potatoes be cultivated in any kind of soil?
12. What do potatoes contain?
13. Why are onions, garlic and leeks essential food?
14. Do we have tomato produce in our country only in a certain season?
15. Which of the vegetables mentioned in the text do you mostly eat?
16. In which type of soil are carrots, cabbages and broccoli cultivated and why are they highly nutritious?
17. Which factors are necessary for the proper growth of apples, cherries and pears?
18. Name the citrus fruits mentioned in the text.
19. Why, do you think, grapevines are mostly cultivated in Mediterranean countries?



## B. Exercises

### 1. Match the words in column A with the words in column B.

A	B
a. cultivate	1. grains
b. basic	2. dryness
c. cereals	3. largely
d. require	4. grow field plants
e. meadow	5. completely
f. drought	6. of two years
g. widely	7. field
h. biennial	8. essential / most important
i. utterly	9. protect against
j. fight (against)	10. cover; demand

### 2. Choose the correct item.

- Wheat and barley belong to the group of \_\_\_\_\_.  
1. legumes, 2. vegetables, 3. cereals.
- Rice grows in \_\_\_\_\_ for part of its life cycle.  
1. mud, 2. water, 3. dry soil.
- Grain crops are \_\_\_\_\_.  
1. annual, 2. biennial, 3. perennial.
- Legumes are the main source of \_\_\_\_\_.  
1. carbohydrates, 2. minerals, 3. proteins.
- Legumes can make the soil \_\_\_\_\_.  
1. sterile, 2. wet, 3. fertile.
- For potatoes to grow, the soil has to be fertilized with \_\_\_\_\_.  
1. bone-meal, 2. nitrates, 3. phosphate and potash.
- Tomatoes need \_\_\_\_\_ to produce nutritious vegetables.  
1. a lot of water, 2. little water, 3. no water.
- In our country we have tomato produce  
1. only in the summer, 2. all the year round, 3. only in winter.
- Onions and garlic help the proper function of the \_\_\_\_\_.  
1. blood circulation, 2. respiratory system, 3. nervous system.
- The grapevine needs \_\_\_\_\_ climate.  
1. a cold, 2. a warm and sunny 3. rainy.

**3. Based on the text, fill in the blanks below:**

Cereals or \_\_\_\_\_<sup>(1)</sup> are believed to be some of the most important food \_\_\_\_\_<sup>(2)</sup> and they \_\_\_\_\_<sup>(3)</sup> cultivated in half of the world's \_\_\_\_\_<sup>(4)</sup>. Some of the basic cereals are wheat, barley, rye, oat and \_\_\_\_\_<sup>(5)</sup>. Part of the corn is used as \_\_\_\_\_<sup>(6)</sup>. It also provides sugar, \_\_\_\_\_<sup>(7)</sup> and \_\_\_\_\_<sup>(8)</sup>. Cereals may be processed into breads, \_\_\_\_\_<sup>(9)</sup> or beverages. They contribute to a \_\_\_\_\_<sup>(10)</sup> diet because they contain proteins, minerals, \_\_\_\_\_<sup>(11)</sup>, vitamins, and a little \_\_\_\_\_<sup>(12)</sup>.

Another widespread \_\_\_\_\_<sup>(13)</sup> food is rice. It \_\_\_\_\_<sup>(14)</sup> in water for part of its life \_\_\_\_\_<sup>(15)</sup>. Its thousands of \_\_\_\_\_<sup>(16)</sup> are mainly \_\_\_\_\_<sup>(17)</sup> in \_\_\_\_\_<sup>(18)</sup> Asia.

**4. Complete the following table.**

	<b>verb</b>	<b>noun</b>
	grow	_____
	cultivate	_____
	offer	_____
	contain	_____
	develop	_____
	_____	weeding
	_____	irrigation
	_____	application
	produce	_____
	expect	_____
	need	_____
	circulate	_____
	_____	quality
	reinforce	_____
	fertilize	_____

**5. Say whether the following statements are True or False. If false, explain why.**

- Grain crops are annual.
- Beans and oats belong to the same group of crops.
- Cotton is sown on well-tilled land.
- Tobacco is always an annual.
- Potatoes grow in any fertile soil except heavy clayey or wet, undrained land.
- Carrots, broccoli and cauliflowers are highly nutritious because they contain a lot of protein and fiber.

- g. Apples, cherries and pears grow in cold lowlands.
- h. Lemons and oranges are citrus fruits.

**6. Give the appropriate form of the verbs in brackets.**

- a. The basic kinds of food \_\_\_\_\_ (remain) the same in the last two thousand years.
- b. It \_\_\_\_\_ (say) that all of our food comes from plants because most animals \_\_\_\_\_ (eat) plants.
- c. The cereals may \_\_\_\_\_ (cook) in their natural state.
- d. Legumes \_\_\_\_\_ (be) deep-rooting.
- e. Legumes can \_\_\_\_\_ (help) the growth of other crops.
- f. Fertilizers and insecticides should \_\_\_\_\_ (apply) for the appropriate cultivation of cotton.
- g. Cotton \_\_\_\_\_ (sow) on well-tilled land.
- h. Potatoes are one of the easiest crops \_\_\_\_\_ (raise).

**7. Making the necessary changes, add the suitable prefix or suffix to form the opposite meaning of the following:**

e.g. possible - impossible, colourful - colourless

- a. important .....
- b. natural .....
- c. like .....
- d. appropriate .....
- e. necessary .....
- f. careful .....
- g. fertile .....
- h. cheerful .....

## Ag Machines preparing the soil for cultivation



Plants grow better when fields are properly prepared for cultivation. Many special machines are used for different agricultural tasks. Potato diggers and planters, beet and bean planters, transplanters, cultivators for beets, beans and vegetables belong to the necessary cultivation equipment a farmer needs to perform his operations.

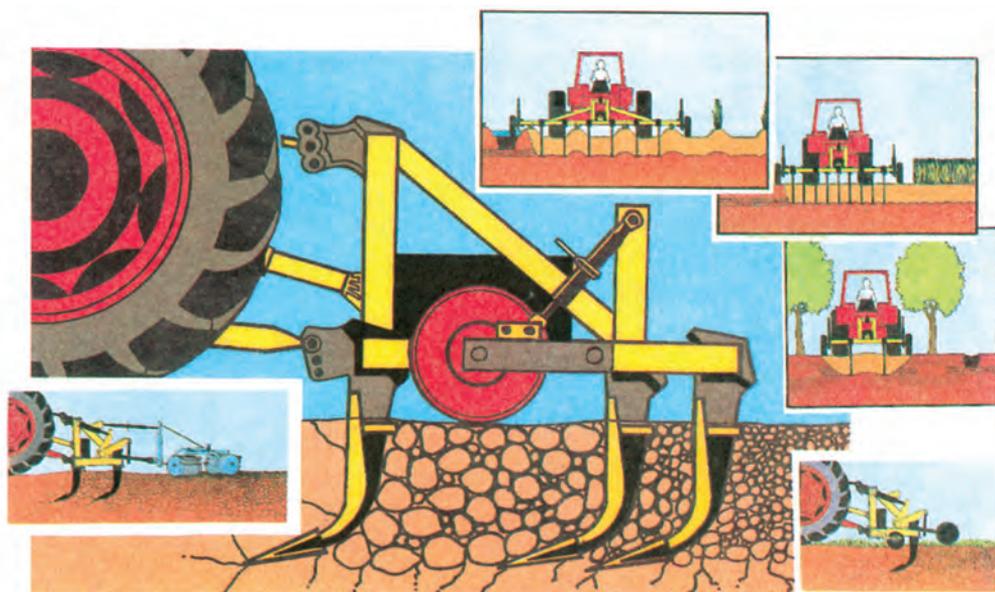
Perhaps, the most important mechanical development in farming is the **tractor**. The tractor is an exceptional machine for various agricultural operations and it is versatile enough and efficient for cultivating, sowing, reaping, pumping water, hauling and generally for any farming, gardening or mowing tasks. It's a powerful motor-driven vehicle with large, heavy treads.

### **Types of tractors:**

- *General - purpose tractors*. These tractors may be used on most farms and they are the most common type used today.
- *Two - wheeled tractors*. They are used in market gardens and they are hand-operated. They do light cultivations and they are steered by a walking operator.

- *Track-laying tractors.* These tractors are capable of doing very heavy work and they are known as “crawlers”.
- *Heavy-wheeled tractors.* These large tractors may be equipped with twin wheels all around, and no longer run in the furrows when ploughing, but they run on top in the same way as a crawler tractor does. They usually carry out very heavy cultivations.

The **plough** is also a necessary agricultural implement used for cutting, lifting, turning over and partly pulverizing the soil. Ploughs are a solution to the problems coming from abrading or heavy soils, or work on rocky tablelands in sloping soils. Their use is quite recommended for recovery of marshes, old meadows or waste lands.



Maximum crop production and minimum costs start at the primary cultivation stage by ensuring that the land is ploughed flat and level. For flat, level work, reversible **disc ploughs** are the answer. Ploughing is simply started at one side of the field and no central or dead furrows are created. The land after ploughing is left flat and level, ensuring maximum water utilization, minimum water run off and control of soil erosion. Designed with simple hydraulic or

mechanical linkages, the disc ploughs ensure that the primary cultivation job is well done. They are regarded as unrivalled machines because of their:

- Efficient, strong, progressive oil reverse shaft under casing.
- Quick, easy and genuine depth adjustment.
- Quick transformation from one motor to another to reduce traction.
- Quick and sure adjustment.

Some of the earliest types of ploughs are still in use in certain parts of the world, but modern ploughs are sturdy and they are easily pulled by tractors.

## **A. Questions**

1. Which machines belong to the necessary cultivation equipment a farmer needs?
2. Why is the tractor a versatile and efficient machine?
3. Which is the most common type of tractors?
4. Refer to the uses of the two-wheeled tractors?
5. What are track-laying tractors otherwise called?
6. Do heavy-wheeled tractors carry out light cultivations?
7. What is the plough used for?
8. Which types of soil are ploughs especially recommended for?
9. Which ploughs are used for, flat and level work?
10. Refer to two qualities of the ploughs which make them regarded as unrivalled machines.

## **B. Exercises**

### **1. Which of the words in the text mean the following?**

- a. a machine that digs
- b. a tool or machine for loosening the soil around growing plants and for uprooting weeds
- c. works; activities
- d. a powerful motor vehicle with large wheels and thick tyres used for pulling farm machinery or other heavy objects
- e. a person who operates a machine or an apparatus
- f. a farming tool with a heavy cutting blade drawn by a tractor or animal(s) used for preparing the soil in a field to be planted
- g. pieces of low-lying land that are all or partly soft and wet
- h. trenches in the earth made by a plough
- i. moved by the pressure of water or other liquids
- j. a long rod transmitting motion to a part of a machine

**2. Match the words of the first column with the appropriate words or explanations of the second one.**

- |               |   |
|---------------|---|
| a. properly   | 1. edible plants or edible parts of a plant     |
| b. task       | 2. to direct the course of a vehicle            |
| c. vegetables | 3. in a right way                               |
| d. versatile  | 4. producing the desired or satisfactory result |
| e. steer      | 5. work; duty                                   |
| f. waste      | 6. real   |
| g. efficient  | 7. non productive; empty                        |
| h. genuine    | 8. having, many different uses                  |

**3. Based on the text, use each of the following words once to complete the blanks in the sentences: *Farmer, vehicles, equipment, planters, level, agricultural, over, mowing, land, special, tasks, implements, exceptional, operations, soil*:**

- Different agricultural \_\_\_\_\_<sup>(1)</sup> need many \_\_\_\_\_<sup>(2)</sup> machines. Diggers, \_\_\_\_\_<sup>(3)</sup>, transplanters and cultivators are necessary cultivation \_\_\_\_\_<sup>(4)</sup>, which a \_\_\_\_\_<sup>(5)</sup> needs for his \_\_\_\_\_<sup>(6)</sup>.
- Tractors are \_\_\_\_\_<sup>(7)</sup> machines used for various \_\_\_\_\_<sup>(8)</sup> operations. They are efficient for any farming, gardening or \_\_\_\_\_<sup>(9)</sup> task. They are motor-driven \_\_\_\_\_<sup>(10)</sup> with large wheels and thick tyres.
- Ploughs are also necessary agricultural \_\_\_\_\_<sup>(11)</sup>. They are used for cutting, lifting, turning \_\_\_\_\_<sup>(12)</sup>, and pulverizing the \_\_\_\_\_<sup>(13)</sup>. The \_\_\_\_\_<sup>(14)</sup> after ploughing is left flat and \_\_\_\_\_<sup>(15)</sup>.

**4. Form the nouns deriving from the verbs in the list below:**

Remember that some nouns have the same formation as their corresponding verbs; e.g. need (*verb*) → need (*noun*).

- |            |       |
|------------|-------|
| a. prepare | ..... |
| b. grow    | ..... |
| c. perform | ..... |
| d. pump    | ..... |
| e. equip   | ..... |
| f. plough  | ..... |
| g. solve   | ..... |

- h. start .....
- i. create .....
- j. design .....

**5. Fill in the table below:**

	noun	adjective
a.	.....	different
b.	.....	agricultural
c.	.....	necessary
d.	.....	important
e.	.....	exceptional
f.	.....	various
g.	.....	versatile
h.	.....	efficient
i.	.....	powerful
j.	.....	heavy
k.	.....	capable
l.	.....	same
m.	.....	waste
n.	.....	flat
o.	.....	central
p.	.....	simple
q.	.....	hydraulic
r.	.....	strong
s.	.....	progressive
t.	.....	quick
u.	.....	easy
v.	.....	genuine
w.	.....	sure
x.	.....	certain
y.	.....	modern
z.	.....	sturdy

**6. Choose the suitable items to complete the blanks.**

*Example:* Ploughs prepare the soil for \_\_\_\_\_.

1. irrigation 2. cultivation 3. harvesting

*Answer:* Ploughs prepare the soil for cultivation.

- a. For plants to grow better, fields must be properly \_\_\_\_\_.  
1. developed 2. cultivated 3. operated
- b. A tractor is a large powerful motor-driven vehicle with large heavy \_\_\_\_\_.  
1. seats 2. engines 3. treads
- c. Ploughs are a solution to the problems coming from \_\_\_\_\_ soils.  
1. abrading 2. light 3. sandy
- d. A reversible disc plough is recommended for flat, \_\_\_\_\_ work.  
1. sloping 2. reversible 3. level
- e. The land after ploughing ensures \_\_\_\_\_ water run off.  
1. minimum 2. maximum 3. medium
- f. Modern ploughs are easily pulled by \_\_\_\_\_.  
1. lorries 2. tractors 3. vans

**7. Say whether the following statements are True or False. If false, explain why.**

- a. The tractor is a farming machine for various agricultural operations.
- b. Two-wheeled tractors are hand-operated.
- c. Track-laying tractors do light cultivations.
- d. Heavy-wheeled tractors are known as “crawlers”.
- e. A plough is used for sowing, reaping and pumping water.
- f. Ploughs are quite recommended for recovery of marshes, old meadows or waste lands.
- g. If the land is ploughed flat and level we have maximum crop production and minimum cost.
- h. Central or dead furrows are created when ploughing with a reversible disc plough.

## A short reference to harvesting and tying pick-up machines



The harvesting of special crops often requires a machine completely different from anything connected to grain or forage harvesting. Different mechanical harvesting systems are in various stages of development. They include combinations of pulling, twisting and snapping motions which are the same as the ones used in handpicking. Some of the machines falling in this category are:

- sweet-corn harvesters
- sugar beet harvesters
- cotton harvesters
- bean harvesters
- peanut harvesters
- citrus harvesters

Mechanical means for detaching the fruit are classified in those that physically contact the fruit, and in those that transmit a force to the fruit. These are referred to: a) *contact machines* which have either a spindle or a comb-like mechanism to detach the fruit, and b) *mass removal machines* which employ some type

of external shaking force which is transmitted to the fruit through the limbs or foliage. Some of the most widespread machines used for detaching fruit are:

- *The mechanical harvester.* It uses comb to detach and collect the fruit. Machines of this type have a low harvest rate. The outside fruit is stripped off by the rotating forks.
- *The trunk shaker.* It harvests tall trees which do not have single tree trunks.
- *The self-propelled limb shaker.* It removes fruit which is picked up later.
- *The foliage shaker.* It employs a vertical shaking motion to detach fruit. Long teeth-like bars clamp on the soft foliage to transmit the motion to the fruit.

The most advanced labour-saving device for grain farming is the *combine*. This machine reaps, threshes, and winnows grain in one operation. It is self-propelled or drawn by a tractor. Rice combines and peanut combines are two typical examples. There are also *feed-grinding machines* to cut and chop some crops like grass, green corn and sorghum. Corn pickers belong to this category. These machines pick the ears up and husk or remove the outer covering of the corn. The shelling attachments and blowers remove the kernels from the corn and finally drop the shelled corn into a container.

Another machine for harvesting crops such as hay is the *baler*. Balers are the most popular hay machines. Modern farm-type balers are automatic tying pick-up machines. They may be trailing or self-propelled. One of the chief functions of balers is the tying of the bales with either twine or wire. A star wheel, whose teeth penetrate the bales, releases the tying mechanism clutch after rotating a predetermined amount to give a definite bale length.

All the above operations are accomplished by the use of diesel or gasoline engines mounted on the machines themselves or contained in the tractor pulling the machine.

The use of farm machinery may increase agricultural production, but in the harvesting of certain crops, human labour may cause less damage than what machines do.

## A. Questions

1. Name the harvesting machines referred in the text.
2. Which tasks are performed by means of the harvesting systems?

3. What kind of machines are the mechanical means for detaching the fruit classified into?
4. Which are some of the most widely spread machines used for detaching fruit?
5. What is the combine used for?
6. What do the feed-grinding machines do?
7. Refer to the functions of the corn pickers.
8. Why are balers the most popular hay machines?
9. Which is one of the basic functions of balers?
10. Why is human labour important as far as harvesting is concerned?

## B. Exercises

### 1. Match the items.

- |                   |  |
|-------------------|--|
| a. harvesting     | 1. belonging to                          |
| b. require        | 2. draw                                  |
| c. connected      | 3. cutting and gathering (grain / crops) |
| d. pull           | 4. speed                                 |
| e. falling in(to) | 5. developed                             |
| f. detach         | 6. remove                                |
| g. rate           | 7. linked / joined                       |
| h. employ         | 8. demand                                |
| i. advanced       | 9. machine                               |
| j. device         | 10. use                                  |

### 2. Match the operations of each machine (column A) with machine's name (column B).

- | A   | B                             |
|---|-------------------------------|
| a. It employs a vertical shaking motion to detach fruit.        | 1. mechanical harvester       |
| b. It reaps, threshes and winnows grain in one operation.       | 2. trunk shaker/              |
| c. It ties the bales with twine or wire.                        | 3. foliage shaker             |
| d. It removes fruit which is picked up later.                   | 4. self-propelled limb shaker |
| e. It uses comb to detach and collect fruit.                    | 5. combine                    |
| f. It harvests tall trees which do not have single tree trunks. | 6. baler                      |

**3. Complete the table below.**

<b>verb</b>	<b>noun</b>
connect	_____
_____	harvest
_____	category
_____	combination
_____	motion
contact	_____
_____	removal
transmit	_____
detach	_____
rotate	_____
_____	shaker
_____	attachment
_____	damage

**4. Say whether the following statements are True or False. If false, explain why.**

- a. Sweet-corn harvesters belong to the category of the tying pick-up machines.
- b. The combine is self-propelled or drawn by a tractor.
- c. Corn pickers are combine machines.
- d. The blowers of the corn pickers remove the ears and the outer covering from the corn.
- e. Balers have star wheels whose teeth penetrate the bales.
- f. Feed-grinding machines collect some crops like grass and green corn.
- g. Modern farm-type balers are automatic machines.
- h. We never use diesel or gasoline engines for balers.

**5. Drawing information from the text, fill in the blanks with the appropriate adjectives.**

- a. The use of farm machinery may increase \_\_\_\_\_ production.
- b. In the harvesting of certain crops, \_\_\_\_\_ labor may cause less damage than what machines do.
- c. One of the \_\_\_\_\_ functions of balers is the tying of bales.
- d. Harvesting machines are completely \_\_\_\_\_ ifrom tying pick-up machines.

- e. \_\_\_\_\_ means for detaching fruit are classified into two categories.
- f. The foliage shaker makes use of a \_\_\_\_\_ shaking motion to detach fruit.
- g. The trunk shaker harvests tall trees which do not have \_\_\_\_\_ tree-trunks.
- h. Balers give the bale a \_\_\_\_\_ length.

**6. Put the (sets of) words in the right order so as to form eight meaningful sentences.**

- a. contact machines / comb-like / spindle / fruit / either / a / or / to detach / have / a / mechanism
- b. fruit / the / long teeth-like / bars / motion / clamp on / the / to transmit / to / the soft foliage
- c. a tractor / is / the combine / self-propelled / by/ or drawn
- d. combines / there / peanut / are / rice combines / and
- e. fruit / mass / to the / removal machines / use / transmitted / some / is / shaking force / which
- f. low / have / harvesters / a / harvest rate / mechanical
- g. the / corn pickers / of / corn / covering / pick the ears up / and / outer / the / husk / remove / or

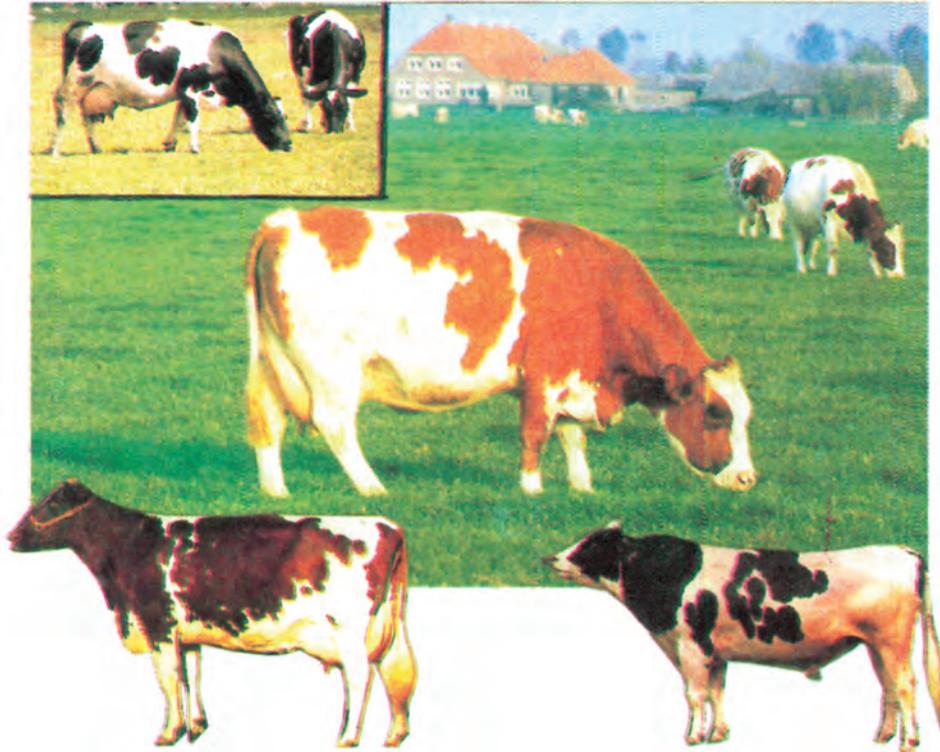
## Breeding animals



When selecting breeding stock, the most important concern is to choose the best animals. The essential features to be considered are their health and their vigor. The performance of an animal depends on its environment, its food, its genetic factors, the diseases it contracts and the way it is treated.

## Environment

If we want to have *dairy cows* of high productivity we must offer them a controlled environment. At the same time, we must offer an adequate working environment to the people working in the barn or the cowshed,

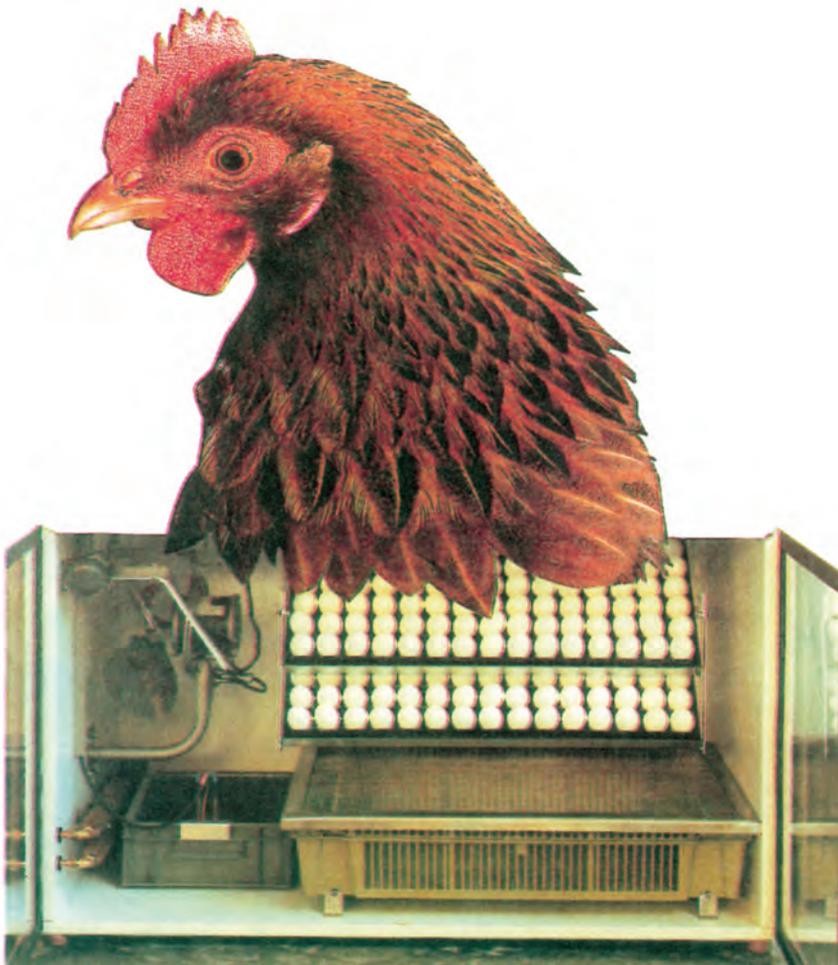


who have to spend many hours a day there, the whole year round. Last but not least, such a barn or cowshed must meet certain conditions for the production of high quality milk.

As far as *rabbits* are concerned they can be housed in outdoor hutches, but it is preferable, particularly with large units, to keep them in simple hutches indoors, ensuring shelter for both stock and attendant. Any building which is well ventilated, dry and free from direct draughts is suitable.



On the other hand, modern technology has greatly contributed to the improvement of *poultry rearing* and *egg production*. For caging layers, rearing pullets and the transfer of eggs, the poulterer can use a fully automatic layer cage system which delivers more eggs per square foot at a lower cost per



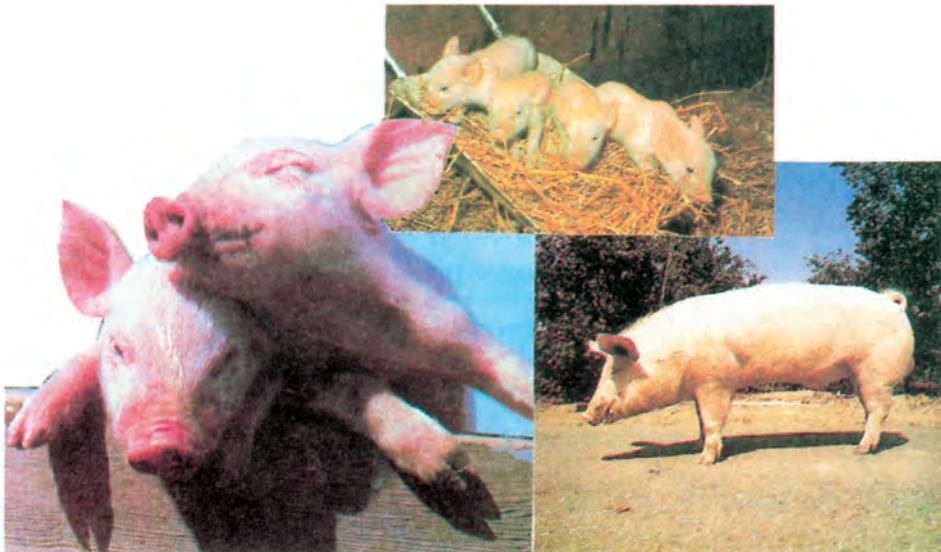
dozen. It includes egg collection, an exclusive egg-saver, and automatic manure removal. It saves energy and labor. It doesn't need any special floor or pit construction and it's easy to install.

### Selecting a breed

When selecting breeding stock, the essential features to be considered are the health and the vigor of the animals. For example, healthy and vigorous *rabbits* are characterized by alertness, brightness of the eyes, smooth and glossy coat, longevity and ability to reproduce profitably, offspring of the desired quality and size.

If one thinks of raising *pigs* their most desirable characteristics are:

A firm and medium body, well-curved ribs, well-shaped hams, light neck and shoulder, straight and firm baseline, well-placed and well-shaped legs with well-developed strong hooves, a well-proportioned and not too heavy head and a straight and narrow snout.



### Feeding

Proper dieting is essential for all animals subjected to the methods of intensive production. The balanced ratio and the composition of the feeding stuffs provided to farm animals are very important for milk production, rapid growth and maintenance of good health. Livestock food varies according to the animals' digestive system, but it must basically consist of water and dry food

which mostly derives from plants. Whatever the dry food comes from, it should contain a proper ratio of carbohydrates, fats and oils, proteins, minerals and vitamins.

### **Diseases**

The good farmer must be able to detect early symptoms of a disease, so that prompt action can be taken to prevent it from spreading and to reduce loss. Some typical symptoms of diseased animals are: high temperature, very high or very low pulse, irregular breathing and loss of appetite. If the stockman sees that the dung and urine are stained with blood, or that the milk quantity in dairy cows falls, or that the eyes become watery or sunken and produce a discharge, he should take immediate action. A common disease, which is caused by bacteria is *Brucella*. It is contracted by human beings and it is called *undulant* or *Malta fever*. People contract it from infected milk or dairy products. The disease causes remittent fever and general exhaustion and it can last for months.

The first major applications of biotechnology in animal agriculture are in the areas of animal growth, reproduction and health. One of the consequences of genetic engineering is the mass production in microorganisms of proteins, including hormones, enzymes, activating factors, amino acids and feed supplements. These biological substances can be used for detection, prevention, and treatment of infectious and genetic diseases or stimulation to growth.

### **A. Questions**

1. What is the most important concern when selecting breeding stock?
2. Which features should be considered?
3. Which factors contribute to the animal's performance?
4. Is a controlled environment important, if we desire dairy cows of high productivity?
5. What kind of building is suitable for rabbits?
6. Why is the fully automatic layer cage system of primary importance, as far as poultry rearing and egg production are concerned?
7. Refer to the features that characterise healthy and vigorous rabbits.
8. What must a good farmer consider, if he wants to raise pigs?
9. According to what does livestock food vary?
10. What must livestock food consist of?
11. Which are some of the typical symptoms of diseased animals?
12. How do people contract Malta fever from animals?
13. Which are the symptoms of this disease?
14. Which is one of the consequences of genetic engineering?

## B. Exercises

### 1. Match the following, so as to form fifteen pairs of synonyms.

- |                   |                             |
|-------------------|-----------------------------|
| a. select         | 1. think seriously about    |
| b. rear           | 2. livestock                |
| c. consider       | 3. farm animals             |
| d. vigor          | 4. establish                |
| e. treat          | 5. state of becoming better |
| f. breeding stock | 6. choose                   |
| g. ensure         | 7. tight                    |
| h. improvement    | 8. shiny                    |
| i. stock          | 9. raise                    |
| j. install        | 10. bring about             |
| k. alertness      | 11. decrease                |
| l. glossy         | 12. take care of            |
| m. firm           | 13. brilliance              |
| n. reduce         | 14. make sure               |
| o. cause          | 15. strength                |

### 2. Complete the table.

verb	noun
select	_____
_____	concern
choose	_____
_____	performance
treat	_____
_____	house
prefer	_____
ventilate	_____
contribute	_____
_____	delivery
_____	removal
_____	construction
install	_____
reproduce	_____
_____	loss
_____	application

**3. Based on pieces of information provided in the text, complete the following sentences.**

- a. A cowshed for dairy cows must respond to certain requirements for .....
- b. It is better to keep rabbits in hutches indoors, because .....
- c. Well-curved ribs and a firm and medium body are not the only .....
- d. Livestock food varies according to the animals' digestive system, but .....
- e. A symptom of a diseased dairy cow is that the eyes .....
- f. The first major applications of biotechnology in animal agriculture are in the field of.....

**4. Match the items from the columns A and B so as to form meaningful expressions.**

A	B
a. vegetarian	1. milk
b. prompt	2. action
c. stained with	3. diseases
d. low	4. health
e. infected	5. pulse
f. remittent	6. symptoms
g. genetic	7. diet
h. good	8. system
i. typical	9. fever
j. layer cage	10. blood
k. manure	11. hutches
l. outdoor	12. removal

**5. Rewrite the sentences using the prompts given.**

- e.g. The farmer selected high quality dairy cows.  
High quality dairy cows *were selected by the farmer.*
- a. The stockbreeder should consider the health and vigor of the animals.  
The health and vigor of the animals.....
- b. The farmer must offer the dairy cows a controlled environment.  
The dairy cows.....

- c. He has housed the rabbits in outdoor hutches.  
The rabbits .....
- d. Mr Smith has raised pigs of the most desirable characteristics.  
Pigs .....
- e. A good farmer easily detects symptoms of Malta fever.  
Symptoms of Malta fever .....
- f. Human beings contract undulant fever from diseased animals.  
Undulant fever .....

**6. Decide whether the bold-faced words are nouns, adjectives, or verbs.**

- a. The **performance** of an animal depends on several factors.
- b. **Prompt** action must be taken by the farmer to prevent the diseases of animals from spreading.
- c. A diseased cow **suffers** from high temperature and loss of appetite.
- d. Most animal diseases are **infectious**.
- e. Any building which is **dry** and free from **draughts** is suitable for the housing of rabbits.
- f. Modern technology **has** greatly **improved** poultry rearing and egg **production**.
- g. Healthy rabbits are characterized by **longevity**.
- h. A straight and firm **baseline** is one of the desirable **characteristics** when choosing high quality pigs.

## Dairy production – Milking systems and techniques



Farmers spend a lot of money and time to breed cows, sheep and goats. They build barns, cowsheds, stalls and buy various equipment to ensure high quality and productivity of both meat and milk. The production of high quality milk depends on different factors. An important factor to be considered is the utilization of milking machines, systems and techniques.

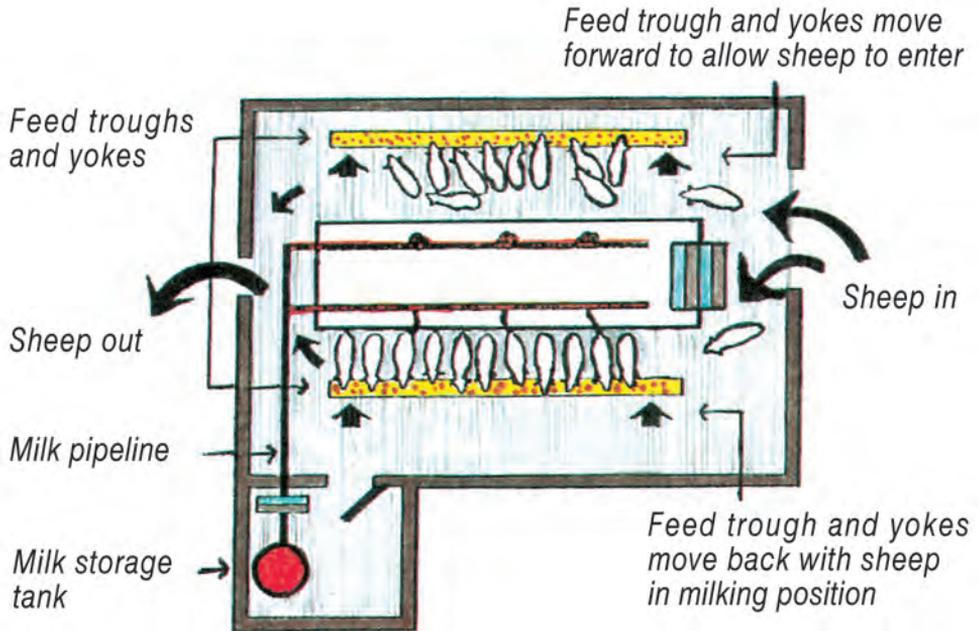
The milking machines and systems are usually made of stainless steel, which is an essential material for the protection of milk from deterioration and infections. The **bucket milking system** is used for milking cows. Milk is sucked from the four teats through four stainless steel tubes in conjunction with simultaneous pulsation. The milk is transferred through the four steel tubes into a long milk tube, which ends in stainless buckets where milk is collected.



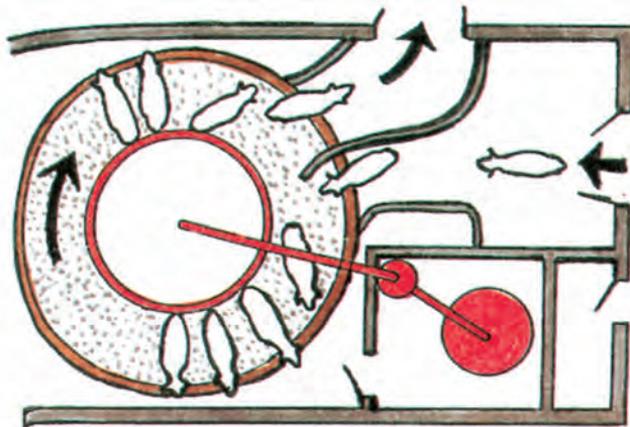
*Bucket milking system*

With reference to milking sheep, there are four main systems of mechanical milking:

1. The **mobile milking buckets** which are used in a series of stalls through which the ewes pass.
2. The **parlour system** as per which the milking workers stand in a pit between one or two rows of sheep (single or double parlour). The ewes are restrained in yokes. There is one milking unit between each pair of sheep. One of each pair of sheep is first milked; then the unit is switched to the other of the pair. The milk passes through a pipeline, via a cooler, to a holding tank or churns. When all the sheep in the row have been milked, the complete line of ewes is released together. The yokes are fixed and the ewes are only able to enter and fill the row from one end; a yoke at a time (the “**cascade**” system).
3. Another **parlour system** is almost the same as the previous one, except for the yoke system which is different. The row of yokes moves backwards and forwards on wheels. They can be occupied by the ewes in any order and when the yokes are all full, the whole row is moved backwards into the milking position.



*Milking parlour with moving rows of yokes*



4. A parlour system known as **Carousel** is a system according to which the sheep move round on a rotating circular platform and are milked as they move, on the conveyor belt principle. The worker stands in the center.

## A. Questions

1. Why do farmers spend a lot of money and time?
2. Refer to an important factor for the production of high quality milk.
3. Why are the milking machines and systems usually made of stainless steel?
4. What is the process of milking in the bucket milking system?
5. Where are the mobile milking buckets placed when they are used for milking sheep?
6. How does the milk pass to churns in the parlour system?
7. What happens after all the sheep in the row have been milked? (Parlour system)
8. What is the role of yokes in the “cascade” system?
9. How are the sheep milked in the Carousel system?

## B. Exercises

### 1. Find the words in the text meaning the following:

- a. a building to which cows are taken to be milked or in which they live during the coldest winter months
- b. to draw liquid from
- c. able to move, or be moved quickly and easily
- d. row (of things)
- e. controlled or prevented from doing something or moving
- f. a large container for storing liquid or gas
- g. a large metal container in which milk is stored or carried from the farm
- h. fastened firmly in position
- i. causing to turn round a fixed point
- j. an endless moving belt that carries objects from one place to another

### 2. Give the definition of the bold-faced words to complete the sentences below:

- a. A **stall** is .....
- b. A **trough** is .....
- c. A **yoke** is .....
- d. A **milk pipeline** is .....
- e. A **ewe** is .....
- f. A **cooler** is .....
- g. A **bucket** is .....

**3. Match the words of the first column with the appropriate words of the second one.**

- |                |   |
|----------------|---|
| a. system      | 1. keep; hold                               |
| b. breed       | 2. method; technique                        |
| c. utilization | 3. carried; caused (sth) to change position |
| d. pipe        | 4. raise; bring up                          |
| e. material    | 5. stuff; matter                            |
| f. transferred | 6. sent out; passed on (sth)                |
| g. retain      | 7. tube                                     |
| h. transmitted | 8. use                                      |

**4. Rewrite the sentences without changing their meaning.**

**e.g.** A lot of money is spent for the purchase of milking machines.

The manufacturers .....

The manufactures spend a lot of money for the purchase of milking machines.

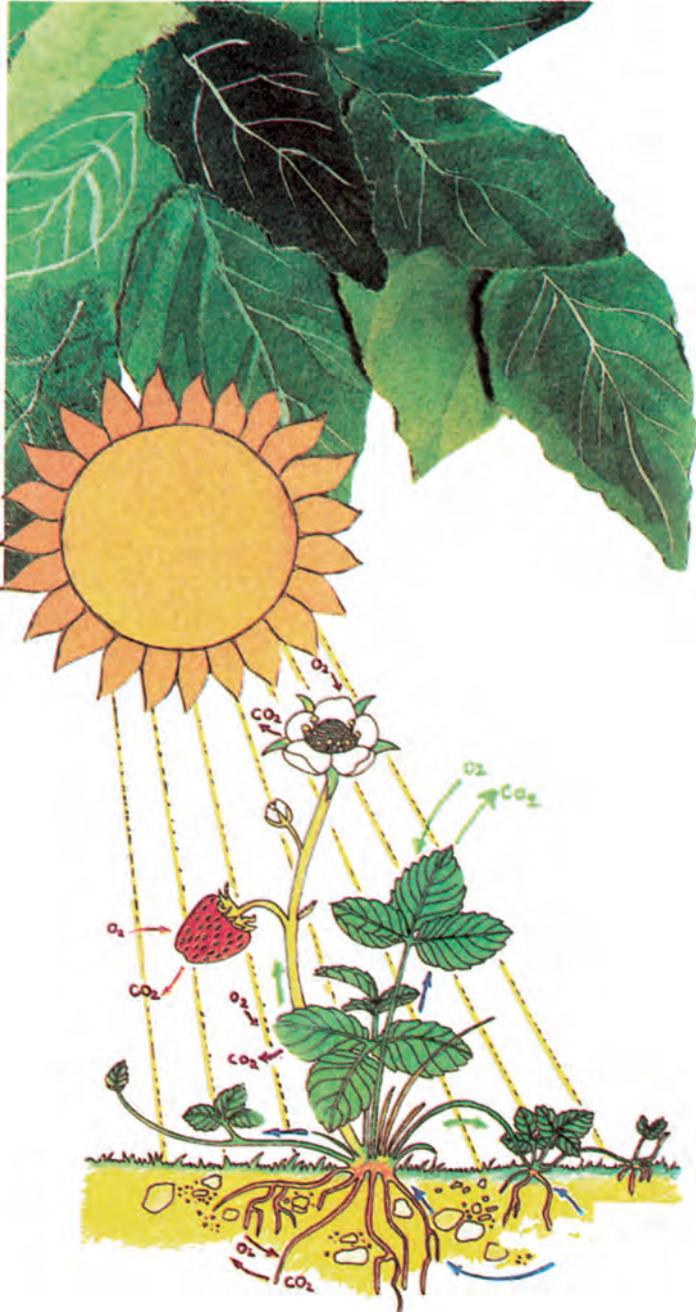
- a. The milk is collected in stainless steel buckets.  
The farmers .....
- b. The ewes are restrained in yokes.  
The milking workers.....
- c. One of each pair of sheep is first milked.  
The workers.....
- d. All the sheep in the row have been milked.  
The worker.....
- e. The yokes are fixed.  
The workers.....
- f. They can be occupied by the ewes.  
The ewes.....

**5. Rewrite the process of the parlour system using the following sequence devices: first, secondly, thirdly, then, after that, finally.**

**6. Based on the text, put the (sets of) words below in the correct order so that they make sense.**

- a. stalls / through / pass / of / the ewes / a series
- b. the sheep / between / is / the / there / a pit / of / rows
- c. a cooler / the milk / holding tank / a / through / passes / to
- d. a / is / system / time / the "cascade" / a yoke / at
- e. move / circular platform / as / the sheep / a rotating / are milked / on / they

# Photosynthesis: Storing energy



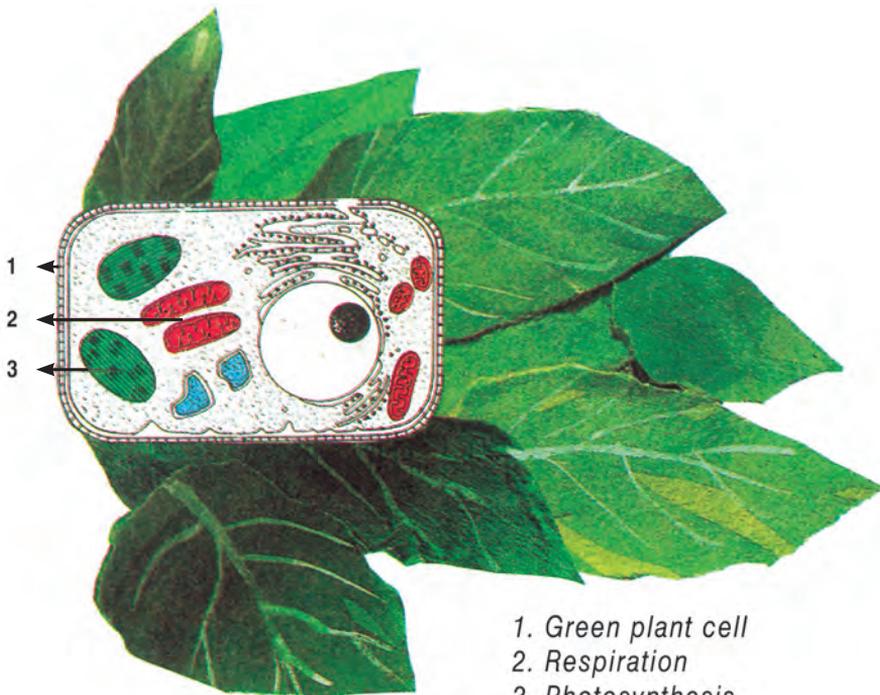
*Photosynthesis*

Like all living beings, the food that plants actually use as a source of energy is **sugar**, but unlike other living organisms, plants themselves manufacture their own sugar through the marvellous process of **photosynthesis**.

In photosynthesis, light, chlorophyll, energy, carbon dioxide, and water act together within the plant to produce sugar and release oxygen. Plants harness the sun's energy to stimulate this process which will take place only when they are in the presence of light. What happens, very simply, is this:

Plant leaves draw in carbon dioxide from the atmosphere and roots absorb water from the soil. The chlorophyll in the leaves and other green tissues absorbs the light energy and uses it to split the water into hydrogen and oxygen. The hydrogen and carbon dioxide immediately combine into sugar and the oxygen is given off into the surrounding atmosphere.

It's worth noting that the oxygen, which in this process frees into the air, makes up all of the oxygen we breathe. And the role of photosynthesis becomes even grander if we consider that it not only provides us with oxygen, but –by converting sunlight into chemical energy– it produces the energy that sustains all plant and animal life on earth, as well.



For photosynthesis to occur, a plant's leaves, stems, and roots must be healthy and interacting properly in a favourable environment with adequate light, temperature, and humidity.

The role of photosynthesis, then, is to make food for the plant. When it produces more than the food the plant can use immediately, the excess is stored for later use.

## **A. Questions**

1. How do plants manufacture their own sugar to use it as a source of energy?
2. What is the process of photosynthesis?
3. Why does photosynthesis take place only in the presence of light?
4. What does the chlorophyll in the leaves and other green tissues do during the process of photosynthesis?
5. What happens when the hydrogen and carbon dioxide have combined into sugar?
6. How much of the oxygen we breathe does photosynthesis make up?
7. Which environmental factors must exist for photosynthesis to occur?
8. What happens when more food is produced than what the plant can use?

## **B. Exercises**

### **1. Find the words in the text meaning the following:**

- a. Green colouring matter found in all green plants.
- b. A chemical element; a gas present in the air, without colour, taste or smell but necessary for all forms of life on earth.
- c. Chemical synthesis brought about by the action of light, particularly the building of complex plant material from carbon dioxide and water in the presence of chlorophyll.
- d. The gas produced when people or animals breathe out, or when carbon is burnt in air.
- e. The capacity for, power used for working (machines, etc.); the force, strength, capacity (of a person) to do things.
- f. Sweet substance obtained from various plants.
- g. (Amount of) water vapor contained in the air.

**2. Complete the following table:**

verb	noun	adjective
_____	_____	living
_____	stimulate	_____
presence	_____	_____
_____	consider	_____
_____	_____	marvellous
_____	_____	simple

**3. Match the words of column A with their meaning in column B**

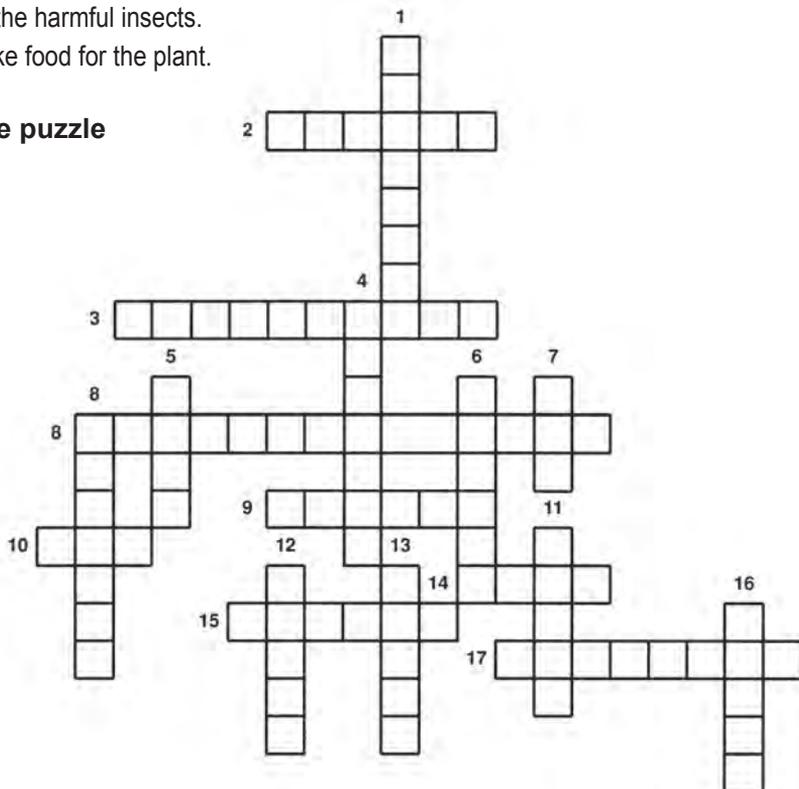
A	B
a. free	1. inhale and exhale
b. marvellous	2. give; offer
c. breathe	3. happen
d. provide	4. wonderful
e. occur	5. release

**4. Choose the answer that best completes the following:**

- Plants actually use ..... as a source of energy.
  - vitamins
  - nutrients
  - sugar
  - fertilizers
- In the process of photosynthesis,
  - light, chlorophyll, energy and water, all act together within the plant to produce sugar and release oxygen.
  - light, chlorophyll, energy, carbon dioxide and water act together within the plant to produce sugar and release oxygen.
  - light, chlorophyll and energy act together within the plant to produce sugar and release oxygen.
  - light, chlorophyll and water act together within the plant to produce the sugar and release oxygen.

3. Which elements combine immediately into sugar, so that oxygen is given off into the atmosphere?
  - a. Hydrogen and oxygen.
  - b. Carbon dioxide and oxygen.
  - c. Hydrogen and light.
  - d. Carbon dioxide and hydrogen.
  
4. Which of the following do you agree with?
  - a. Through photosynthesis sunlight is converted into chemical energy.
  - b. The oxygen that the photosynthesis process frees into the air makes up some of the oxygen we breathe.
  - c. For photosynthesis to occur, leaves, stems and roots don't need to be healthy.
  - d. Temperature, light and humidity are irrelevant factors as far as photosynthesis is concerned.
  
5. The role of photosynthesis is
  - a. to support the plant.
  - b. to fertilize the soil.
  - c. to kill the harmful insects.
  - d. to make food for the plant.

**5. Solve the puzzle**



1. enough for a purpose
2. more than what is needed
3. the mixture of gases surrounding the earth
4. to use a natural force to produce (useful) power
5. an eatable substance
6. set free
7. the mixture of gases which we breathe
8. (*across*) the process that keeps plants alive and their leaves green
8. (*down*) a connected series of actions, changes, operations, etc.
9. animal or plant cells that make up a particular organ
10. do sth; work
11. the opposite of dark
12. of great importance
13. keep a supply for future use
14. top covering of the earth in which plants grow
15. air taken into and sent out of the lungs
16. the name of our planet
17. connected with, used in, or made by chemistry

**6. Say whether the following statements are True or False. If false, explain why.**

- a. Plants themselves, create their own sugar through the process of photosynthesis.
- b. Plant leaves draw in carbon dioxide from the soil.
- c. The chlorophyll in the leaves absorbs the light energy.
- d. Photosynthesis provides us with hydrogen.
- e. Through the photosynthesis process the sunlight is converted into chemical energy.

# Greenhouses



## PART A

### Materials and equipment necessary for their construction

Greenhouses meet all modern cultivation requirements. A greenhouse is a covered and enclosed space which is built to protect the crops and the gardening plants from the winter cold. Greenhouses consist of a peripheral basic wall on which an iron or wooden glass frame is based.

Every greenhouse should preserve the appropriate degree of temperature and humidity. That is why it is equipped with a *heating system*, *thermometers* which inform of the abrupt changes of temperature, *run off basins* for the moisture and a reliable *hydrometer*.

Glass, fiber glass or plastic material –depending on the climatic conditions– are among the most widespread materials used for the construction of the peripheral wall. Single or double glass, mounted with rubber strips, provides optimal daylight transmission. An alternative of fibre glass is also possible. The construction requires minimal maintenance. Optimal climate control is achieved automatically by an efficient system of ventilation, space heaters and evaporative cooling methods. Large exhaust fans and cooling corridors form the basis of the ventilation system. Various types and capacities of space heaters are suitable for partial and total house heating. A central switch panel coordinates ventilation and heating, ensuring an even temperature throughout the greenhouse.

## **A. Questions**

1. What is a greenhouse?
2. What do greenhouses consist of?
3. What are greenhouses equipped with, so that they can preserve the appropriate degree of temperature and moisture?
4. Which material provides the best daylight transmission?
5. How is an optimal climate control achieved?
6. Which devices form the basis for the ventilation system?
7. Why must ventilation and heating be coordinated?

## **B. Exercise**

**Say whether the following statements are True or False. If false, explain why.**

- a. Greenhouses meet all modern cultivation requirements.
- b. A greenhouse is an open space.
- c. Greenhouses should preserve the appropriate degree of temperature and humidity.
- d. A construction of fiber glass requires repeated maintenance.
- e. Only one type of space heaters is suitable for partial and total house heating.

## PART B

### Types of greenhouses

Greenhouses are classified by the temperature needed for the growth of the plants that are to be cultivated. That's why farmers have to choose among greenhouses of low temperature, mild temperature and tropical temperature.

*Greenhouses of low temperature:* They serve for the growth of plants which must be protected from frost (e.g. chrysanthemum) or from excessive heat (e.g. cyclamen).

*Greenhouses of mild temperature:* The temperature must be proper for the subtropical plants of Australia and southern China (e.g. anthurium, begonia, ficus, kentia).

*Greenhouses of tropical temperature:* The temperature may reach 30 °C, but it must not fall below 15 °C. Therefore, strong thermal units are necessary. Plants grown in these greenhouses also need a lot of water for the maintenance of the atmospheric humidity. They are usually tropical plants such as orchids, crotons and dracaenae.

*Reproduction greenhouses* are the ones which avoid the loss of heat. They are usually equipped with mould or sand and are covered with glass or plastic frames for the growth of transplants in a sheltered area.

The greenhouses' dimensions, installations, irrigation and ventilation systems usually differ. If they are properly chosen, as the case may be, experiments have proved that cultivation of different plants is more successful and productive in greenhouses than cultivation by means of conventional methods (open-air gardens, fields etc.). Production can usually be three times higher.

It's worth noting that, all the year round, people can enjoy a great variety of food –mainly consisting of vegetables and fruit– which they couldn't enjoy before the greenhouses' establishment. In our country, for example, bananas, tomatoes, cucumbers, eggplants, marrows, lettuces and artichokes are cultivated in the appropriate temperature of a greenhouse throughout the year, while some decades ago they were seasonal vegetables.

### A. Questions

1. How are greenhouses classified?
2. What do greenhouses of low temperature serve for?

3. What do plants grown in greenhouses of tropical temperature need a lot of water for?
4. What are *reproduction greenhouses* usually equipped and covered with?
5. Refer to the crops mentioned in the text which are cultivated in our country.

## B. Exercises

### 1. Which of the words in the texts (parts A and B) mean the following?

- a. demands; needs
- b. shut on all sides
- c. agricultural plants; yearly or seasonal produce of a grain, fruit etc.
- d. perimetric
- e. framed
- f. perfect
- g. is accomplished
- h. effective
- i. categorized in groups / types
- j. more than normal
- k. suitable; appropriate
- l. of heat
- m. degree of moisture in the air
- n. supplied with what is needed
- o. range
- p. periods of ten years

### 2. Find the words, in both texts, which best replace the underlined parts in the following sentences.

- a. Greenhouses satisfy the requirements of modern cultivation.
- b. Their construction needs the smallest maintenance.
- c. The best climate control is achieved by an efficient system of ventilation.
- d. A central switch panel makes ventilation and heating work effectively together.
- e. That's why agriculturists have to choose among greenhouses of different temperatures.
- f. They are used for plants which must be kept safe from frost.

**3. Which verbs correspond to the following nouns?**

- a. change .....
- b. cultivation .....
- c. requirement .....
- d. transmission .....
- e. construction .....
- f. maintenance .....
- g. control .....
- h. ventilation .....
- i. heater .....
- j. increase .....

**4. Complete the blanks in the 2nd list below:**

	<b>verb</b>	<b>noun</b>
a.	meet	.....
b.	cover	.....
c.	protect	.....
d.	provide	.....
e.	achieve	.....
f.	evaporate	.....
g.	preserve	.....
h.	equip	.....
i.	inform	.....
j.	moisten	.....
k.	classify	.....
l.	coordinate	.....
m.	establish	.....
n.	grow	.....
o.	lose	.....
p.	reproduce	.....
q.	differ	.....
r.	install	.....
s.	irrigate	.....
t.	enclose	.....

**5. Put the (sets of) words in the correct order so as to make meaningful sentences.**

- a. humidity / should preserve / of temperature / degree / and / every greenhouse / the appropriate
- b. thermometers / the abrupt / inform of / in greenhouses / of temperature / changes
- c. strong / for greenhouses / temperature / of tropical / thermal units / are necessary
- d. dimensions / usually differ / installations / the greenhouses' / ventilation / and / systems / irrigation
- e. successful / cultivation / usually proves / and productive / in greenhouses / to be

**6. Fill in the blanks with the proper form of the verbs in the parentheses.**

*Example:* Greenhouses \_\_\_\_\_ (meet) all modern cultivation requirements.

*Answer:* Greenhouses meet all modern cultivation requirements.

- a. Glass, which \_\_\_\_\_ (mount) with rubber strips, \_\_\_\_\_ (provide) perfect daylight transmission.
- b. The best climate control \_\_\_\_\_ (achieve) by an efficient system of ventilation.
- c. A central switch panel \_\_\_\_\_ (coordinate) ventilation and heating.
- d. All greenhouses should \_\_\_\_\_ (preserve) an appropriate degree of temperature and humidity.
- e. Greenhouses \_\_\_\_\_ (classify) by the kind of the \_\_\_\_\_ (cultivate) plants.
- f. Greenhouses of low temperature serve for the growth of plants which must \_\_\_\_\_ (protect) from frost or from excessive heat.
- g. In greenhouses of tropical temperature, the temperature may \_\_\_\_\_ (reach) 30 °C.

## Cooperatives - What are they?



Agricultural cooperation implies the voluntary joining together of physical, financial, and human resources. In this way, it is possible and easier to market farm products, obtain supplies, and ensure many needed farm services. The underlying principles that distinguish cooperatives from other types of free enterprise businesses are:

1. Democratic control by members.
2. Payment for capital – limited to a conservative rate.
3. Savings – distributed in direct proportion to the patronage of each member.

The desired result of formal cooperation is to bring the benefits of permanent and efficient business organization to farmers. This is achieved through the following aims and activities of cooperatives:

1. A cooperative business tries to render the greatest possible service to its members.
2. It sells on account of its members –under their or its own name– their products.
3. It sets at the disposal of its members technical means for the conditioning and the commercialization of the products.

4. It rationalizes the various work systems, the cure and the presentation of the products.
6. It makes research and studies concerning both the production and the marketing.
7. It accepts the rules for the commercialization which improve the quality of the products.
8. It buys all the materials and equipment which are necessary for the production.
9. It makes studies and plans for the installations.

To sum up, the chief aim of farmer cooperatives is to help their members promote their own economic well-being, by marketing farm products and obtaining the needed goods and services effectively. A cooperative buys and sells in order to help its members –as producers– increase their individual earnings.

## A. Questions

1. What does the term “agricultural cooperation” imply?
2. What are the principles that distinguish cooperatives from other types of free enterprise businesses?
3. In your opinion, which activities of the cooperatives are of primary importance?
4. Do you think that farmer cooperatives greatly help with the development of farming and agriculture?
5. What are the benefits of the individual farmers who are members of a cooperative? (Give your answer based on the text and on your own experience).

## B. Exercises

1. **Match the words in the 1st column with their meaning in the 2nd column.**

- |                      |   |
|----------------------|---|
| a. enterprise        | 1. farm owned and controlled by the people who work in it             |
| b. render            | 2. obtain   |
| c. commercialization | 3. the way of arranging and carrying on business                      |
| d. rationalize       | 4. divide among several or many                                       |
| e. cure              | 5. give   |
| f. earnings          | 6. the act of making sth a matter of profit                           |
| g. cooperative       | 7. make a method or system more modern and sensible and less wasteful |
| h. (to) market       | 8. the act of removing sth bad  |
| i. distribute        | 9. offer for sale   |
| j. get               | 10. money made by a company; profits                                  |

**2. Complete the following table.**

	verb	noun	adjective
a.	cooperate	_____	_____
b.	market	_____	_____
c.	conserve	_____	_____
d.	_____	production	_____
e.	_____	commercialization	_____
f.	_____	_____	presentable
g.	_____	_____	acceptable
h.	_____	necessity	_____
i.	_____	_____	qualified
j.	_____	_____	effective

**3. Complete the blanks with the proper form of the words deriving from the ones in capitals at the end of each sentence.**

- \_\_\_\_\_ cooperatives market farm products. AGRICULTURE
- The desired result of formal \_\_\_\_\_ is to bring the benefits of permanent and efficient business \_\_\_\_\_ to farmers. COOPERATE, ORGANIZE
- A cooperative sells on account of its members their \_\_\_\_\_. PRODUCE
- It rationalizes the \_\_\_\_\_ of the products. PRESENT
- It buys the necessary \_\_\_\_\_ for the production. EQUIP

**4. Drawing information from the text, fill in the blanks to complete the sentences.**

- Agricultural cooperation implies ..... and human resources.
- The democratic control by members is one of the .....
- Savings ..... in direct proportion to the ..... member.
- The cooperative sets at the ..... technical means for the ..... of the products.
- It makes research and studies concerning .....

**5. True or False? If false, explain why.**

- Through cooperatives the benefits of permanent and efficient business organization are brought to farmers.
- Each member is awarded according to his participation.

- c. Products are sold on account of the manager of the cooperative.
- d. The cooperatives borrow the equipment and materials which are necessary for the production.
- e. Members are helped to increase their individual income.
- f. No studies on the marketing and the production are made.

**6. Fill in the blanks with the right form of the verbs in brackets.**

- a. The aims of modern cooperation recently \_\_\_\_\_ (*change*) for the benefit of the farmers.
- b. If a cooperative business did not make research and studies concerning marketing, there \_\_\_\_\_ (*not be*) any progress.
- c. If you want to be a member of a cooperative you \_\_\_\_\_ (*have*) to follow its principles.
- d. If there \_\_\_\_\_ (*not be*) a democratic control by its members, the cooperative business would not have achieved its purpose.
- e. The chief aim of farmer cooperatives is \_\_\_\_\_ (*help*) their members \_\_\_\_\_ (*promote*) their own economic well-being.
- f. All savings \_\_\_\_\_ (*distribute*) in direct proportion to the patronage of each member.

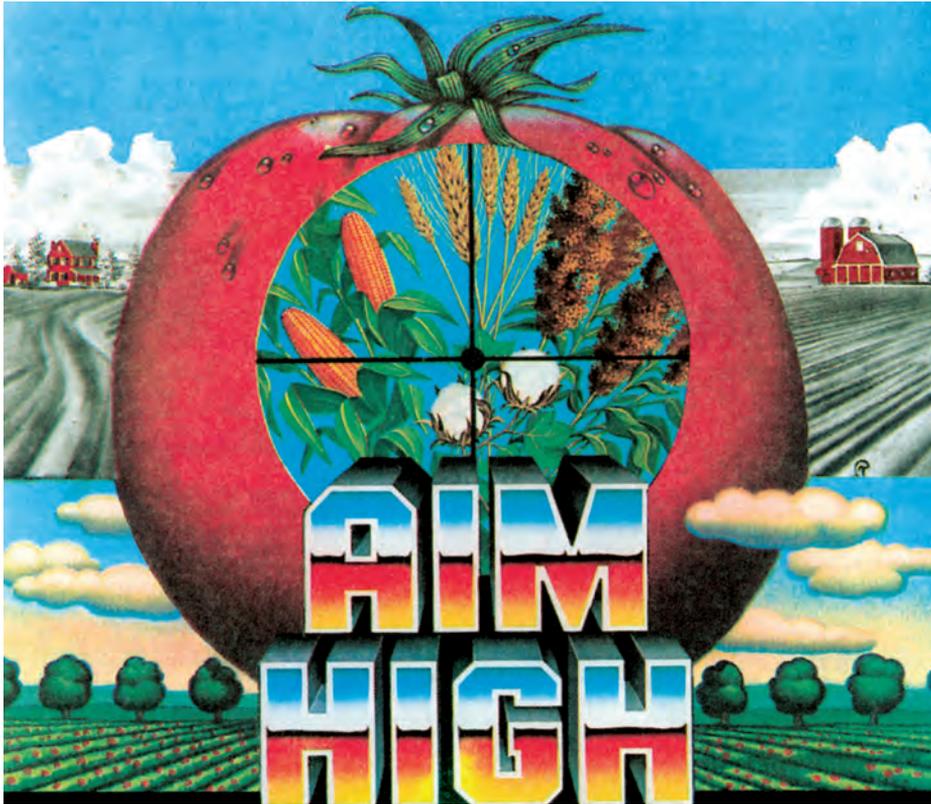
**7. Speaking**

Look through the eight aims and activities of cooperatives and connect the subsequent information with the earlier information provided. Use the connectors **first of all, second(ly), third(ly), then, in addition (to this), also, furthermore, finally.**

Start like this:

*First of all*, a cooperative business tries to render the greatest possible service to its members.  
*Secondly*, it sells on account of its members –under their or its own name– their products...

## Farm management



The modern farmer needs far more than the traditional agricultural skills.

1. He must exercise good judgement when he selects and buys equipment, so as not to enlarge his overhead costs.
2. He may find it wiser to rent certain machines than to invest heavily in one that he will use for only a few days a year.
3. He must know how and when to borrow money, as he will need credit at times.
4. He must watch the market prices to know when to sell to his best advantage.
5. He must be aware of new fertilizers, chemicals and techniques, and he must learn how to apply them without needless expense or waste.
6. He must keep his costly machinery in good working order.
7. He must keep complete records of his income and outgo, not simply to report his income tax properly, but also to aid himself to make decisions upon improving his operations.

8. He must keep in mind the farmer's formula for success: "Volume times price minus costs equals profit".

All in all, farming demands greater and more versatile managerial skills than almost any other business of comparable size.

## Preparing charts and checking up on vital signs

A farmer should keep and consider three prime charts in order to achieve the goals he has set for his business:

1. A **balance sheet**, which lists all of his assets, liabilities, and net worth.
2. An **earnings statement**, which shows how he has progressed financially during the year.
3. A **cash flow chart**, which keeps a track of all cash that comes in and goes out of his business during a time period. The time periods can be daily, weekly, monthly and/or yearly.

Some vital signs which must also be checked are:

**Profitability**, which has to do with the amount of money a farmer made the previous year.

**Liquidity**, which ties into cash flow and has to do with his ability to pay his family living expenses, cash operating expenses and debt service commitments in a timely fashion.

**Solvency**, which has to do with his financial strength to last out a decade.

## A. Questions

1. Why must the modern farmer exercise good judgement when he buys equipment?
2. Why must he know the time he can borrow money?
3. Why must he watch the market prices?
4. What should he be aware of?
5. What must he keep in good working order and why?
6. How can he improve his operations?
7. What's the conclusion drawn from the principles mentioned in the text?
8. Which are the three prime charts a farmer should keep and consider in order to achieve the goals he has set for his business?
9. What does the "balance sheet" list?
10. What does the "earnings statement" show?
11. What do we mean by the term "cash flow chart"?
12. Explain the meaning of the terms *profitability*, *liquidity* and *solvency*.

**B. Exercises**

**1. Find the words in the text meaning the following:**

- a. have; practise
- b. money spent regularly to keep a business running
- c. use (money) to make more money out of something that will increase in value
- d. a system of buying goods or services when they are wanted, and paying for them later
- e. amount of money that is spent
- f. a sum of money paid, in accordance with the law, to the government according to income, property, goods bought, etc.
- g. all things owned by a person or business and having some money value, esp. if they can be used to pay debts, produce goods, or in some way help the business to make a profit
- h. the debts owed by a business to its creditors and to its owner(s)
- i. the difference between total assets and total liabilities, representing the capital owned by a business

**2. Based on the text fill in the blanks with the appropriate words.**

- a. The modern farmer needs far more than the traditional agricultural \_\_\_\_\_.
- b. Sometimes, it's better for a farmer to \_\_\_\_\_ certain machines instead of buying one which he will use for only a short time.
- c. He must know when to borrow money, because he may need \_\_\_\_\_ at times.
- d. He must know all about the new \_\_\_\_\_ chemicals and techniques.
- e. He must keep complete \_\_\_\_\_ of his income and outgo.
- f. Modern farming \_\_\_\_\_ greater and more versatile managerial skills.

**3. Fill in the blanks with the person who deals with the following:**

- a. farms .....
- b. management .....
- c. credits .....
- d. market .....
- e. investments .....
- f. operations .....

**4. Say whether the following statements are True or False. If false, explain why.**

- a. The modern farmer may find it wiser to rent certain machines than to buy them.
- b. The modern farmer shouldn't be aware of new fertilizers and chemicals.

- c. He must keep complete records of his income and outgo.
- d. He should keep his expensive machines in a good working order.
- e. Farming today does not demand any special managerial skills.
- f. A balance sheet lists all of the farmer's assets, liabilities and net worth.
- g. Profitability has to do with the amount of money a farmer spent the previous year.
- h. An earnings statement shows the farmer's financial progress during the year.

**5. You're an expert on farm management. Advise a farmer on how he can improve his farm and make a better profit.**

**Make suggestions starting like this:**

- a. Why don't you...
- b. You had better...
- c. I suggest you (should)...
- d. Wouldn't it be a good idea to...

**6. Match the two parts of the conditional sentences.**

Part A

- a. If he watches the market prices,
- b. If he watched the market prices,
- c. If he had watched the market prices,

Part B

- 1. he would know when to sell to his best advantage. (But unfortunately, he doesn't watch the market prices.)
- 2. he will know when to sell to his best advantage.
- 3. he would have known when to sell to his best advantage. (But unfortunately, he didn't watch the market prices.)

**7. Rewrite the sentences using the new prompts.**

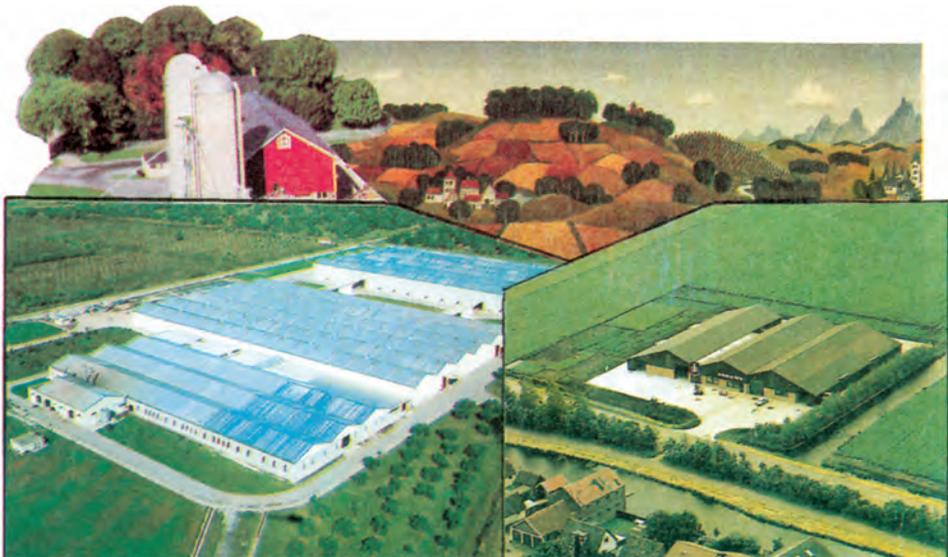
- a. The modern farmer may have to rent certain machines.  
Certain machines .....
- b. Sometimes he borrows money.  
Sometimes money .....
- c. The farmer must keep his machinery in good working order.  
The farmer's machinery .....
- d. The farmer should make useful decisions upon improving his operations.  
Useful decisions .....
- e. Modern farming demands versatile managerial skills.  
Versatile managerial skills .....

- f. Your earnings statement shows your financial progress.  
Your financial progress .....

**8. Rewrite the sentences using «so as to» and «so that» as in the example.**

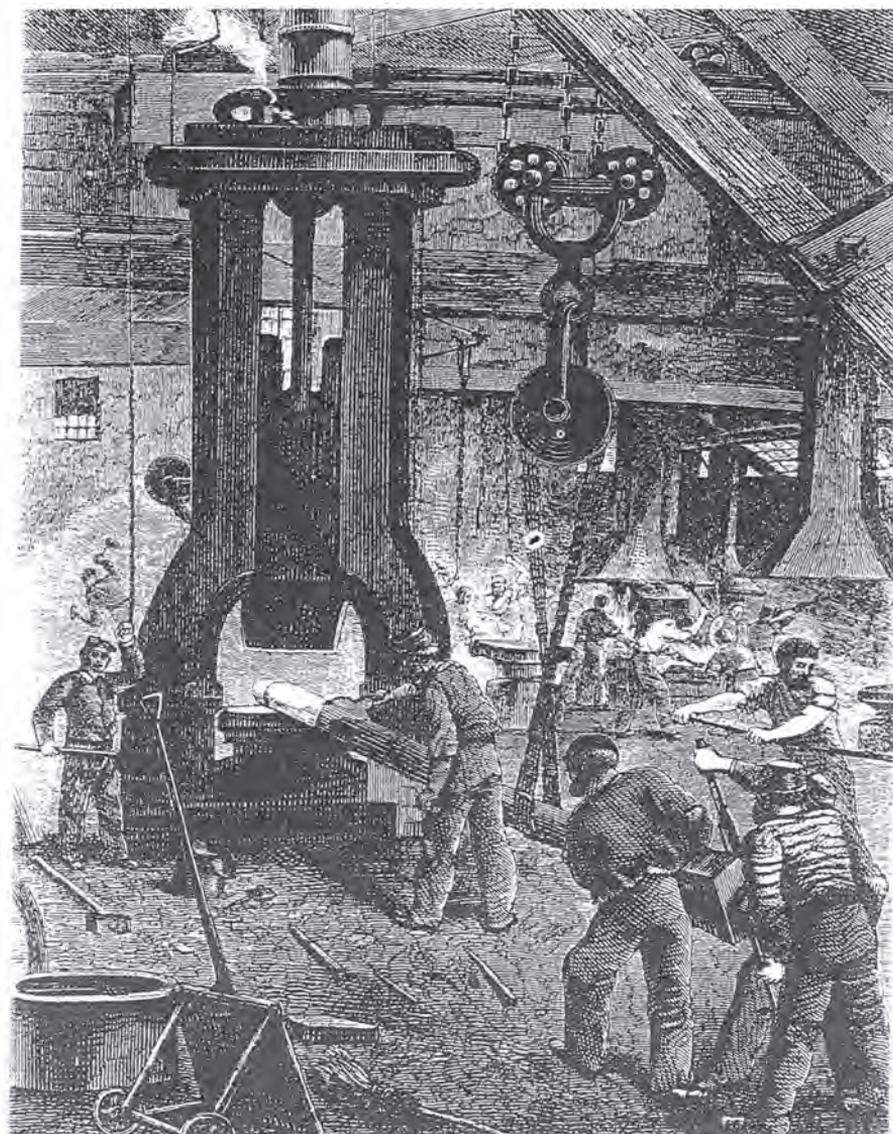
**Example**

- He must run through the financial analysis **to find out** whether his business is on course towards his goals.
  - He must run through the financial analysis **so as to find out** whether his business is on course towards his goals.
  - He must run through the financial analysis **so that he can / will find out** whether his business is on course towards his goals.
- a. He must know how and when to borrow money **to avoid** throwing his money about.
- b. He must judge carefully when he selects and buys equipment **to minimize** the danger of overhead costs.
- c. He must watch his markets **to know** when to sell to his best advantage.
- d. He must know how to apply fertilizers and chemicals **to avoid** needless expense or waste.
- e. He needs far more than the traditional agricultural skills **to have** better results.
- f. He often takes care of his costly machinery **to keep** it in good working order.



# Part two

## Elements of metallurgy and mining





## Part 2

Unit	Skills/Functions	Structures/Activities
<p><b>1. Rock formation and classification</b></p>	<p>Reading: Giving information~ categorizing in types and groups~Describing features</p> <p>Acquiring vocabulary</p> <p>Understanding and using the language for the metallurgical specialization</p> <p>Emphasizing facts</p>	<ul style="list-style-type: none"> <li>• Answering questions</li> <li>• Completing sentences with suitable words</li> <li>• Identifying words with their definitions</li> <li>• Matching synonyms</li> <li>• Forming opposite meanings by adding prefixes</li> <li>• Forming sentences by putting words / phrases in their correct order, drawing information from the text</li> <li>• Turning active into passive voice</li> </ul>
<p><b>2. Sciences, techniques and devices contributing to the exploration of an area for mineral deposits</b></p>	<p>Reading: Understanding terms~ Identifying sciences~ Describing devices and their use~ Describing techniques</p> <p>Acquiring vocabulary</p> <p>Dealing with prepositions</p>	<ul style="list-style-type: none"> <li>• Answering questions</li> <li>• Guessing what term a description refers to</li> <li>• Identifying words with their definition</li> <li>• Forming derivatives (nouns, adjectives)</li> <li>• Replacing words in sentences with their synonyms</li> <li>• Completing blanks with prepositions</li> </ul>

Unit	Skills/Functions	Structures/Activities
<b>3. Minerals- Metals- Metals' physical properties</b>	<p>Reading: Describing features and properties</p> <p>Acquiring vocabulary</p> <p>Stating similarities and differences</p> <p>Making comparisons</p>	<ul style="list-style-type: none"> <li>• Answering questions</li> <li>• Completing blanks with metals' properties</li> <li>• Forming derivatives (nouns, adjectives)</li> <li>• Choosing appropriate verbs to form meaningful sentences</li> <li>• Completing blanks in sentences by identifying metals' properties</li> <li>• Forming sentences by comparing metals' properties</li> </ul>
<b>4. Metallurgy - Methods of ore dressing</b>	<p>Reading: Describing processes</p> <p>Acquiring vocabulary</p> <p>Emphasizing facts, places, and items</p>	<ul style="list-style-type: none"> <li>• Answering questions</li> <li>• Forming paragraphs by putting sentences in their correct order</li> <li>• Identifying words with their definitions</li> <li>• Completing a table with derivatives</li> <li>• Forming meaningful phrases</li> <li>• Completing sentences with the suitable words</li> <li>• Turning from active to passive voice and vice versa</li> </ul>
<b>5. Metallurgy - Methods of removing additional gangue and making alloys</b>	<p>Reading: Describing processes and techniques</p> <p>Acquiring vocabulary</p> <p>Dealing with prepositions</p>	<ul style="list-style-type: none"> <li>• Answering questions</li> <li>• Identifying True-False statements</li> <li>• Forming paragraphs by putting sentences in their correct order</li> <li>• Identifying words with their definitions</li> <li>• Forming meaningful expressions</li> <li>• Forming derivatives (nouns)</li> <li>• Completing blanks</li> </ul>

Unit	Skills/Functions	Structures/Activities
	Confirming statements  Expressing purpose	<ul style="list-style-type: none"> <li>• Adding question tags</li> <li>• Joining sentences with “so that”</li> </ul>
<b>6.</b> Some hints on surface and underground mining: <b>a.</b> Surface mining <b>b.</b> Underground mining	Reading: Describing facts~ Describing types of mining~Describing uses of equipment  Acquiring vocabulary  Speaking and writing  Referring to people and items~Explaining the reason~ Describing simultaneous acts and purposes	<ul style="list-style-type: none"> <li>• Answering questions</li> <li>• Identifying True-False statements</li> <li>• Joining parts of sentences</li> <li>• Forming derivatives (verbs, nouns, adjectives)</li> <li>• Classifying items</li> <li>• Agreeing or disagreeing on the meaning of words</li> <li>• Completing a guided dialogue</li> <li>• Rewriting 2 sentences in one, using connectors (which, while, because, that, who, not only... but)</li> </ul>
<b>7.</b> Metallurgy of iron - Steelmaking	Reading: Describing processes, facts, techniques and methods~Identifying features~Describing items  Acquiring vocabulary	<ul style="list-style-type: none"> <li>• Answering questions</li> <li>• Identifying True-False statements</li> <li>• Completing sentences with suitable words</li> <li>• Matching synonyms</li> <li>• Forming derivatives (nouns)</li> <li>• Replacing Greek words in a text</li> </ul>
<b>8.</b> Metallurgy of aluminum	Reading: Describing characteristics, uses and applications  Acquiring vocabulary	<ul style="list-style-type: none"> <li>• Answering questions</li> <li>• Agreeing or disagreeing on information provided in the text</li> <li>• Matching halves to form sentences</li> <li>• Identifying words with their definitions</li> <li>• Giving opposites</li> <li>• Forming derivatives</li> </ul>

Unit	Skills/Functions	Structures/Activities
	Confirming information	<ul style="list-style-type: none"> <li>• Adding question tags</li> </ul>
<b>9.</b> Metals: Their conductivity and their chemical properties	Reading: Describing properties and features~ Describing chemical reactions  Acquiring vocabulary  Comparing facts	<ul style="list-style-type: none"> <li>• Answering questions</li> <li>• Agreeing / disagreeing on information provided in the text</li> <li>• Completing sentence blanks</li> <li>• Matching synonyms</li> <li>• Identifying words with their meaning</li> <li>• Forming derivatives (nouns)</li> <li>• Completing sentences with comparative forms</li> </ul>
<b>10.</b> Castings and heat treatment of metals	Reading: Describing properties and uses~Referring to the metal working process  Acquiring Vocabulary  Identifying materials	<ul style="list-style-type: none"> <li>• Answering questions</li> <li>• Identifying processes by ticking columns</li> <li>• Identifying words with their definitions</li> <li>• Completing sentences choosing the appropriate word</li> <li>• Matching items with the material they are made of</li> </ul>
<b>11.</b> Working with metal - Bench and sheet metal tools	Reading: Describing processes~ Describing tools' uses and functions~ Identifying tools with their pictures  Acquiring vocabulary	<ul style="list-style-type: none"> <li>• Giving the Greek equivalent of the English term</li> <li>• Classifying tools according to their use</li> <li>• Ticking columns to indicate tools' uses</li> <li>• Combining parts to make meaningful sentences</li> <li>• Labelling pictures</li> </ul>

Unit	Skills/Functions	Structures/Activities
<p><b>12.</b> Methods of joining pieces of metal</p>	<p>Reading: Describing methods/ tasks, processes and techniques~Describing items and tools</p> <p>Acquiring vocabulary</p> <p>Writing</p>	<ul style="list-style-type: none"> <li>• Identifying pictures with methods</li> <li>• Matching processes with techniques</li> <li>• Matching methods with devices</li> <li>• Matching questions with answers</li> <li>• Matching equipment with techniques</li> <li>• Identifying techniques with devices</li> <li>• Matching parts of sentences</li> <li>• Completing sentences with suitable words</li> <li>• Identifying words with their definitions</li> <li>• Matching words to form meaningful phrases</li> <li>• Forming derivatives</li> <li>• Solving a puzzle</li> <li>• Writing a guided paragraph</li> </ul>
<p><b>13.</b> Atoms - molecules and their compounds</p>	<p>Reading: Defining chemical properties and features</p> <p>Acquiring vocabulary</p>	<ul style="list-style-type: none"> <li>• Answering questions</li> <li>• Identifying True-False statements</li> <li>• Completing sentences</li> <li>• Identifying words with their definitions</li> <li>• Forming derivatives (adj.)</li> <li>• Substituting Greek terms with their English equivalent</li> </ul>

Unit	Skills/Functions	Structures/Activities
<p><b>14. Earthquakes</b></p>	<p>Reading: Describing features and processes- Expressing cause and result</p> <p>Acquiring vocabulary</p> <p>Dealing with prepositions</p> <p>Revising verb tenses</p> <p>Emphasizing processes, results and events</p>	<ul style="list-style-type: none"> <li>• Answering questions</li>   <li>• Identifying words with their definitions</li> <li>• Matching opposites</li>   <li>• Completing sentences</li>   <li>• Rewriting a sentence in different tenses</li>   <li>• Turning from active to passive and vice-versa</li> </ul>

## Rock formation and classification

The composition of the earth surface includes an unlimited variety of rocks; hard, soft, heavy, light, coarse-grained and fine-grained rocks. There are rocks of all colours, shapes and sizes. All these make rock division into categories difficult, because their distinction is not always completely evident in nature. Rocks could be classified *on the basis of their origin* but this is not always feasible, as we do not always know how some rocks have been originally formed. They could also be classified *according to the types and the amount of mineral deposits* rocks are composed of. Nevertheless, this classification is not always accurate because rocks of widely different origins and structures have the same mineral composition. Furthermore, rocks could be classified *in accordance with their chemical composition*, but in this case –as in the previously mentioned one– we would categorize rocks of evidently different types into the same group. The fact that chemical compositions need laboratory analysis makes rock categorization more complicated. To sum up, a classification based on rocks' origin, composition and structure at the same time, is difficult to be carried out.

To most geologists, rocks are divided into three groups according to their formation:

- a. ***Igneous or primary rocks.*** These rocks were formed from the very hot molten material (magma) beneath or within the earth's crust. When this molten fluid material issues from a volcano (lava) it solidifies after becoming cool and forms the *volcanic rocks*. When the molten material becomes cool within the earth, it forms the *plutonic rocks*. Both volcanic and plutonic rocks belong to the group of igneous rocks. An example of such rocks are granite (coarse crystals) and basalt (fine crystals).
- b. ***Sedimentary or transported rocks.*** These rocks were formed from weathering materials (e.g. sand, clay, silt, etc.) which had been carried and deposited by wind, water or glaciers. In the course of time, these materials, deposited in layers, cemented together and formed new rocks such as sandstones, clays and shales. Some rocks of organic origin (such as chalk, coal, etc.) and most of the surface rocks belong to this group.

- c. **Metamorphic rocks.** These rocks were formed after the igneous or sedimentary rocks had changed or metamorphosed by heat and pressure, deep under the earth's surface. Heat and pressure caused the original rocks' melting and then the molten material solidified again, forming the metamorphic rocks. Some rocks belonging to this group are limestones, marbles and slates (from shales).

## A. Questions

1. Refer to some varieties of rocks which compose the earth's surface.
2. Why is the division of rocks into categories difficult?
3. According to which factors could rocks be classified?
4. Name the three groups into which rocks are divided, according to most geologists.
5. What were igneous rocks formed from?
6. How are the volcanic rocks formed?
7. How were the sedimentary rocks formed?
8. Which forces under the earth's surface have changed the igneous or sedimentary rocks into metamorphic ones?

## B. Exercises

### 1. Which of the words in the text mean the following?

- a. material made up of various substances
- b. stones which form the major part of the earth's crust
- c. divisions, in a system of classification, of objects into groups according to their nature
- d. the first existence of something
- e. relating to (the applications of) chemistry
- f. a place equipped and used for experimental study, research, analysis and testing in any branch of science
- g. a specialist in geology
- h. a mountain with a large opening (crater) through which lava, steam, gases or ashes from the depth of the earth are erupted at the surface
- i. a mass of ice which moves very slowly down a high mountain valley
- j. a fine-grained sedimentary rock easily splitting into thin plates or layers

**2. Match the words of column A with the words of column B.**

- | <b>A</b>     | <b>B</b>        |
|--------------|-----------------|
| a. unlimited | 1. obvious      |
| b. variety   | 2. kind         |
| c. evident   | 3. initial      |
| d. feasible  | 4. limitless    |
| e. accurate  | 5. altered      |
| f. type      | 6. below; under |
| g. beneath   | 7. range        |
| h. changed   | 8. exact        |
| i. original  | 9. make; shape  |
| j. form      | 10. possible    |

**3. Fill in the blanks in the 1st list below.**

- | <b>verb</b> | <b>noun</b>    |
|-------------|----------------|
| a. _____    | composition    |
| b. _____    | variety        |
| c. _____    | division       |
| d. _____    | shape          |
| e. _____    | origin         |
| f. _____    | deposit        |
| g. _____    | classification |
| h. _____    | structure      |
| i. _____    | group          |
| j. _____    | analysis       |
| k. _____    | categorization |
| l. _____    | formation      |
| m. _____    | metamorphosis  |
| n. _____    | heat           |
| o. _____    | pressure       |

**4. Add the prefixes de- , un- , in- , to form opposite meanings to the following:**

- |             |       |
|-------------|-------|
| a. limited  | ..... |
| b. complete | ..... |
| c. composed | ..... |

- d. accurate .....
- e. form .....
- f. organic .....
- g. changed .....
- h. natural .....

**5. Based on the text put the (sets of) words below in the correct order, so that they make sense.**

**Example:** were / do / how / not / we / rocks / know / some / always / formed

**Answer:** We do not always know how some rocks were formed.

- a. mineral composition / rocks / according to / their / be classified / could
- b. needs / chemical composition / laboratory / analysis
- c. divide / most geologists / three groups / rocks / into / their formation / according to
- d. are / formed / crystal rocks / cools / if lava / rapidly
- e. transported rocks / by wind, water / were / formed / or glaciers / from weathering / material / deposited / and / carried
- f. some rocks / such as / coal / or / chalk / sedimentary rocks / belong to / origin / organic / of
- g. sedimentary / of the rocks / most / of the earth / surface / on the / are
- h. come from / metamorphic rocks / igneous / or sedimentary / rocks

**6. Using the prompts given, rewrite the sentences without changing their meaning.**

**Example:** A large variety of rocks covers the earth surface. (active)

**Answer:** The earth surface is covered by a large variety of rocks. (passive)

- a. We can classify rocks on the basis of their origin.  
Rocks .....
- b. They would categorize rocks of evidently different types into the same group.  
Rocks of evidently different types.....
- c. We need a laboratory analysis to know the rocks' chemical composition.  
A laboratory analysis .....
- d. Geologists divide rocks into three groups according to their formation.  
Rocks .....
- e. A deep layer of volcanic ash buried the city of Pompeii on August 24th, 79 A.D.  
The city of Pompeii.....

- f. The crater of the long inactive volcano of Vesuvius had let out a deadly layer of gas and ash.  
A deadly layer of gas and ash .....
- g. Heat and pressure under the earth's surface have changed the igneous or sedimentary rocks into metamorphic rocks.  
The igneous or sedimentary rocks .....

**7. Based on the text, fill in the blanks below:**

- a. The \_\_\_\_\_ of the earth surface includes a great variety of \_\_\_\_\_ .
- b. Rock division into \_\_\_\_\_ is difficult.
- c. Rocks could be classified on the \_\_\_\_\_ of their origin.
- d. Chemical compositions need \_\_\_\_\_ analysis.
- e. Geologists divide rocks into three groups \_\_\_\_\_ to their \_\_\_\_\_ .
- f. Volcanic and plutonic rocks belong to the group of \_\_\_\_\_ rocks.

## Sciences, techniques and devices contributing to the exploration of an area for mineral deposits

With reference to mining, **exploring** or **prospecting** is the process of searching an area for mineral deposits. The sciences that contribute to the search for minerals are geology, geophysics, geochemistry and paleontology.

**Geology** is the science dealing with the study of the earth's crust or surface and the materials in it. Geology particularly deals with the dynamics and physical history of the earth and the rocks which it is composed of, as well as with the physical, chemical and biological changes that earth has undergone or is undergoing. This proves that this science plays an important role in the search for valuable mineral deposits. **Geophysics** combines geology and physics. As it includes dealing with the physics of the earth and its atmosphere as well as dealing with oceanography, seismology, volcanology and geomagnetism, this scientific discipline contributes to the techniques used in prospecting for mineral deposits. **Geochemistry** applies chemistry to the study of the earth's features and, as it deals with the chemical changes in the composition of the earth, it can determine the geological and chemical characteristics or features of any area to be explored. **Paleontology** also contributes to the exploration for mineral deposits, as it can detect evidence of the presence of fossil fuels, such as coal, natural gas and petroleum which are formed from organisms that lived millions of years ago.

The first step for exploring or prospecting the earth for mineral deposits is a geological survey of the surface of the area which is going to be explored. After that, studies must be attempted for the processing of the findings in the subsurface. Geophysical and geochemical techniques are used to track down samples of minerals in the explored area and to determine the extent of the mineral deposits.

All the above processes require some necessary techniques. One of the most important geophysical techniques is the *core drilling*. It is carried out with a hollow cylinder through subsurface layers to obtain samples of rocks

(cores). Geochemists analyze mineral samples, so that they can determine their elements.

Some of the devices used for finding out what lies beneath the crust of the earth are:

- The *gravimeter* which measures the earth's gravity; e.g. stone has a smaller gravitational pull than granite.
- The *Geiger counter* which examines carefully the presence of radioactive substances.
- The *seismograph* which records the period, magnitude and direction of earth tremors. The waves recorded on a seismograph show the densities of the various rock strata.
- The *magnetometer* which measures the strength of the earth's magnetic field. The densities of different rocks beneath the soil indicate the changes in magnetism that can be shown by this meter.

Mineral wealth also lies under the seas, especially where the layers of the earth come together. The most extensive underwater mining is for *tin* and *oil* which has proved to be profitable. Experts decide on the commercial importance of the deposits after the data have been run through a computer. In this way, the deposit is analyzed and it is shown whether it is rich enough or not.

## A. Questions

1. What is the search for mineral deposits called?
2. Which sciences contribute to the search for mineral deposits?
3. Which science deals with the study of the earth's crust or surface and the materials in it?
4. Why does geology play an important role in the search for mineral deposits?
5. Which sciences does geophysics combine?
6. What does geochemistry deal with?
7. Why does paleontology contribute to the exploration for mineral deposits?
8. Which fossil fuels formed from organisms which lived millions of years ago are mentioned in the text?
9. What is the first step for exploring the earth for mineral deposits?
10. Which techniques are used to track down samples of minerals in an explored area?
11. How is the core drilling technique carried out?
12. Why do geochemists analyze mineral samples?
13. Which are some of the devices used for finding out what lies beneath the crust of the earth?
14. What does the seismograph record and why is this important?
15. Does mineral wealth lie only under the earth?

## B. Exercises

### 1. Which of the words in the text mean the following?

- a. the exploration of an area for minerals, oil, gold, etc.
- b. the scientific study of matter and energy
- c. the hard outer covering of the earth
- d. a mineral oil obtained from below the surface of the earth and used to produce petrol, paraffin and various chemical substances
- e. detailed inspection showing the general condition of (an area, sth, etc.)
- f. having to do with the study of the chemical composition and changes in the crust of the earth
- g. to find something by searching
- h. central parts of rock masses removed by boring
- i. abundance of something
- j. layers of rocks composed of one material lying between rock beds of other materials

### 2. Can you guess what the following descriptions refer to?

**Example:** It's the scientific study of the ocean.

**Answer:** Do you mean the oceanography?

- a. It's the science of volcanic phenomena.  
.....
- b. It's an instrument like a hydrometer for measuring the specific gravity of a liquid or solid.  
.....
- c. It's the scientific study of earthquakes.  
.....
- d. It's a device for measuring the intensity of ionizing radiation.  
.....
- e. It's a person with special knowledge or training.  
.....
- f. It's an instrument used for comparing the strengths of magnetic field and magnetic moments.  
.....

3. Complete the table below.

noun (science)	noun (scientist)	adjective
_____	_____	physical
_____	_____	chemical
_____	_____	biological
_____	_____	geological
_____	geochemist	_____
geophysics	_____	_____
paleontology	_____	_____
_____	seismologist	_____

4. Form the nouns deriving from the following verbs:

[Remember that some nouns have the same formation as their corresponding verbs, e.g. search (v.) → search (n.)]

- a. deposit .....
- b. demand .....
- c. know .....
- d. compose .....
- e. change .....
- f. study .....
- g. attempt .....
- h. require .....
- i. analyze .....
- j. measure .....
- k. record .....
- l. indicate .....

5. Replace the bold-faced words of the following sentences with words or phrases found in the text, so that the meaning of the sentences remains unchanged.

*Example:* The search for mineral deposits **requires** knowledge of geology.

*Answer:* The search for mineral deposits **demands** knowledge of geology.

- a. Geology **is concerned** with the dynamics and physical history of the earth and its rocks.

- b. The first **move** for exploring the earth for mineral deposits is a geological survey.
- c. Special **methods** are used **to find (by searching)** samples of minerals in the explored area.
- d. Geochemists analyze mineral samples, so that they can **find out precisely** their elements.
- e. Certain devices are used to **discover** what lies **underneath** the crust of the earth.
- f. **Specialists** decide on the commercial importance of the deposits after the **stored information** has been run through a computer.

## 6. Fill in the missing prepositions.

- a. The search \_\_\_\_\_ mineral deposits needs knowledge of geology.
- b. Geochemistry deals \_\_\_\_\_ the chemical composition of the matter in the earth's crust.
- c. Geochemical techniques are used to track \_\_\_\_\_ samples of minerals in the explored area.
- d. Core drilling is carried \_\_\_\_\_ with a hollow cylinder.
- e. Some devices are used for finding \_\_\_\_\_ what lies under the surface of the earth.
- f. The waves recorded \_\_\_\_\_ a seismograph show the densities of the various rock layers.
- g. Scientists decide \_\_\_\_\_ the commercial importance of the deposits.
- h. The data concerning the mineral deposits are usually run \_\_\_\_\_ a computer.

## Minerals

## Metals

## Metals' physical properties

Minerals and metals are among the most important materials found in nature, that are utilized to enable us dominate over our environment.

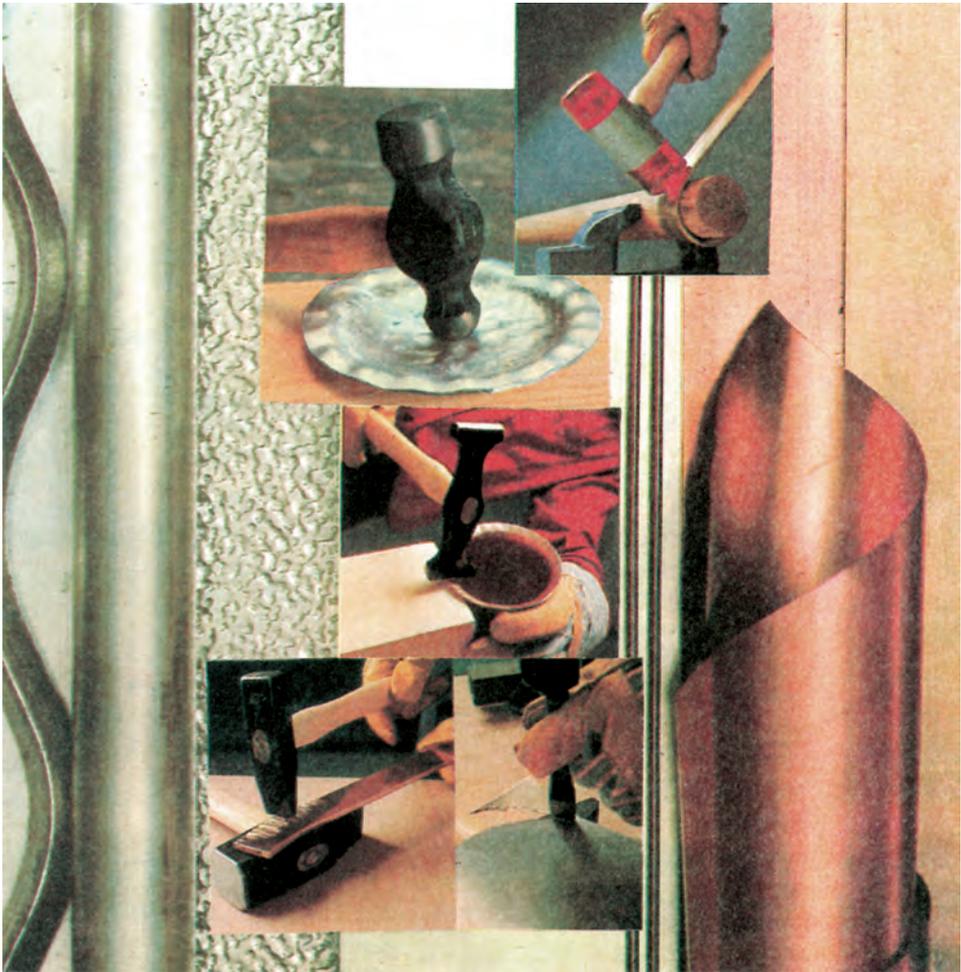
**Minerals** are inorganic substances usually in the form of crystals from which metals are extracted. They have a relatively definite chemical composition and physical characteristics. *Stones, rocks and grains of sand* are also classified as minerals. Sometimes, *coal* belongs to the same classification, although in its rocklike form it's originally organic, because it comes from decayed vegetable matter which, over millions of years, has solidified under pressure and heat.

**Metals** are chemical elements which are extracted from chemical compounds in minerals called *ores*, and have similar properties.

- They are usually *shiny* and are characterized by a silvery white luster when they are polished. They absorb and emit light of all frequencies in the visible range.
- They are *ductile*; that is to say, they have the capability of being pulled out into rods and wire. They do not break and they retain their new shape. One of the most ductile metals is copper. Tin and aluminium are also very ductile.
- They are *malleable*; that is, they can be hammered or rolled into thin sheets and foils, as a malleable material does not break easily under pressure. Gold is extremely malleable and copper as well as lead are malleable, too.
- Some of them are *elastic*. An elastic material stretches easily under stress. However, when the stress is removed, it does not retain its new shape but it regains its original one. Among metals, some alloys of steel are quite elastic.
- Metals are also *durable*. A durable material resists corrosion; it is corrosion resistant. Among metals, chromium and platinum are extremely durable. Gold and aluminium are quite durable.

## A. Questions

1. What kind of substances are minerals?
2. What kind of composition do they have?
3. Which solid mineral materials that are not metals are also classified as minerals?
4. Which material belongs to minerals, although in its rocklike form it's originally organic?
5. What are the chemical compounds in minerals, from which metals are extracted, called?
6. Refer to the five similar properties of metals, mentioned in the text.



## B. Exercises

1. Fill in the blanks in the following table.

	noun	adjective
a.	importance	.....
b.	nature	.....
c.	.....	environmental
d.	chemistry	.....
e.	classification	.....
f.	.....	original
g.	similarity	.....
h.	shine	.....
i.	.....	frequent
j.	ductility	.....
k.	.....	malleable
l.	elasticity	.....
m.	durability	.....
n.	.....	corrosive

2. Write the properties of the following metals as presented in the above text.

Metals	Properties
Copper	
Tin	
Gold	
Chromium	
Aluminium	
Steel	
Lead	
Platinum	

3. Complete the blanks at the end of the sentences by identifying metal properties with their definition.

- The ability to return to the original shape after deformation: .....
- The ability to resist surface abrasion or penetration: .....

- c. The ability to be shaped by rolling out or hammering when cold: .....
- d. The ability to change shape or be drawn into wires without breaking: .....

**4. Complete the paragraph below which states the similarities and differences between a malleable and a ductile metal.**

Both a malleable and a ductile metal can \_\_\_\_\_ (a). In a malleable material the change of the shape can be made by \_\_\_\_\_ (b) it, whereas in a ductile by \_\_\_\_\_ (c) it. A malleable material can be \_\_\_\_\_ (d) thin sheets, while a ductile one can be \_\_\_\_\_ (e).

**5. Choose the appropriate verbs or phrases from the tables below to make meaningful sentences.**

a.

A malleable metal can be	broken hammered drawn into wires pressed mined rolled into sheets pushed beaten shaped formed
--------------------------	---

b.

A ductile metal can be	stretched broken hammered drawn into sheets pulled into wires formed into wires formed into rolls drawn into wires
------------------------	---

**6. The table below indicates to what degree each of the metals has certain properties.**

<b>Metals</b>	<b>Malleability</b>	<b>Ductility</b>	<b>Durability</b>
lead	3	1	2
chromium	2	2	4
zinc	3	2	3
cast iron	–	–	1
nickel	2	3	2
brass	2	2	3
steel	2	1	1
bronze	2	2	4
tin	3	3	3

**Note:** 1 not very, 2 quite, 3 very, 4 extremely, – not at all

**Now use the table to quote the above mentioned metals' properties as in the examples.**

- Lead is not very ductile.
- It is more ductile than cast iron.
- Zinc is more malleable than chromium.
- Brass is quite ductile.
- Nickel is less durable than brass.
- Nickel is not so durable as brass.

# Metallurgy - Methods of ore dressing

**Metallurgy** is the science and the techniques used to remove metals from their ores. The branch of metallurgy that includes separating valuable metals from worthless ores, after they have been mined, is known as **process metallurgy**. Metallurgy also includes purifying metals and forming alloys. A lot of techniques are used to purify metals which are extracted from their ores and are to be collected. That's why process metallurgy is also known as **extractive metallurgy**.

Metallurgical processes may be divided into three principal stages:

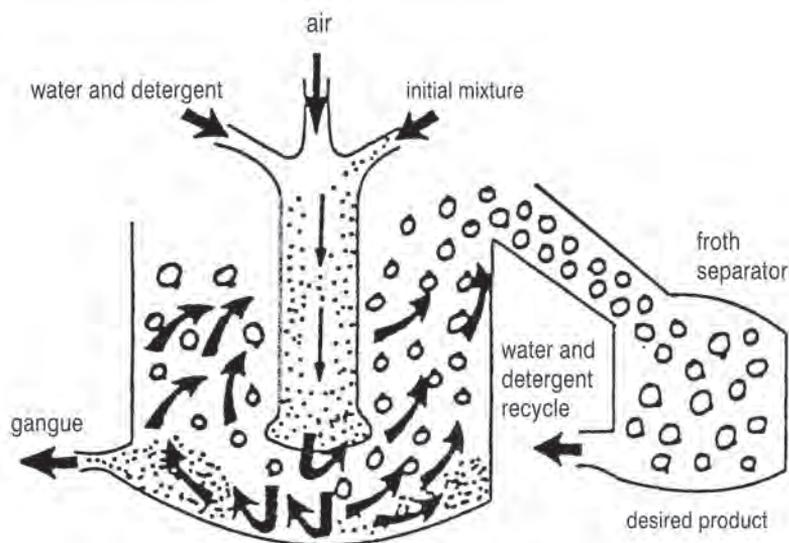
**1. Preliminary treatment**, in which some impurities are removed and the desired component of the ore is concentrated. **2. Reduction**, in which ore minerals are converted to a metallic state by driving off nonmetallic elements. **3. Refining**, in which the metal is purified and, in some cases, substances are added to give the desired properties to the final product.

The treatment of ores often begins at the mine with **ore dressing** (or **concentration** as it is called) to concentrate the ore. In a great number of mined ores, only a small amount of the desired metal is contained. For example, less than 1% copper is contained in copper ores. Nevertheless, this percentage can reach the amount of 30%. Through **concentration method**, the ore is crushed into small particles. After that, flowing water is used to wash and separate heavy from light particles.

Another method of ore dressing is **flotation**, through which the finely crushed ore is mixed with water and detergent, oil or a chemical, while air bubbles are passed through the particles suspended in the above mentioned mixture. While the mixture is agitated, the particles which rise to the surface can be removed.

A third method is the **magnetic separation** which is mostly used with certain kinds of iron ores. Magnetic oxide ( $\text{Fe}_3\text{O}_4$ ) is separated from waste material. The ore is crushed and then electromagnets are used to attract the particles of  $\text{Fe}_3\text{O}_4$  which is ferromagnetic.

**Agglomeration** is another method, according to which particles of the ore stick together, through the technique of sintering. In this way, particles are partially fused into porous lumps which are called *sinters*. The waste material - consisting of physical and chemical separations - that results from the above methods is called **gangue**.



*Diagram of flotation tank. A rotating paddle at the bottom of the cell distributes the mixture and also sweeps the bubbles around the central pipe.*

## A. Questions

1. What is metallurgy?
2. What is the process of separating valuable metals from worthless ores called?
3. Why is process metallurgy also known as extractive metallurgy?
4. Name the three stages of metallurgical processes.
5. Where and how does the treatment of ores often begin?
6. To what extent is the amount of the desired metal contained in mined ores?
7. Through which method is the ore crushed into small particles which are washed and separated into heavy and light ones?
8. According to the flotation method, what is the finely crushed ore mixed with?
9. Why are air bubbles passed through the particles suspended in the previously mentioned mixture?
10. Which method is mostly used with certain kinds of iron ores?
11. Through which technique do the particles of the ore stick together?
12. What do we call the waste material that results from the four methods you have already studied?

## B. Exercises

### 1. Find the words in the text meaning the following:

- a. academic subjects and areas of study in which exact measurement, observation and calculation are used
- b. practical skills or methods applied to a particular task
- c. a series of operations deliberately undertaken; method, esp. one used in manufacture or industry
- d. make pure or clean
- e. serving to extract or based upon extraction
- f. coming first and preparing for what follows
- g. working out; handling; process(ing)
- h. freeing or separating from impurities or other extraneous substances
- i. a rate, amount or number as a share of one hundred parts
- j. pressed or squeezed with force or pounded into small pieces
- k. balls formed of liquid and containing air or gas
- l. moved or shaken (a liquid); stirred
- m. causing metal particles to bond together by pressing and heating
- n. pieces or masses of solid matter without regular shape or of no particular shape

### 2. Put the sentences that follow in their correct order to have a paragraph which makes sense.

- a. A great number of mined ores contains only a small amount of the desired metal.
- b. Nevertheless, this percentage can reach the amount of 30%.
- c. After that, flowing water washes and separates heavy from light particles.
- d. Through concentration method, the ore is crushed into small particles.
- e. For example, copper ores contain less than 1% copper.

### 3. Fill in the blanks below:

	<b>verb</b>	<b>noun</b>	<b>adjective</b>
a.	.....	purity	.....
b.	.....	.....	reducible
c.	.....	product; production	.....
d.	.....	.....	concentrated
e.	.....	.....	separable

f.	.....	suspension	X
g.	.....	.....	mixed
h.	.....	.....	agitated
i.	.....	attraction	.....
j.	.....	.....	resultant

**4. Match the items from List A with items from List B to form meaningful phrases.**

List A	List B
a. extractive	1. state
b. preliminary	2. ores
c. metallic	3. lumps
d. ore	4. metallurgy
e. mined	5. dressing
f. flowing	6. material
g. air	7. treatment
h. magnetic	8. separation
i. porous	9. water
j. waste	10. bubbles

**5. Complete the sentences with the appropriate words drawing information from the text.**

- The branch or metallurgy that includes reducing valuable metals from worthless ores is known as \_\_\_\_\_ .
- \_\_\_\_\_ includes conversion of ore minerals into a metallic state by driving off nonmetallic elements.
- Concentration method is also known as \_\_\_\_\_ \_\_\_\_\_ method.
- \_\_\_\_\_ are extremely small constituents of matter.
- \_\_\_\_\_ is a method for separating the different minerals in a mass of powdered ore, based on their tendency to sink in or float on a given liquid.
- \_\_\_\_\_ is mostly used with certain kinds of iron ores.
- Electromagnets are used to attract the particles of ore oxide ( $\text{Fe}_3\text{O}_4$ ) which is \_\_\_\_\_ .
- In agglomeration, particles are partially fused into porous lumps known as \_\_\_\_\_ .

**6. Rewrite the sentences, without changing their meaning, using the prompts given.**

- e.g. Metallurgy includes separating valuable metals from their ores.  
Separating valuable metals *from their ores* is included in *Metallurgy*.
- a. Metallurgy also includes purifying metals and forming alloys.  
Purifying metals and forming alloys .....
- b. The treatment of ores often begins at the mine.  
The mine is the place .....
- c. A great number of mined ores contains only a small amount of the desired metal.  
In a great number of mined ores, .....
- d. The particles risen to the surface can be removed.  
The particles which .....
- e. Electromagnets attract the particles of the ore oxide ( $\text{Fe}_3\text{O}_4$ ).  
The particles of the ore oxide ( $\text{Fe}_3\text{O}_4$ ) .....
- f. They call "gangue" the waste material that results from the treatment of ores.  
The waste material .....

# Metallurgy - Methods of removing additional gangue and making alloys

The techniques used for removing additional gangue or impurities and making alloys are divided into the following groups:

**a. Pyrometallurgy** which uses heat. In this group, a well known technique is **roasting**, that is heating ore in the air in order to oxidize. The heating of the ore takes place in an enclosed space, so that undesirable substances –such as sulfur- can be removed. During the heating process, sulfur combines with oxygen and is moved away in the form of gas sulfur dioxide. Most sulfide ores and carbonate ores are converted into oxides by roasting. In this way, the free metals are more readily obtained from their oxides than from their sulfides or carbonates.

**Distillation** is another pyrometallurgical technique. Mercury, zinc, cadmium and other metals which can be changed into vapors are easily separated from other substances through distillation. The separation is achieved by heating the ore up to the point that metal vaporises. The vapor is captured in vessels, where it can condense, on condition that it is not combined with oxygen.

**Smelting** is also a very widespread pyrometallurgical technique, as it is used for iron production. According to this technique, the ore is heated until it reaches a liquid state, so that the gangue can be removed. In other words, the ore is led into tall blast furnaces with coke and flux, which is usually limestone. The slag, which is formed from the coagulated gangue, floats on top of the melted metal. Heated air is forced into the furnace to provide the oxygen which is necessary for combustion.

**b. Hydrometallurgy** is another group of techniques where water is used. **Leaching** belongs to this group. According to this technique metals are extracted at ordinary temperatures by leaching ore with liquid solvents. The ore is dissolved in water or in a mixture with selective solvents which must dissolve only the desired metal or mineral, but no other elements in the ore. Sometimes, a chemical compound is formed (salt) in which a metal replaces hydrogen. The pure metal is recovered by treating the solution with hydrogen or by the process of electrolysis. For example, carbonate and oxide ores of copper may be leached with dilute sulfuric acid, and the resulting copper sulfate solutions may be directly subjected to electrolysis.

**c. Electrometallurgy** is also another group of techniques and it uses electricity. The most important technique belonging to this group is **Electrolysis**, that is the passage of an electric current through an electrolyte with subsequent migration of charged ions to the negative and positive electrodes. The *electrodes* are electrically charged rods or plates placed in a leaching solution. The negative ions move towards the positive electrodes (anode) and the positive ions move towards the negative electrodes (cathode).

The combination of leaching and electrolytic processes reaches the highest standards of reducing metals from their ores. Magnesium, copper and aluminium are obtained through this combination of processes. The method of electrolysis can be followed either with leached or with melted metals and ores. Through this method, the purifying of metals such as copper and nickel is definitely achieved.

## A. Questions

1. Name the three groups of techniques used for removing additional gangue or impurities and making alloys.
2. Which pyrometallurgical technique is first mentioned in the text?
3. Why is the ore heated in the air?
4. Where and why does the heating of the ore take place?
5. How is sulfur removed from the ore during the heating process?
6. Are only sulfide ores converted into oxides by roasting?
7. Which technique is used for changing mercury, zinc and cadmium into vapors and for separating them from other substances?
8. Where is the vapor captured and how can it condense?
9. Which pyrometallurgical technique is used for iron production?
10. Which raw materials are used for iron production?
11. Why is heated air forced into the blast furnaces?
12. Which group of techniques does leaching belong to?
13. What's the definition of "electrolysis"?
14. What do the negative ions move towards?
15. What else do we call a negative electrode?
16. Which metals are obtained through the combination of leaching and electrolysis?

## B. Exercises

1. Use the terms “Leaching, Smelting, Sulfides, Oxides, Roasting, Vapor, Carbonates, Electrolyte, Solution, Electricity” to complete the gaps.

- a. \_\_\_\_\_ : Heating ore in the air in order to oxidize.
- b. \_\_\_\_\_ : Compounds in which oxygen is bonded to one or more electropositive atoms.
- c. \_\_\_\_\_ : Compounds of sulfur with a more electropositive element or –less often–group.
- d. \_\_\_\_\_ : Salts or esters of carbonic acid.
- e. \_\_\_\_\_ : A visible exhalation, as fog or smoke, suspended in the air.
- f. \_\_\_\_\_ : Fusing or melting ore in order to separate the metal contained.
- g. \_\_\_\_\_ : Using water or a mixture with selective solvents to dissolve or extract the metallic compound from the gangue in the ore.
- h. \_\_\_\_\_ : The process by which a gas, liquid, or solid is dispersed homogeneously in a gas, liquid, or solid without chemical change.
- i. \_\_\_\_\_ : Electric current or power.
- j. \_\_\_\_\_ : Any substance that dissociates into ions when melted or dissolved in a suitable medium and thus forms a conductor of electricity.

2. Match items from list A with items from list B to form meaningful expressions found in the text.

A	B
a. additional	1. substances
b. enclosed	2. technique
c. undesirable	3. furnaces
d. pyrometallurgical	4. gangue
e. liquid	5. state
f. blast	6. electrodes
g. selective	7. space
h. chemical	8. process
i. positive	9. solvents
j. electrolytic	10. compound

3. Form the abstract nouns deriving from the following:

- a. impure .....
- b. oxidize .....

- c. convert .....
- d. combine .....
- e. distil .....
- f. vapo(u)rize .....
- g. produce .....
- h. coagulate .....
- i. mix .....
- j. solve .....
- k. pass .....
- l. migrate .....

**4. Complete the blanks with a suitable preposition.**

- a. The techniques used \_\_\_\_\_ removing additional gangue are divided \_\_\_\_\_ three groups.
- b. Sulfur combines \_\_\_\_\_ oxygen and is moved away \_\_\_\_\_ the form \_\_\_\_\_ gas sulfur dioxide.
- c. \_\_\_\_\_ this way, the free metals are obtained \_\_\_\_\_ their oxides.
- d. Vapor can condense, \_\_\_\_\_ condition that it is not combined with oxygen.
- e. The slag floats \_\_\_\_\_ top \_\_\_\_\_ the melted metal.
- f. Oxygen is necessary \_\_\_\_\_ combustion.
- g. Leaching belongs \_\_\_\_\_ the Hydrometallurgy group of techniques.
- h. The pure metal is recovered \_\_\_\_\_ treating the solution \_\_\_\_\_ oxygen.
- i. \_\_\_\_\_ example, carbonate and oxide ores of copper may be leached \_\_\_\_\_ dilute sulfuric acid.
- j. Electrolysis is the passage \_\_\_\_\_ an electric current \_\_\_\_\_ an electrolyte with subsequent migration \_\_\_\_\_ charged ions \_\_\_\_\_ the negative and positive electrodes.

**5. Decide whether the following sentences are True or False. Correct the false ones.**

- a. Roasting belongs to the hydrometallurgical techniques.
- b. Most sulfide ores and carbonate ores are converted into oxides by roasting.
- c. Mercury, zinc and cadmium which can be changed into vapors are easily separated from other substances through distillation.
- d. Through distillation, the separation is achieved by heating the ore up to the point that the metal is melted.

- e. Leaching is widely used for iron production.
- f. Blast furnaces are used in the smelting technique.
- g. Carbonate and oxide ores of copper may be leached with dilute sulfuric acid, and the resulting copper sulfate solutions may be directly subjected to electrolysis.
- h. Cadmium, zinc and silver are obtained through the combination of leaching and electrolytic processes.

**6. Confirm the following statements, as in the examples.**

**e.g.** This technique is used for removing additional gangue or impurities, *isn't it?* (Yes, it is.)

Hydrometallurgy doesn't use heat, *does it?* (No, it doesn't.)

- a. Pyrometallurgy uses heat .....
- b. Undesirable substances can be removed, .....
- c. The vapor isn't captured in the air, .....
- d. The ore is heated until it reaches a liquid state, .....
- e. The slag floats on top of the melted metal,.....
- f. They have dissolved the ore in a mixture with selective solvents, .....
- g. This pure metal hasn't been recovered through the process of electrolysis,.....
- h. I think electrolysis will be the most suitable technique for removing additional gangue from this ore of copper,.....

**7. Join the pairs of sentences to express purpose.**

**e.g.** • The ore is heated in an enclosed space.

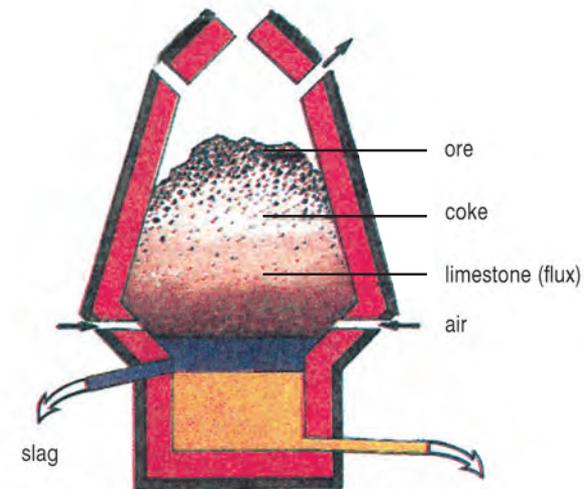
• Undesirable substances can be removed.

The ore is heated in an enclosed space, so that undesirable substances can be removed.

- a. • Most sulfide ores are converted into oxides.
- The free metals will be more readily obtained.
- b. • You must heat the ore up to the point that metal vaporises.
- The separation of the metal from other substances can be achieved.
- c. • Heated air is forced into the furnace.
- The oxygen which is necessary for combustion will be provided.
- d. • Treat the solution with hydrogen.
- The pure metal will be recovered.

**8. Put the sentences that follow in their correct order so that you can form a paragraph describing the roasting process.**

- a. The heating of the ore takes place in an enclosed space, so that undesirable substances –such as sulfur– can be removed.
- b. Roasting is a well known technique belonging to the pyrometallurgical methods.
- c. During the heating process, sulfur combines with oxygen and is moved away in the form of gas sulfur dioxide.
- d. According to this technique, the ore is heated in the air in order to oxidize.
- e. In this way, the free metals are more readily obtained from their oxides than from their sulfides or carbonates.
- f. Most sulfide and carbonate ores are converted into oxides by roasting.



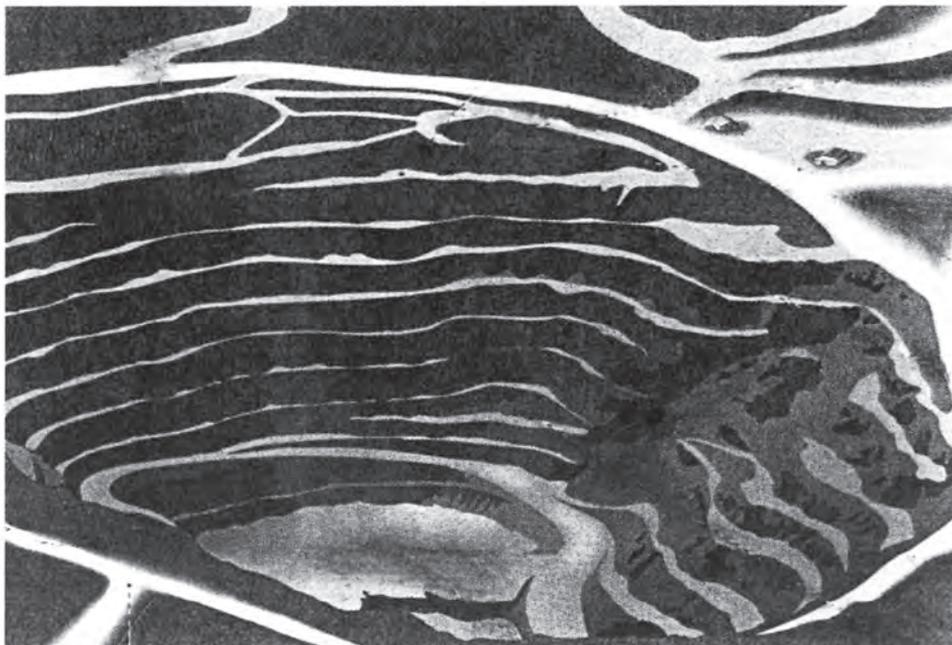
*Blast furnace*

## Some hints on surface and underground mining

### A. Surface mining

**Mining** is the act, process or industry of excavating minerals or metallic substances from the earth. The place where this process takes place is the **mine**.

Before an area is to be mined, the surface must be explored to have evidence of mineral deposits. If the exploration has determined that there are deposits near the surface of the ground, then they are excavated by **surface mining**. The overburden must be removed to recover ore. Depending on its nature, the overburden can be removed by using different equipment: *Power shovels* or *bucket excavators* can be used to remove soil and loose or weak rock. On the



*An open pit mine with benches cut into the ground*

other hand, *explosives* must be used to remove the overburden, if it is hard rock. They are placed in holes which have been drilled at intervals and then blasted to break and remove the rock. The waste material is thrown at a place far from the mine and then it is moved away by *bulldozers* or in *trucks*.

Surface mining can be of various types, such as: **a. Open pit or open cut mining** in which benches, like terraces, are cut into the ground, **b. Strip mining** in which the overburden is removed in such a way, that the vein of ore runs horizontally to the surface, **c. Contour strip mining** in which the strips follow the contours –that is, the lines that separate different heights or elevations– in mountainous or hilly areas, **d. Placer mining** in which heavy substances are separated from the light ones –contained in minerals that are found in alluviums– by the use of flowing water and the force of gravity. This system of mining needs simple equipment which is the *placer miner's pan*. The mineral-bearing alluvium is placed in the water-filled pan and while it's being shaken, the heavy particles sink to the bottom and the light ones are removed while they are being washed. Of course, there are some *mechanized devices* not only for excavating, but for removing waste material from valuable minerals. *Shovels* or *scoops* adjusted to *dredges* or *floating barges* belong to this kind of devices, **e. Quarrying**, which is another type of surface mining, is the process of excavating rock from which building stones, slates, gravel, sand or the like are obtained by cutting or blasting.

## A. Questions

1. Why must the surface of an area be explored before it is mined?
2. Are shafts and tunnels involved in surface mining?
3. How is an overburden of weak rock or soil removed?
4. How is an overburden of hard rock removed?
5. Name the various types of surface mining.
6. Which process of surface mining includes excavating rock from which building materials are obtained?

## B. Exercises

1. Tick the False or True box. If you tick false, explain why.

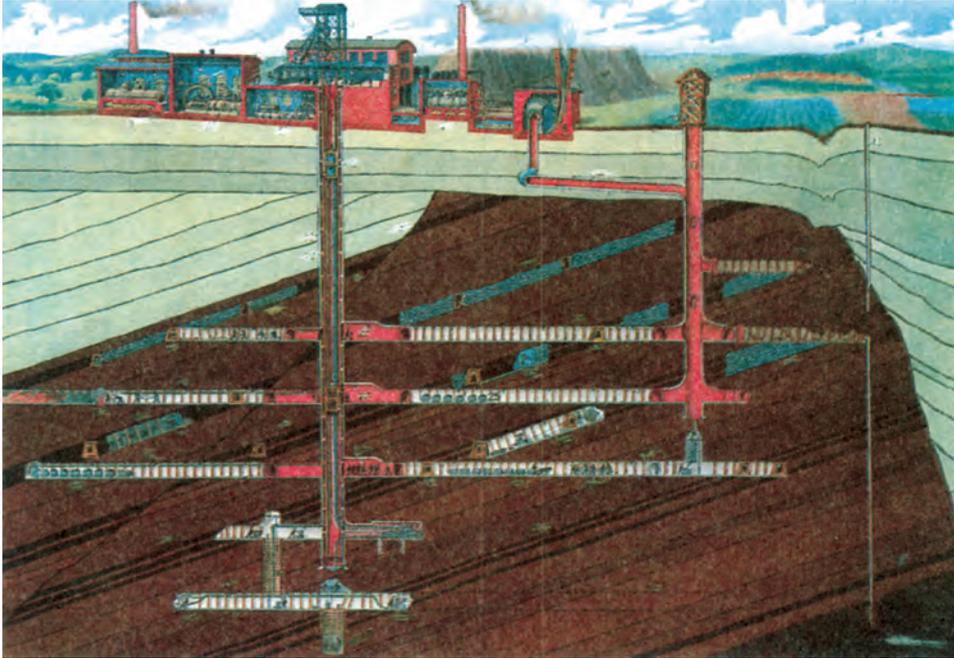
- a. Mining is the process of excavating minerals from the earth surface.
- b. While an area is being mined, the surface is also being explored.
- c. Power shovels can be used to remove soil and loose or weak rock.
- d. Bucket excavators can be used to remove hard rock.
- e. Open pit mining is a type of surface mining according to which benches like terraces are cut into the ground.
- f. Contour mining is applied in hilly or mountainous areas.
- g. The only equipment used for placer mining is the placer miner's pan.
- h. Quarrying is the process of excavating rock from which valuable metals are extracted.

T	F

2. Two students are trying to consolidate what they have learned about mining in general and about surface mining in particular. Based on the text, complete their dialogue.

- Student A :** What do we call the process of excavating minerals from the earth?  
**Student B :** .....
- Student A :** When must the earth surface be explored to have evidence of mineral deposits?  
**Student B :** .....
- Student A :** .....
- Student B :** Only when they are near the surface of the ground.  
**Student A :** .....
- Student B :** To recover ore.  
**Student A :** What kind of equipment is useful for surface mining?  
**Student B :** .....
- Student A :** I think bulldozers and trucks are also needed for throwing waste material at a place far from the mine.  
**Student B :** That's right. I've forgotten it. Now, let's name the types of surface mining mentioned in the text.  
**Student A :** Yes, it's the open pit (or open cut mining) the .....
- Student B :** What differentiates quarrying from other types of surface mining?  
**Student A :** .....

## B. Underground mining



*Shaft mine*

If mineral deposits lie deep, beneath the surface of the ground, then **underground mining** is required. It's the most complicated field of mining because veins of ore are found in various sizes and shapes and they follow different directions. That's why intensive underground exploration is needed to determine the possibility and practicality of mining a site, and to relocate the veins. Horizontal *shafts* or *tunnels* that provide an entrance to an underground mine are called **adits**. Underground mines are classified according to the type of the openings that provide the way into them. Mines with access through horizontal shafts are called **drift mines**. Mines with access through vertical shafts are called **shaft mines** and the ones with access through inclined (slope) shafts are called **slope mines**.

At the top of the shafts there is constructed the *headframe*, which is made of timber or steel and it carries the *sheave* or *pulley* for *hoisting rope*. It also serves different purposes such as lifting or transferring the mineral deposits.

Another piece of equipment necessary for underground mining is the *cage*. It's an elevator which lowers or brings up the miners. The *sump* is a pit at the bottom of a shaft where water is collected. The tunnels which are horizontally excavated to reach and follow the veins of ore are called *drifts*. Some other tunnels which connect the drifts, usually at right angles to them, are called *crosscuts*. Shafts directed upward are called *raises*, while shafts directed downward are called *winzes*. The productive area of the mine from which the mineral deposit is to be removed is the *stope*.

Some of the machines and devices belonging to the equipment which is necessary for underground mining are: **a. The ones used for haulage** such as *wheelbarrows* or *hand-pushed carts* for small mines and *conveyer belts*, *cars mounted on tracks*, *rubber-tired cars* and *diesel-powered cars* for large mines. *Trucks* are also used in mines with good ventilation, **b. The continuous miner** which is a machine, in continuous operation, with cutting edges to break up soft and weak mineral deposits and to remove them from the mine. **c. Pneumatic drills**, working by means of compressed air, such as the hand-held drill which is known as *jackhammer*. **d. Mobile machines** which hold several drills and are known as *jumbos* or *drifters*, **e. Hydraulic devices** such as the *hydraulic jack*, for raising and lifting heavy weight, which can operate by water supply or another liquid.

Of course, the existing equipment is not enough for the good operation of a mine. Ventilation, support and stabilization systems are very important factors to be considered for the mine personnel's safety. Protective equipment such as steel-tipped shoes and hard hats must also be worn by the people who are involved in this hazardous occupation.

## A. Questions

1. When is underground mining required?
2. Name the types of mines which are classified according to the shafts that provide entrance to them.
3. What is constructed at the top of the shafts?
4. What do we call the pit at the bottom of a shaft where water is collected?
5. What is a drift?
6. Name some underground shafts.
7. What is the productive area of a mine called?
8. Which machines or devices for underground mining are mentioned in the text?
9. What must miners wear to protect themselves?

## B. Exercises

(Note: The exercises that follow are related to both parts A and B of the unit.)

### 1. Complete the missing words.

a. verb	noun
.....	excavation
explore	.....
deposit	.....
.....	natural
.....	explosive
elevate	.....
.....	adjustment
enter	.....
.....	construction
equip	.....
ventilate	.....

b. noun	adjective
.....	industrial
explosion	.....
weakness	.....
horizon	.....
mountain	.....
elevate	.....
hill	.....
.....	alluvial
variety	.....
.....	practical
production	.....
.....	safe
hazard	.....

### 2. Based on the text, complete each sentence a. to l. with one of the endings 1. to 12.

- Power shovels or bucket excavators .....
- Explosives must be used to .....
- Waste material is moved away .....
- In open pit mines .....
- In contour strip mines .....
- The placer miner's pan .....
- Quarrying is the process of excavating rock .....

- h. Adits are the .....
- i. Slope mines are the ones with .....
- j. The headframe is usually made of .....
- k. The tunnels which connect the drifts .....
- l. Pneumatic drills work by means of .....
  - 1. .... by bulldozers or in trucks.
  - 2. .... is used in placer mining.
  - 3. .... can be used to remove soil or loose and weak rocks.
  - 4. .... horizontal shafts or tunnels that provide an entrance to a mine.
  - 5. .... are known as *crosscuts*.
  - 6. .... remove the overburden, if it is hard rock.
  - 7. .... benches, like terraces, are cut into the ground.
  - 8. .... from which building materials are obtained.
  - 9. .... compressed air.
  - 10. .... the strips follow the lines that separate different heights or elevations in mountainous areas.
  - 11. .... timber or steel.
  - 12. .... access through inclined shafts.

**3. Combine the following pairs of sentences into one, using the joining words in the brackets.**

**e.g.** The area is to be mined. The surface must be explored to have evidence of mineral deposits. (before)  
*Before* the area is to be mined, the surface must be explored to have evidence of mineral deposits.

- a. The placer mining needs a very simple piece of equipment. It's the placer miner's pan. (which)
- b. The water-filled pan is being shaken. The heavy particles sink to the bottom and the light ones are removed as they are being washed. (while)
- c. Quarrying is another type of surface mining. It's the process of excavating rock from which building materials are obtained. (which)
- d. Underground mining is the most complicated field of mining. The veins of ore that are to be mined are found in various sizes and shapes and they follow different directions. (because)
- e. Horizontal shafts or tunnels provide an entrance to an underground mine. They are called adits. (that)
- f. The headframe carries the sheave or pulley for hoisting rope. It also serves different purposes such as lifting or transferring the mineral deposits. (not only ..... but)
- g. Miners are involved in this hazardous occupation. They must wear steel-tipped shoes and hard hats. (who)



.....

.....

.....

.....

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.....

.....

.....

.....

.....

**6. Identify which of the following statements are True and which are False. In case they are false explain why.**

- a. Power shovels are used to remove soil and loose or weak rock.
- b. Waste material is moved away by bucket excavators.
- c. In contour strip mining the strips follow the lines that separate different heights or elevations in mountainous or hilly areas.
- d. The placer miner's pan is the only equipment used in placer mining.
- e. Quarrying is a type of underground mining.
- f. The horizontal shafts or tunnels that provide an entrance to an underground mine are called adits.
- g. Pneumatic machines work by means of compressed air.
- h. Ventilation, support and stabilization systems are not very important factors to be considered for the miners' safety.



# Metallurgy of iron ~ Steelmaking



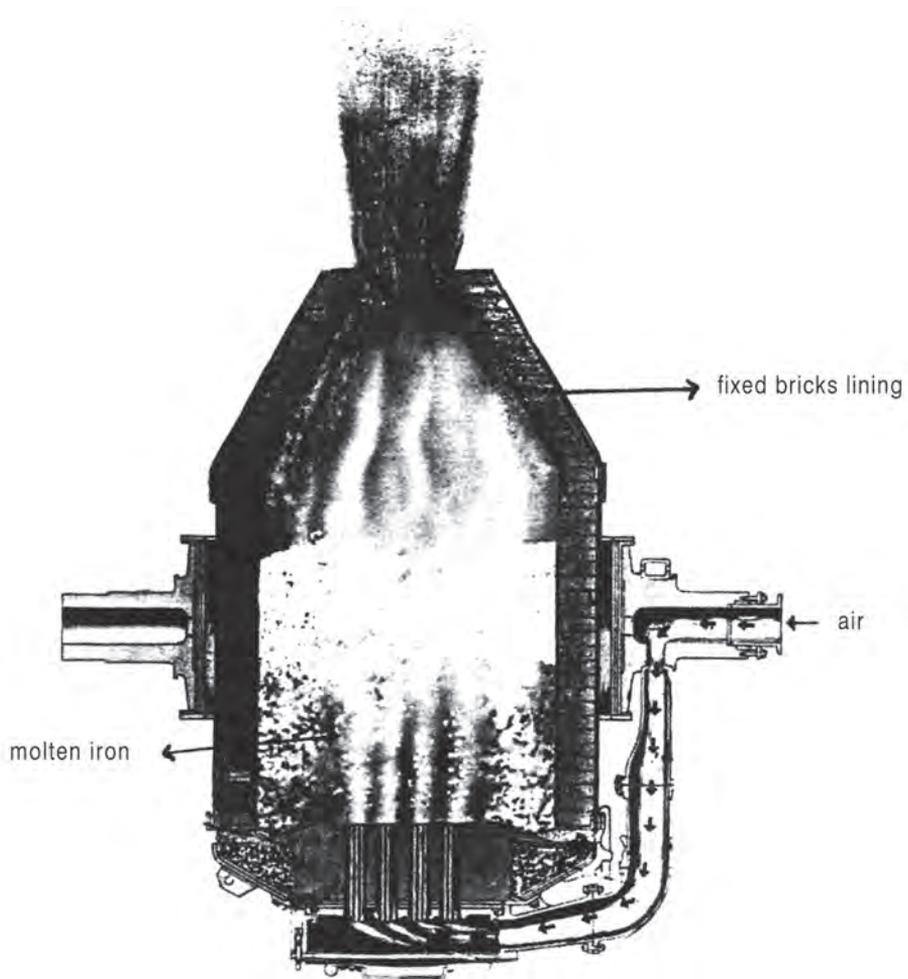
About 5 percent of the earth's crust is iron. Most of it is combined with oxygen, silicon, or sulfur. Important source minerals for iron production are **haematite** ( $\text{Fe}_2\text{O}_3$ ), **limonite** ( $\text{Fe}_2\text{O}_3 \cdot \text{H}_2\text{O}$ ), **magnetite** ( $\text{Fe}_3\text{O}_4$ ), and **siderite** ( $\text{FeCO}_3$ ). **Iron pyrites** ( $\text{FeS}_2$ ) are quite abundant, but they cannot be used as sources of iron because sulfur is an objectionable impurity in the final product.

The industrial production of impure iron is carried out by carbon reduction in a reaction vessel called a **blast furnace** which is designed to operate continuously and it's a tall cylindrical structure which is used for *smelting* - the most common pyrometallurgical technique. The ore is fed into the furnace while coke and flux (limestone and /or silica) are added. By means of high temperature, the mixture becomes liquid and the valueless waste material (gangue) coagulates in the form of slag which floats on top of the melted metal. In the meanwhile, air is forced into the furnace, so that the necessary oxygen for combustion can be provided. The iron drawn from the blast furnace is called *pig iron*. Although it contains carbon and sometimes other impurities, pig iron is used for the production of steel by various methods.

**Steelmaking** is a purifying process through which steel is produced. *Steel* is any of various forms of refined iron containing less carbon than pig iron and more than wrought iron. It possesses various qualities of hardness, elasticity and strength. One of the most widespread means of steelmaking is the **Bessemer converter**. It's a big container, which is lined with fired bricks and other substances which render the lining refractory. According to the **Bessemer process**, air is forced through the

molten iron and the converter blows the oxygen upward to remove the impurities. The refined metal, which is steel of excellent quality, can be cast, cooled and hardened in a barlike or bricklike shape which is called *ingot*.

The **open hearth process** is another steelmaking method which uses a large rectangular chamber and a heating device which is called a **regenerator**. According to this method, the slag floats on top of the melted metal and the air is heated to a very high degree –by means of the regenerator– so that the fuel is burnt. The above method is followed especially for used metal that can be recycled and which is known as *scrap steel*.



*The Bessemer converter*

The blast furnace, the Bessemer converter and the regenerator of the open hearth process, belong to the means used for iron production and steelmaking by means of pyrometallurgical techniques, that is, by means of heat. Nowadays, electricity is used to provide the necessary heat for steelmaking. One of the most common electric furnaces used in steelmaking is the *electric arc furnace*.

## A. Questions

1. Which minerals can be used as sources of iron?
2. Why cannot iron pyrites be considered as sources of iron?
3. How is the industrial production of impure iron carried out?
4. What is the blast furnace?
5. What is the product of a blast furnace in iron smelting?
6. What is produced from pig iron?
7. What's the difference between: a) steel and pig iron, and b) steel and wrought iron?
8. What's the most widespread means of steelmaking?
9. How does the Bessemer process work?
10. What's the other method -mentioned in the text- that is used for producing steel?
11. What is the heating device used in the open hearth method called?
12. For what has open hearth process been especially useful?
13. What's the steel that can be recycled known as?
14. What is the furnace which uses electricity to provide the necessary heat for steelmaking called?

## B. Exercises

1. Match the items in List A with their definitions in List B.

### List A

- a. Converter
- b. A blast furnace
- c. Pig iron
- d. Smelting

### List B

1. high temperature reduction processes for obtaining metals in the liquid state
2. the compounds formed between the flux and the gangue during the smelting process

- |              |   |
|--------------|---|
| e. Flux      | 3. a vessel used to produce iron from its ores                        |
| f. Slag      | 4. vessel for refining melted metal                                   |
| g. Container | 5. a substance added during the smelting process to remove impurities |
| h. Ingot     | 6. the molten iron drawn from the blast furnace                       |
|              | 7. barlike or bricklike shape   |
|              | 8. vessel   |

**2. Which are the abstract nouns that derive from the following?**

- |              |       |
|--------------|-------|
| a. combine   | ..... |
| b. important | ..... |
| c. abundant  | ..... |
| d. reduce    | ..... |
| e. operate   | ..... |
| f. add       | ..... |
| g. purify    | ..... |
| h. remove    | ..... |
| i. convert   | ..... |
| j. compose   | ..... |

**3. Replace the Greek words in the following text with their English equivalent.**

Κωκ (1) is necessary in iron-making since it is able to support heavy charge in the υψικάμνο (2). Α μείγμα (3) of coke, ορυκτού (4) and ασβεστόλιθου (5) is fed in at the top of the blast furnace and a ισχυρό ρεύμα ζεστού αέρα (6) is passed in near the πυθμένα (7). Here, άνθρακας (8) burns to give μονοξείδιο του άνθρακα (9) and a υψηλή θερμοκρασία (10). The monoxide and some free carbon perform the αναγωγή (11). Carbon together with ακαθαρσίες (12) from the ore and καύσιμη ύλη (13) passes into the ρευστό (14) iron which is tapped off as ακατέργαστος σίδηρος (15). The λειωμένη σκωρία (16) is tapped off separately.

**4. Decide whether the following statements are True or False. Correct the false ones.**

- Most of the earth's crust is iron, most of which is combined with oxygen, hydrogen or sulfur.
- The blast furnace is a tall cylindrical structure, used for smelting and designed to operate continuously.

- c. The waste material coagulates in the form of flux which floats on top of the melted metal which is produced when the furnace method is followed.
- d. Steel is produced from pig iron by means of various methods.
- e. The open hearth process is a technique for producing pig iron.
- f. In the open hearth process, the air is heated and the fuel is burnt by means of a regenerator.
- g. Scrap metal is the discarded metal that can be recycled.

**5. Drawing information from the text, fill in the blanks in the following sentences.**

- a. Steelmaking is a \_\_\_\_\_ through which \_\_\_\_\_ is produced. It contains less \_\_\_\_\_ than pig iron.
- b. The Bessemer process uses a large \_\_\_\_\_ which is \_\_\_\_\_ with fired \_\_\_\_\_ and other \_\_\_\_\_ .
- c. In the Bessemer process the refined \_\_\_\_\_ is poured, \_\_\_\_\_ and \_\_\_\_\_ in the form of bars or bricks which are called \_\_\_\_\_ .
- d. The open hearth process uses a big \_\_\_\_\_ .
- e. The open hearth technique is useful for the \_\_\_\_\_ of \_\_\_\_\_ .
- f. In the electric \_\_\_\_\_ furnace, \_\_\_\_\_ is used to provide the necessary \_\_\_\_\_ for steelmaking.

# Metallurgy of aluminum

**Aluminum** is a silver-white metallic element, light in weight. It is ductile, malleable and not readily corroded or tarnished. It is used in alloys and for lightweight products. It is the most abundant metal (8 per cent of the earth's crust). *Bauxite* is a claylike rock which consists of aluminum oxides and hydroxides with various impurities. It is the principal ore of aluminum. Pure aluminum is obtained by means of electrolytic reduction.

Bauxite is purified through the *Bayer* process. The crude oxide is treated with hot solution of sodium hydroxide in which the aluminum oxide dissolves. Silicon oxide also dissolves. The solution is filtered to remove the undissolved ferric oxide ( $\text{Fe}_2\text{O}_3$ ) and then to be cooled. The filtered solution is then agitated with air and crystalline aluminum hydroxide is added as a seed. This causes the precipitation of aluminum hydroxide  $\text{Al}(\text{OH})_3$  while the silicates remain in solution. Pure aluminum oxide ( $\text{Al}_2\text{O}_3$ ) is obtained by heating the resulting  $\text{Al}(\text{OH})_3$ . Purified  $\text{Al}_2\text{O}_3$  (alumina) is then electrolyzed in the Hall-Heroult process. Alumina -dissolved in a molten mixture of fluorides such as cryolite ( $\text{Na}_2\text{AlF}_6$ ), calcium fluoride, and sodium fluoride- is electrolyzed at about  $1000^\circ\text{C}$ .

Although large amounts of aluminum exist in nature, it was a rare metal in a pure state, until this century. Through electrolytic process aluminum is now available for commercial and industrial use. It's been one of the most familiar metals as it is quite soft and weak when it is pure, but when alloyed with other metals, it becomes quite strong. It's light and tough and it's chemically active but it resists corrosion, because of a self-protecting oxide coat. All the above properties of aluminum make it one of the most important materials for replacing steel in many construction jobs. It is also a good conductor of electricity and is often used for electric wiring instead of copper, which has become scarce and expensive.

## A. Questions

1. What are the features of aluminum?
2. Which is the principal ore of aluminum? What does it consist of?
3. How is pure aluminum obtained?
4. How is bauxite purified? Describe the process.
5. In which process is purified alumina electrolyzed?

6. Through which process is aluminum an available material for commercial and industrial use?
7. Does aluminum resist corrosion?
8. Can it be used in electric wiring? Why?

## B. Exercises

### 1. Refer back to the text and find the words which mean the following:

- a. able to be pressed, beaten or pulled into fine strands without being heated
- b. it can be beaten or pressed into different shapes easily
- c. destroyed slowly by chemical action
- d. cause something to lose its brightness by being exposed to air or damp
- e. metal formed of admixture of metals
- f. plentiful; more than enough
- g. substances present in another substance that make it of poor quality
- h. in the natural state; unrefined
- i. separation of a solid substance from the liquid in which it is held
- j. special qualities or characteristics of a substance

### 2. Which are the opposites of the following?

- a. light .....
- b. readily .....
- c. most .....
- d. impure .....
- e. hot .....
- f. undissolved .....
- g. cooled .....
- h. soft .....
- i. strong .....
- j. extensive .....

### 3. Ask for confirmation of the following information by adding question tags to the sentences.

- a. Aluminum is malleable, .....?
- b. Bauxide consists of aluminum oxides and hydroxides, .....?
- c. While the aluminum hydroxide precipitates, the silicates remain in solution, ..... ?
- d. Aluminum is used as a structural material, ..... ?
- e. Pure aluminum is soft, .....?

**4. Match the items in list A with the items in list B so as to form meaningful sentences.**

- | List A                                    | List B                                     |
|---|--|
| 1. Bauxite is                             | a. light in weight.                        |
| 2. Aluminum is                            | b. at about 1000° C.                       |
| 3. To remove the undissolved ferric oxide | c. a claylike rock.                        |
| 4. Alumina is electrolyzed                | d. the silicon oxide solution is filtered. |
| 5. Aluminum is                            | e. aluminum is strong.                     |
| 6. When alloyed with other metals         | f. a good conductor of electricity.        |

**5. Use your knowledge and tick appropriately in the following table:**

	USES	PROPERTIES
A	plastics	light
L	cooking utensils	good conductor of electricity
U	windows, doors, roofs	malleable
M	magnet	occurs free in nature
I	paints	rapidly diffused
N	alloys for washing machines	inactive
U	foil in place of tin	ductile
M	transmission lines	responds to heat
I	glass	responds to heat treatment
N	scavengers	transparent
U	jewellery	corrosion resistant
M	airplane alloys	soluble in water
	pipe insulation	reducing agent
	flashlight bulbs	compressible
	chains	when alloyed strong
	containers for soft drinks	

**6. Write whether you agree or disagree on the following statements. In case you disagree, explain why.**

- a. Pure aluminum is soft and remains as such when mixed with other metals.
- b. Bauxite is purified through the Bayer process.
- c. Purified alumina is electrolyzed in the Hall-Heroult process.
- d. Gryolite, calcium fluoride and sodium fluoride are a molten mixture in which alumina is not dissolved.
- e. Pure aluminum oxide is obtained by heating the resulting aluminum hydroxide.
- f. Aluminum does not resist corrosion because it lacks a protective oxide coat;

**7. Complete the nouns in the list below.**

<b>verb</b>	<b>noun</b>
corrode	.....
consist	.....
treat	.....
cause	.....
precipitate	.....
remain	.....
proceed	.....
resist	.....

# Metals: Their conductivity and their chemical properties

One of the common physical properties that characterizes metals is that they are conductors of heat and electricity. Heat and electrical conductivity of solid or molten metals are unusually high. The electrical conductivity of metals is over a million times greater than that of a strong electrolyte. A metal undergoes no changes in properties when it carries current.

The conductivity of metals decreases with increasing temperature. At very low temperatures ( $-255\text{ }^{\circ}\text{C}$  or lower) certain metals become **superconductors**; the electrical resistance drops to zero. Certain elements, like silicon (Si), and germanium (Ge), have conductivities that, unlike metals, increase with increasing temperature. These are called **semiconductors**.

Chemically, the metallic character of an element is associated with the tendency to lose electrons. In chemical reactions with nonmetals, metal atoms tend to donate electrons. Their electronegativities are low. The metals with very low electronegativities form oxides which react with water and yield OH ions. Metal oxides which act in this way are called **basic oxides**. The higher the oxidation state of a given metal is, the greater is the acidity of the oxide. Because of their strong tendency to lose electrons, metals usually act as reducing agents and generally emit electrons when exposed to high frequency photons (**photoelectric effect**) or when heated at high temperatures (**thermionic emission**).

## A. Questions

1. Which is one of the common physical properties that characterizes metals?
2. Is the electrical conductivity of metals greater or smaller than that of a strong electrolyte?
3. Does a metal undergo any changes in properties when it carries current?
4. In which case do metals become superconductors?
5. What do metal atoms tend to do in chemical reactions with nonmetals?
6. Which metals form oxides which react with water and yield OH ions?
7. Which factor controls the acidity of the oxide?
8. How do metals act because of their strong tendency to lose electrons?

## B. Exercises

### 1. Match the synonymous items of the two columns.

- |              |                    |
|--------------|--------------------|
| a. common    | 1. reduce          |
| b. strong    | 2. inclination     |
| c. decrease  | 3. ordinary; usual |
| d. associate | 4. provide; supply |
| e. tendency  | 5. send; radiate   |
| f. donate    | 6. powerful        |
| g. yield     | 7. have to do with |
| h. emit      | 8. produce         |

### 2. Which words in the text mean the following?

- a. substance that allows heat or electric current to pass through it
- b. being liquefied by heat
- c. be subjected to a process
- d. non-metallic chemical element found combined with oxygen in quartz, sandstone, etc.
- e. the process of becoming rusty
- f. give or send out; discharge
- g. rate of occurrence or repetition of something
- h. indivisible unit of electromagnetic radiation

### 3. Which nouns derive from the following?

- a.chemical .....
- b.electric .....
- c.solid .....
- d.resist .....
- e.associate .....
- f.lose .....
- g.tend .....
- h.emit .....

### 4. Fill in the blanks with the right form of the adjective in each parenthesis.

- a. One of the \_\_\_\_\_ (common) physical properties of metals is that they are conductors of heat and electricity.

- b. The electrical conductivity of metals is over a million times \_\_\_\_\_ (great) than that of a \_\_\_\_\_ (strong) electrolyte.
- c. The (high) the oxidation of a given metal is, the \_\_\_\_\_ (great) is the acidity of the oxide.
- d. Metals emit electrons when they are exposed to \_\_\_\_\_ (high) frequency photons or when they are heated at \_\_\_\_\_ (high) temperatures.
- e. At very low temperatures (-225 °C) or even \_\_\_\_\_ (low) certain metals become superconductors.

**5. Do you agree or disagree on the following? If you disagree, explain why.**

- a. Metals are conductors of heat and electricity.
- b. A metal undergoes many changes in properties when it carries current.
- c. The conductivity of metals increases with increasing temperature.
- d. Semiconductors' conductivity increases with increasing temperatures.
- e. In chemical reactions with nonmetals, metal atoms tend to donate electrons.
- f. The higher a metal's oxidation state is, the lower is the acidity of the oxide.
- g. Metals act as reducing agents, because of their strong tendency to lose electrons.

**6. Referring back to the text, fill in the blanks with the appropriate words.**

- a. One \_\_\_\_\_ the common physical \_\_\_\_\_ that characterizes metals is that they are conductors of heat and \_\_\_\_\_ .
- b. The electrical \_\_\_\_\_ of metals is much greater \_\_\_\_\_ that of a strong electrolyte.
- c. A metal does not undergo any \_\_\_\_\_ in properties when it carries \_\_\_\_\_ .
- d. The conductivity of metals \_\_\_\_\_ with increasing \_\_\_\_\_ .
- e. Semiconductors are called the \_\_\_\_\_ whose conductivity \_\_\_\_\_ with increasing temperatures.
- f. Chemically, the \_\_\_\_\_ character of an element has to do with the \_\_\_\_\_ to lose electrons.
- g. In chemical \_\_\_\_\_ with nonmetals, metal \_\_\_\_\_ tend to donate \_\_\_\_\_ .
- h. Metals act usually as reducing \_\_\_\_\_ and generally \_\_\_\_\_ electrons when \_\_\_\_\_ to high frequency \_\_\_\_\_ .

## Castings and heat treatment of metals

The advances in mining, refining and metal working have made the utilization of metal products an established practice in human life. Household and personal items, ornamental, building and industrial products or tools, machines, weapons, even spacecrafts are made of metal. But how are metals treated so that their products can take their final shape?

Most of the metal products we use contain cast parts which are produced in the foundry. The process of producing metal objects in the foundry by pouring molten metal into a mould is called *founding*. Articles produced by founding are called *castings*. Examples of castings are tools.

Depending on their use, castings, as all metal objects, must have certain characteristics, such as hardness and toughness. To obtain these characteristics they are often specially heat treated through the following principal methods:



*Mould*

### **Hardening**

It is a process of heating metal to a certain temperature and then quenching (cooling) it in a suitable medium such as water, oil, etc., in order to make it harder. The hardness of the metal depends on the amount of carbon in it, the temperature of heating and the speed of cooling it.

## Tempering

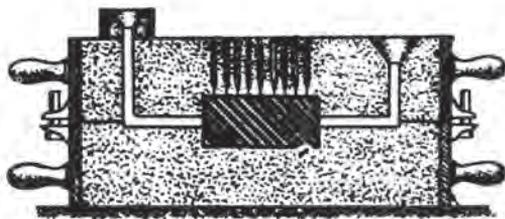
It is a process which is used to remove a certain degree of hardness and brittleness of a metal and increase its toughness. This process is often applied to hardened steel tools which break easily and must lose some of their hardness. One of the methods used is to place the hardened metal in a bath of molten lead and then quench it.

## Annealing

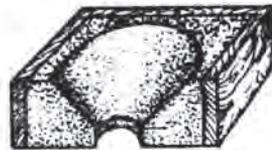
It is the opposite of the hardening process. It is the process of softening a metal to make it easier to machine, cut, shape etc. In annealing, the metal is first heated and then cooled as slowly as possible. The slower the cooling, the softer the metal becomes when it gets cold.

## Surface hardening

It is the hardening of the outer surface of a metal. Only low-carbon steel and wrought iron can be surface hardened. In this process a small amount of carbon is added to the surface of a metal to make it hard. Metal items which need a hard surface, such as screws, hand tools etc. are subjected to the surface hardening method.



*Foundry*



*Mould*

## A. Questions

1. Which advances have made the utilization of metal products an established practice in human life?
2. What kind of metal products are mentioned in the first paragraph?
3. Where are cast parts of metal products produced?
4. Which four principal methods are used, so that metal products can obtain the characteristics of hardness and toughness?
5. What does the hardness of a metal depend on?
6. Which process is applied to hardened steel tools? Why?
7. Through which process are metals softened, so that it'll be easier for them to be machined, cut and shaped?
8. Which metals can be surface hardened?

## B. Exercises

### 1. Match the words with their definitions.

- |              |   |
|--------------|---|
| a. brittle   | 1. a place where metal or glass is melted and formed into a particular shape                                    |
| b. treatment | 2. (a metal) which has been heated to a very high temperature, and so it has become a hot, thick, sticky liquid |
| c. tough     | 3. a container used to form something into a particular shape   |
| d. foundry   | 4. something that is hard but it breaks easily  |
| e. molten    | 5. something strong and difficult to break, cut or tear   |
| f. mould     | 6. process followed to obtain a desired result  |

### 2. Choose the appropriate word to complete the sentences.

- a. Glass is .....  
1) brittle 2) corrosive 3) malleable
- b. Plasticine is .....  
1) ductile 2) corrosive 3) tough
- c. Porcelain is .....  
1) soft 2) brittle 3) ductile
- d. A piece of meat may be .....  
1) durable 2) tough 3) ductile
- e. He is as ..... as iron.  
1) hard 2) soft 3) elastic
- f. Rock is .....  
1) malleable 2) elastic 3) hard
- g. Rubber is .....  
1) brittle 2) corrosive 3) elastic
- h. Hardened steel tools are usually .....  
1) soft 2) brittle 3) elastic
- i. Butter is .....  
1) tough 2) hard 3) soft

### 4. Choose the appropriate words to fill in the gaps.

#### a. harden - hardness - hard

1. The \_\_\_\_\_ of metals greatly depends on the amount of carbon they contain.
2. A very \_\_\_\_\_ tool breaks easily.
3. We add carbon to metals to \_\_\_\_\_ them.

**b. brittleness - brittle**

1. To remove some \_\_\_\_\_ from tools we apply the tempering process.
2. Ice is a \_\_\_\_\_ material.

**c. toughen - toughness - tough**

1. \_\_\_\_\_ rubber is needed for tyres.
2. To \_\_\_\_\_ metals we apply the tempering process.
3. A special treatment is applied to increase the \_\_\_\_\_ of the leather.

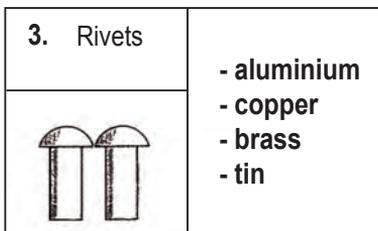
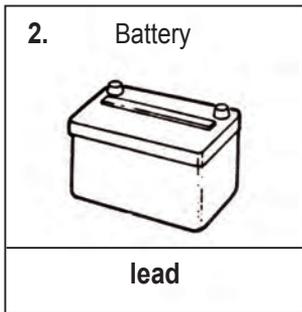
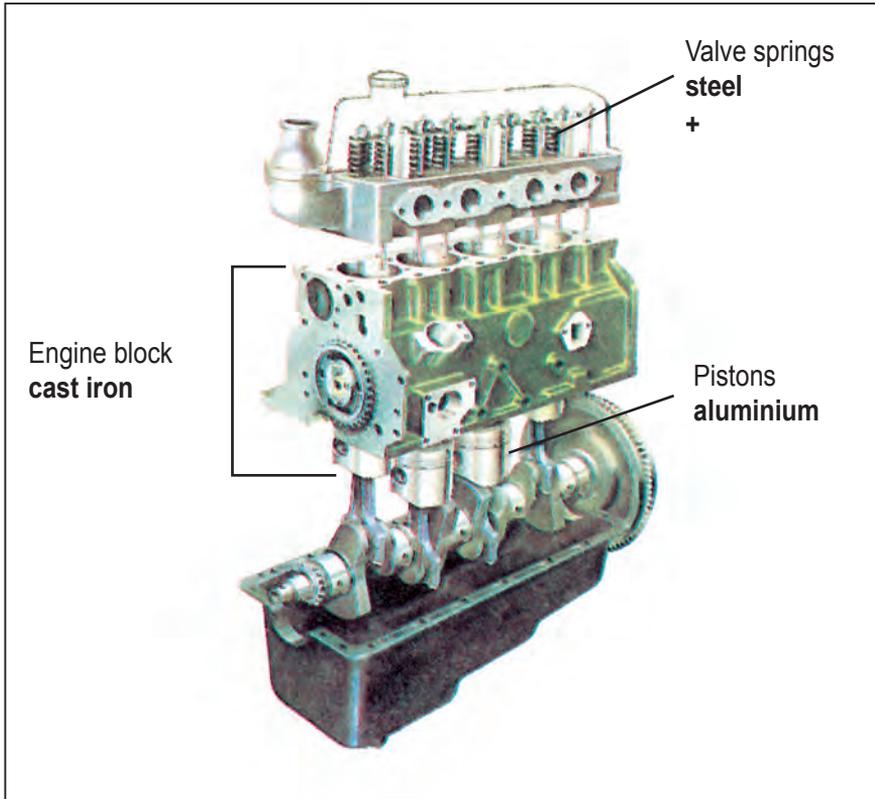
**d. soften - softness - soft**

1. Her handbag is made of \_\_\_\_\_ leather.
2. Heat \_\_\_\_\_ metals.
3. Velvet is famous for its \_\_\_\_\_ .

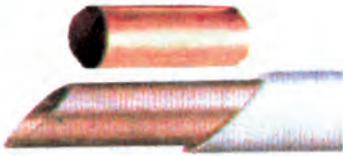
**4. Tick (✓) in the appropriate column, drawing information from the text.**

		Hardening	Tempering	Annealing	Surface hardening
a.	Hardness is added to the metal.				
b.	A certain degree of hardness and brittleness is removed.				
c.	The metal is heated and then cooled.				
d.	The metal is softened.				
e.	An amount of carbon is added to the surface of the metal.				
f.	The metal is cooled as slowly as possible.				
g.	The hardened metal is placed in a bath of molten lead and then quenched.				
h.	It is applied on hardened steel tools.				
i.	The metal becomes easier to cut or machine.				
j.	It is applied where a hard surface is needed.				

5. Look at the pictures and say what each of the items shown is made of.  
 e.g. **Picture 1:** The engine block is made of cast iron.

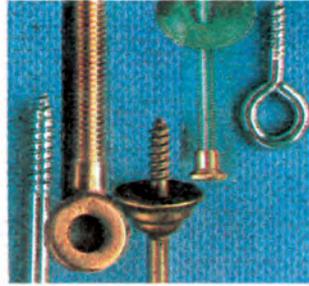


5. Tube



**copper**

7. Screws



- steel  
- brass  
- aluminium

6. Head



**bronze**

8. Hammer



**steel**

9. Earrings



**gold**

10. Cutlery



**silver**

11. Socket



**steel**  
**zinc-chromium plated**

13. Tap



**nickel**

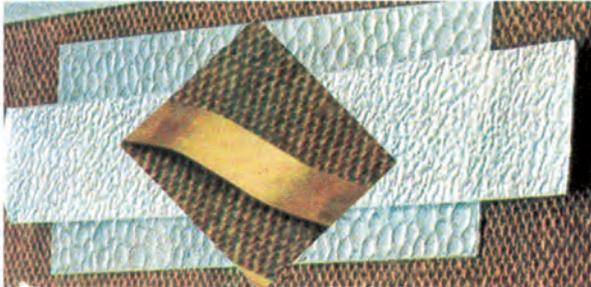
12. Musical instrument



**brass**

## Working with metal - Bench and sheet metal tools

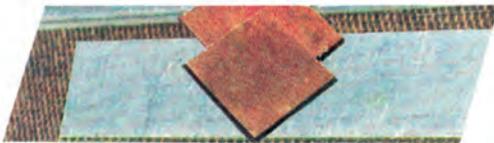
Bench and sheet metal is the most important material used for metal working. It is available in the form of rods, squares, flat bars and sheet stock of various sizes and thicknesses. It is worked usually cold with hand tools and some kinds of machines, such as the drill press, the rolls, the bar folders, etc.



sheet



rod



bar



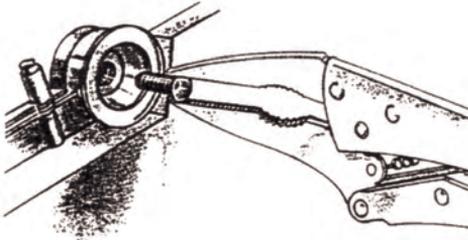
square

Using hand tools and precision measuring instruments properly enables skilled metal workers to have excellent job opportunities. Working with bench or sheet metal tools is not so easy, however; on the contrary, it is sometimes more difficult than operating some machines.

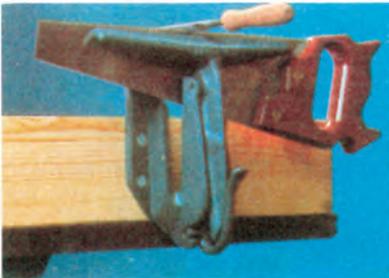
A metal worker must be able to perform various activities, such as the ones illustrated below.



**1** Screwing / unscrewing, tightening or loosening screws, bolts, nuts...



**2** Gripping metal pieces, pipes and other small objects



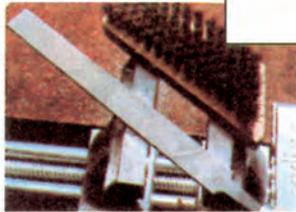
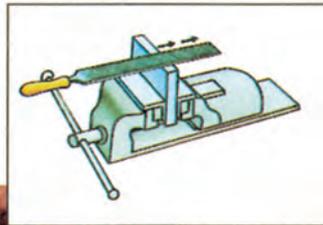
**3** Holding workpieces



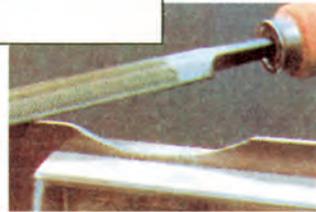
**4** Scribing lines or circles on metal surfaces



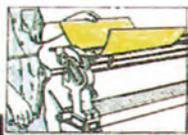
**5** Marking or starting a hole



**6** Filing



**7** Draw filing



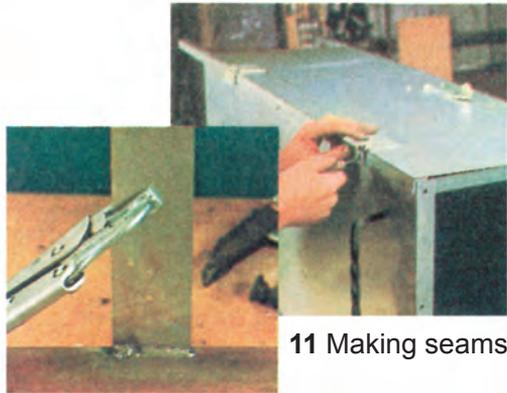
**8** Forming sheets of metal/making rolls



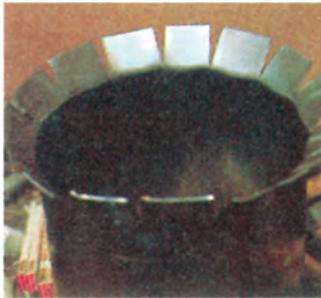
**9** Making various bends on metal rods, bars, tuber or wires



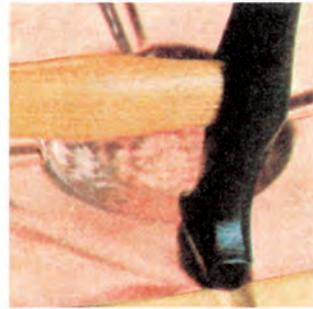
**10** Bending metal sheets



**11** Making seams



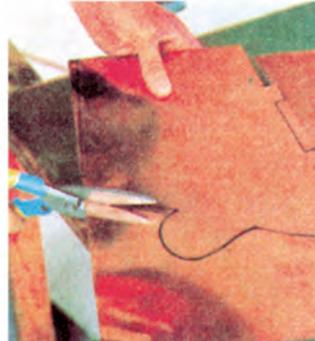
**12** Hemming



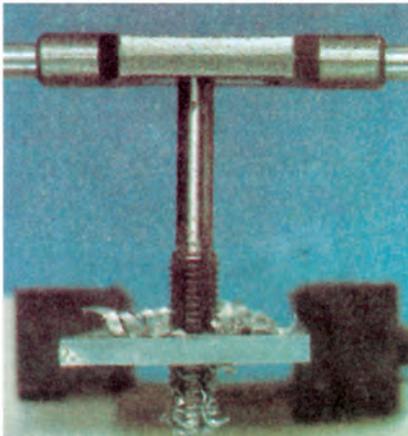
13 Forging



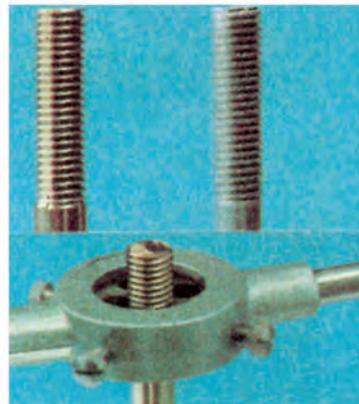
14 Cutting pieces of metal



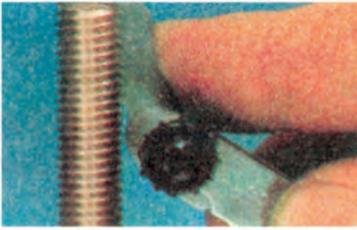
15 Shearing thin sheets of metal



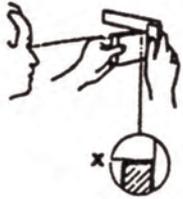
16 Cutting internal threads



17 Making external threads



18 Measuring threads



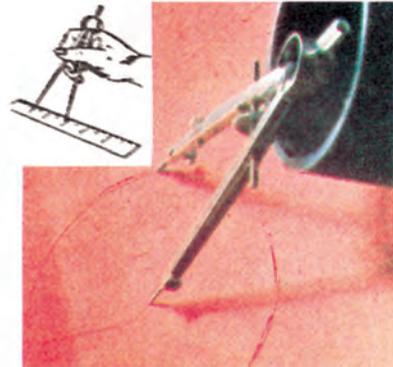
20 Checking right angles



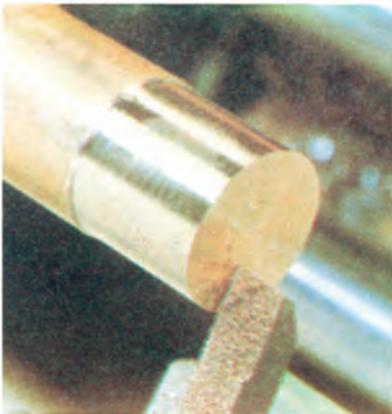
19 Cutting holes in metal pieces (drilling)



21 Scraping metal surfaces



22 Taking measurements

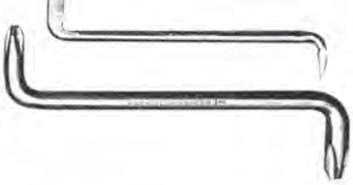


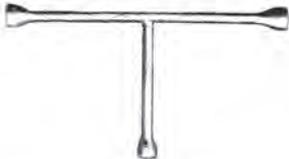
23 Grinding blunt (=dull edged) tools

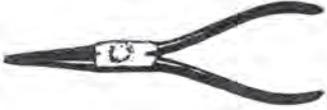
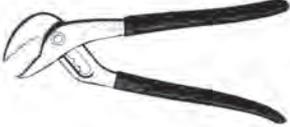
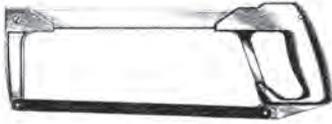
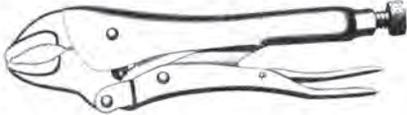
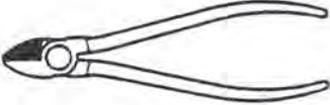
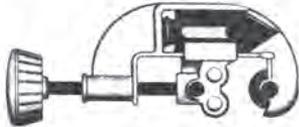
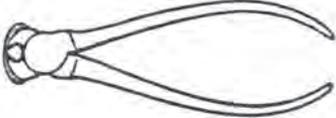
To perform all the previously illustrated activities, a technician must be able to use a wide variety of tools skillfully.

Below you can see the most common hand and measuring tools, machines and accessories which are necessary for working with metal.

### HAND TOOLS

<p>1 Flat-tip screwdriver</p>  <p>.....</p>	<p>5 Allen-hex socket</p>  <p>.....</p>
<p>2 Cross-point screwdriver</p>  <p>.....</p>	<p>6 Socket spanner</p>  <p>.....</p>
<p>3 Offset screwdriver</p>  <p>.....</p>	<p>7 Socket</p>  <p>.....</p>
<p>4 Automatic/Retaining screwdriver</p>  <p>.....</p>	<p>8 Ratchet</p>  <p>.....</p>

<p><b>9</b></p> <p>Swivel handle</p>  <p>.....</p>	<p><b>14</b></p> <p>Combination wrench</p>  <p>.....</p>
<p><b>10</b></p> <p>Extension</p>  <p>.....</p>	<p><b>15</b></p> <p>Adjustable wrench</p>  <p>.....</p>
<p><b>11</b></p> <p>Tee handle</p>  <p>.....</p>	<p><b>16</b></p> <p>Pipe adjustable/Monkey wrench</p>  <p>.....</p>
<p><b>12</b></p> <p>Open-ended wrench</p>  <p>.....</p>	<p><b>17</b></p> <p>Combination/Universal pliers</p>  <p>.....</p>
<p><b>13</b></p> <p>Ring wrench</p>  <p>.....</p>	<p><b>18</b></p> <p>Flat-nose pliers</p>  <p>.....</p>

<p>19 Round-nose pliers</p>  <p>.....</p>	<p>24 Tin snips/Shears</p>  <p>.....</p>
<p>20 Adjustable pliers</p>  <p>.....</p>	<p>25 Hacksaw/Metal saw</p>  <p>.....</p>
<p>21 Lock-grip pliers</p>  <p>.....</p>	<p>26 (Cold) chisel</p>  <p>.....</p>
<p>22 Side cutters</p>  <p>.....</p>	<p>27 Pipe/Tube cutter</p>  <p>.....</p>
<p>23 End cutters</p>  <p>.....</p>	<p>28 (Screw) Tap</p>  <p>.....</p>

29

Die



.....

34

Punch



.....

30

Scrapers



.....

35

Ball peen hammer



.....

31

File



.....

36

Mallet



.....

32

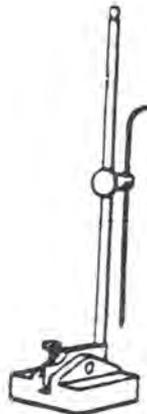
Scriber



.....

37

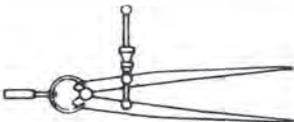
Surface gauge



.....

33

Dividers



.....

38

Hand drill



.....

39

Hand groover

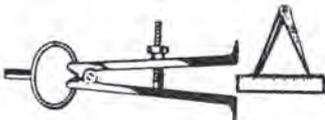


.....

### MEASURING TOOLS

1

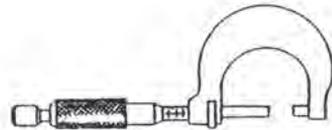
Internal/inside calipers



.....

4

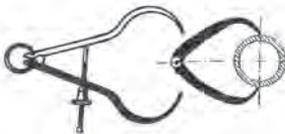
Micrometer



.....

2

External/Outside calipers



.....

5

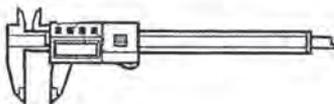
Steel rule



.....

3

Vernier calipers



.....

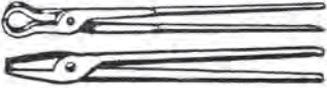
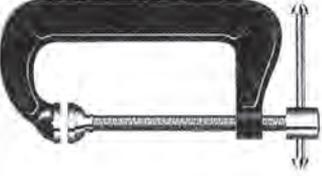
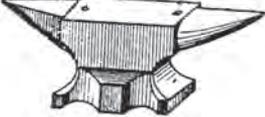
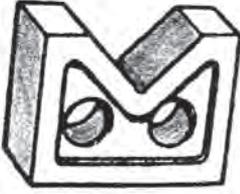
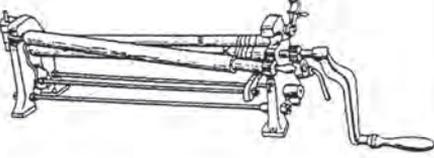
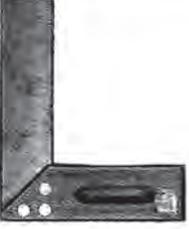
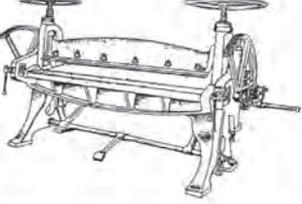
6

Screw-pitch gauge



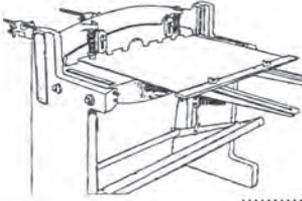
.....

## OTHER PIECES OF EQUIPMENT

<p>1</p> <p>Forging tongs</p>  <p>.....</p>	<p>6</p> <p>Clamp</p>  <p>.....</p>
<p>2</p> <p>Anvil</p>  <p>.....</p>	<p>7</p> <p>Vice</p>  <p>.....</p>
<p>3</p> <p>Surface plate</p>  <p>.....</p>	<p>8</p> <p>Bending machine</p>  <p>.....</p>
<p>4</p> <p>Vee block</p>  <p>.....</p>	<p>9</p> <p>Forming machine/Roll</p>  <p>.....</p>
<p>5</p> <p>Try square</p>  <p>.....</p>	<p>10</p> <p>Bar folder</p>  <p>.....</p>

11

Squaring shears



.....

15

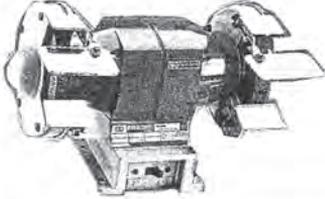
Drill press



.....

12

Grinder -Polisher- Buffer



.....

13

Impact wrench



.....

16

Steel brush



.....

14

Electric drill



.....

17

Oiler



.....

18

Spirit level



.....

# Exercises

1. Go over the lists of pictures again –depicting the hand tools, the measuring tools and other pieces of equipment– and complete the blanks below their English name with the Greek equivalent.

2. Classify the tools and other equipment in the following categories, according to their use.

a. Holding/Gripping

.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....

b. Tightening/Loosening

.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....

c. Cutting

.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....

d. Measuring

.....  
.....  
.....  
.....  
.....

e. Bending/Forming  
(Making bends, loops,  
angles, hems, seams, rolls)

.....  
.....  
.....  
.....  
.....  
.....

f. Threading

.....  
.....

g. Scribing/Marking

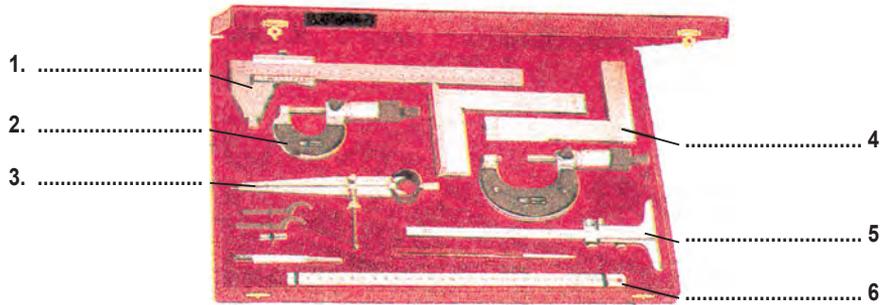
.....  
.....  
.....  
.....

h. Drilling

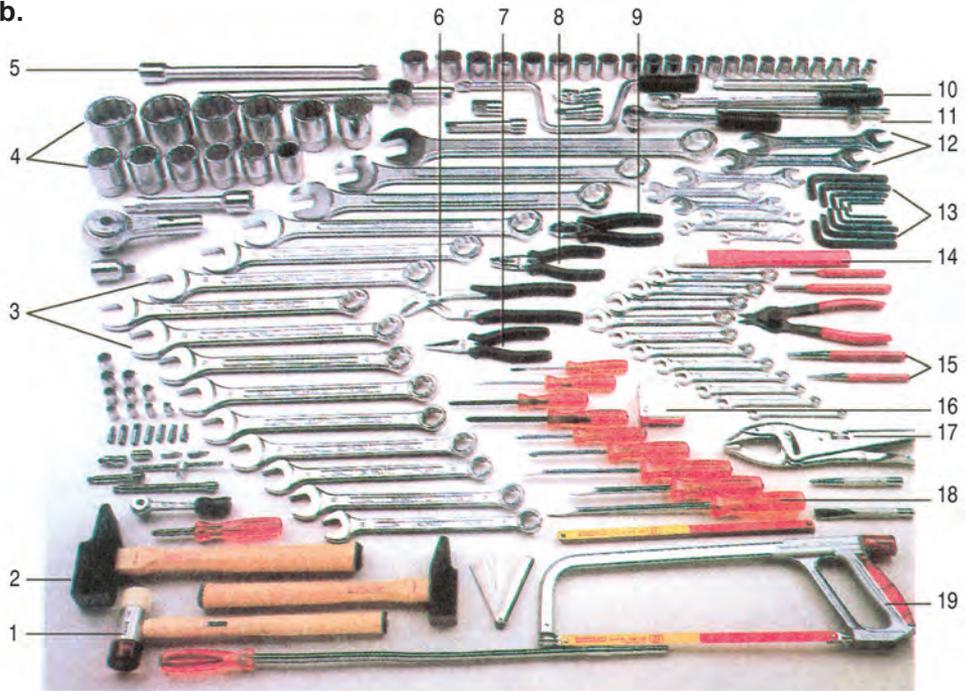
.....  
.....  
.....  
.....

**3. Label the pictures below.  
Check how many words for tools you can remember.**

**a.**



**b.**



- 1. ....
- 2. ....
- 3. ....
- 4. ....
- 5. ....
- 6. ....
- 7. ....
- 8. ....
- 9. ....
- 10. ....

- 11. ....
- 12. ....
- 13. ....
- 14. ....
- 15. ....
- 16. ....
- 17. ....
- 18. ....
- 19. ....

c.



1. ....



2. ....



4. ....



7. ....



9. ....



3. ....



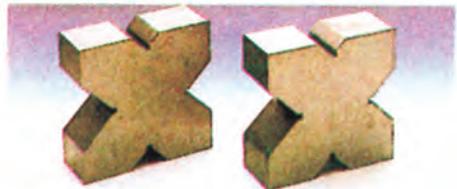
5. ....



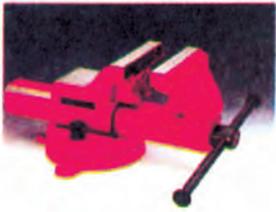
6. ....



8. ....



10. ....



11. ....



12. ....



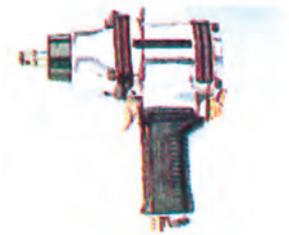
13. ....



14. ....



15. ....



16. ....



17. ....



18. ....



19. ....



20. ....

4. a. Tick (✓) in the proper place to indicate the use of the following tools:

TOOLS	use								
	cutting	measuring	gripping holding	screwing tightening loosening	scribing	drilling	threading	filing	hammering striking
scribers									
forging tongs									
socket spanners									
Vices									
dies									
universal pliers									
steel rules									
wrenches									
dividers									
files									
mallets									
chisels									
calipers									
monkey wrenches									
screwdrivers									
tube cutters									
lock-grip pliers									
drills									
shears									
clamps									
taps									
adjustable pliers									
hacksaws									
surface gauges									
adjustable wrenches									

**b. Use the grid to make sentences as in the examples.**

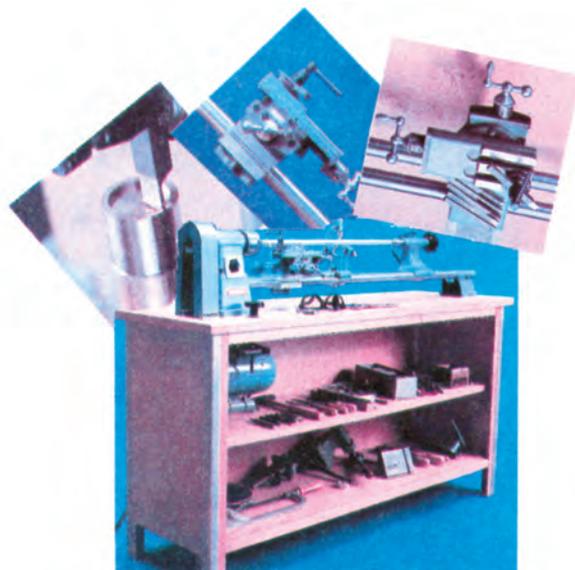
We can cut rods of metal (by) using (a) hacksaw(s).

To cut rods of metal we (can) use (a) hacksaw(s).

(A) hacksaw(s) is/are used to cut/for cutting rods of metal.

**5. Use the table to make meaningful sentences.**

Bench and sheet metal workers use (a) .....		
<ol style="list-style-type: none"> <li>1. forming machine</li> <li>2. drill</li> <li>3. punch</li> <li>4. dies</li> <li>5. surface gauge</li> <li>6. mallet</li> <li>7. vice</li> <li>8. calipers</li> <li>9. vee block</li> <li>10. lock-grip pliers</li> <li>11. bending machine</li> </ol>	<p>for to</p>	<ol style="list-style-type: none"> <li>a. starting holes on metal to make drilling easier.</li> <li>b. hold tightly pieces of metal while working on them.</li> <li>c. making bends on rods, bars or tubes.</li> <li>d. cut threads on the surface of metal rods or bolts.</li> <li>e. gripping objects or holding pieces of metal steady.</li> <li>f. take internal or external measurements.</li> <li>g. curving sheet metal and forming cylinders of various diameters.</li> <li>h. making bends on rods and bars, and also bending, hemming or seaming sheet metal.</li> <li>i. cut holes in solid metal.</li> <li>j. set objects on them for marking.</li> <li>k. scribing lines parallel to a surface or vertical to another line.</li> </ol>



**6. Match the two columns to form meaningful sentences.**

**A**

- a. We use chisels to
- b. Forging tongs are used for
- c. With flat-tip screwdrivers,
- d. Use a screw-pitch gauge to
- e. Files are useful for
- f. Scrapers are used for
- g. Tee handles give
- h. Metal workers use try squares to
- i. We often use grinding machines for
- j. A bar folder is used for
- k. Use a surface plate to

**B**

- 1. find the number of threads per inch.
- 2. scraping metal surfaces to clean or make them smooth.
- 3. check flat surfaces.
- 4. cut sheets of metal, shear off rivets and split rusted nuts from bolts, especially in hard-to-get-to places.
- 5. bending metal sheets, making hems, or turning an edge to receive a wire.
- 6. check right angles on metal pieces.
- 7. holding pieces of metal while forging or heat treating them.
- 8. a better grip and save effort during repetitive work, or provide extra power.
- 9. cutting, smoothing and removing small amounts of metal.
- 10. grinding dull-edged tools, e.g. chisels. Furthermore, by fixing another wheel they can also do polishing or buffing.
- 11. we can screw slot-head screws.

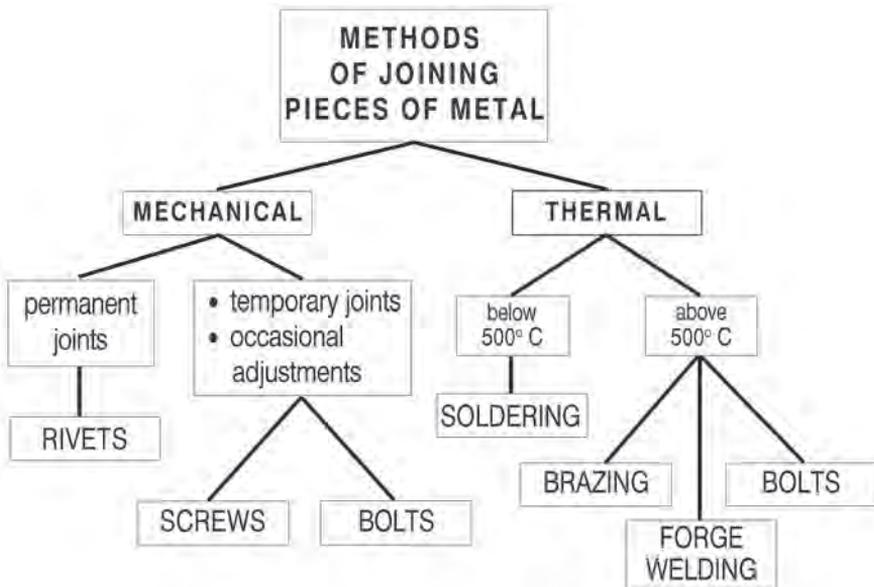
# Methods of joining pieces of metal

Joining metals is a routine in the making of metal objects and constructions. Especially in the making of metal constructions, it is often necessary to fasten or join pieces of metals. The metals can be castings, metal sheets, iron bars, rods, etc. Pieces that are to be joined may be composed of the same or different metals and they may be joined either permanently or occasionally. There are various methods of joining metals. The choice of the method that is to be followed depends on the requirements of the construction.

The diagram below presents the basic classification of these methods.

## Task 1

Study the diagram, and then complete the text that follows.



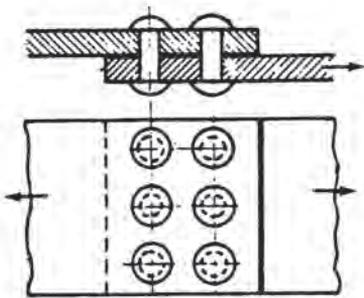
There are two methods of joining pieces of metals. The ..... (1) and the ..... (2). In the mechanical method, metals are joined by using fastening devices such as ..... (3), ..... (4) and ..... (5), while in the ..... (6), by using a heat source.

..... (7) are used for holding pieces permanently..... (8) and..... (9) are used, on the other hand, for making temporary joints, or if the ..... (10) requires occasional adjustment.

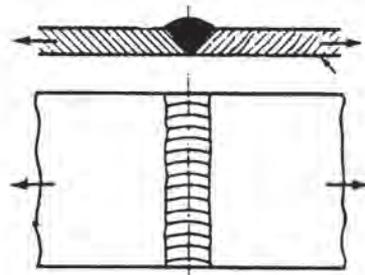
According to the temperature of the heat source to be used, the thermal method is distinguished into..... (11), ..... (12) and ..... (13).

## Task 2

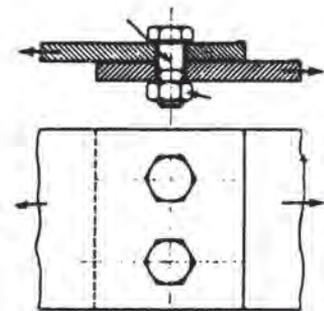
In the spaces provided below each picture, write if the method illustrated, is mechanical or thermal.



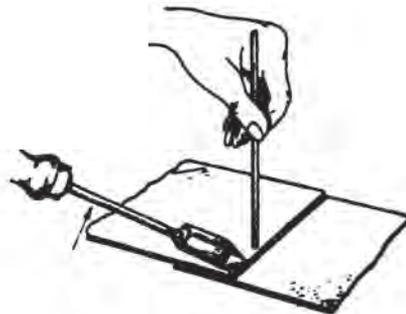
1. ....



2. ....



3. ....



4. ....

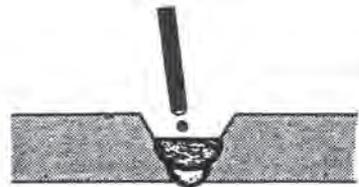
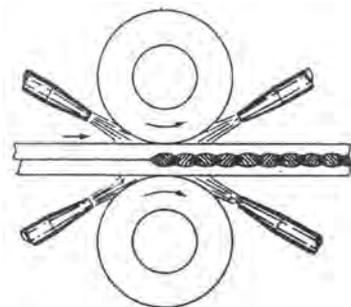
### Task 3

The definitions that follow, refer to the joining of metals using a heat source. In the spaces provided, write the Greek term for the various techniques of joining metals by the heat source described below.

- a. melting both pieces (base metals) at the point to be joined: .....
- b. using (melting) a filler metal to join the pieces: .....
- c. melting both the base metals and the filler: .....
- d. heating the base metals at the point to be joined (in temperature lower than their melting point) and pressing them at that point: .....
- e. joining pieces composed of the same metal: .....
- f. joining pieces composed of different metals: .....

### Task 4

Relate the pictures to the techniques of joining metals using a heat source described in the previous task (3).



e.g. Picture 1 corresponds  
to technique (d)

Picture 2 .....



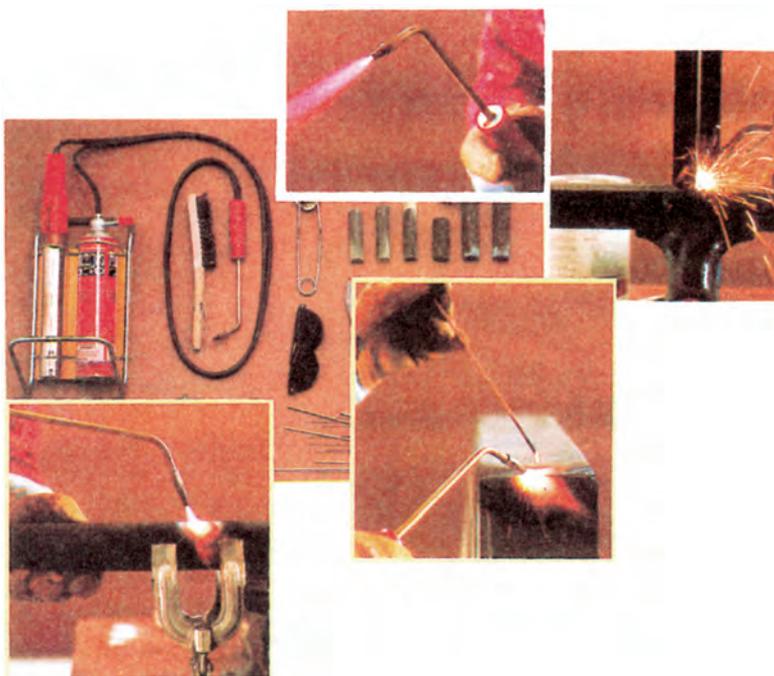
Picture 3 .....



Picture 4 .....

### Task 5

Look through the diagram presenting the methods of joining pieces of metal again, to identify the process described (Soldering, Brazing or Welding).



- a. It is the process of joining metals together at temperatures above 500 °C using brass or bronze as a filler: .....



Soldering

- b. It is the process of joining metals at very high temperatures either with the use of a filler or by heating (fusing) metals to their melting point: .....
- c. It is the process of fastening two or more pieces of metal together by means of a filler (solder) having a low melting point (below 500 °C): .....



Welding

## Task 6

Mention the methods, fastening devices and processes you would use to join:

- a. girders and beams of a bridge  
e.g. I could join them either by the thermal method (welding) or by the mechanical one using rivets.

- b. pieces of wrought iron furniture  
.....

- c. aluminium frames of window panes  
.....

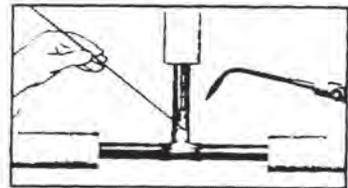
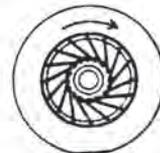
- d. ducts used in heating, ventilation, air-conditioning systems  
.....

- e. wheels of cars  
.....

- f. the edges of a metal box  
.....

- g. the handle to the blade of a trowel  
.....

- h. copper tubes  
.....



## Task 7

Match the answers with the questions to consolidate what you've learnt about soldering, brazing and welding. Fill in the gaps provided at the end of each question with the number of the corresponding answer.

### Questions

- a. What kind of filler is used in soldering? .....
- b. What are the fillers used in the welding process called? .....
- c. How many welding techniques are there? Which are they? .....
- d. What kind of gaseous mixture is used to create the flame in gas welding? .....
- e. What is arc welding? .....

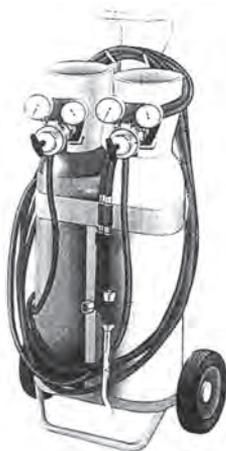
- f. In arc welding, how are the pieces joined? .....
- g. What is the minimum amperage used to create the electric arc? .....
- h. What is the oldest form of welding called? .....
- i. What is melted in brazing? The filler or the base metals? .....
- j. Which is the alternative term used for the gas welding process? .....

## Answers

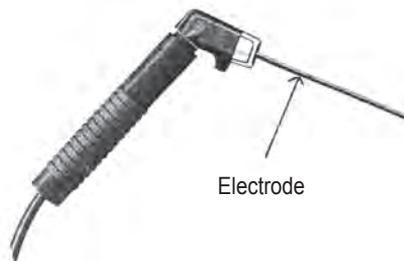
1. Three. The gas, arc and forge welding.
2. Only the filler is melted.
3. Oxyacetylene welding process.
4. It is the forge welding which has been practised by blacksmiths for centuries.
5. They are called welding rods.
6. A mixture of acetylene and oxygen.
7. It is the process of fusing metals using the heat of an electric arc.
8. An alloy of tin and lead, which is called solder.
9. 60 A.
10. By means of an electrode. The electrode used to create the arc melts and serves as a filler rod for the joint.

## Pieces of equipment and techniques used for joining metals

Below are illustrated some pieces of equipment used in the various processes and techniques for joining metals using a heat source.



Cylinders with oxygen and acetylene





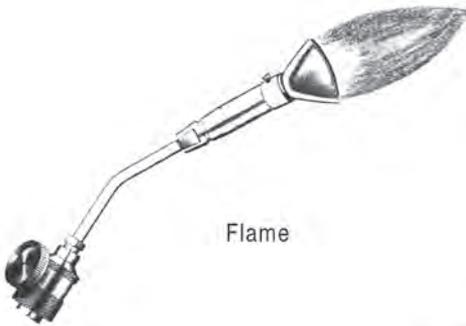
Torches



Soldering iron



Soldering copper



Flame



Gas soldering device

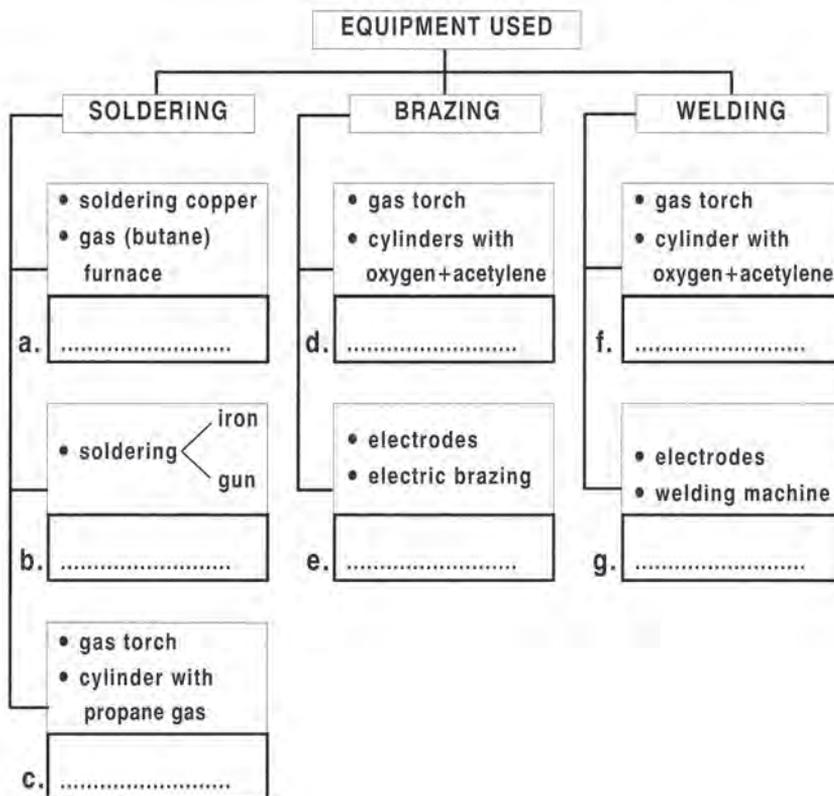


Welding machine

## Task 8

- The following diagram presents the equipment used in the various soldering, brazing and welding techniques.
- The table below the diagram names the various soldering, brazing and welding techniques.

Use your knowledge to identify the soldering, brazing and welding techniques according to the equipment used in each one of them. Write the name of the technique in the spaces provided in the diagram.



SOLDERING-BRAZING-WELDING TECHNIQUES	
<ul style="list-style-type: none"> <li>• Gas soldering</li> <li>• Gas brazing</li> <li>• Arc welding</li> <li>• Soldering with a soldering copper</li> </ul>	<ul style="list-style-type: none"> <li>• Oxyacetylene (gas) welding</li> <li>• Electric soldering</li> <li>• Electric brazing</li> </ul>

## Exercises

### 1. Complete the following table:

	SOLDERING	BRAZING	WELDING
FILLERS	e.g. solder (an alloy of tin and lead)		
GASES			
DEVICES			

### 2. Fill in the blanks with the technique or process used for the following cases:

#### Joining metals:

- by melting the parts of the metal pieces we want to join .....
- with an alloy of tin and lead as a filler .....
- with brass or bronze as a filler .....
- with an electrode as a filler .....

#### Using (the following devices):

- a soldering copper and a gas furnace .....
- a gas torch .....
- an electric iron or gun .....

#### Using (the following as a heat source):

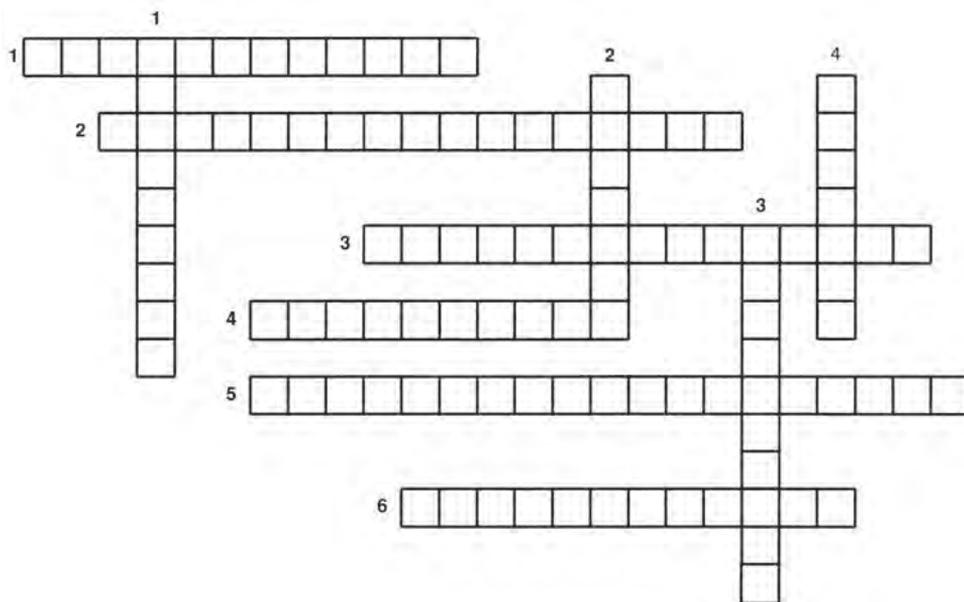
- a welding machine .....
- a mixture of oxygen and acetylene gases .....
- propane gas .....

#### According to the temperature:

- melting point of the filler below 500 °C.....
- melting point of the filler above 500 °C .....

### 3. Complete with the English equivalent.

#### CROSSWORD PUZZLE



#### Across

1. Κασσιτεροκόλληση με αέριο\*
2. Ηλεκτρική κασσιτεροκόλληση\*
3. Ηλεκτρική μπρουτζοκόλληση\*
4. Μπρουτζοκόλληση αερίου\*
5. Οξυγονοκόλληση\* (σκληρή συγκόλληση οξυγόνου-ασετυλίνης)
6. Σκληρή συγκόλληση με σφυρηλάτηση\*

#### Down

1. Κασσιτεροκόλληση
2. Μπρουτζοκόλληση
3. Ηλεκτρική συγκόλληση\*  
(σκληρή)
4. Σκληρή συγκόλληση

\* two words

**4. Make six pairs of similar in meaning words out of the two lists.**

**List A:** join, melt, process, alloy, equipment, create

**List B:** technique, mixture, produce, device, fasten, fuse

- |                  |                  |
|------------------|------------------|
| 1. ....<br>..... | 4. ....<br>..... |
| 2. ....<br>..... | 5. ....<br>..... |
| 3. ....<br>..... | 6. ....<br>..... |

**5. Write nouns deriving from the following verbs:**

	<b>Verb</b>	<b>Noun</b>
e.g.	join	joint
	heat	.....
	practise	.....
	fill	.....
	process	.....
	press	.....
	compose	.....
	classify	.....
	solder	.....
	mix	.....

**6. Writing Activity**

**(Building up a paragraph - Describing items and processes)**

**Use the information given, below to write a paragraph describing the equipment used in Gas Welding.**

**Expressions to help you**

is / are ... equipped with ...  
 one ... while the other ...  
 that is ...  
 either ... or  
 that / which / whose ...  
 also / too / as well ...

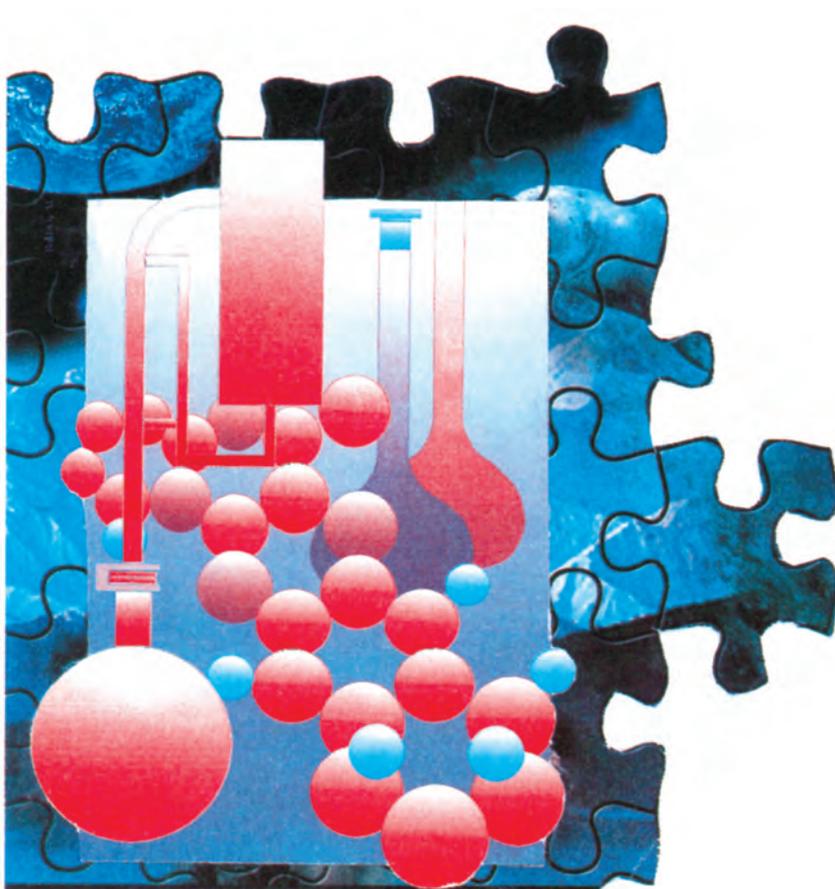
One indicates the  
 cylinder pressure.  
 The other, the amount  
 of pressure in the hose.



**7. Expressing Usefulness and Purpose.**  
**Use the table to make meaningful sentences.**

<ul style="list-style-type: none"> <li><b>a.</b> Two regulators</li> <li><b>b.</b> Two manometers</li> <li><b>c.</b> The hoses</li> <li><b>d.</b> Screws and bolts</li> <li><b>e.</b> Rivets</li> <li><b>f.</b> A heat source</li> <li><b>g.</b> An amperage over 60 A</li> <li><b>h.</b> Welding rods</li> <li><b>i.</b> Acetylene and oxygen</li> </ul>	<p>is / are needed/ used</p>	<p>to in order to so as to</p>	<ul style="list-style-type: none"> <li><b>1.</b> join metals in the arc welding process.</li> <li><b>2.</b> carry the gases from the cylinders to the torch.</li> <li><b>3.</b> control the pressure of the gas flow in the cylinder.</li> <li><b>4.</b> make temporary joints.</li> <li><b>5.</b> carry out soldering, brazing and welding.</li> <li><b>6.</b> make strong joints.</li> <li><b>7.</b> produce a flame in gas welding.</li> <li><b>8.</b> indicate the amount of pressure in the hoses and cylinders.</li> <li><b>9.</b> hold metal pieces together permanently.</li> </ul>
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## Atoms - molecules and their compounds



It is known that **ores** are mineral compounds containing metal. **Compounds** are pure substances composed of two or more elements whose chemical composition is constant. For example, quartz is a compound of one atom of silicon and two atoms of oxygen. But, what is the atom?

The **atom** is a particle, which is the smallest component of an element having the chemical properties of the element. It consists of a positively charged nucleus of neutrons and protons. This positively charged nucleus exerts an electrical attraction on one or more electrons in motion around it.

The smallest physical unit of an element or compound – consisting of one or more different atoms in an element and two or **more** different atoms in a compound - is the **molecule**.

**Atomic weight** is the average weight of an atom of an element based on 1/12 the weight of the carbon -12 atom. The quantity of an element, whose weight in grams is numerically equal to the atomic weight of the element, is a **gram atom** or the **gram-atomic weight**.

**Molecular weight** is the average weight of a molecule of an element or compound measured in units based on 1/12 the weight of the carbon -12 atom. That is to say, it's the sum of the atomic weights of all the atoms in a molecule. The quantity of a substance the weight of which equals the substance's molecular weight is the **mole**. This weight is expressed in grams and contains  $6.02 \times 10^{23}$  molecules of the substance.

## A. Questions

1. What is a compound?
2. What is the smallest component of an element called?
3. What does an atom consists of?
4. What does the positively charged nucleus of the atom exert?
5. How is the molecule defined?
6. What is the average weight of an atom of an element called?
7. What else is a gram atom called?
8. Is the molecular weight the average weight of an atom of an element or compound?
9. What is the molecular weight measured in?
10. What do we call the weight expressed in grams and containing  $6.02 \times 10^{23}$  molecules of the substance?

## B. Exercises

### 1. Referring back to the text, identify the bold-faced words.

e.g. **Compounds** are.....

Compounds are pure substances composed of two or more elements whose chemical composition is constant.

- a. **Quartz** is .....
- b. The **atom** is.....
- c. The **atomic weight** is .....
- d. A **gram atom** is .....
- e. The **mole** is .....

**2. Match the synonyms in columns A and B.**

- | A              | B                   |
|----------------|---------------------|
| a. contain     | 1. movement towards |
| b. substance   | 2. include          |
| c. composed of | 3. depending on     |
| d. properties  | 4. amount           |
| e. attraction  | 5. qualities        |
| f. quantity    | 6. consisting of    |
| g. based on    | 7. matter           |

**3. Complete the table**

nouns	adjective
atom	.....
metal	.....
element	.....
example	.....
electricity	.....
attraction	.....
difference	.....
molecule	.....
equality	.....
substance	.....

**4. In the following paragraph replace the Greek words with their English equivalent.**

The atom is **ένα μόριο**<sup>1</sup>, that is the smallest **σωματίδιο**<sup>2</sup> of an element having the chemical **ιδιότητες του στοιχείου**<sup>3</sup>. It consists of a positively **φορτισμένο πυρήνα**<sup>4</sup> of neutrons **και πρωτονίων**<sup>5</sup>. This **θετικά**<sup>6</sup> charged nucleus **ασκεί**<sup>7</sup> an electrical **έλξη**<sup>8</sup> on one or more **ηλεκτρόνια**<sup>9</sup> in **κίνηση**<sup>10</sup> around it.

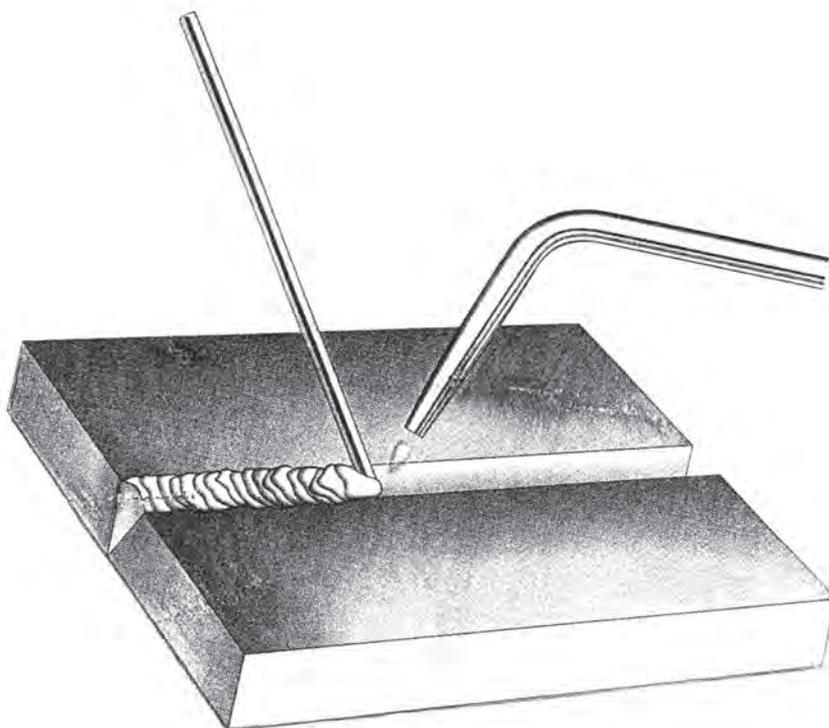
**5. Drawing information from the text, complete the following:**

- Ores are \_\_\_\_\_ compounds which contain \_\_\_\_\_ .
- The atom consists \_\_\_\_\_ a positively \_\_\_\_\_ nucleus of neutrons and \_\_\_\_\_ .
- The smallest physical \_\_\_\_\_ of an element or \_\_\_\_\_ is the \_\_\_\_\_ .

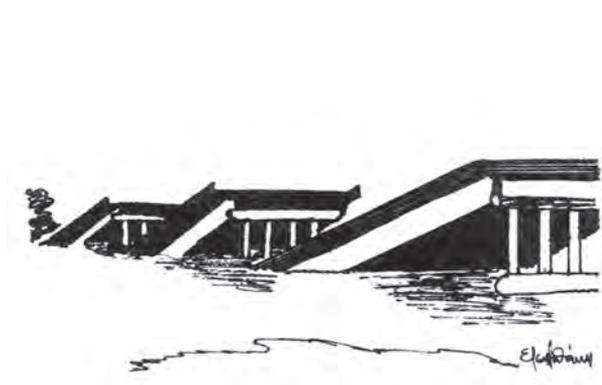
- d. Molecular \_\_\_\_\_ is the \_\_\_\_\_ of the \_\_\_\_\_ weights of all the atoms \_\_\_\_\_ a molecule.
- e. The \_\_\_\_\_ of a substance, the \_\_\_\_\_ of which equals the substance's \_\_\_\_\_ weight, is the \_\_\_\_\_ .

**6. Say whether the following statements are True or False. Correct the false ones.**

- a. Ores are mineral compounds containing silver and gold.
- b. Compounds are impure substances composed of two or more elements.
- c. The smallest physical unit of an element is the molecule.
- d. Quartz is a compound of one atom of silicon and two atoms of oxygen.
- e. The atom consists of a negatively charged nucleus of neutrons and protons.
- f. The gram atom is also called the gram-atomic weight.



# Earthquakes



A bridge damaged by an earthquake



Territorial rupture

An earthquake is the most destructive of all natural phenomena. It consists of rapid vibratory motions of rock near the earth's surface. A single shock usually lasts for no more than a few seconds, but severe earthquakes may last for even three minutes. Most earthquakes are due to rock movement along faults.

When the earth moves suddenly along a fault line, shock waves spread out in all directions, just as the waves which are created when you drop a pebble into a pond or when you tap the side of a bowl of gelatin with a spoon. But these are greatly oversimplified examples. The nature of an earthquake is extremely complex and involves masses and energies almost beyond comprehension.

Earthquakes occur without warning. A big earthquake is felt over thousands of kilometres, but the destruction it causes is limited to a much smaller area. The rapid vibrations are more responsible for the damage than the displacements involved. A great number of earthquakes shake man-made buildings to pieces. Water in stream beds can actually be thrown completely over the banks. Strong shock waves can uproot trees and cause massive landslides. However, sturdy houses on solid rock foundations may be able to survive with minor damage.

Earthquake intensities tend to be higher in alluvium and soft soil. A town located in a river basin of flat alluvial plain may be badly damaged, while a similar city closer to the fault but constructed on bedrock mountains escapes unscathed. At great distances, damage is usually limited to taller buildings that are swayed by slow surface waves. Damage may also occur when two buildings set up different motion and pound each other.



massive landslides

## A. Questions

1. What does an earthquake consist of?
2. How long does a single shock last?
3. What is usually the cause of an earthquake?
4. Which examples of waves can be compared to the shock waves?
5. Does the destruction caused by an earthquake spread out in distances of thousands of kilometres?
6. Which factor basically causes the damage caused?
7. Refer to some kinds of damage caused by a severe earthquake.
8. Is the kind of soil significant, as far as the earthquake intensities are concerned?

## B. Exercises

### 1. Find the words in the text which mean the following:

- a. disastrous
- b. moving with great speed
- c. movements
- d. a violent blow or shake caused by a collision or an explosion
- e. serious
- f. a crack in the earth's surface, where one rock has slid againsts another
- g. expand
- h. a small roundish smooth stone
- i. difficult to understand or explain
- j. quantity of matter (in an object)
- k. restricted
- l. moving sth from the usual or correct place
- m. built
- n. intact
- o. beat sth with a great force

### 2. Match words from the two columns to make eight pairs of opposites

- |               |             |
|---------------|-------------|
| a. rapid      | 1. excludes |
| b. simplified | 2. plant    |
| c. involves   | 3. slow     |
| d. strong     | 4. complex  |
| e. uproot     | 5. liquid   |
| f. solid      | 6. expanded |
| g. minor      | 7. weak     |
| h. limited    | 8. major    |

### 3. Write a noun that derives from the following:

- a. move .....
- b. destroy .....
- c. vibrate .....
- d. involve .....
- e. comprehend .....
- f. displace .....
- g. survive .....

- h. intense .....
- i. set .....
- j. different .....



4. **“Shock waves spread out in all directions.” Rewrite the sentence in the following tenses: Simple Past, Present Continuous, Past Continuous, Present Perfect Simple, Present Perfect Continuous, Past Perfect Simple and Future Perfect Simple.**

**5. Fill in the blanks with the following words: with, to, beyond, very, in, over, when, of, on, out, along.**

- a. .... the earth moves suddenly ..... a fault line, shock waves spread ..... in all directions.
- b. The nature ..... an earthquake is ..... complicated.
- c. When an earthquake takes place, masses and energies are involved which are ..... comprehension.
- d. It is difficult to express the strength ..... an earthquake ..... common terms.
- e. Water ..... stream beds can be thrown ..... the banks.
- f. Sturdy houses ..... solid rock foundations may be able ..... survive ..... minor damage.

**6. Rewrite the sentences using the prompts given.**

- a. Strong shock waves will uproot trees.  
Trees .....
- b. A town located in a river basin or flat alluvial plain may be badly damaged by a high earthquake intensity.  
A high earthquake intensity .....
- c. Some earthquakes shake man-made buildings to pieces.  
Man-made buildings.....
- d. Tall buildings are swayed by slow surface waves.  
Slow surface waves .....



# Vocabulary - Terminology

## A

- ability**, ικανότητα  
**abrading**, διαβρωμένος  
**abrasion**, τριβή, απόξεση, λείανση, γδάρισμα  
**abrupt**, απότομος  
**absorb**, απορροφώ  
**abundant**, άφθονος  
**accept**, (απο)δέχομαι  
**acceptable**, αποδεκτός  
**access**, πρόσβαση  
**accessory**, εξάρτημα, αξεσουάρ, συμπληρωματικό / βοηθητικό εξάρτημα  
**accomplish**, επιτελώ, εκτελώ, διεκπεραιώνω, πραγματοποιώ, επιτυγχάνω  
**accordance**, συμφωνία  
**in accordance with**, σύμφωνα / ανάλογα με  
**according to**, σύμφωνα με  
**account**, λογαριασμός  
**accumulate**, επισωρεύω, συσσωρεύω  
**accurate**, ακριβής, σωστός  
**acetylene**, ακετυλένιο, ασετυλίνη  
**achieve**, κατορθώνω, επιτυγχάνω  
**acid**, οξύ  
**acidity**, οξύτητα  
**act**, ενέργεια, πράξη, ενεργώ, δρω  
**action**, δράση, πράξη, ενέργεια  
**activate**, δραστηριοποιώ, ενεργοποιώ  
**active**, ενεργός, ενεργητικός, δραστήριος  
**activity**, δραστηριότητα, ενέργεια  
**adapt**, προσαρμόζω  
**add**, προσθέτω  
**addition**, προσθήκη, αύξηση, πρόσθεση  
**additional**, (επι)πρόσθετος, συμπληρωματικός  
**adequate**, επαρκής, αρκετός  
**adit**, είσοδος, στοά (ιδιαιτ. ορυχείου)  
**adjust (to)**, προσαρμόζω (σε), ρυθμίζω  
**adjustable**, ρυθμιζόμενος, επιδεχόμενος ρύθμιση  
**adjustable pliers**, λαβίδα (τσιμπίδι) με ρυθμιζόμενο άνοιγμα σιαγόνων, γαντζοτανάλια  
**adjustable wrench**, γαλλικό κλειδί, κλειδί με ρυθμιζόμενο άνοιγμα  
**adjustment**, εφαρμογή, ρύθμιση, προσαρμογή  
**advance**, πρόοδος, εξέλιξη  
**advanced**, προηγμένος, ανεπτυγμένος  
**advantage**, πλεονέκτημα, όφελος  
**to one's advantage**, προς όφελος / για το συμφέρον κάποιου  
**advisable**, ενδεδειγμένος, ορθός  
**aeration**, αερισμός  
**affect**, επηρεάζω, επιδρώ (σε), προσβάλλω (επί ασθενειών)  
**affirm**, επιβεβαιώνω  
**Ag (Agricultural)**, γεωργικός, αγροτικός  
**age**, ηλικία  
**agglomeration**, συγκερασμός, συσσωμάτωση, συμπίερωση, σύντηξη  
**aggregate**, συναθροίζω, σύνολο, άθροισμα, τιμεντολάσπη, συμπίετρωμα, σύγκριμα, (αδρανές) πρόσμιγμα  
**agitate**, ταράσσω, αναταράσσω, αναδεύω  
**agricultural**, αγροτικός, γεωργικός  
**agriculture**, γεωργία  
**aid**, βοηθώ, έχω ως βοήθημα, βοήθημα  
**aim**, σκοπός, στόχος  
**air**, αέρας  
**air pocket**, θύλακας αέρος  
**air-conditioning**, κλιματισμός  
**alertness**, εξυπνάδα, ζωηράδα, "σπιρτάδα", σβελτάδα, ζωηρότητα  
**all in all**, συνολικά  
**Allen-hex socket**, κλειδί τύπου Άλλεν, σωληνωτό κλειδί για ξεβίδωμα εξαγώνων παξιμαδιών  
**allow**, επιτρέπω, αφήνω, παρέχω  
**alloy**, κράμα (μετάλλων), ανάμιξη μετάλλων, κραματοποιώ  
**alluvial**, προχωσιγενής  
**alluvium (pl. -s / -ia)**, πρόσχωση (από άμμο, λάσπη κ.λπ. που σχηματίζεται με τη ροή των υδάτων), βούρκος, λάσπη  
**along**, κατά μήκος  
**along with**, μαζί με  
**alteration**, μεταβολή, αλλαγή  
**alternative**, εναλλακτικός, εναλλακτική λύση  
**alumina / aluminium oxide**, οξειδίο του αλουμινίου

**aluminium/aluminum**, αλουμίνιο, αργίλιο  
**aluminum hydroxide**, υδροξειδίο του αργιλίου  
**amending**, βελτίωση, διόρθωση, συντήρηση  
**amino acids**, αμινοξέα  
**amount**, ποσότητα, ποσόν  
**amperage**, (έν)ταση ρεύματος, βαθμός αμπέρ, αμπεράζ  
**analysis**, ανάλυση  
**analyze**, αναλύω  
**anatomy**, ανατομία  
**anchor**, στερεώνω, αγκυροβολώ, άγκυρα  
**angle**, γωνία  
**animal**, ζώο, ζωικός  
**animal agriculture**, εκτροφή ζώων  
**annealing**, ξεπύρωμα, βραδεία ψύξη, ανόπτηση, μαλάκωμα / αποσκλήρυνση μετάλλων  
**annual**, μονοετές φυτό, μονοετής  
**anode**, άνοδος (χημ.)  
**anthurium**, ανθοούριο  
**anticipation**, πρόβλεψη, πρόληψη  
**anvil**, αμόνι, άκμονας  
**apart**, μακριά, χωριστά  
**aphid**, αφίδα, μελίγκρα  
**apparatus**, συσκευή  
**appetite**, όρεξη  
**application**, εφαρμογή, χρήση, αίτηση  
**apply**, παρέχω, διανέμω, χρησιμοποιώ  
**apply for**, κάνω αίτηση, αιτούμαι  
**apply (to sth)**, εφαρμόζω (σε κτ)  
**appropriate**, κατάλληλος, αρμόζων  
**aquatic**, υδροβίος, υδάτινος  
**arc**, τόξο (ηλεκτρικό ή γεωμετρικό), Βολταϊκό τόξο  
**arc welding**, ηλεκτροσυγκόλληση (σκληρή)  
**area**, έκταση, περιοχή, τομέας, πεδίο  
**array**, σειρά, παράταξη  
**artichoke**, αγκινάρα  
**article**, είδος, πράγμα  
**artificial**, τεχνητός  
**ash**, στάχτη  
**Asia**, Ασία  
**asset**, περιουσιακό στοιχείο, ενεργητικό (επιχείρησης)  
**associate (with)**, συνδέω / έχω σχέση με, συνεταιρίζομαι  
**atmosphere**, ατμόσφαιρα  
**atmospheric**, ατμοσφαιρικός  
**atom**, άτομο (χημ.)  
**atomic weight**, ατομικό βάρος  
**attachment**, εξάρτημα, προσάρτημα  
**attack**, επιτίθεται  
**attempt**, επιχειρώ, δοκιμάζω, προσπαθεία  
**attendant**, επιστάτης, φύλακας

**attention**, προσοχή  
**attract**, έλκω, έλκύω, τραβώ  
**attraction**, έλξη  
**attractive force**, δύναμη έλξης, έλκτική δύναμη  
**auger**, τρυπάνι  
**automatic**, αυτόματος  
**automatic / retaining screwdriver**, αυτόματο κατσαβίδι με καστάνια, κατσαβίδι με αυτόματη παλινδρόμηση  
**automatically**, αυτομάτως  
**available**, διαθέσιμος, ελεύθερος, υπάρχων  
**average**, μέσος (όρος)  
**avoid**, αποφεύγω  
**aware**, ενήμερος  
**be aware of**, *εντυλαμβάνομαι, είμαι γνώστης, είμαι ενήμερος*  
**axle**, άξονας (τροχού)

## B

**backbone**, σπονδυλική στήλη  
**backfill**, παραγέμισμα  
**backwards**, προς τα πίσω  
**bacterium (pl. -a)**, βακτηρίδιο, βακτήριο  
**balance**, ισορροπία, υπόλοιπο λογαριασμού, ισοζύγιο  
**balance sheet**, ισολογισμός, δελτίο πωλήσεων  
**balanced**, ισορροπημένος, κατάλληλος  
**bale**, μπάλα, δέμα  
**baler**, χορτοδετικό μηχάνημα  
**ball**, μπάλα  
**ball peen hammer**, σφυρί με ημισφαιρική κεφαλή, σφυρί μπάλας  
**banana**, μπανάνα  
**bank**, όχθη  
**bar**, πλάκα, ράβδος, μοχλός  
**bar folder**, καμπτική μηχανή, στράντζα, μηχανή κάμψης φύλλων μετάλλου  
**barge**, μαούνα, φορτηγίδα  
**bark**, φλοιός (δέντρου)  
**barley**, κριθάρι  
**barn**, (σιτ)αποθήκη  
**basalt**, βασάλτης  
**base**, βασίζω, εξαρτώ, στηρίζομαι, βασίζομαι  
**base metals**, ευτελή μέταλλα, μη πολύτιμα μέταλλα (όπως χαλκός, μόλυβδος, ψευδάργυρος κ.λπ.)  
**baseline**, βάση, γραμμή/περίγραμμα σώματος  
**basic**, βασικός, κύριος  
**basically**, βασικά  
**basin**, λεκάνη, γούρνα  
**basis**, βάση

**on the basis of**, βάσει του / της  
**batch**, ποσότητα, παρτίδα, μέρος, τμήμα  
**bath**, λουτρό  
**bauxite**, βωξίτης  
**beam**, δοκός, πάτερο, μαδέρι, πλάτος (πλοίου, γέφυρας), καμάρι (Ναυπηγ.)  
**bean**, φασόλι  
**bear**, φέρω, βαστάζω, κρατώ  
**bear the weight**, σηκώνω / βαστάζω το βάρος  
**beat (- beat - beaten)**, κτυπώ  
**bedrock**, βραχώδες υπόστρωμα  
**bee**, μέλισσα  
**beet**, τεύτλο  
**beetle**, σκαθάρι  
**begonia**, βιγκόνια  
**belief**, πίστη, πεποίθηση  
**believe**, πιστεύω  
**belong (to)**, ανήκω (σε)  
**below**, κάτω από, παρακάτω  
**bench**, πάγκος (εργασίας), τράπεζα εφαρμοστού, πρόσχωση, έδαφος πρόσχωσης  
**bench metal**, μέταλλο κατεργαζόμενο στο εφαρμοστήριο  
**bend**, κάμψη, στροφή, λύγισμα, καμπή, λυγίζω, κάμπτω  
**bending machine**, καμπτική μηχανή, κουρμπανόδορος  
**beneath**, κάτω από, παρακάτω  
**beneficial**, ευεργετικός, ωφέλιμος  
**benefit**, όφελος, κέρδος  
**beverage**, ποτό (όχι οινοπνευματώδες), αφέψημα  
**biennial**, διετής (φυτό), διετής  
**biological**, βιολογικός  
**biologically**, βιολογικά  
**biotechnology**, βιοτεχνολογία  
**blackish**, μαυριδερός  
**blacksmith**, σιδηρουργός  
**blade**, λεπίδα, μεταλλικό έλασμα, λάμα, βελόνη (σιδηρ.)  
**blast**, ανοίγω / ανατινάσσω με δυναμίτιδα, βάζω φουρνέλο, προκαλώ έκρηξη, ρεύμα (αέρος, κ.λπ.)  
**blast furnace**, υψικάμινος  
**blood**, αίμα  
**blood circulation**, κυκλοφορία αίματος  
**bloom**, ανθίζω, άνθιση  
**blow**, φυσώ  
**blow in**, εμφυσώ  
**blower**, φυσητήρας, φυσερό  
**blunt**, στρογγύλεμα, αμβλύτητα  
**bolt**, μπουλόνι, κοχλίας, μάνδαλος  
**bond**, δεσμεύω, δεσμός

**bone**, οστούν, κόκκαλο  
**bore**, τρυπώ  
**borrow**, δανειζομαι  
**botrytis blight**, ξήρανση οφειλόμενη σε βοτρυτή, καπνιά (φυτών)  
**bottom**, κάτω μέρος, πυθμένας, πάτος, βυθός  
**branch**, κλαδί, κλάδος (επιστήμης)  
**branchlet**, κλαδάκι  
**brass**, μπρούτζος, λευκός ορείχαλκος  
**brass hammer**, ορειχάλκινος βραχιόνας/σφύρα  
**brazing**, ετερογενής/ετεροφυής σκληρή συγκόλληση με χαλκοκόλληση/μπρουντζοκόλληση  
**bread**, ψωμί  
**break (- broke - broken)**, σπάζω  
**breakdown**, αποσύνθεση, βλάβη (σε μηχανές), εξάντληση, κατάρρευση  
**breathe**, αναπνέω  
**breathing / breath**, αναπνοή  
**breed**, τρέφω, εκτρέφω  
**breeding stock**, ζώα για αναπαραγωγή  
**bridge**, γέφυρα  
**brightness**, φωτεινότητα  
**bring**, φέρω  
**bring up**, ανατρέφω, μεγαλώνω  
**brittle**, εύθραυστος  
**brittleness**, ευθραυστότητα  
**broccoli**, μπρόκολο  
**bronze**, ορείχαλκος κασσιτέρου, μπρούντζος, μπρούτζινος  
**bubble**, φουσκάλα, φουσαλιδα  
**bubble plan**, διαγραμματικό σχέδιο  
**bucket**, κάδος, κουβάς  
**bud**, μπουμπούκι, οφθαλμός / μάτι (φυτού)  
**buffer**, σπλιβωτικός τροχός/μηχανή  
**build**, κτίζω, κατασκευάζω  
**building**, κτιριακός, κτίριο  
**bulb**, βολβός  
**bulldozer**, μπουλντόζα, μηχανή εκσκαφής και ισοπέδωσης  
**burn**, καίω  
**burst**, ξεπετιέμαι, εκρήγνυμαι, ξεσπώ, σκάω  
**business**, επιχείρηση, εμπορικές εργασίες  
**butane**, βουτάνιο  
**butter**, βούτυρο  
**butterfly**, πεταλούδα

## C

**cabbage**, λάχανο  
**cadmium**, κάδμιο  
**cage**, θαλαμίσκος, κλουβί, κλωβός, εγκλωβίζω  
**layer cage**, κλουβί για κότες ωστοκίας (διατη-

ρούμενες σε κλωβοστοιχίες)

**cal(l)ipers**, διαβήτης συγκριτικών μετρήσεων με κυρτά άκρα, κομπάσο εσωτερικών διαστάσεων, διαβήτης μέτρησης διαμέτρου

**calcium**, ασβέστιο

**calcium silicate**, πυριτικό ασβέστιο

**calculation**, υπολογισμός

**call**, ονομάζω, καλώ, τηλεφωνώ

**can**, τενεκές, κονσερβοκούτι

**capability**, δυνατότητα, ικανότητα

**capacity**, ικανότητα, χωρητικότητα

**capillarity**, τριχοειδή φαινόμενα

**capillary**, τριχοειδές αγγείο

**capital**, κεφάλαιο, κεφαλαίος, πρωτεύουσα

**capture**, αιχμαλωτίζω, συλλαμβάνω

**carbohydrates**, υδρογονάνθρακες, υδατάνθρακες

**carbon**, άνθρακας

**carbon dioxide**, διοξείδιο του άνθρακα

**carbon monoxide**, μονοξείδιο του άνθρακα

**carbonate**, ανθρακικό άλας

**carrot**, καρότο

**carry**, (μετα)φέρω, έχω, βαστώ

**carry out**, φέρω εις πέρας, εκτελώ, διεξάγω, πραγματοποιώ, εφαρμόζω

**cart**, κάρο, καρότσι

**cascade**, σύζευξη σε σειρά

**case**, περίπτωση, περίσταση

**cash**, μετρητά (χρημ.), ρευστό χρήμα

**cash flow chart**, διάγραμμα ροής (πορείας) κεφαλαίου / ταμείου

**cash operating expenses**, δαπάνες για τη λειτουργία της επιχείρησης που καταβάλλονται σε μετρητά

**casings**, θήκη, κουτί, κασόνι

**cast**, καλούπι, μήτρα, χυτός (για μέταλλα)

**cast iron**, χυτοσίδηρος

**casting**, καλούπιωμα / χύσιμο μετάλλων, χυτό μέταλλο / κομμάτι

**categorization**, κατάταξη σε κατηγορίες, ταξινόμηση

**categorize**, κατατάσσω σε κατηγορία, ταξινομώ

**category**, κατηγορία, τάξη

**caterpillar**, κάμπια, ερπύστρια

**cathode**, κάθοδος (χημ.)

**cauliflower**, κουνουπίδι

**cause**, προκαλώ, προξενώ, αιτία

**cement**, τσιμεντάρω, ενώνω σταθερά, τσιμεντό

**ceramic**, κεραμικός, πήλινος

**cereal**, δημητριακά, σιτηρά

**certain**, συγκεκριμένος

**chain**, αλυσίδα, σειρά

**chalk**, κρητίν, ασβεστόλιθος

**chamber**, θάλαμος

**change**, αλλαγή, αλλάζω

**change my mind**, αλλάζω γνώμη

**channel**, δίαυλος, δίοδος, πόρος, κανάλι, διέξοδος

**characteristic**, χαρακτηριστικό(ς), γνώρισμα

**characterize**, χαρακτηρίζω

**charge**, φορτίζω, γεμίζω (ηλεκτρ.)

**chart**, διάγραμμα, πίνακας πληροφοριών

**check**, παρακολούθηση, έλεγχος, ελέγχω

**cheerful**, χαρούμενος

**chemical**, χημικό στοιχείο, χημικός (επιθ.)

**chemically**, χημικά (επιπρ.)

**chemicals**, χημικά, χημικές ουσίες / προϊόντα

**chemistry**, χημεία

**cherry**, κεράσι

**chickpea**, ρεβύθι

**chief**, πρωταρχικός, κύριος, πρωτεύων

**chisel**, κοπίδι, σμίλη

**chlorophyll**, χλωροφύλλη

**choose**, διαλέγω, επιλέγω

**chop**, λιανίζω, κόβω (σε κομματάκια)

**chromium**, χρώμιο

**chrysanthemum**, χρυσάνθεμο

**chuck out**, ξεριζώνω, πετώ ως άχρηστο

**churn**, κάδος (μεγάλος)

**circular**, κυκλικός

**circumstance**, περίσταση

**citron**, κίτρο

**citrus (fruit)**, εσπεριδοειδές

**clamp**, συσφιγγω, σφιγκτήρας, τσεμπερί

**classification**, κατάταξη, ταξινόμηση, κατηγορία

**classify**, ταξινομώ, κατατάσσω

**clay**, πηλός, άργιλος

**clayey**, αργιλώδης

**clean**, καθαρός

**clear**, φανερός, σαφής, προφανής, διαυγής

**climate**, κλίμα

**climatic**, κλιματολογικός, του κλίματος

**cling**, προσκολλώμαι

**close**, κοντινός, εγγύς, πυκνός

**close spacing**, πυκνά διαστήματα

**clutch**, συμπλέκτης, ντεμπραγιάζ

**coagulate**, πήζω

**coal**, γαιάνθρακας, κάρβουνο

**coarse**, τραχύς

**coarse-grained**, χονδρόκοκκος, αδρός κόκκος

**coat**, γούνα, τρίχωμα (ζωολ.), επίστρωση

**coating**, στρώμα, επικάλυψη

**coccinella (pl. -ae)**, κοκκινέλλα (Εντομ.)

**cochineal insect**, κοχενίλλη, νοπάλ (βαφικό)

έντομο)

**coke**, κοκ, σππάνθρακας, είδος λιθάνθρακα

**cold**, κρύος, ψυχρός

**collect**, μαζεύω, συγκεντρώνω, συλλέγω

**combination**, συνδυασμός

**combination / universal pliers**, πένσα γενικής χρήσης

**combination wrench**, κλειδί με συνδυασμό γερμανικού και αμερικάνικου ανοίγματος

**combine**, κομπίνα, θεριζοαλωνιστική μηχανή, συνδυάζω

**combine into**, ενώνομαι (και μετατρέπομαι) σε, αντιδρώ σε (χημ.)

**combine with**, ενώνομαι/συνδυάζω/-ομαι με

**combustion**, καύση, διαπύρρωση

**come across**, συναντώ, βρίσκω

**commercial**, εμπορεύσιμος, εμπορικός

**commercialization**, εμπορευματοποίηση

**commitment**, δέσμευση, οφειλή, υποχρέωση

**compact(ed)**, συμπαγής

**comparable**, δυνάμενος να συγκριθεί

**complete**, συμπληρώνω, ολοκληρώνω, πλήρης, τελειωμένος

**complex**, πολύπλοκος, περίπλοκος, σύνθετος

**complicated**, περίπλοκος

**component**, εξάρτημα, συστατικό μέρος, απαρτίζον τμήμα, σωματίδιο

**compose**, απαρτίζω, αποτελώ, συνθέτω, συγκροτώ

**be composed of**, αποτελούμαι από

**composition**, σύνθεση, δομή

**compost**, κομπόστα, κοπρόχωμα

**compound**, ένωση (χημ.), μίγμα

**comprehension**, αντίληψη, κατανόηση

**beyond comprehension**, δύσκολα κατανοητός, πέρα από τα όρια της αντίληψης, που δεν το συλλαμβάνει /χωράει ανθρώπινος νους

**compress**, συμπιέζω, πιέζω

**compressible**, συμπιεστός

**concentrate**, συγκεντρώνω και καθαρίζω μέταλλα

**concentration**, διαλογή, συγκέντρωση και καθαρισμός μεταλλεύματος, διαχωρισμός

**concept**, ιδέα, σύλληψη ιδέας

**conceptual design**, σχέδιο που έχω κατά νου / που έχω σκεφτεί / συλλάβει

**concern**, αφορώ, μέλημα, φροντίδα

**conclusion**, συμπέρασμα

**draw a conclusion**, συμπεραίνω, βγάζω/κατλήγω σε συμπέρασμα

**condense**, υγροποιώ αέριο, συμπυκνώνω

**condition**, όρος, προϋπόθεση, κατάσταση

**on condition that**, υπό τον όρο ότι, με την

προϋπόθεση ότι

**conditioning**, προετοιμασία

**conditions**, συνθήκες, περιστάσεις

**conductivity**, αγωγιμότητα

**conductor**, αγωγός (θερμ. κ.λπ.)

**confine**, κατακρατώ, δεσμεύω, περιορίζω

**conifer (tree)**, κωνοφόρο (δέντρο)

**conjunction**, σύζευξη, σύνδεσμος

**in conjunction with**, από κοινού, σύμφωνα με, σε συνδυασμό με

**connect**, συνδέω, ενώνω

**consequence**, συνέπεια

**conservative**, συντηρητικός(ς)

**consider**, μελετώ, εξετάζω, λαμβάνω σοβαρά υπόψη

**consist of**, αποτελούμαι από

**constant**, συνεχής, σταθερός

**construct**, κατασκευάζω, χτίζω, φτιάχνω

**construction**, δομή, κατασκευή

**contact**, έχω επαφή με, επαφή

**contain**, περιέχω, (συμ)περιλαμβάνω

**container**, δοχείο, κιβώτιο

**continuous**, συνεχής, διαρκής

**continuous miner**, ορύκτης, μηχανήμα διαρκούς λειτουργίας για την εξόρυξη και απομάκρυνση αποθεμάτων ορυκτών

**contour**, περίγραμμα

**contour strip mining**, εξόρυξη με τη μέθοδο περιμετρικών βαθμίδων

**contract**, προσβάλλομαι από (ασθένεια), κολλώ, αρπάζω

**contrary**, αντίθετος

**on the contrary**, αντιθέτως, απεναντίας, τουναντίον

**contribute (to)**, συνεισφέρω, συμβάλλω

**control**, έλεγχος, ελέγγω

**conventional**, συντηρητικός, παραδοσιακός, συμβατικός

**convert (into)**, μετατρέπω / αλλάζω (σε)

**converter**, μετατροπέας

**conveyor**, μεταφορέας

**conveyor/conveyor belt**, ατέρμονας ιμάντας, ιμάντας μεταφοράς, περιστρεφόμενη ζώνη

**cooking utensils**, μαγειρικά σκεύη

**cool**, δροσερός, ψυχρός, κρυώνω, δροσίζω, ψυχραίνω, ψύχω

**cooler**, συσκευή ψύξης

**cooperation**, συνεργασία, σύμπραξη

**cooperative**, συνεταιρισμός, συνεργάσιμος

**coordinate**, συντονίζω

**copper**, χαλκός

**core**, κύλινδρος, κυλινδρικό τμήμα (βράχου, εδάφους, κ.λπ.) αποσπασθέν δια γεωργήσεως,

πυρήνας

**corn**, καλαμπόκι

**corrode**, διαβρώνω

**corrosion**, διάβρωση, σκούριασμα

**corrosive**, διαβρωτικός, οξειδωτικός

**cost**, κόστος, κοστίζω

**costly**, ακριβός

**cotton**, βαμβάκι

**country**, χώρα, πατρίδα, εξοχή

**cover**, καλύπτω

**covering**, κάλυψη, κάλυμμα, περίβλημα

**cow**, αγελάδα

**cowshed**, βουστάσιο

**crater**, κρατήρας

**crawler / crawler tractor**, ερπυστριοφόρο

τρακτέρ

**create**, δημιουργώ

**creature**, ον, πλάσμα

**credit**, πίστωση

**crop**, σοδειά, συγκομιδή, καλλιέργεια (φυτών)

**cropland**, καλλιεργήσιμη γη

**cross**, σταυρός, διασταύρωση, διασταυρούμε-

νος, τέμνων, διασχίζω, διασταυρώνω

**crosscut**, σταυροειδής/εγκάρσια τομή

**cross-point screwdriver**, σταυροκατσάβιδο

**croton**, κρότων (Bot.)

**crown**, κόμη δέντρου

**crude**, ακατέργαστος

**crumb**, κομμάτι, τρίμμα, θρύψαλο, ψήγμα

**crumble**, θρυμματίζω / -ομαι

**crumbly**, εύθρυπτος, που τριβεται εύκολα

**crush**, θρυμματίζω, συνθλίβω, κονιοροποιώ

**crust**, φλοιός

**cryolite**, κρυόλιθος

**crystal**, κρύσταλλος

**crystalline**, κρυσταλλικός

**crystallize**, κρυσταλλώνω, μετατρέπω σε κρύ-

σταλλο

**cucumber**, αγγούρι

**cultivate**, καλλιεργώ

**cultivation**, καλλιέργεια

**cultivator**, καλλιεργητική μηχανή, καλλιεργητής

**cure**, φροντίδα, επεξεργασία

**current**, ρεύμα

**curve**, καμπύλη

**cut**, τομή, κόψιμο, μείωση, κόβω

**cut open**, ανοίγω (κόβοντας)

**cute**, όμορφος, χαριζόμενος

**cutlery**, μαχαιροπήρουνα

**cyclamen**, κυκλάμινο

**cycle**, κύκλος

**cylinder**, κύλινδρος

## D

**dacus**, δάκος

**dairy**, γαλακτοκομείο

**dairy cows**, γαλακτοπαραγωγικές αγελάδες

**dairy production**, γαλακτοκομική παραγωγή

**damage**, καταστρέφω, ζημιά

**damp**, υγρασία

**data (sing, datum)**, δεδομένα

**daylight**, φως της ημέρας

**dead**, ξερός, νεκρός

**dead furrows**, άχρηστα / ξερά αυλάκια

**deal with**, έχω να κάνω με, ασχολούμαι με,

πραγματεύομαι

**debris**, υπολείμματα, συντρίμια, μπάζα

**decade**, δεκαετία

**decay**, σαπίζω, παρακμάζω, σάπισμα

**decide**, αποφασίζω, κρίνω

**decide on sth**, αποφασίζω για κτ., καταλήγω σε κτ.

**deciduous**, φυλλοβόλος

**decision**, απόφαση

**deck**, ψευδόστεγο, στεγασμένο σύδεντρο

**decompose**, αποσυνθέτω, διασπώ

**decomposition**, αποσύνθεση

**decrease**, μειώνω / -ομαι

**deep**, βαθύς, βαθιά

**deep-rooting**, με βαθιές ρίζες

**definite**, συγκεκριμένος, σαφής, (καθ)ορισμένος

**deformation**, παραμόρφωση

**degree**, βαθμός, βαθμίδα

**deliberately**, σκόπιμα, μελετημένα

**delight**, απόλαυση, ευχαρίστηση

**demand**, απαιτώ, ζητώ, απαίτηση

**democratic**, δημοκρατικός

**density**, πυκνότητα

**depend (on)**, εξαρτώμαι (από)

**dependent on**, εξαρτώμενος από

**depending on**, ανάλογα με

**deposit**, απόθεμα, κοίτασμα, καθίζανω, κατα-

καθίζω

**debt**, χρέος

**debt service**, επίδοση χρεών

**depth**, βάθος

**depth adjustment**, ρύθμιση βάθους

**design**, σχέδιο, σχεδιάζω

**designation**, (προσ)διορισμός, χαρακτηρισμός, περιγραφή

**designing**, σχεδιασμός, σχεδίαση

**desirable**, επιθυμητός

**desire**, επιθυμώ, επιθυμία

**desired**, επιθυμητός  
**destruction**, καταστροφή  
**destructive**, καταστρεπτικός  
**detach**, αποκόπτω, αποσπώ  
**detect**, ανιχνεύω  
**detection**, ανίχνευση  
**detergent**, απορρυπαντικό  
**deterioration**, επιδείνωση, φθορά, χάλασμα  
**determination**, (προσδι)ορισμός  
**determine**, προσδιορίζω, υπολογίζω, καθορίζω  
**develop**, αναπτύσσω/-ομαι  
**development**, εξέλιξη, ανάπτυξη  
**device**, μηχανισμός, τέχνασμα, εξάρτημα, μέσο, μαραφέτι, επινόηση, συσκευή, μηχανήμα  
**die**, σπειροτόμος εξωτερικών σπειρωμάτων, βιολόγος, φιλιέρα  
**diesel**, ντήζελ, πετρέλαιο καύσης  
**diesel engine**, πετρελαιοκίνητη / ντηζελοκίνητη μηχανή  
**diesel-powered**, ντηζελοκίνητος  
**diet**, τρόπος διατροφής, διαίτα  
**differ**, διαφέρω  
**diffuse**, διαχέω  
**dig**, σκάβω  
**digestive**, πεπτικός  
**digger**, σκαπτικό μηχανήμα  
**dilute**, αραιώνω υγρό  
**dimension**, διάσταση  
**dioxide**, διοξειδίο  
**diptera (sing, -us)**, δίπτερα  
**direct**, άμεσος  
**direction**, διεύθυνση, κατεύθυνση  
**directly**, άμεσα, κατ' ευθείαν, άμεσα  
**directly related**, που έχει άμεση σχέση  
**disadvantage**, βλάβη, ζημιά, μειονέκτημα  
**disc**, δίσκος  
**disc plough**, δισκάροτρο  
**discard**, πετώ, ξεσκαρτάρω  
**discharge**, εκβαλλόμενο υγρό, εκβάλλω, εκρέω, εκτόξευση, παροχή  
**disease**, ασθένεια  
**diseased**, άρρωστος, ασθενής  
**disintegration**, αποσύνθεση  
**disorder**, διαταραχή  
**displacement**, μετατόπιση, μετακίνηση  
**dissociate**, διαχωρίζω, αποσπώ  
**dissolve**, διαλύω/ -ομαι  
**distillation**, απόσταξη, μέθοδος δι' αποστάξεως  
**distinction**, διάκριση, διαφορά  
**distinguish**, διακρίνω, ξεχωρίζω, διαχωρίζω  
**distribute**, (δια)μοιράζω, διανέμω, κατανέμω  
**distribution**, διανομή, κατανομή, μοιρασιά  
**ditch**, τάφος, χαντάκι

**divide (into)**, διαιρώ/χωρίζω (σε)  
**dividers**, διαστημόμετρο, διαβήτη σχεδίασης/εγχάραξης σε μεταλλική επιφάνεια  
**division**, χώρισμα, όριο, τμήμα, (υπο)διαίρεση  
**dominate**, κυριαρχώ, επικρατώ  
**donate**, δωρίζω, δίνω, παρέχω  
**dormant**, αδρανής, κοιμώμενος  
**double**, διπλός  
**dracaena**, δράκαινα (Bot.)  
**drain**, (απο)στραγγίζω  
**drainage**, (απο)στράγγιση  
**draught**, ρεύμα (αέρος)  
**draw**, σύρω, τραβώ, βγάζω  
**draw in**, εισπνέω, απορροφώ  
**draw a conclusion**, βγάζω συμπέρασμα  
**draw filing**, ξεχόνδρισμα, λείανση επιφάνειας μετάλλου προς στίλβωση  
**drawing**, σκίσο, σχεδιάγραμμα  
 **dredge**, βυθοκόρος, φαγάνα  
**drift**, στοά διαφυγής  
**drift mine**, ορυχείο/μεταλλείο με οριζόντιες στοές / φρέατα  
**drifter**, χρυσορύχος βάθους  
**drill**, τρυπή (με τρυπάνι), διαπερώ, ανοίγω (τρύπα), τρυπάνι, δράπανο  
**drill press**, μηχανοκίνητο δράπανο / τρυπάνι  
**drilling**, γεώτρηση, τρυπάνισμα, διάτρηση  
**drip**, στάζω  
**drip line of branches**, αγωγός ενστάλαξης των κλάδων  
**drip / trickle system**, σύστημα σταξίματος / λεπτής ροής σταγόνων  
**drive**, μετάδοση κίνησης, οδηγώ  
**drive off**, διώχνω, απομακρύνω  
**drop**, πέφτω, ρίχνω, πετώ, στάζω, σταγόνα  
**drought**, ξηρασία  
**drown**, πνίγομαι  
**dry**, ξηρός  
**dry up**, στεγνώνω εντελώς  
**dryness**, ξηρότητα  
**dual**, διπλός  
**duct**, αγωγός, σωλήνας  
**ductile**, όλκιμος, εύπλαστος, μαλακός, ελατός  
**due (to)**, οφειλόμενος (σε)  
**dull**, μουντός, αμβλύς  
**dull edged**, με στρογγυλεμένα άκρα  
**dung**, κόπρος, καβαλίνα, σβουινιά (ζώου)  
**durable**, ανθεκτικός, με διάρκεια, σταθερός  
**dynamics**, δυναμική (τμήμα της μηχανικής)

## E

**ear**, ωτίδιον (καλαμποκιού)  
**earnings**, κέρδη  
**earnings statement**, λογαριασμός/κατάσταση κερδών  
**earrings**, σκουλαρίκια  
**earth**, γη  
**earthquake**, σεισμός  
**earthworm**, γεωσκώληκας  
**eat**, τρώγω  
**economically**, με οικονομία, οικονομικά  
**edge**, άκρο, κόψη, χείλος, ακμή, αιχμή  
**effect**, αποτέλεσμα, συνέπεια, επιρροή  
**effectively**, αποτελεσματικά  
**efficient**, αποτελεσματικός, αποδοτικός, ικανός  
**efficiently**, αποτελεσματικά, αποδοτικά  
**effort**, προσπάθεια  
**egg**, αυγό  
**egg saver**, σύστημα ασφαλείας αυγών  
**eggplant**, μελιτζάνα  
**elastic**, ελαστικός  
**electric**, ηλεκτρικός  
**electric drill**, ηλεκτρικό τρυπάνι / δράπανο  
**electrical**, ηλεκτρολογικός  
**electricity**, ηλεκτρισμός  
**electrode**, ηλεκτρόδιο  
**electrolysis**, ηλεκτρόλυση  
**electrolyte**, ηλεκτρολύτης  
**electrolytic**, ηλεκτρολυτικός  
**electrolyze**, ηλεκτρολύω  
**electromagnet**, ηλεκτρομαγνήτης  
**electrometallurgy**, ηλεκτρομεταλλουργία  
**electron**, ηλεκτρόνιο  
**electronegativity**, ηλεκτροαρνητικότητα  
**element**, στοιχείο  
**elevation**, ανύψωση, ύψωμα, υψόμετρο  
**elevator**, ανελκυστήρας, ασανσέρ  
**eliminate**, απομακρύνω, αποκλείω, εξαλείφω, περιορίζω  
**emerge**, ξεπροβάλλω, εμφανίζομαι, αναδύομαι  
**emit**, εκπέμπω  
**employ**, χρησιμοποιώ, απασχολώ, προσλαμβάνω, αναθέτω έργο  
**enable**, παρέχω τη δυνατότητα  
**enclose**, περικλείω, περιβάλλω, εσωκλείω, περιφράσσω  
**end**, τέρμα, άκρη, τέλος, τελειώνω  
**end in**, απολήγω, καταλήγω (σε)  
**end cutters**, εμπροσθοκόπτης  
**enemy**, εχθρός  
**energy**, ενέργεια  
**engine**, μηχανή

**engine block**, κυρίως σώμα/“μπλοκ” κινητήρα  
**enjoy**, απολαμβάνω  
**enlarge**, αυξάνω, επεκτείνω, διευρύνω  
**enormous**, πελώριος, τεράστιος  
**enormously**, πάρα πολύ, τεράστια  
**enrich**, εμπλουτίζω  
**ensure**, εξασφαλίζω, εγγυώμαι  
**enter**, εισέρχομαι  
**enterprise**, εμπορική επιχείρηση  
**entire**, ολόκληρος, όλος, ολοσχερής  
**entirely**, εντελώς, εξ ολοκλήρου, ολοσχερώς  
**entrance**, είσοδος  
**environment**, περιβάλλον  
**enzyme**, ένζυμο  
**equal**, ισοδυναμώ, ισούμαι, ίσος (προς)  
**equal to**, αντάξιος, ικανός, σε θέση  
**equip**, εφοδιάζω  
**equipment**, εφόδια, εφοδιασμός, εξοπλισμός  
**erosion**, διάβρωση  
**erupt**, εκρήγνυμαι  
**escape**, γλυτώνω, ξεφεύγω, διαφεύγω  
**essential**, βασικός, ουσιώδης, απαραίτητος, αναγκαίος  
**establish**, δημιουργώ, σχηματίζω, καθιερώνω, εγκαθιδρύω  
**establishment**, εγκατάσταση, ίδρυση  
**ester**, εστέρας  
**evaporation**, εξάτμιση  
**evaporative**, με εξάτμιση, εξατμιζόμενος  
**even**, ομοιόμορφος, ομαλός  
**even though**, ακόμα και αν, παρόλο που  
**evenly**, ομοιόμορφα  
**evenness**, ομοιομορφία  
**evergreen**, αιθαλής  
**evidence**, μαρτυρία, απόδειξη  
**evident**, εμφανής, φανερός, έκδηλος  
**ewe**, προβατίνα  
**examine**, εξετάζω, ανιχνεύω  
**excavate**, ανασκάπτω, κάνω ανασκαφές/εκσκαφές, εκσκάπτω  
**excellent**, θαυμάσιος, έξοχος  
**exception**, εξαίρεση  
**exceptional**, εξαιρετικός, σπουδαίος  
**excess**, πλεόνασμα  
**excessive**, υπερβολικός, πλεονάζων  
**excrement(s)**, περίπτωμα  
**exercise**, έχω, κάνω χρήση, ασκώ/ούμαι  
**exert**, (εξ)ασκώ  
**exhaust**, εκδίωξη αερίων, εξάτμιση, εξαντλώ  
**exhaustion**, εξάντληση  
**existence**, ύπαρξη, παρουσία  
**expand**, επεκτείνω  
**expense**, έξοδο, δαπάνη

**experiment**, πείραμα  
**experimental**, πειραματικός  
**expert**, ειδικός, εμπειρογνώμων  
**exploration**, έρευνα, διερεύνηση, εξερεύνηση, εξέταση  
**explore**, εξερευνώ, (δι)ερευνώ, εξετάζω  
**explosive**, εκρηκτικό, εκρηκτική ύλη, εκρηκτικός  
**expose**, εκθέτω (π.χ. στο φως)  
**express**, εκφράζω  
**extension**, προέκταση, επέκταση, διαστολή  
**extensive**, εκτενής, εκτεταμένος  
**extent**, έκταση, μέγεθος  
**external**, εξωτερικός  
**extra**, επιπλέον, παραπάνω  
**extract**, αποσπώ, εξάγω (μεταλλ.), βγάζω  
**extractive**, εξακτικός  
**extractive metallurgy**, ο κλάδος της μεταλλουργίας που αφορά τις εξακτικές εργασίες  
**extraneous**, ξένος, άσχετος  
**extremely**, υπερβολικά

## F

**fact**, γεγονός  
**factor**, παράγοντας  
**fairly**, αρκετά, πολύ, δίκαια, σωστά  
**fall**, πέφτω  
**fall apart**, θρυμματίζομαι, χάνω τη συνεκτικότητά (για εδάφη)  
**fall in**, εμπίπτω / ανήκω σε  
**fancy**, γούστο  
**far**, μακριά  
**farm**, αγρός, αγρόκτημα, κτήμα  
**farm products**, αγροτικά προϊόντα  
**farmer**, εκτροφέας, αγρότης, κτηνοτρόφος  
**farming**, αγροκαλλιέργεια, γεωργικός  
**farming operations**, αγροκαλλιέργειες, αγροτικές εργασίες  
**fashion**, τρόπος, μόδα  
**fasten**, στερεώνω, προσδένω, μπήγω, σφίγγω, κολλώ, δένω  
**fat**, λίπος, παχύς  
**fault**, ρήγμα, εγκατακρήμνιση  
**fault line**, τεκτονικό ρήγμα, γραμμή μεταπτώσεως  
**feasible**, εφικτός, πραγματοποιήσιμος, δυνατός, εφαρμόσιμος  
**feature**, χαρακτηριστικό (γνώρισμα)  
**feed**, τρέφομαι, ζωοτροφή  
**feed on sth**, τρέφομαι με κτ  
**feed supplements**, συμπληρωματικά στοιχεία διατροφής  
**feeding**, (δια)τροφή, τάισμα, βοσκή

**feel (-felt - felt)**, αισθάνομαι  
**be felt**, γίνομαι αισθητός  
**ferric oxide**, οξείδιο του σιδήρου  
**ferromagnetic**, σιδηρομαγνητικός  
**ferrum**, σίδηρος (χημ.)  
**fertile**, γόνιμος, εύφορος  
**fertilize**, λιπαίνω (έδαφος)  
**fertilizer**, λίπασμα  
**fiber / fibre**, ίνα  
**fiber / fibre glass**, φάιμπερ γκλας (είδος πλαστικού γυαλιού)  
**figus**, φίκος  
**field**, αγρός, χωράφι, πεδίο, τομέας  
**fight**, (κατα)πολεμώ, μάχομαι  
**figure**, υπολογίζω  
**file**, λίμα  
**filig**, ρίνισμα, λιμάρισμα, λείανση με λίμα  
**fill**, συμπληρώνω, γεμίζω  
**fill in**, πληρώ, γεμίζω, συμπληρώνω  
**filler (metal)**, μέταλλο που χρησιμοποιείται σαν συγκολλητικό υλικό στις συγκολλήσεις, "κόλληση"  
**film**, μεμβράνη, λεπτό στρώμα  
**filter**, διηθώ, φιλτράρω, φίλτρο  
**final**, τελικός  
**financial**, οικονομικός  
**financially**, οικονομικώς  
**find out**, βρίσκω, ανακαλύπτω  
**finding**, εύρημα  
**fine**, λεπτός, καλός, περίφημος  
**fine-grained**, λεπτόκοκκος  
**finely**, λεπτά, ψιλά  
**fire**, φωτιά, πυρ  
**fired brick**, πυρότουβλο  
**firm**, σταθεροποιώ, σφιχτός, σταθερός, εταιρία  
**firmly**, σταθερά  
**fix**, στερεώνω  
**flame**, φλόγα  
**flat**, επίπεδο (ουσ.), επίπεδος, αβαθής, ομαλός  
**flat-nose pliers**, πλατυσίμπιδο  
**flat-tip screwdriver**, κοινό κατσαβίδι με πεπλατυσμένο άκρο, κατσαβίδι εγκοπής, κοχλιοστρόφιο  
**float**, επιπλέω  
**flotation**, επίπλευση  
**flow**, ρέω, ροή, κυλώ  
**flower**, λουλούδι, άνθος  
**flower bed**, παρτέρι  
**fluid**, ρευστός, υγρό  
**fluoride**, φθοριούχος  
**flux**, συλλίπασμα, ρευστή και εύτηκτος ύλη  
**fly**, μύγα  
**foil**, έλασμα (μετάλλου)  
**foliage**, φύλλαμα

**following**, επόμενος, ακόλουθος, εξής  
**food**, τροφή  
**forage**, τροφή ζώων, βοσκή, νομή  
**force**, δύναμη, ισχύς, εξαναγκάζω, φορτσάρω (μηχανή κ.λπ.)  
**force (into)**, κατευθύνω / πιέζω με βία (μέσα σε)  
**forge welding**, σκληρή συγκόλληση με σφυρηλάτηση, ηλεκτροσυγκόλληση σε κάμινο σιδηρουργού  
**forging**, σφυρηλάτηση, χάλκευση  
**forging tongs**, λαβίδα καμινευτή, τσιμπίδα καμινευτηρίου  
**fork**, πιρούνι  
**form**, μορφή, σχήμα, είδος, τύπος, σχηματίζω  
**formal**, τυπικός, επίσημος  
**formation**, σχηματισμός  
**forming machine/roll**, μηχανήμα κυκλικής κάμψης (φύλλων μετάλλου), κύλινδρος κάμψης, μηχανή κυλίνδρωσης  
**formula**, συνταγή, τύπος, όρος  
**forwards**, προς τα εμπρός  
**fossil**, απολιθώμα  
**fossil fuel**, φυσικό καύσιμο, καύσιμος ύλη προερχόμενη από απολιθώματα  
**foundation**, θεμέλιο  
**founding**, καλούπωμα/χύσιμο/χώνευση μετάλλων  
**foundry**, χυτήριο, χωνευτήριο  
**frame**, σκελετός, πλαίσιο, κορνίζα  
**framework**, σκελετός, πλαίσιο, δομή  
**free**, απελευθερώνω, αποδεσμεύω, ελεύθερος  
**frequency**, συχνότητα  
**frost**, παγετός, παγωνιά  
**frost-free**, χωρίς ψύχος/παγετό  
**froth**, αφρός  
**fruit**, φρούτο, φρούτα  
**fuel**, καύσιμα, καύσιμη ύλη  
**fullness**, πληρότητα  
**function**, λειτουργία, λειτουργικότητα  
**fungicide**, μυκητοκτόνο  
**fungus (pl. fungi)**, μύκητας  
**funnel**, κάμινος, εστία, φούρνος  
**furrow**, αυλάκι  
**furthermore**, επιπλέον, επίσης, εξάλλου  
**fuse**, λιώνω, συγχωνεύω /-ομαι, τήκω, κολλώ δια τήξεως  
**fuse (into)**, συγχωνεύω / -ομαι, (συγκολλώ δια τήξεως, λιώνω (σε)

## G

**gallery**, γαλαρία, στοά  
**gangue**, γαιώδεις προσμίξεις, περίβλημα με-

ταλλεύματος, πέτρωμα που περιέχει μετάλλευμα, πέτρωμα επαφής  
**garden**, (λαχανό)κήπος  
**market garden**, περιβόλι / κήπος για καλλιέργεια εμπορεύσιμων οπωροκηπευτικών  
**gardening**, κηπευτικός  
**gardening plant**, φυτό κήπου  
**garlic**, σκόρδο  
**gas**, αέριο  
**gas welding**, σκληρή συγκόλληση με τη χρήση καμινέτου  
**gaseous**, αεριώδης, αεριούχος  
**gasoline / gasolene**, βενζίνη  
**gasoline engine**, βενζινοκίνητη μηχανή  
**gauge**, μέτρο, μετρητής, όργανο μέτρησης  
**Geiger counter**, μετρητής Γκάιγκερ (για την ανίχνευση της ραδιενέργειας)  
**gelatin**, ζελατίνη  
**generation**, γενιά  
**genetic**, γενετικός  
**genetic engineering**, γενετική μηχανική  
**genuine**, γνήσιος, σωστός  
**genus**, γονίδιο  
**geochemical**, γεωχημικός  
**geochemist**, ο γεωχημικός  
**geochemistry**, γεωχημεία  
**geological**, γεωλογικός  
**geologist**, γεωλόγος  
**geology**, γεωλογία  
**geomagnetism**, γεωμαγνητισμός  
**geophysical**, γεωφυσικός  
**geophysics**, γεωφυσική  
**germanium**, γερμάνιο  
**girder**, σκελετός (γέφυρας κ.λπ.), ατσάλινο δοκάρι  
**give**, δίδω  
**give off**, αναδίδω, αποδίδω, ελευθερώνω  
**glacier**, παγετώνας  
**glass**, γυαλί  
**glossy**, στιλπνός, γυαλιστερός  
**goal**, σκοπός, επιδίωξη  
**goat**, κατσίκα, γίδα  
**gold**, χρυσός, χρυσάφι  
**grain**, δημητριακά, κόκκος, κουκούτσι, ψήγμα  
**gram**, γραμμάριο  
**gram atom**, γραμμοάτομο  
**grand**, μεγαλοπρεπής, μεγάλος, έξοχος  
**granite**, γρανίτης  
**grape**, σταφύλι  
**grapevine**, κλήμα  
**grass**, χλόη, χορτάρι  
**grass walk**, διάδρομος/μονοπάτι με χλόη  
**gravel**, χαλίκι  
**gravimeter**, βαρύμετρο, βαρυτόμετρο

**gravitational**, ελκτικός, της βαρύτητας  
**gravitational pull**, έλξη, βαρύτητα  
**gravity**, παγκόσμια έλξη, βαρύτητα  
**greenhouse**, θερμοκήπιο  
**grind**, αλέθω  
**grinder**, μηχανήμα τροχίσματος-λείανσης-στίλβωσης, ακονιστήρι, σμυριδοτροχός-λειαντής, λειαντικός τροχός  
**grinding**, ακόνισμα  
**gripping**, λαβή, γάντζωμα, πιάσιμο με γάντζο  
**groove**, πατούρα, ράβδωση, αυλακιά  
**groover**, εργαλείο για τη διαμόρφωση θηλιαστικών συνδέσεων / πατούρων πίεσης και κλεισίματος ραφών και αναδιπλώσεων (σε φύλλα μετάλλου)  
**ground**, έδαφος  
**grow**, αναπτύσσομαι, καλλιεργώ, μεγαλώνω  
**growth**, ανάπτυξη  
**guide**, (καθ)οδηγώ, κατευθύνω  
**gummy**, κολλώδης  
**gun**, πιστόλι (λίπανσης), λιπαντήρας

## H

**hacksaw/metal saw**, σιδηροπρίονο  
**haematite (Fe<sub>2</sub>O<sub>3</sub>)**, αιματίτης  
**hairlike**, (λεπτός) σαν τρίχα  
**ham**, γλουτός  
**hammer**, σφυροκοπώ, σφυρηλατώ, σφυρί  
**hand**, χέρι  
**hand drill**, χειροδράπανο, χειροπρίονο  
**hand groover**, διαμορφωτικό εργαλείο θηλιαστικών συνδέσεων, εργαλείο χειρός για την πίεση/κλείσιμο ραφών και αναδιπλώσεων σε φύλλα μετάλλου, εργαλείο για πατούρες  
**hand-held**, που κρατιέται / συγκρατείται με το χέρι  
**hand-operated**, χειροκίνητος  
**hand picking**, (προσεκτικό) μάζεμα με το χέρι  
**hand-pushed**, χειροκίνητος, που προωθείται / σπρώχνεται με το χέρι  
**hand tool**, εργαλείο χειρός  
**handful**, φούχτα  
**handle**, (χειρο)λαβή, χερούλι  
**hanger**, κλάδος καρποφορίας, ποδιά  
**hard**, σκληρός  
**harden**, σκληραίνω  
**hardening**, σταθεροποίηση, σκλήρυνση  
**hardness**, σκληρότητα, στερεότητα, βαθμός αντοχής, στερεοποίηση  
**harmful**, βλαβερός  
**harness**, δαμάζω, δεσμεύω (ηλιακή ενέργεια

κ.λπ.), τιθασεύω  
**harvest**, σοδειά, συγκομιδή, τρύγος, θερισμός  
**harvester**, μηχανήμα συλλογής / συγκομιδής  
**harvesting machine**, μηχανήμα συλλογής/συγκομιδής, θεριστική μηχανή  
**haul**, έλκω, ρυμουλκώ  
**haulage**, μεταφορά (βαρέων προϊόντων/υλικών κυρίως με φορτηγά αυτοκίνητα ή με ιμάντες μεταφοράς)  
**hay**, σανός, άχυρο/-α  
**hazardous**, επικίνδυνος  
**headframe**, βαρούλκο κορυφής  
**health**, υγεία  
**healthy**, υγιής  
**heat**, θερμότητα, ζέστη, θερμαίνω  
**heater**, θερμάστρα  
**heating**, θέρμανση  
**heating system**, σύστημα θέρμανσης  
**heavily**, βαριά, ασυνήθιστα  
**heavy**, βαρύς  
**heavy-wheeled tractor**, τρακτέρ βαρέος τύπου  
**heel (of a hand)**, βάση παλάμης (προς τον καρπό του χεριού)  
**height**, ύψος  
**help**, βοήθεια  
**helpful**, χρήσιμος, βοηθητικός  
**hemming**, στραντζάρισμα, αναδίπλωση άκρων  
**herbicide**, ζιζανιοκτόνο  
**high**, υψηλός  
**hint**, νύξη, υπαινιγμός  
**hill**, λόφος  
**hilly**, λοφώδης  
**hoisting**, ανυψωτικός, ανύψωση, ανέβασμα  
**hold**, (κατα)κρατώ  
**hold on to**, κρατώ, προσκολλώμαι (σε)  
**holding**, (συγ)κράτηση, κράτημα  
**hole**, οπή, τρύπα  
**hollow**, κοίλος, κούφιος, κενός  
**homogeneously**, ομοιογενώς  
**hoof (pl. hooves)**, σπλή ζώου  
**horizon**, ορίζων, στρώμα (γεωλ.)  
**horizontal**, οριζόντιος  
**horizontally**, οριζοντίως  
**hose**, εύκαμπτος υδροσωλήνας, μάνικα, λάστιχο (ποτίσματος), ελαστικός σωλήνας  
**hot**, ζεστός  
**hot tub**, θερμαινόμενη πισίνα  
**house**, στεγάζω, σπíti, κατοικία  
**household**, οικιακός, της οικίας  
**human**, ανθρώπινος  
**human being**, ανθρώπινο ον  
**human resources**, ανθρώπινες πηγές/πόροι

**humidity**, υγρασία (ατμόσφαιρας)  
**humus**, χούμος, μαυρόχωμα  
**husk**, αποφλοιώ, ξεφλουδίζω  
**hutch**, κλουβί (για κουνέλια κ.λπ.)  
**hydraulic**, υδραυλικός, που λειτουργεί με τη διαχέτευση νερού  
**hydraulic conductivity**, υδραυλική αγωγιμότητα  
**hydrogen**, υδρογόνο  
**hydrometallurgy**, υδρομεταλλουργία, επεξεργασία μετάλλου δια υγράς οδού  
**hydrometer**, πυκνόμετρο, αραιόμετρο  
**hydroxide**, υδροξειδίο  
**hymenoptera (sing, -us)**, υμενόπτερα

## I

**idea**, ιδέα  
**igneous**, πυριγενής, εκρηξιγενής, μαγματογενής  
**illustrate**, απεικονίζω  
**immense**, πελώριος, τεράστιος  
**immensely**, τεράστια  
**impact**, πρόσκρουση, αντίκτυπος, επιρροή  
**impact wrench**, επαναφορτιζόμενο εργαλείο/ τρυπάνι/δράπανο βιδώματος  
**implement**, σύνεργο/εργαλείο (παρελκόμενο)  
**imply**, υπονοώ, υποδηλώνω  
**improve**, βελτιώνω, καλύτερεύω  
**improvement**, βελτίωση  
**impure**, ακάθαρτος  
**impurity**, ακαθαρσία  
**impurities**, ξένες προσμίξεις (γεωλ.)  
**inadequate**, ανεπαρκής  
**inch**, ίντσα (1/12 ποδιού=2,54 εκ. του μ.)  
**incline**, κλίνω, γέρνω  
**include** (συμ)περιλαμβάνω, περικλείω  
**income**, έσοδα, εισόδημα  
**increase**, αυξάνω / -ομαι, αύξηση  
**indicate**, δείχνω, (υπο)δηλώνω, υποδεικνύω  
**individual**, ξεχωριστός, ένας-ένας, διαφορετικός, ατομικός, μεμονωμένος  
**indoors**, σε εσωτερικό χώρο, μέσα  
**industrial**, βιομηχανικός  
**industry**, βιομηχανία  
**infect**, μολύνω, μεταδίδω νόσο  
**infection**, μόλυνση, μετάδοση νόσου  
**infectious**, μολυσματικός, λοιμώδης  
**infest**, λυμαίνομαι, μαστίζω  
**infiltration capacity**, διηθητική ικανότητα  
**influence**, επηρεάζω  
**inform**, πληροφοροῦ  
**ingot**, ράβδος (χρυσού, κ.λπ.)

**initial**, αρχικός  
**injury**, βλάβη, ζημιά, τραυματισμός  
**inner**, εσωτερικός  
**inorganic**, ανόργανος  
**insect**, έντομο  
**insect-fed**, που τρέφεται με έντομα, εντομοφάγος  
**insecticide**, εντομοκτόνο  
**insoluble**, αδιάλυτος  
**inspect**, εξετάζω σχολαστικά  
**install**, εγκαθιστώ  
**installation**, εγκατάσταση  
**instalment**, δόση  
**instrument**, εργαλείο, όργανο  
**insulation**, μόνωση  
**intensity**, ένταση  
**intensive**, εντατικός  
**interact**, αλληλεπιδρώ  
**intermingle**, αναμιγνύω, / -ομαι  
**internal**, εσωτερικός  
**interval**, διάστημα (χρονικό), διάλειμμα, απόσταση  
**at intervals**, κατά διαστήματα  
**invest**, επενδύω  
**involve**, (συμ)περιλαμβάνω  
**be involved**, έχω σχέση, λαμβάνω χώρα  
**be involved in**, ασχολούμαι με, εμπλέκομαι (σε)  
**ion**, ιόν  
**iron**, σίδηρος  
**iron pyrite (FeS<sub>2</sub>)**, σιδηροπυρίτης, θειούχος σίδηρος  
**irregular**, ακανόνιστος, ανώμαλος, άρρυθμος  
**irrigation**, άρδευση  
**issue**, εκρέω, βγαίνω, έξοδος, έκδοση, έκβαση, θέμα  
**item**, πράγμα, είδος

## J

**jack**, γρύλλος  
**jackhammer**, σφυρί για σπάσιμο μπετόν / σκληρών κοιτασμάτων κ.λπ.  
**jewellery**, κοσμήματα  
**job**, δουλειά, έργο, εργασία  
**join**, συνδέω, ενώνω, σμίγω, συνάπτω  
**joining**, ένωση  
**joint**, σύνδεση, ένωση, αρμός  
**judgement**, κρίση, γνώμη  
**juice**, χυμός  
**jumbo**, μεγάλη μηχανοκίνητη μηχανή για εξόρυξη βάθους, χρυσωρύχος βάθους

## K

**keep**, φυλάττω, διατηρώ, κρατώ  
**keep a close eye on**, φροντίζω συνεχώς /  
/ αδιάκοπα  
**keep track of all cash**, (δια)τηρώ αρχείο του  
συνολικού ρευστού χρήματος  
**kentia**, κεντιά (Bot.)  
**kernel**, πυρήνας, κουκούτσι  
**killer**, δολοφόνος  
**kilometre/kilometer**, χιλιόμετρο  
**kind**, είδος  
**knoll**, λοφίσκος, βουναλάκι  
**knowledge**, γνώση

## L

**label**, ετικέτα, τοποθετώ / κολλώ ετικέτα  
**labo(u)r**, κόπος, μόχθος, εργασία  
**laboratory**, εργαστήριο (επιστημονικό)  
**lack**, στερούμαι, έλλειψη  
**land**, γη, έδαφος, ξηρά  
**landscape**, τοπίο  
**landslide**, γεωλογική κατολίσθηση  
**larva (pl. larvae)**, κάμπια εντόμου, προνύμφη  
**last**, διαρκώ, κρατώ, προηγούμενος, τελευταίος  
**last out**, διαρκώ, κρατώ (για χρόνο)  
**last but not least**, τελευταίο αλλά εξίσου ση-  
μαντικό  
**lateral**, πλευρικός, πλάγιος  
**lava**, λάβα  
**lawn**, χλοοτάπητας, χλόη, πεζούλα  
**lay (- laid - laid)**, τοποθετώ, βάζω, στρώνω  
**lay (eggs)**, γεννώ (αυγά)  
**layer**, κότα ωοτοκίας, στρώμα (γεωλ.)  
**layer cage**, κλουβί για κότες ωοτοκίας (διατη-  
ρούμενες σε κλωβοστοιχίες)  
**leach**, διυλίζω, φιλτράρω (υγρό)  
**leaching**, διύλιση, φιλτράρισμα, η μετά καθαζή-  
σεως διάλυση  
**lead**, μόλυβδος  
**lead (- led - led)**, οδηγώ, καταλήγω  
**leader**, ηγέτης, αρχηγός, κύριος βλαστός  
**leader branch**, το κεντρικό ψηλότερο κλαδί που  
είναι η προέκταση του κορμού  
**leaf (pl. leaves)**, φύλλο  
**leafhopper**, ακρίδα  
**leafy**, φυλλώδης  
**learn**, μαθαίνω  
**leather**, δέρμα, πετσι  
**leek**, πράσσο

**leg**, σκέλος, πόδι  
**legumes**, όσπρια  
**length**, μήκος  
**lengthen**, μακραίνω, επιμηκύνω  
**lentil**, φακή  
**lettuce**, μαρούλι  
**level**, επίπεδο, επίπεδος (επιφάνεια), στάθμη,  
ισοπεδώνω  
**liability**, οφειλή, σύνολο (οικονομικών) υποχρε-  
ώσεων, (συνήθως στον πληθ.) παθητικό  
**lie (- lay - lain)**, κείμαι, βρίσκομαι  
**life**, ζωή  
**lift**, υψώνω, σηκώνω  
**lifting**, ανύψωση, ανέβασμα, σήκωμα  
**light**, ελαφρύς, λεπτός, όχι βαρύς, φως  
**light-brown**, ανοικτό καφέ (χρώμα)  
**limb**, (χοντρός) κλώνος/κλάδος (δέντρου), άκρο  
(σώματος)  
**lime**, ασβέστης  
**limestone**, ασβεστόλιθος, πέτρωμα  
**limit**, περιορίζω, όριο  
**limonite (Fe<sub>2</sub>O<sub>3</sub> · 3 H<sub>2</sub>O)**, λειμωνίτης  
**line**, γραμμή, σειρά, επενδύω, επιστρώνω  
**linkage**, σύνδεση  
**liparis / lymandria monachus**, λιπαρίς (έντομο  
που προσβάλλει δάση)  
**liquid**, υγρό, ρευστό (ουσ.), υγρός, ρευστός  
**liquidity**, ρευστότητα  
**list**, βάζω σε / φτιάχνω κατάλογο, κατάλογος  
**live**, ζω  
**livestock**, ζώα, ζωντανά, κοπάδι  
**living**, ζωντανός  
**living expenses**, έξοδα διαβίωσης  
**loam**, παχύ χώμα, πηλός  
**loam soil**, πηλώδες έδαφος  
**loamy**, πηλώδης  
**locate**, εγκαθιστώ, ιδρύω  
**be located**, *ευρίσκομαι, κείμαι*  
**lock**, κλειδαριά, κλειδωμα, κλειδώνω  
**lock-grip pliers**, πένσα για συγκράτηση σω-  
λήνων / κομματιών κ.λπ., "σκύλα", γρίππος,  
αρπάγη  
**longevity**, μακροζωία  
**loose**, αφήνω ελεύθερο, χαλαρώνω, χαλαρός,  
λυτός, ελαφρός  
**loosening**, χαλάρωση, ξελασκάρισμα  
**lose**, χάνω  
**loss**, απώλεια, χάσιμο  
**low**, χαμηλός  
**low capacity**, μικρής κλίμακας, μικρής χωρητι-  
κότητας, μικρής δυνατότητας / ικανότητας  
**low-carbon**, με χαμηλή περιεκτικότητα (σε)  
άνθρακα

**lowland**, πεδινή περιοχή  
**lump**, σβόλος, κομμάτι, μάζα  
**luster/lustre**, ακτινοβολία, στιλπνότητα, λάμψη

## M

**machine**, μηχανή, μηχανήμα, κατεργάζομαι με εργαλειομηχανή  
**machinery**, μηχανήματα, μηχανές  
**magma**, μάγμα, πικνόρευστη διάπυρος ύλη από τα έγκατα της γης  
**magnesium**, μαγνήσιο  
**magnetic**, μαγνητικός  
**magnetic field**, μαγνητικό πεδίο  
**magnetic oxide (Fe<sub>3</sub>O<sub>4</sub>)**, μαγνητίτης  
**magnetism**, μαγνητισμός  
**magnetite (Fe<sub>3</sub>O<sub>4</sub>)**, μαγνητίτης  
**magnify**, μεγεθύνω  
**magnitude**, μέγεθος, έκταση  
**magnometer**, μαγνητόμετρο (όργανο μέτρησης της μαγνητικής απόκλισης)  
**maillable**, ταχυδρομήσιμος, που μπορεί να ταχυδρομηθεί  
**main**, κύριος, βασικός  
**mainly**, κυρίως, πρωτίστως  
**maintain**, συντηρώ, διατηρώ  
**maintenance**, διατήρηση, συντήρηση  
**major**, κύριος, πρωτεύων, σημαντικότερος, μεγαλύτερος  
**major purpose**, κύριος σκοπός  
**majority**, πλειονότητα  
**make up**, σχηματίζω, παράγω, κατασκευάζω  
**making**, κατασκευή, έργο, φτιάξιμο  
**malleable**, ελατός, εύπλαστος, σφυρηλατήσιμος  
**mallet**, μαλακό σφυρί (ξύλινο ή πλαστικό)  
**Malta/undulant fever**, μελιταίος πυρετός, με λιτοκοκκίαση, βρουκέλλωση  
**management**, διοίκηση, διαχείριση  
**managerial skills**, διαχειριστικές / διοικητικές ικανότητες  
**mandarine**, μανταρίνι  
**manganese**, μαγγάνιο  
**man-made**, κατασκευασμένος από ανθρώπινα χέρια  
**manometer**, μανόμετρο  
**manufacture**, παράγω, κατασκευάζω  
**manufacturer**, κατασκευαστής, βιομήχανος  
**manure**, κόπρος  
**marble**, μάρμαρο  
**market**, εμπορεύομαι, αγορά  
**market garden**, περιβόλι/κήπος στον οποίο καλλιεργούνται εμπορεύσιμα οπωροκηπευτικά

**market price**, τιμή αγοράς, αγοραία τιμή, τρέχουσα τιμή εμπορεύματος  
**marketing**, μάρκετινγκ, το σύνολο ενεργειών για την προώθηση των αγαθών από την παραγωγή στον τελικό καταναλωτή  
**marking**, σημάδεμα, μαρκάρισμα, σύμβολα ή αριθμοί αναγραφόμενα στις συσκευασίες εμπορευμάτων  
**marrow**, κολοκυθάκι  
**marsh**, έλος  
**mass**, μάζα, όγκος, πλήθος  
**mass production**, μαζική παραγωγή  
**mass removal machines**, μηχανήματα μαζικής απόσπασης  
**massive**, μαζικός, ομαδικός  
**matter**, ύλη, υλικό, ουσία, ζήτημα, θέμα  
**no matter what**, *άσχετα / ανεξάρτητα από*  
**mature**, ώριμος  
**meadow**, λιβάδι  
**mean**, εννοώ  
**means**, μέσο, τρόπος  
**by means of**, *μέσω (του/της), με τη βοήθεια*  
**measure**, μετρώ, υπολογίζω, μέτρο  
**measurement**, μέτρηση, μέτρημα  
**measuring instrument**, όργανο μέτρησης  
**meat**, κρέας  
**mechanical**, μηχανικός, της μηχανικής  
**mechanize**, μηχανοποιώ  
**Mediterranean**, Μεσογειακός, της Μεσογείου  
**medium**, μεσαίος, μέσο  
**meet sth**, ανταποκρίνομαι σε, καλύπτω, ικανοποιώ  
**melt (-melted-melted/molten)**, λιώνω, τήκω  
**melting point**, σημείο τήξης  
**member**, μέλος  
**membrane**, μεμβράνη  
**mention**, αναφέρω  
**mercury**, υδράργυρος  
**metal**, μέταλλο  
**metal worker**, μεταλλοκατασκευαστής  
**metallic**, μεταλλικός  
**metallurgical**, μεταλλουργικός  
**metallurgy**, μεταλλουργία  
**metalworking**, μεταλλοκατασκευές, μεταλλουργικές εργασίες  
**metamorphic**, μεταμορφωσιγενής  
**metamorphose**, μεταμορφώνω /-ομαι  
**method**, μέθοδος  
**micrometer**, μικρόμετρο  
**migration**, (μετα)κίνηση, μετατόπιση, μετανάστευση  
**mild**, ήπιος

**milk**, γάλα, αρμέγω  
**milking**, άρμεγμα  
**mind**, μυαλό, πνεύμα, νους, γνώμη  
**change one's mind**, αλλάζω γνώμη, μετανιώνω  
**mine**, εξορύσσω, βγάζω μέταλλα, ορυχείο, μεταλλείο, μεταλλωρυχείο  
**miner**, μεταλλωρύχος, ανθρακωρύχος  
**mineral**, μεταλλικός, ορυκτός, ορυκτό, μέταλλευμα, ανόργανος  
**mineral-bearing**, ο εμπιριέχων / φέρων ορυκτά  
**minerals**, ανόργανα άλατα, μεταλλικά στοιχεία  
**minimal**, ελάχιστος  
**minimum**, ελάχιστο  
**mining**, μεταλλευτική εκμετάλλευση, εξόρυξη μετάλλων, μέταλλευση, διάνοιξη μεταλλείου  
**minor**, μικρός, ασήμαντος, επουσιώδης, δευτερεύων  
**minus**, πλην, μείον  
**minute**, μικροσκοπικός  
**mist**, (υγρό) αχλός, ελαφρά ομίχλη  
**mite**, ζώυφιο  
**mix (with)**, αναμ(ε)ιγνύω/ανακατεύω (με)  
**mixture**, μ(ε)ίγμα, ανάμ(ε)ιξη  
**mm** (millimetre), χιλιοστόμετρο  
**mobile**, κινητός, ευκολοκίνητος  
**modern**, σύγχρονος  
**moist**, υγρός, νοτερός  
**moisture**, υγρασία  
**moisture-holding capacity**, ικανότητα συγκράτησης της υγρασίας  
**mold**, μούχλα  
**mole**, μολ  
**molecular**, μοριακός  
**molecule**, μόριο  
**monkey wrench**, σωληνοκάβουρας  
**mood**, διάθεση  
**moth**, λεπιδόπτερο  
**motion**, κίνηση  
**motor**, μηχανή, κινητήρας, μοτέρ  
**motor-driven**, μηχανοκίνητος  
**mould**, μαυρόχωμα, μήτρα, καλούπι, πρότυπο  
**mount**, εφαρμόζω, τοποθετώ, στηρίζω, στήνω, πλαισιώνω, προσαρτώ, προσαρμόζω  
**mountainous**, ορεινός  
**move**, κινώ / -ούμαι  
**move away**, απομακρύνω  
**movement**, (μετα)κίνηση  
**mow**, κουρεύω (γρασίδι)  
**mowing**, θεριστικός (για χορτάρι)  
**multiply**, πολλαπλασιάζω / -ομαι  
**musical**, μουσικός

## N

**narrow**, στενός  
**natural**, φυσικός  
**naturally**, φυσικά  
**nature**, φύση, είδος, χαρακτήρας  
**nearly**, σχεδόν  
**neck**, λαιμός  
**need**, ανάγκη  
**needless**, άχρηστος, αχρείαστος, περιττός  
**negative**, αρνητικός  
**net**, καθαρός, νέτος  
**net worth**, καθαρό κέρδος  
**network**, δίκτυο  
**neutron**, νετρόνιο  
**nevertheless**, πάντως, παρ' όλα αυτά, ωστόσο  
**nickel**, νικέλιο  
**non metallic**, μη μεταλλικός, αμέταλλα στοιχεία  
**nonmetal**, αμέταλλο  
**non-metal**, μη μεταλλικός  
**noxious**, επιβλαβής, επιζήμιος  
**nozzle**, ακροφύσιο, μπεκ  
**nucleus**, πυρήνας  
**numerically**, αριθμητικός  
**nut**, παξιμάδι, περικόχλιο  
**nutrient**, θρεπτική ουσία / στοιχείο / συστατικό  
**nutrified bark**, υπολείμματα φλοιού με θρεπτικές ουσίες  
**nutritious**, θρεπτικός  
**nymph**, νύμφη, χρυσαλλίδα

## O

**oat**, βρώμη  
**object**, αντικείμενο, είδος  
**objectionable**, δυσάρεστος, απαράδεκτος, ενοχλητικός  
**observation**, παρατήρηση  
**obtain**, λαμβάνω, εξασφαλίζω, αποκτώ, προμηθεύομαι, εξευρίσκω, παίρνω  
**occasional**, περιστασιακός, σποραδικός  
**occasionally**, περιστασιακά, τυχαία, συμπτωματικά, κάπου-κάπου, πότε-πότε  
**occupation**, απασχόληση  
**occupy**, καταλαμβάνω/συμπληρώνω (χώρο / θέση κ.λπ.), απασχολώ  
**occur**, συμβαίνω, λαμβάνω χώρα, προκύπτω  
**oceanography**, ωκεανογραφία  
**offset screwdriver**, στραβοκατσάβιδο, τεθλασμένο/αγκωνωτό/γωνιοποιημένο κατασβίδι (με κυρτά άκρα)

**offspring**, απόγονος  
**OH- ion**, ιόν υδροξυλίου ή υδροξειδίου  
**oil**, πετρέλαιο, έλαιο, λάδι  
**oiler**, λαδωτήρι, “λαδικό”  
**okra**, μπάμια  
**olea (pl. oleae)** ελιά  
**olive**, ελιά (καρπός)  
**olive-tree**, ελιά (δέντρο)  
**onion**, κρεμμύδι  
**open**, ανοίγω, ανοικτός  
**open hearth process**, μέθοδος ανοικτής εστίας  
**open pit/cut mining**, εκμετάλλευση επιφανειακών μεταλλείων  
**open-ended wrench**, κλειδί σταθερού ανοίγματος, γερμανικό κλειδί, κλειδί με δυο στόμια  
**opening**, άνοιγμα  
**operate**, λειτουργώ, χειρίζομαι  
**operation**, επιχείρηση, εκμετάλλευση/λειτουργία επιχείρησης, εργασία, λειτουργία  
**operator**, χειριστής  
**opinion**, γνώμη  
**opportunity**, ευκαιρία  
**optimal**, άριστος  
**optimist**, αισιόδοξος  
**orchid**, ορχιδέα  
**order**, σειρά, διάταξη  
**in good working order**, σε καλή κατάσταση / λειτουργία  
**ore**, μέταλλευμα, ορυκτό μετάλλων  
**ore dressing**, εμπλουτισμός του μεταλλεύματος  
**ore minerals**, ορυκτά μεταλλεύματα  
**organic**, οργανικός  
**organic matter**, οργανική ουσία / ύλη  
**organism**, οργανισμός (βιολ.)  
**origin**, προέλευση, καταγωγή  
**original**, αρχικός, πρωτογενής  
**originally**, αρχικά  
**ornamental**, διακοσμητικός  
**outdoor**, υπαίθριος  
**outer**, εξωτερικός  
**outer pipe**, εξωτερικό αγγείο  
**outgo**, έξοδο, δαπάνη  
**oval**, ωοειδής  
**overburden**, έδαφος υπερκαλύψεως, άγονες αποθέσεις, χώματα, φόρτος λατομείου / ορυχείου, μπάζα  
**overhead**, υπερωψωμένος, γενικός (εμπ.)  
**overhead costs**, πάγια / γενικά έξοδα επιχείρησης  
**oversimplified**, υπεραπλουστευμένος

**overwinter**, διαχειμάζω, ξεχειμωνιάζω  
**oxidation**, οξειδωση  
**oxide**, οξειδίο  
**oxidize**, οξειδώνω, οξειδώνομαι  
**oxyacetylene welding**, οξυγονοκόλληση, σκληρή συγκόλληση με οξυγόνο/ ασετυλίνη  
**oxydizing agent**, οξειδωτικό μέσο  
**oxygen**, οξυγόνο

## P

**pack**, πακέτο, συσκευάζω, στοιβάζω  
**pair**, ζεύγος  
**pale**, ξεπλυμένος (για χρώμα), παλ  
**paleontology**, παλαιοντολογία  
**pan**, δοχείο, λεκάνη, σκάφη (για το στράγγισμα μεταλλοφόρου πρόσχωσης)  
**pane**, τζάμι/υαλοπίνακας παράθυρου  
**parent rock**, (πρωτ)αρχικό πέτρωμα  
**parlour system**, σύστημα αιθουσών αρμέγματος  
**part**, τμήμα, μέρος  
**partial**, μερικός, ο κατά ένα μέρος  
**partially**, μερικώς  
**particle**, μόριο, σωματίδιο, ψήγμα (μετάλλου)  
**particular**, συγκεκριμένος, ειδικός, ιδιαίτερος  
**passage**, δίοδος, πέρασμα  
**pasta**, ζυμαρικό  
**pasture**, βοσκοτόπι, λιβάδι  
**pasture grasses**, χορτονομή, βοσκή  
**potato**, πατάτα  
**path**, διέξοδος, πορεία, μονοπάτι  
**patronage**, τακτική πελατεία επιχειρήσεων, οικονομική υποστήριξη, συμμετοχή  
**pattern**, δείγμα, πρότυπο  
**paving**, λιθόστρωτο  
**pay**, πληρώνω, εξοφλώ, πληρωμή  
**payment**, πληρωμή, εξόφληση  
**peanut**, αράπικο φυστίκι  
**pear**, αχλάδι  
**peat**, τύρφη (είδος ελαφρού χώματος)  
**pebble**, χαλίκι, βότσαλο  
**penetrate**, διαπερνώ  
**penetration**, διάτρηση, τρύπημα, διαπερατότητα, διείσδυση  
**per cent**, επί τοις εκατό  
**percentage**, ποσοστιαία αναλογία  
**perennial**, πολυετές (φυτό), αιώνιος, μόνιμος  
**perform**, εκτελώ, πραγματοποιώ, λειτουργώ, επιτελώ  
**performance**, απόδοση, επίδοση  
**perimetric**, περιμετρικός

**period**, περίοδος, χρονικό διάστημα  
**peripheral**, περιμετρικός, περιφερικός, περιφερειακός  
**permanent**, μόνιμος, σταθερός  
**permanently**, μόνιμα, διαρκώς, σταθερά  
**permeability**, διαπερατότητα  
**personal**, προσωπικός  
**personnel**, προσωπικό, εργαζόμενοι  
**pest**, επιβλαβές έντομο  
**pesticide**, εντομοκτόνο  
**petroleum**, πετρέλαιο  
**phenomenon (pl. phenomena)**, φαινόμενο  
**phosphate**, φωσφορικό άλας  
**photoelectric**, φωτοηλεκτρικός  
**photoelectric effect**, φωτοηλεκτρικό φαινόμενο  
**photon**, φωτόνιο  
**photosynthesis**, φωτοσύνθεση  
**phylloxera (vine louse)**, φυλλοξήρα (phylloxera vastatrix προσβάλλει τους αμπελώνες)  
**physical**, φυσικός, υλικός  
**physics**, φυσική (επιστ.)  
**pick up**, συλλέγω, μαζεύω (με το χέρι)  
**picker**, συλλέκτης (κυρίως ως β' συνθετικό)  
**pig**, γουρούνι, χοίρος  
**pig iron**, ακατέργαστος/αργός σίδηρος  
**pint**, πίντα (μονάδα μέτρησης υγρών ίση με 568 γρ.), 1/8 γαλονιού  
**pipe**, σωλήνας, αγωγός, αγγείο (φυτολ.)  
**pipe adjustable wrench**, ρυθμιζόμενο κλειδί σωληνώσεων, παπαγάλος, σωληνοκάβουρας  
**pipe/tube cutter**, σωληνοκόπτης  
**pipeline**, αγωγός  
**piston**, έμβολο, πιστόνι  
**pit**, σκάμμα, λάκκος, ορυχείο  
**place**, τοποθεσία, θέση, τοποθετώ  
**placer**, μεταλλοφόρο (κυρίως χρυσοφόρο) πρόσχωμα  
**placer mining**, εξόρυξη μεταλλοφόρων προσχωμάτων  
**plain**, πεδιάδα, καθαρός, σαφής, απλός  
**plan**, (προ)σχέδιο, σχεδιάγραμμα, πλάνο  
**plant**, φυτεύω, φυτό  
**planter**, φυτευτικό μηχάνημα  
**planting**, φύτεμα, (εμ)φύτευση  
**plastic**, πλαστικό, πλαστικός  
**plate**, πλάκα, φύλλο, έλασμα, επιμεταλλώνω, επικαλύπτω  
**platform**, πλατφόρμα, εξέδρα  
**platinum**, λευκόχρυσος, πλατίνα  
**play**, παίζω, παιχνίδι  
**play area**, χώρος παιχνιδιού

**pliers**, πένσα  
**combination / universal pliers**, πένσα γενικής χρήσης  
**round-nose pliers**, μυτοσίμπιδο με στρογγυλά άκρα, στρογγυλοσίμπιδο  
**plough**, οργώνω, άροτρο, αλέτρι  
**plumbing pipe**, αγγείο, αγωγός ιστός  
**plutonic / plutonian**, πλουτώνιος, πυριγενής  
**pneumatic**, (που λειτουργεί) με πεπιεσμένο αέρα  
**point**, σημείο  
**up to the point**, μέχρι (του σημείου) που, έως ότου  
**poke**, ψηλαφώ  
**polichrosis botrana**, ευδημής (προσβάλλει τα αμπέλια)  
**polish**, γυαλίζω, λουστράρω  
**polisher**, στίλβωτής, στίλβωτική μηχανή  
**pond**, λίμνη (τεχνητή)  
**poorly**, λίγο, ελάχιστα, φτωχά  
**popular**, δημοφιλής, γνωστός  
**pore**, πόρος  
**porous**, πορώδης  
**portion**, τμήμα, μέρος, μερίδα  
**position**, θέση  
**positive**, θετικός  
**positively**, θετικά  
**possibility**, πιθανότητα, δυνατότητα  
**possible**, πιθανός, δυνατός, μπορετός  
**pot**, γλάστρα, δοχείο  
**potash**, ποτάσσα  
**poultry**, πουλερικά  
**poultry rearing**, εκτροφή πουλερικών  
**pound**, προσκρούω με δύναμη πάνω σε κάτι, τρίβω, κοπανίζω  
**pour**, χύνω, ρίχνω (υγρό)  
**powdery mildew**, περονόσπορος  
**power**, δύναμη, ισχύς, ενέργεια, ικανότητα  
**power shovel**, ατμοκίνητο φτυάρι, πτυοφόρος εκσκαφέας  
**powerful**, ισχυρός, δυνατός  
**practical**, πρακτικός  
**practicality**, πρακτικότητα  
**practice**, πρακτική, άσκηση, συνήθεια  
**practise**, (εξ)ασκούμεαι  
**precipitation**, καθίζηση  
**precision**, ακρίβεια, ορθότητα  
**predetermined**, προκαθορισμένος  
**preferable**, προτιμητέος  
**prehistoric**, προϊστορικός  
**preliminary**, προκαταρκτικός  
**premature**, πρόωρος, πρῶιμος

**prepare**, προετοιμάζω  
**presence**, παρουσία  
**present**, παρών  
**presentation**, παρουσίαση  
**preserve**, διατηρώ, συντηρώ,  
**press**, πιέζω, σφίγγω  
**pressure**, πίεση, βάρος, τάση (ηλ.)  
**prevent**, εμποδίζω  
**prevention**, πρόληψη, προφύλαξη, προστασία  
**previously**, προηγουμένως  
**primary**, (πρωτ)αρχικός  
**prime**, κύριος, πρωτεύων, βασικός  
**principal**, κύριος, πρωταρχικός, βασικός, αρχι-  
κός, πρώτος  
**principally**, αρχικά, βασικά  
**principle**, αρχή, κανόνας, στοιχείο  
**priority**, προτεραιότητα  
**privacy**, εκούσια απομόνωση, μοναξιά, ησυχία  
**procedure**, διαδικασία, μέθοδος, τεχνική  
**process**, διαδικασία, πορεία, τεχνική μέθοδος,  
κατεργασία, επεξεργάζομαι  
**process metallurgy**, μέθοδος εξαγωγής και  
επεξεργασίας / κατεργασίας μετάλλων  
**produce**, παράγω  
**producer**, παραγωγός  
**product**, προϊόν  
**production**, παραγωγή  
**productive**, παραγωγικός  
**productive area**, διαμέρισμα εγκατακρήμνισης  
και αποθήκευσης μεταλλεύματος  
**productivity**, παραγωγικότητα  
**profile**, (δια)τομή πλάγια όψη, κατατομή, προφίλ  
**profit**, κέρδος  
**profitability**, αποδοτικότητα σχετική με το  
κέρδος, ωφελιμότητα, κέρδος  
**profitable**, επικερδής  
**profitably**, με κέρδος, επικερδώς  
**progress**, πρόοδος, εξέλιξη  
**progressive**, προοδευτικός  
**promote**, προωθώ, προάγω  
**prompt**, άμεσος  
**propagation**, πολλαπλασιασμός, εξάπλωση  
**propane**, προπάνιο  
**proper**, κατάλληλος  
**properly**, ορθά, σωστά, κατάλληλα  
**property**, ιδιότητα, χαρακτηριστικό, ιδιοκτησία,  
περιουσία  
**proportion**, αναλογία  
**protect**, προστατεύω  
**protection**, προστασία  
**protective**, προστατευτικός  
**protein**, πρωτεΐνη  
**proton**, πρωτόνιο

**prove**, αποδεικνύω/-ομαι  
**provide**, παρέχω, δίδω, προμηθεύω, προσφέ-  
ρω  
**provide sb with sth**, παρέχω σε κάποιον κάτι  
**prune**, κλαδεύω, δαμάσκηνo  
**pull**, σύρω, τραβώ, έλξη  
**pull apart**, αποχωρίζω, κόβω, σχίζω, κομμα-  
τιάζω  
**pull out into sth**, τραβώ/έλκω και μετατρέπω  
σε κτ.  
**pullet**, νεαρή κότα, κοτόπουλο, πουλάδα  
**pulley**, τροχαλία, καρούλι  
**pulsation**, παλμός  
**pulse**, σφυγμός  
**pulverize**, κονιο(ρτο)ποιώ  
**pump**, αντλία, αντλώ  
**pumpkin**, κολοκύθα  
**punch**, πόντα, στιγέας, τρυπητήρι  
**pupa**, νύμφη, χρυσαλίδα (εντόμου)  
**purchase**, αγορά  
**pure**, καθαρός, αμιγής  
**purify**, καθαρίζω  
**purpose**, σκοπός  
**push**, σπρώχνω  
**pyrometallurgy**, πυρομεταλλουργία, μεταλ-  
λουργία θερμικής κατεργασίας που συνίσταται  
κυρίως από ανθρακικό ασβέστιο/ασβεστίτη

## Q

**quality**, ποιότητα  
**quantity**, ποσότητα  
**quarry**, λατομείο  
**quarrying**, λατόμηση  
**quartz**, χαλαζίας  
**quench**, σβήνω, δροσίζω, ψυχραίνω

## R

**radioactive**, ραδιενεργός,  
**radish**, ραπανάκι  
**railings**, κάγκελα, κιγκλιδώμα  
**raise**, καλλιεργώ (φυτά), εκτρέφω (ζώα), σηκώ-  
νω, υψώνω, έξοδος/άνοδος ορυχείου  
**range**, ομάδα/σειρά/γκάμα ομοίων αντικειμέ-  
νων, πεδίο, ακτίνα  
**rapid**, ραγδαίος, ταχύς  
**rapidly**, ταχέως  
**ratchet**, κασάνια, μανέλλα, τροχός αναστολής  
**rate**, αναλογία, ποσοστό, βαθμίδα, συντελε-  
στής, τιμή, επιβάρυνση, ρυθμός, ταχύτητα  
**ratio**, αναλογία, λόγος, σχέση (μεταξύ ποσών ή  
ποσοτήτων).

**rationalize**, οργανώνω ορθολογικά (επιχείρηση κ.λπ.), αιτιολογώ  
**reach**, φθάνω, ανέρχομαι (σε)  
**react**, αντιδρώ  
**reaction**, αντίδραση  
**readily**, εύκολα, γρήγορα, αμέσως  
**reap**, θερίζω  
**rear**, εκτρέφω  
**receive**, λαμβάνω, δέχομαι  
**recognition**, αναγνώριση  
**record**, καταγράφω  
**records**, αρχεία  
**recover**, εξάγω, εξασφαλίζω, αποσπώ, εξορύσσω  
**recovery**, αποκατάσταση, επανόρθωση  
**rectangular**, ορθογώνιος  
**recycle**, ανακυκλώνω, ξαναχρησιμοποιώ, δοχείο ανακύκλωσης  
**recycling**, ανακύκλωση  
**reddish**, κοκκινωπός  
**reduce**, περιορίζω, ελαττώνω, μειώνω  
**reduce (from)**, αποσπώ από (μεταλλ.), μεταβάλλω, μειώνω  
**reducing agent**, αναγωγικό μέσο, αναγωγικός παράγων  
**reduction**, ελάττωση, μείωση, μεταβολή (μεταλλ.), αναγωγή  
**reference**, αναφορά  
**with reference to**, σχετικά με, όσον αφορά  
**refine**, βελτιώνω, ραφινάρω, καθαρίζω  
**refining**, καθαρισμός, ραφινάρισμα, εξευγενισμός μετάλλων, εκκαθάριση  
**regain**, επανακτώ, ξανακερδίζω  
**regard**, θεωρώ, νομίζω  
**regenerator**, αναθερμαντήρας  
**regular**, κανονικός, συμμετρικός  
**regulator**, ρυθμιστής, ρεγουλαδόρος  
**reinforce**, ενισχύω, τονώνω  
**relatively**, σχετικά, συγκριτικά  
**release**, αποδεσμεύω, (απ)ελευθερώνω  
**reliable**, αξιόπιστος  
**relocate**, εντοπίζω  
**remain**, (απο)μένω, παραμένω  
**remittent fever**, υφέσιμος πυρετός  
**removal**, απομάκρυνση, αφαίρεση  
**remove**, απομακρύνω, αφαιρώ, βγάζω, παίρνω, μετακινώ, μετατοπίζω  
**render**, (απο)δίδω, επιστρέφω, καθιστώ  
**rent**, ενοικιάζω  
**repeat**, επαναλαμβάνω  
**replace**, αντικαθιστώ  
**report**, αναφέρω, εκθέτω

**represent**, αντιπροσωπεύω  
**representative**, αντιπροσωπευτικός, αντιπρόσωπος  
**reproduce**, αναπαράγω  
**reproduction**, αναπαραγωγή  
**require**, απαιτώ, ζητώ, χρειάζομαι  
**requirement**, απαίτηση, ανάγκη  
**research**, έρευνα, μελέτη  
**resist**, ανθίσταμαι, αντέχω  
**resistance**, αντίσταση  
**resistant**, ανθεκτικός, αντιστεκόμενος  
**resistor**, αντιστάτης (ηλεκτρ.)  
**respiration**, διαπνοή  
**responsible**, υπεύθυνος  
**restrain**, συγκρατώ, περιορίζω  
**result**, αποτέλεσμα, κατάληξη, έχω ως τέλος  
**result from**, απορρέω/ προκύπτω από  
**resulting**, προκύπτων  
**retain**, (κατα)κρατώ, συγκρατώ, διατηρώ  
**retaining/automatic screwdriver**, αυτόματο κατσαβίδι με καστάνια, κατσαβίδι με αυτόματη παλινδρόμηση  
**reverse**, μηχανισμός επαναφοράς/επιστροφής, αντίστροφος, αντίθετος  
**reverse shaft**, άξονας αναστροφής  
**reversible**, αναστρεφόμενος  
**reward**, ανταμοιβή, ανταμείβω  
**rib**, πλευρό, παιδί  
**rice**, ρύζι  
**ridged**, ζαρωμένος  
**right**, ορθός, σωστός  
**right angle**, ορθή γωνία  
**ring**, δακτύλιος, κύκλος  
**ring emitter**, κυκλικός εκτοξευτήρας  
**ring-wrench**, πολυγωνικό (κλειστό) κλειδί, αμερικάνικο κλειδί, κλειδί με δυο δακτυλίους  
**ripe**, παραγινωμένος, (πολύ) ώριμος  
**rise**, υψώνω/ -ομαι, ανεβαίνω  
**river**, ποταμός  
**river basin**, λεκάνη απορροής ποταμού  
**rivet**, καρφοβελόνα, πιρτσίνι, καρφή λαμαρίνας, ήλος  
**roasting**, φρύξη, ψήσιμο μεταλλεύματος, όπτηση, έψηση, (δια)πύρρωση  
**rob**, ληστεύω, διαρπάζω, αποστερώ  
**rock**, πέτρα, βράχος, πέτρωμα, βραχώδης  
**rock hard**, σκληρός σαν βράχος, πετρώδης  
**rock path**, πέτρινο μονοπάτι  
**parent rock**, (πρωτ)αρχικό πέτρωμα  
**rocklike**, σαν/ομοίως με τα πετρώματα  
**rocky**, βραχώδης  
**rod**, ράβδος, μοχλός, βέργα  
**roll**, ρόλος, κύλινδρος κάμψης, μηχανήμα κυκλι-

κής κάμψης, τυλίγω / -ομαι, απλώνω / -ομαι  
**room**, χώρος, δωμάτιο  
**root**, ρίζα  
**rootball**, ρίζα με μπάλα χρώματος  
**rope**, σχοινί  
**rotate**, περιστρέφω / -ομαι  
**rotating**, περιστρεφόμενος  
**round**, στρογγυλός  
**round-nose pliers**, μυτοσίμπιδο με στρογγυλά άκρα, στρογγυλοσίμπιδο  
**routine**, ρουτίνα, μηχανική και στερεότυπη επανάληψη ίδιων πραγμάτων  
**row**, σειρά  
**rubber**, καουτσούκ, λάστιχο, ελαστικός  
**rubber-tired/tyred**, με ελαστικά/λάστιχα από καουτσούκ  
**rule**, κανόνας, κανονισμός  
**run**, τρέχω, διευθύνω (επιχείρηση κ.λπ.)  
**run off**, αδειάζω, διαρροή, απορροή  
**run off basin**, λεκάνη απορροής  
**run through**, διασχίζω επί τροχάδην, διαπερνώ  
**rupture**, ρωγμή  
**rust**, σκωρία, σκουριά  
**rye**, σίκαλη

## S

**safety**, ασφάλεια  
**salt**, άλας, αλάτι  
**same**, ίδιος  
**sample**, δείγμα, υπόδειγμα  
**sampler**, δειγματολήπτης (εργαλείο)  
**sampling tube**, δοκιμαστικός σωλήνας  
**sand**, άμμος  
**coarse sand**, χοντρή άμμος  
**sandstone**, ψαμμίτης, ψαμμόλιθος, αμμόλιθος  
**sandy**, αμμώδης  
**satisfy**, ικανοποιώ  
**saturate**, διαβρέχω, μουσκεύω  
**save**, (εξ)οικονομώ, φυλάω  
**savings**, κέρδη, αποθέματα  
**saw**, πριόνι  
**sawdust**, πριονίδι  
**scaffold branches**, κύρια πλευρικά κλαδιά  
**scalelike**, λεπιδωτός  
**scheduling**, προγραμματισμός, πρόγραμμα  
**science**, επιστήμη  
**scoop**, κουτάλα βυθοκόρου/εσκακπτικού - μεταφορικού μηχανήματος, αντλία  
**scrap**, κομματάκι, θρύψαλο  
**scrap steel**, παλιοσίδηρα  
**scraper**, αποξεστήρας, ρασκέτα, εξομαλυντή-

ρας, ξύστρα  
**scraping**, απόξεση, καθαρισμός / αφαίρεση περιπτώων σωμάτων με ξύσιμο  
**screen/sunscreen**, παραπέτασμα, σκέπαστρο (για προστασία από τον ήλιο)  
**screen planting**, φράχτης από φυτά  
**screw**, βίδα, κοχλίας  
**screwdriver**, κατασβίδι  
**screwing**, βίδωμα, κοχλίωση  
**screw-pitch gauge**, σπειρωματόμετρο, σπειρόμετρο  
**screwtap**, κοχλιοτομέας, κοχλιοτρίπανο, σπειροτόμος εσωτερικών σπειρωμάτων, κολαούζο  
**scriber**, χαρακτήρας  
**scribing**, εγχάραξη  
**seam**, συρραφή, ένωση, αρμός  
**search**, (δι)ερευνώ, ανιχνεύω, ψάχνω, έρευνα  
**season**, εποχή  
**season after season**, εποχή την εποχή, κάθε εποχή  
**section**, (δια)τομή, τμήμα, τεμάχιο  
**secure**, εξασφαλίζω, ασφαλής  
**sedimentary**, ιζηματώδης, ιζηματογενής  
**seed**, σπόρος, πυρήνας κρυσταλλώσεως  
**seismograph**, σειсмоγράφος  
**seismology**, σεισμολογία  
**select**, διαλέγω, επιλέγω  
**selective**, επιλεκτικός  
**self-propelled**, αυτοπροωθούμενος, αυτοκινούμενος  
**self-protecting**, αυτοπροστατευόμενος  
**semiaquatic**, ημιυδροβίος  
**semiconductor**, ημιαγωγός  
**separate (from)**, αφαιρώ, αποσπώ, (δια)χωρίζω/ -μαι, (ξε)χωρίζω  
**separately**, χωριστά  
**separation**, (δια)χωρισμός, απόσπαση, μέθοδος απομάκρυνσης  
**separator**, διαχωριστήρας, μηχανήμα διαχωρισμού  
**series**, σειρά (ειδών)  
**serious**, σοβαρός, σημαντικός  
**serve**, (εξ)υπηρετώ, βοηθώ,  
**serve for**, χρησιμεύω για  
**service**, υπηρεσία  
**set (-set-set)**, θέτω, βάζω, φέρω, κάνω  
**set a goal**, βάζω ένα στόχο, έχω ένα σκοπό  
**set at the disposal**, θέτω στη διάθεση  
**set up**, υφίσταμαι, τίθεται σε  
**settle**, κατακθρομαι, εγκαθιστώ, κανονίζω, ρυθμίζω, τακτοποιώ  
**severe**, ισχυρός, σοβαρός

**sexual**, σεξουαλικός  
**sexual portion**, όργανο αναπαραγωγής  
**shade**, σκιά  
**shaft**, φρέαρ, πηγάδι  
**shaft mine**, ορυχείο/μεταλλείο με κάθετες στοές / φρέατα  
**shake**, κουνώ, σείω, τινάζω  
**shake to pieces**, καταδαφίζω, καταστρέφω  
**shaker**, δονητής, αναταράκτης  
**shale**, αργιλικός σχιστόλιθος  
**shallow**, ρηχός  
**shape**, μορφή, σχήμα, δίνω σχήμα  
**share**, μερίδιο, (συμ)μετοχή  
**sharp**, αιχμηρός, οξύς  
**shearing**, κόψιμο φύλλων μετάλλου με μεταλλοψάλιδο  
**sheave**, καρούλι τροχαλίας, ράουλο  
**sheep**, πρόβατο/-α  
**sheet**, φύλλο, έλασμα  
**sheet metal**, φύλλο/έλασμα μετάλλου, λαμαρίνα  
**shell**, αποφλοιώνω, ξεφλουδίζω, κέλυφος, όστρακο  
**shelter**, καταφύγιο, στέγαση, στεγάζω, προφυλάσσω  
**shiny**, λαμπερός, γυαλιστερός  
**shock**, δόνηση  
**shock wave**, σεισμικό/κρουστικό κύμα  
**shoot**, οφθαλμός, μάτι (φυτ.)  
**short**, σύντομος, κοντός  
**in short**, με λίγα λόγια, εν συντομία  
**shoulder**, ώμος  
**shrub**, θάμνος, χαμόδεντρο  
**side**, πλευρά  
**side cutters**, πλαγιοκόπτης, πλαγιοκοπτική πέννα  
**siderite (FeCO<sub>3</sub>)**, σιδηρίτης  
**sign**, σημείο, ένδειξη, δείγμα  
**signs of water stress**, σημάδια παραμόρφωσης λόγω ακατάλληλου ποτίσματος  
**significant**, σημαντικός  
**silica**, πυρίτιο  
**silicates**, πυριτικά ορυκτά  
**silicon**, πυρίτιο, σιλικόνη  
**silicon oxide**, οξειδίο του πυριτίου  
**silkworm**, μεταξοσκώληκας  
**sill**, κατώφλι  
**silt**, ιλύς, λάσπη  
**silver**, άργυρος, ασήμι, με απόχρωση ασημιού/αργύρου  
**similar**, (παρ)όμοιος  
**simplify**, απλοποιώ, απλουστεύω  
**simultaneous**, ταυτόχρονος  
**single**, μόνος, μοναδικός, απλός, μονός, ένας  
**sink**, βυθίζω/ -ομαι

**sinter**, συμπύκνωση, σύντηξη  
**sintering**, περίτηξη, αρχομένη τήξη  
**site**, περιοχή, χωράφι, τοποθεσία  
**situated**, κείμενος, ευρισκόμενος  
**be situated**, *κείμει, ευρίσκομαι (σε ορισμένη θέση)*  
**size**, μέγεθος  
**skill**, ικανότητα, (επι)δεξιότητα  
**skilled/skillful**, έμπειρος, επιδέξιος  
**skillfully**, επιδέξια  
**slag**, σκωρία  
**slate**, σχιστόλιθος  
**slave**, σκλάβος  
**slice**, τεμάχιο, δείγμα, φέτα  
**slightly**, ελαφρώς, λίγο  
**slope**, κλίση, παίρνω επικλινή θέση, πρηνές, με κλίση  
**slope mine**, ορυχείο/μεταλλείο με κεκλιμένα φρέατα / στοές  
**sloping**, επικλινής  
**slot**, σχισμή  
**slot-head screw**, βίδα/κοχλίας με σχισμή στην κεφαλή  
**slowly**, αργά  
**smelting**, τήξη / λιώσιμο μεταλλεύματος, εξαγωγή μετάλλου, εκκαμίνευση  
**smooth**, λείος, μαλακός  
**snap**, αρπάζω  
**snout**, μουσούδα  
**soaker**, καταβρεχτήρας  
**soaker hose**, πορώδης σωλήνας διαβροχής  
**socket**, ρευματοδότης, υποδοχή, ακροδέκτης, καρυδάκι, σωληνωτό κλειδί  
**socket spanner**, σωληνωτό κλειδί, ακροδεκτικό κλειδί  
**sod**, χορταρισμένο χώμα, χώμα που περιέχει ρίζες  
**sodium**, νάτριο  
**sodium hydroxide**, υδροξείδιο νατρίου  
**soft**, μαλακός, εύπλαστος  
**soft-bodied**, με μαλακό σώμα  
**soften**, μαλακώνω, απαλώνω  
**soil**, χώμα, έδαφος  
**soil bulk-density**, πυκνότητα στερεών συστατικών του εδάφους  
**soil moisture content**, περιεκτικότητα / ποσότητα υγρασίας εδάφους  
**soil moisture tension**, τάση υγρασίας εδάφους  
**solder**, καλάι ως συγκολλητική ουσία, υλικό συγκόλλησης μετάλλων  
**soldering**, μαλακή συγκόλληση, κασσιτεροκόλληση  
**solid**, στερεά/συμπαγής ύλη, στερεός(ς)

**solid rock**, συμπαγές πέτρωμα, βράχος  
**solidify**, στερεοποιώ / -ούμαι, σταθεροποιώ  
**soluble**, διαλυτός  
**solution**, διάλυμα, διάλυση, λύση, αντιμετώπιση  
**solvency**, φερεγγυότητα  
**solvent**, διαλύτης, διαλυτικός  
**sorghum**, σόργον το κοινό  
**source**, πηγή, προέλευση  
**southeastern**, νοτιοανατολικός  
**sow**, σπέρνω  
**soya bean**, σόγια (ο καρπός)  
**space**, διάστημα, χώρος  
**spacecraft**, διαστημόπλοιο  
**spade**, φτυάρι (σκαφτικό)  
**specialist**, ειδικός, εμπειρογνώμων  
**species** (αμετάβλητο στον πληθ.), είδος, γένος (βιολ.)  
**specific**, ορισμένος, ειδικός, ακριβής  
**specimen**, δείγμα  
**speed**, ταχύτητα  
**spend**, ξοδεύω  
**spindle**, αδράχτι  
**spirit level**, αλφάδι, στάθμη φυσαλίδας  
**splash**, πτισιλίζω  
**split (into)**, διασπώ, χωρίζω, σχίζω  
**spot**, κηλίδα, στίγμα  
**spot spitter**, σημειακός αποβολέας νερού  
**spread**, (δια)σκορπίζω / -ομαι, απλώνομαι, επεκτείνομαι, εξάπλωση  
**spread out**, εξαπλώνομαι  
**spreading**, διάδοση, εξάπλωση  
**spring**, ελατήριο, άνοιξη  
**sprinkler**, εκτοξευτήρας  
**sprout**, βλασταίνω, ξεπετάγομαι  
**spur**, μικρός βλαστός με καρποφόρα όργανα  
**square**, τετράγωνο, ορθογωνισμένος  
**squaring shears**, μηχανικό ψαλίδι (ποδοκίνητο)  
**squeeze**, (συ)σφιγγώ, (συμ)πιέζω, ζουλώ  
**stabilization**, σταθεροποίηση, ζυγοστάθμιση  
**stable**, σταύλος  
**stage**, φάση, στάδιο  
**stain**, λεκιάζω, λεκές  
**stainless**, ανοξειδωτος, ακηλίδωτος  
**stake**, πάσσαλος  
**stall**, ατομική θέση ζώου, χώρισμα σταύλου, σταύλος, πάγκος (υπαιθριου μικροπωλητή)  
**standard**, πρότυπο, δεδομένο  
**standing**, σταθερός, αμετάβλητος  
**standing water**, στάσιμο νερό  
**staphylinus (pl. -i)**, σταφυλίνος  
**staple food**, κύριο προϊόν (τόπου)  
**starch**, άμυλο

**state**, κατάσταση  
**steam**, ατμός  
**steel**, ασάλι, χάλυβας  
**steel brush**, ασσαλόβουρτσα  
**steel rule**, μεταλλικός κανόνας/χάρακας μετρήσεων  
**steel-tipped**, με ασάλινα / από χάλυβα άκρα / μύτες  
**steep**, απόκρημνος, απότομος  
**steep knoll**, απότομος λοφίσκος / βουναλάκι  
**steer**, οδηγώ, κινώ  
**stem**, μίσχος  
**step**, βήμα, ενέργεια, πράξη  
**stick**, κομμάτι/ράβδος ξύλου, κολλώ  
**stick together**, παραμένω ενωμένος, συγκολλώ/ -ούμαι  
**sticky**, κολλώδης, γλοιώδης  
**stimulate**, διεγείρω, υποκινώ, προκαλώ, τονώνω  
**stimulation**, κίνητρο, ώθηση, ερέθιση, παρακίνηση  
**stir**, ανακατεύω  
**stock**, απόθεμα, εμπορεύματα, ζώα, θρέμματα  
**(live-) stock**, κοπάδι, ζώα, ζωντανά  
**stockman**, κτηνοτρόφος  
**stone**, λίθος, πέτρα  
**stope**, (υπόγεια) βαθμίδα λατομείου  
**storage**, αποθήκευση  
**store**, αποθηκεύω, αποταμιεύω  
**straight**, ευθύς, ίσιος  
**strand**, καλώδιο, κλώνος  
**stratum (pl. strata)**, στρώμα, στοιβάδα  
**stream**, χείμαρρος, ποτάμι  
**stream bed**, κοίτη ποταμού / χείμαρρος  
**strength**, ισχύς, δύναμη  
**stress**, πίεση, τάση  
**stretch**, εκτείνω / -ομαι, τεντώνω / -ομαι  
**strictly**, αποκλειστικά, αυστηρά  
**strike**, χτυπώ  
**striking**, χτύπημα, χτυπητός  
**string**, σπάγγος  
**strip**, λουρίδα  
**strip mining**, εξόρυξη με τη μέθοδο οριζοντίων βαθμίδων (με κατακόρυφα μέτωπα και οριζόντια κράσπεδα)  
**strip off**, αποκόπτω  
**structural**, δομικός  
**structure**, σύνθεση, δομή  
**sturdy**, σθεναρός, γερός, δυνατός, στέρεος  
**subject (to)**, υποβάλλω/ εκθέτω (σε)  
**be subjected to**, υπόκειμαι / υποβάλλομαι / εκτίθεμαι σε

**subsequent**, επόμενος, ακολουθών, μεταγενέστερος  
**subsoil**, υπέδαφος  
**substance**, ουσία, περιεχόμενο, υλικό, σώμα  
**subsurface**, υπέδαφος  
**subtropical**, υποτροπικός  
**successful**, επιτυχής  
**suck**, απομυζώ, εκμυζώ  
**sucker**, παραφυάδα  
**suction**, (αναρ)ρόφηση, άντληση, απομύζηση, απορρόφηση  
**sufficient**, επαρκής, αρκετός  
**suffocation**, ασφυξία  
**sugar**, ζάχαρη  
**sugar beat**, ζαχαρότευτλο  
**suit**, ταιριάζω  
**suitable**, αρμόδιος, κατάλληλος  
**suitable rooting medium**, κατάλληλο μέσον / περιβάλλον για ρίζωμα  
**sulfide**, θειούχο (ουσ.)  
**sulfur/sulphur**, θείον, θειάφι  
**sulfuric acid**, θειικό οξύ, βιτριόλι  
**sum**, σύνολο  
**sum up**, συνοψίζω  
**sump**, χώρος / λεκάνη αποστράγγισης  
**sunken**, βυθισμένος, χωμένος, βαθουλωτός  
**sunscreen**, παραπέτασμα, σκέπαστρο (για προστασία από τον ήλιο)  
**superconductor**, υπεραγωγός  
**supply**, προμήθεια, εφόδιο, τροφοδοσία, παροχή, προμηθεύω, παρέχω  
**support**, (υπο)στήριξη, υποστήριγμα, υποβάσταγμα, (υπο)στηρίζω  
**surface**, επιστρώνω, επικαλύπτω, ανέρχομαι στην επιφάνεια, επιφάνεια  
**surface gauge**, υψομετρικός χαρακτήρας  
**surface mining**, εκμετάλλευση υπαίθριων μεταλλείων  
**surface plate**, πλάκα εφαρμογής  
**surrounding**, περιστοιχίζω, περιβάλλον  
**survey**, επισκόπηση, έρευνα, μελέτη, τοπογράφιση  
**survive**, αντέχω, επιβιώνω  
**suspend**, αιωρούμαι, επιπλέω (σε υγρά), αναρτώ  
**sustain**, διατηρώ, συντηρώ  
**sway**, ταλαντεύω/-ομαι, κουνώ/-ιέμαι  
**be swayed**, γέρνω, κλίνω, κουνιέμαι, ταλαντεύομαι  
**sweet**, γλυκός  
**sweet-corn**, γλυκό καλαμπόκι  
**sweeten**, γλυκαίνω

**swell**, φουσκώνω, εξογκούμαι  
**switch**, αλλάζω κατεύθυνση, μετατροπή, διακόπτης (ηλεκτρ.), στρέφομαι  
**switch panel**, πίνακας διανομής ηλεκτρικού ρεύματος  
**swivel handle**, σπαστό στρεφόμενο σωληνωτό κλειδί, σπαστή λαβή, κυρτωμένο στα άκρα δακτυλιωτό κλειδί  
**symptom**, σύμπτωμα  
**system**, σύστημα, μέθοδος

## T

**table**, τραπέζι, πίνακας  
**table olives**, επιτραπέζιες ελιές  
**table-land**, επίπεδη επιφάνεια  
**take**, παίρνω, λαμβάνω  
**take action**, λαμβάνω μέτρα, ενεργοποιούμαι, δραστηριοποιούμαι  
**take out**, εξαγωγή, βγάζω  
**tank**, δεξαμενή, ντεπόζιτο  
**tap**, βρύση, βάνα, κρουνός, κτυπώ (ελαφρά)  
**(screw)tap**, κοχλιοτράπανο, σπειροτόμος εσωτερικών σπειρωμάτων, κοχλιοτομέας, κολαούζο  
**tarnish**, θαμπώνω, μαυρίζω  
**task**, έργο, εργασία  
**tax**, φόρος  
**tear**, σχίζω  
**tear off**, σχίζω, αποσπώ, τραβώ βίαια, ξεριζώνω  
**teat**, θηλή  
**technical**, τεχνικός  
**technician**, τεχνικός, τεχνίτης  
**technique**, μέθοδος, τεχνική  
**tee-handle**, λαβή σχήματος ταφ  
**teeth-like**, οδοντωτός  
**temperature**, θερμοκρασία  
**tempering**, σκληρυνση, ψήσιμο μετάλλου και μετριασμός της σκληρότητάς του, θερμική κατεργασία  
**temporary**, προσωρινός, πρόχειρος  
**tend**, περιποιούμαι, φροντίζω, τάση, ροπή, τείνω, κλίνω  
**tendency**, τάση, κλίση, ροπή  
**tensiometer / tensiometre**, τασίμετρο  
**tension**, τάση, ένταση, πίεση  
**terminal**, ακραίος, τελικός (σταθμός)  
**terrace**, πεζούλα χωραφιού (σε πλαγιά), τάρτα  
**territorial**, εδαφικός, τοπικός  
**test**, δοκιμή, ανάλυση, δοκιμάζω  
**texture**, υφή  
**therefore**, ως εκ τούτου, επομένως

**thermal**, θερμικός, θερμαντικός, (της) θερμότη-  
τας, της θερμικής  
**thermionic emission**, θερμιονική εκπομπή  
**thermometer**, θερμόμετρο  
**thick**, παχύς, πυκνός  
**thicken**, χονδραίνω, πυκνώνω  
**thickness**, πυκνότητα, πάχος, στρώμα  
**thin**, λεπτός  
**thought**, σκέψη  
**thread**, σπείρωμα, κοχλιοτομή  
**threading**, κατασκευή σπειρωμάτων  
**threat**, απειλή  
**threaten**, απειλώ  
**threatening**, απειλητικός  
**thresh**, αλωνίζω  
**thrips**, θρίπτα  
**through**, με, μέσω, με τη βοήθεια/τρόπο, μέσα  
από  
**throughout**, απ' άκρου σ' άκρο, παντού, καθ'  
όλη τη διάρκεια  
**thumb**, αντίχειρας  
**tie**, δένω  
**tight**, σφιχτός  
**tightening**, σφίξιμο, σφιχτό δέσιμο  
**till**, καλλιεργώ (γη), οργώνω  
**tilled-land**, οργωμένη γη  
**timber**, ξυλεία  
**time**, πολλαπλασιάζω, επί (πολλαπλασιασμού),  
χρόνος, φορά  
**at a time**, κάθε φορά, τη φορά  
**at times**, μερικές φορές, κάπου-κάπου  
**in the course of time**, με το πέρασμα του χρό-  
νου  
**tin**, κασσίτερος, καλάι, τενεκές  
**tin snips/shears**, μεταλλοψάλιδο  
**tiny**, πολύ μικρός  
**tip**, σωλήνας, άκρη, χωματερή, γέρνω, κλίνω  
**tip (sth over)**, ανατρέπω, αναποδογυρίζω  
**tissue**, ιστός  
**tobacco**, καπνός (φυτό), ταμπάκο  
**tomato**, τομάτα  
**tongs**, τσιμπίδα, λαβίδα  
**tongue**, γλώσσα  
**tool**, εργαλείο  
**top**, κορυφή, επάνω μέρος, επιφάνεια  
**topography**, τοπογραφία  
**topsoil/surface soil**, επιφάνεια εδάφους, πρώ-  
το στρώμα εδάφους  
**torch**, φλόγιστρο, πυρσός, δαυλός  
**total**, ολικός  
**toughness**, σκληρότητα, ανθεκτικότητα, ιδιότη-  
τα καλού ψησίματος και ακαμψίας

**tracing paper**, (διαφανές) χαρτί σχεδίου  
**track**, ίχνος, τροχιά, ερπύστρια (τρακτέρ)  
**track down**, εντοπίζω  
**track-laying**, ερπυστριοφόρο τρακτέρ, ερπύ-  
στρια  
**tractor**, γεωργικός ελκυστήρας, τρακτέρ, ερπύ-  
στρια  
**trailing**, συρόμενος  
**transfer**, μεταφέρω/ -ομαι, μεταθέτω  
**transformation**, μετατροπή, μετακίνηση  
**transmission**, μετάδοση, μεταβίβαση  
**transmission scavenger**, απορριμματοφόρο  
αυτοκίνητο  
**transmit**, μεταδίδω, μεταβιβάζω  
**transparent**, διαφανής  
**transpiration**, διαπνοή  
**transplant**, μεταφυτεύω, φυτό για μεταφύτευ-  
ση, μεταφυτευθέν φυτό  
**transplanter**, μεταφυτευτικό μηχάνημα  
**transport**, μεταφέρω  
**tread**, πέλμα (ελαστικού)  
**treat**, φροντίζω, περιποιούμαι, μεταχειρίζομαι,  
επεξεργάζομαι, κατεργάζομαι  
**treatment**, επεξεργασία, κατεργασία, μεταχειρί-  
ση, περιποίηση, θεραπευτική αγωγή  
**tree**, δέντρο  
**tremor**, σεισμική δόνηση  
**trench**, χαντάκι, όρυγμα  
**trickle**, σταλάζω, λεπτή ροή  
**tropical**, τροπικός  
**trough**, σκάφη  
**trowel**, μυστρί  
**garden trowel**, εργαλείο μεταφυτεύσεων, εκφυ-  
τευτήριο  
**truck**, φορτηγό (αυτοκίνητο), καμιόνι  
**trunk**, κορμός (δέντρων)  
**try square**, ορθογωνιόμετρο, ορθή ελεγκτική  
γωνία  
**tube**, σωλήνας, αγωγός  
**tuber**, βολβώδης ρίζα, κόνδυλος, βολβός  
**tunnel**, στοά, γαλαρία  
**turn**, στροφή, γυρίζω, (περι)στρέφω/-ομαι  
**turn over**, αναποδογυρίζω, αναδεύω, αναστρέ-  
φω, ανατρέπω  
**at every turn**, ανά πάσα στιγμή, σε κάθε στρο-  
φή, βήμα προς βήμα  
**twin**, διπλός, δίδυμος  
**twine**, στριφτό σύρμα  
**twing**, κλωνάρι, βλαστός, κλαρί  
**twist**, στρίβω  
**two-wheeled**, δίτροχος  
**two-wheeled tractor**, δίτροχο τρακτέρ, τρακτέρ

κήπων

**tying mechanism clutch**, συμπλέκτης δετικού μηχανισμού

**tying pick up machine**, χορτοδετικό μηχάνημα

**type**, τύπος, είδος

**typical**, τυπικός

**timely**, εμπρόθεσμα, έγκαιρα

## U

**under**, υπό, κάτω από, μέσα και σκεπασμένος από

**under casing**, μέσα σε θήκη

**undergo**, υφίσταμαι, υποβάλλομαι σε

**underground**, υπόγειος

**underground mining**, εκμετάλλευση υπόγειων μεταλλείων

**underlying**, θεμελιώδης, βασικός

**undertake**, αναλαμβάνω

**underwater**, υποβρύχιος, κάτω από το νερό

**undesirable**, ανεπιθύμητος

**undrained**, μη αποστραγγισμένος/αποξηραμένος

**undue**, άσκοπος, μη αναγκαίος

**undulant / Malta fever**, μελιταίος πυρετός,

μελιτοκοκκίαση, βρουκέλλωση

**unfurl**, ξεδιπλώνω

**uniformly**, ομοιόμορφα

**unit**, μονάδα, συσκευή

**unlimited**, απεριόριστος

**unrivalled**, απαραμίλλος

**unscathed**, άθικτος, ανέπαφος, σώος

**unweathered**, μη αποσαθρωμένος

**uproot**, ξεριζώνω

**upwards**, προς τα επάνω

**urine**, ούρα

**use/jus/**, χρήση

*in use*, σε χρήση, που χρησιμοποιείται

**use/juz/**, χρησιμοποιώ, μεταχειρίζομαι

**useful**, χρήσιμος

**utensil**, σκεύος

**utilization**, χρήση, χρησιμοποίηση, εκμετάλλευση

**utilize**, χρησιμοποιώ, αξιοποιώ, εκμεταλλεύομαι

**utterly**, απολύτως

## V

**vacuum**, κενό (χωρίς αέρα ή ύλη)

**vacuum gauge**, μετρητής πίεσης υγρών, μετρητής τάσης υγρασίας εδάφους

**valley**, κοιλάδα

**valuable**, πολύτιμος

**valve**, βαλβίδα

**valve spring**, ελατήριο βαλβίδας

**vapo(u)r**, ατμός

**vapo(u)rise/ -ize**, εξατμίζω/ -ομαι, αεριοποιούμαι

**variable**, μεταβλητός, ασταθής

**variety**, ποικιλία

**various**, ποικίλλος, διάφορος

**vary**, ποικίλλω

**vee block**, πλάκα/κομμάτι/συγκρότημα εφαρμογής σχήματος V (βε), βάση αξόνων σχήματος V (βε)

**vegetable**, φυτό, χορταρικό, λαχανικά

**vegetable garden**, λαχανόκηπος

**vegetarian**, χορτοφάγος

**vehicle**, όχημα

**vein**, φλέβα, στρώμα (γεωλ.)

**ventilate**, (εξ)αερίζω

**ventilation**, κλιματισμός, (εξ)αερισμός

**Vernier cal(l)ipers**, βερνιέρος, διαβήτηρας/παχύμετρο Βερνιέρου

**versatile**, εύχρηστος, ευέλικτος, (επί μηχανήματος) πολλαπλών χρήσεων, εύστροφος

**vertebrate**, σπονδυλωτός

**vertical**, κάθετος

**vessel**, (μεγάλο) δοχείο, αγγείο

**via**, δια μέσου, μέσω

**vibration**, δόνηση

**vibratory**, δονητικός

**vice / vise**, σφιγκτήρας εφαρμοστού, μέγκενη

**view**, θεωρώ, θέα, άποψη

**vigo(u)r**, σθένος, δύναμη

**vigorous**, σθεναρός, δυνατός

**virus**, ιός

**visible**, ορατός

**vital**, ζωτικός

**vitality**, ζωτικότητα

**vitamin**, βιταμίνη

**volcanic**, ηφαιστειογενής, εκρηξιγενής

**volcano**, ηφαιστειο

**volcanology**, ηφαιστειολογία

**volume**, ποσότητα, όγκος

**voluntary**, εκούσιος, εθελοντικός

## W

**wall**, τοίχος

**warm**, ζεστός, θερμός, ζεσταίνω

**warm-hearted**, καλόκαρδος

**warn**, προειδοποιώ

**warning**, προειδοποίηση

**wash out**, ξεπλένω  
**wastage**, σπατάλη, απώλεια  
**waste**, σπαταλώ, χαραμίζω, πετώ, σπατάλη, απορρίμματα, φθορά, άχρηστος, απόβλητος  
**waste land**, χέρσο έδαφος  
**waste material**, άχρηστο υλικό, απόβλητα  
**water**, ποτίζω, νερό  
**water management**, παροχή νερού  
**water sprouts**, λαίμαργοι για νερό βλαστοί, ριζοβλάστημα  
**waterfilled**, γεμάτος με νερό  
**watering**, πότισμα  
**watery**, υδαρής  
**wave**, κύμα  
**weak**, αδύναμος, ασθενής  
**wealth**, αφθονία, πλούτος  
**weapon**, όπλο  
**wear (- wore - worn)**, φορώ  
**weathered**, αποσαθρωμένος  
**weathering**, διάβρωση, αλλοίωση (οφειλόμενη σε καιρικές επιδράσεις)  
**weed**, ζιζάνιο, αγριόχορτο  
**weeding**, ξεχορτάρισμα  
**weight**, βάρος  
**welding**, σκληρή συγκόλληση, ηλεκτροκόλληση  
**welding machine**, ηλεκτρική μηχανή συγκόλλησης μετάλλων/ηλεκτροκόλλησης  
**well-being**, ευημερία  
**well-proportioned**, με καλές αναλογίες  
**well-shaped**, καλοσχηματισμένος  
**wet**, υγρός, νοτισμένος  
**wheat**, σιτάρι  
**wheel**, τροχός  
**star wheel**, αστεροειδής δίσκος/τροχός  
**two-wheeled**, δίτροχος  
**two-wheeled tractor**, δίτροχο τρακτέρ, τρακτέρ κήπων  
**wheelbarrow**, χειράμαξα, καρτσάκι  
**whitish**, υπόλευκος, ασπριδερός  
**widely**, ευρέως, πλατιά, πολύ  
**widespread**, ευρέως διαδεδομένος  
**wild**, άγριος

**wilt**, μαραίνω /-ομαι, μαρασμός  
**wilting**, μαρασμός  
**wind**, αέρας, άνεμος  
**window**, παράθυρο  
**window sill**, περβάζι παραθύρου  
**wine**, κρασί  
**winged**, φτερωτός  
**winnow**, λιχνίζω  
**winter**, χειμώνας  
**winze**, κάθοδος/είσοδος ορυχείου  
**wire**, σύρμα, καλώδιο, χορδή  
**wise**, συνετός, σοφός  
**wood**, ξύλο  
**wood deck**, ξύλινος εξώστης  
**wood overhead**, ξύλινο υπόστεγο  
**wooden**, ξύλινος  
**work**, λειτουργώ (αποτελεσματικά)  
**worker**, εργάτης  
**worm**, σκουλήκι  
**worth**, αξίζω  
**be worth + (-ing)**, αξίζει (τον κόπο) να  
**worthless**, άχρηστος  
**wrap**, περιτυλίγω, περιβάλλω  
**wrench**, γαλλικό κλειδί  
**combination wrench**, κλειδί με συνδυασμό γερμανικού & αμερικάνικου ανοίγματος  
**wrought**, σφυρήλατος, κατεργασμένος

## Y

**year**, έτος, χρόνος  
**the whole year round**, καθ' όλη τη διάρκεια του έτους, όλο το χρόνο  
**yield**, αποδίδω, αποφέρω, σοδειά  
**yoke**, ζυγός  
**young**, νεογνά, μικρά, τέκνα, νέος

## Z

**zero**, μηδέν  
**zinc**, ψευδάργυρος, τσίγκος  
**zone**, ζώνη



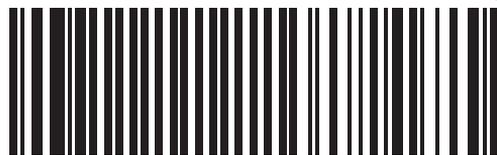




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