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Unit I

1.1 VOCABULARY

These are the words you will practice in this unit:

VERBS

absorb	(ab·sorb')	(+ noun)
advance	(ad·vance')	
behave	(be·have')	
bend		
bent		
bent		
bend		(+ noun)
combine	(com·bine')	(+ noun plural)
combine		(+ noun + with + noun)
combine		
confuse	(con·fuse')	(+ noun + with)
construct	(con·struct')	(+ noun)
create	(cre·ate')	(+ noun)
fit		(+ noun)
fit into		(with impersonal subject)
fit		(+ noun + together)
		(with personal subject)
look at		(+ noun)
magnify	(mag'·ni·fy)	(+ noun)
perform	(per·form')	(+ noun)
polish	(pol'·ish)	(+ noun)
reflect	(re·flect')	(+ noun) (concrete sense)
reflect		(+ noun) (abstract sense)
sail		(+ to, for, etc.)

NOUNS

absence	(ab'·sence)	**a piston**	(pis'·ton)
an advance	(ad·vance')	**polish**	(pol'·ish)
an advantage	(ad·van'·tage)	**presence**	(pres'·ence)
attention	(at·ten'·tion)	**a principle**	(prin'·ci·ple)
behavior	(be·hav'·ior)	**production**	(pro·duc'·tion)
(a) combination	(com·bi·na'·tion)	**psychology**	(psy·chol'·o·gy)
a computer	(com·pu'·ter)	**a ray**	
(a) condition	(con·di'·tion)	**a reflection**	(re·flec'·tion)
confusion	(con·fu'·sion)	**a sail**	
(a) construction	(con·struc'·tion)	**a sailor**	(sail'·or)
a cylinder	(cyl'·in·der)	**a screen**	
a disadvantage	(dis·ad·van'·tage)	**a screw**	
energy	(en'·er·gy)	**a sound**	
a function	(func'·tion)	**a technique**	(tech·nique')
an image	(im'·age)	**technology**	(tech·nol'·o·gy)
a lens		**thickness**	(thick'·ness)
a microscope	(mi'·cro·scope)	**a type**	

1.1 VOCABULARY

ADJECTIVES

advanced	(ad·vanced')	**psychological**	(psy·cho·log'·ı·cal)
combined	(com·bıned')	**simultaneous**	(sı·mul·ta'·ne·ous)
confused	(con·fused')	**slight**	
driven by	(drıv'·en)	**smooth**	
enlarged	(en·larged')	**technical**	(tech'·nı·cal)
inner	(ın'·ner)	**technological**	(tech·no·log'·ı·cal)
invisible	(ın·vıs'·ı·ble)	**thick**	
loose		**tight**	
outer	(out'·er)	**transparent**	(trans·par'·ent)
physical	(phys'·ı·cal)	**visible**	(vıs'·ı·ble)
polished	(pol'·ıshed)		

ADVERBS

finally	(fi'·nal·ly)
loosely	(loose'·ly)
simultaneously	(si·mul·ta'·ne·ous·ly)
smoothly	(smooth'·ly)
tightly	(tıght'·ly)
westwards,	(west'·wards)
eastwards, etc.	(east'·wards)

PHRASES

as well as	
in combination (with)	(com·bı·na'·tion)
in confusion	(con·fu'·sıon)
in the absence (of)	(ab'·sence)
in the presence (of)	(pres'·ence)
on principle	(prın'·ci·ple)

Unit I
1.2 WORD STUDY

INSTRUCTIONS: Study the following words and the uses of them:

finally = in the end, lastly. This is the adverb formed from "final."

Examples: He f___lly decided to remove his son from the school They f___ lly agreed to pay him for the invention.

First the raw cotton is separated from the plant. Then it is spun into thread. The thread is woven into cloth. F_____y, the cloth is made into the clothes we wear.

(a) condition conditions The *condition* of a thing or a place is what it is like at a particular time, e.g. clean or dirty, tidy or untidy, ready for use or not ready. The condition of a person is what he or she is like at a particular time, e.g. healthy or unhealthy, strong or weak, drunk or not drunk.

The *conditions* in (or under) which people live or work, children grow up, etc. are the houses and places they live in, the food they eat, the society they live in, their relations with other people and the way people act towards them. The conditions under which people live, work or grow up are **all the things and people around them which have an effect on them** by making them rich or poor, happy or unhappy, etc., or which have an effect on their health. We can speak in the same way about the conditions under which animals live.

We can also speak of conditions which are suitable or unsuitable for people or their work, or for starting or developing a school or an industry. Schools, industries, etc. depend on certain c_____s for their growth, development and success.

Examples: This room is in a terrible c_____n; it is very dirty and untidy. You cannot go out in this c_____n. (You are too ill or too untidy, etc.) My uncle was not in a c_____n to walk home. (He was too drunk.) I stopped at the hospital to ask about his c_____n. (His health.) The way you cook this fruit will depend on its c_____n (i.e. whether it is hard or soft). This ship is not in a c_____n to go very far. (Can you give a reason?) Everything arrived in good c_____n. (Can you give a reason?)

Many books have been written about the c_____s of the poor in the nineteenth century. You cannot expect children to learn anything under these c_____ns. Before taking the job she asked about the working c_____ns. Most political parties promise to improve the c_____ns of the workers when they get into power. Conditions in the students' hostel are not as good as they ought to be. C_____s are just right now for planting potatoes. The government will start new industries wherever c_____ns are suitable. The size of the new schools will depend on local c_____ns. The plan will be operated only when c_____s are su___ble.

physical A *physical* thing, object or substance is one which does not exist only in the mind or through features given to it by the mind, but can be touched, seen or weighed.

Physical laws are laws of physics and of nature which govern all physical things and substances A physical possibility is something which is possible according to physical laws. A p____cal impossibility is something which, according to these laws, is impossible.

The physical features of a place or of a country are its natural features. The physical geography of a country is the geography of its natural features, p____cal geography is distinguished from political geography.

Examples: Thought is an activity or a process, not a ph_____l thing, though it may have a p_____l basis. When light touches a p_____l object the direction of the light is changed.

1.2 WORD STUDY

All movement is governed by p_____l laws. It is a p_____l impossibility for a man to be in India and England at the same time. Mary's illness is not p_____ but psychological.

The p_____ features of a country have an effect on its political history. I want a p_____l map of New Zealand, not a political map.

psychology
psychological

Psyche was the ancient Greek word for the mind or the spirit, and *psychology* is the science and study of the mind and its activities, especially human behavior. A man's psy___logy is the way he thinks, feels and looks at the world, especially when considered in relation to his behavior. A psychological textbook is a textbook of psy_____gy. A disease is ps_____cal or has ps_____al causes when its origin is not physical, i.e. when its origin is in the mind, not in the body. A problem is ps_____l when its origin is a person's thoughts or feelings and not a physical or "real" situation which he has to face.

Examples: Proust's great novel was a ps_____l novel; it was a novel about inner life. Social scientists are interested in the ps_____y of groups and crowds. For some people fashions in dress have a historical interest; for others their interest is ps_____al. Ps_____gy is a subject in most universities. An important branch of ps_____ is the ps_____ of learning.

behave
behavior
(uncountable)

When we observe how a person *behaves* (in a particular situation), we observe how he *acts*, what he *does* (in that situation). When we observe how a person behaves, i.e., what he does in a particular situation, we observe his *behavior*. When we study what animals do in various situations, we study their be_____r, we study how they be___e. When we observe what happens to a liquid when it is heated, we observe the be_____r of that liquid when it is heated. Originally, the words behave, behavior, only referred to what people did or the way in which they acted, but in modern English these words can also refer to the way **things** or **substances** move or change *in particular situations or under certain conditions.*

Examples: Psychologists are interested in the ways human beings be___e and in the causes of their b_____or. Children often b___ve differently at school and at home. Scientists have made a close study of the b___vior of monkeys living together in groups in the forest. It is not always possible to predict how a particular person will b___ve in a new situation. Mr. X does not know how to *behave** to old people. He *behaved** very badly at the party. I could not forgive his *behavior.**

attention

Attention is the act of directing one's thoughts to something. When we *give attention* or *pay attention* to something or someone, we turn our thoughts towards a thing or a person, or to what a person is saying or doing.

Examples: Please pay a_____n to what you are doing; don't look out of the window. I saw John in the crowd and tried to attract his a_____n, but he did not notice me. She paid very little a_____n to my advice. Now I want you to give your a_____ to this diagram on the blackboard. Children who do not get enough a_____n at home sometimes dem__d a lot of a_____ at school.

look at

When we *look at* a thing or a person, we look in the direction of that thing or person and pay attention to it (or to him or to her).

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* Originally, the words *behave, behavior,* applied only to human beings and referred to standards of what was right or wrong, or conventionally proper or acceptable. The words are still often used in this way, but are now also used without reference to such standards.

1.2 WORD STUDY

Examples: Please l___ __ the blackboard. The teacher asked Tom to _____ __ the blackboard, but he _____ed __ Mary instead. I want you to _____ __ my car; there is something the matter with it. She _____ed __ the photograph carefully but could not find her sister in it.

combine

Two things or substances (or more than two) *combine* when they come together, or join together, and form something–often a new thing. People c_____ne for a special purpose when they work together for a special purpose.

When we c_____ne two or more things or substances, we bring them together to form something. When we c_____ activities, skills, etc. we practice them at the same time.

Examples: Hydrogen and oxygen c_____ to form water. If the workers want higher wages, they must c_____e.

To make a cake we c_____ eggs, flour, sugar and butter. It is not always possible to c_____ work and pleasure. The man who thought of c_____ing a gas engine with wheels was the inventor of the automobile.

a combination
in combination

A combination is the result of combining things or (in special contexts) people. *In combination* means "together."

Examples: Mud is a c_____tion of earth and water. Technology is the c_____n of scientific knowledge with practical skills and operations. Mathematical ability and practical ability are not always found in c_____n.

combined

= joined together, mixed together, thought of together, or effective together in producing a single result.

Examples: When c_____ed, red and yellow produce orange. Their c_____ed incomes do not amount to more than 1000 dollars a year. The c_____d population of the two countries is approximately twelve million. An automobile is produced by the c_____ed skills of many different people.

an advantage
a disadvantage

When we think of *an advantage* possessed by a thing, an activity, a course of action, a plan, a method, etc., we think of a useful, convenient, valuable or helpful feature which we find in it. We often compare the advantages of one thing, course of action, etc. with the advantages of another; or we compare the advantages of a thing, a plan, etc. with its *disadvantages*. A disadvantage of a thing, a plan, etc., is a feature which prevents it (or may prevent it) from being useful, helpful, convenient or successful in relation to our purposes or requirements.

Examples: One ad_____ge of living in a large town is that its shops can supply most of the things we need. The ad_____ges of a good education are obvious. The main ad_____ge of air travel is speed; its main disad_____e is its high cost, and it is neither safer nor more comfortable than other forms of travel. My apartment has ad_____s, and dis_____s. It is warm, well-designed and has a beautiful view, but it is not on the bus route and gets a lot of noise from the road as well as from the apartment above it. The ability to understand and ac__pt other people's feelings is a psy_____al adv_____ge.

production
(uncountable)

Production is the process of producing or a quantity which is produced.

Examples: We must try to improve our methods of p_____n. In some countries agricultural p_____tion has been completely mechanized. In the last two months there has been a sharp fall in the p_____n of automobiles. We cannot increase p_____tion by building new factories, because we do not have sufficient workers. Industrialists sometimes form comb_____ns to limit p_____ion.

1.2 WORD STUDY

a type

A *type* is a class, group or kind which has its own clearly distinctive character or features*

Examples: This t___ of wine is not produced in New Zealand. I do not like houses of this t___.

In a university you will find teachers of many different t___s; those who are interested in their subjects and in doing research, those who are interested in their students, those who are mainly interested in politics, and those who are mainly interested in earning enough money to have a peaceful life.

polish
polish (uncountable)
polished

We *polish* a surface when we rub it to make it smooth and to make it shine. *Polish* (n., uncountable) is a substance used for polishing, to make a surface shine. A surface is *polished* when it is smooth and shining after being polished by a person or a machine.

Examples: Today I will p_____ the furniture. This p_____ is only suitable for metal surfaces. A highly p_____ed surface reflects light. Wood and many types of plastic can be given a p_____ed surface.

simultaneous
simultaneously

Events are *simultaneous* when they happen at the same time. They occur *simultaneously* when they occur at the same time.

Examples: The moment when light leaves a distant star and the moment when it reaches our eyes are not s_____eous; they may be separated by millions of years. The telephone bell and the front door bell rang s_____eously.

slight
the slightest (usually used with *not*, *never*, etc.)

We say that something is *slight* when it is not large enough to be important or serious or to have much effect.

Examples: There is a s____t improvement in the patient's health today. The mistakes in your essay are only s____t, and I am sure you can correct them yourself. This year there was a s____t increase in production. She does not have the s_____est difficulty in making herself understood. In an examination like this one a good memory is only a s____t advantage. He made a s_____ error in his calculations.

confusion (uncountable)
confused
confuse
confuse

A statement, a sentence, a message, a telegram, an explanation, etc. is *confused* when it is unclear in a particular way. It is confused when the meanings, ideas, facts, reasons, etc. which it tries to express are mixed up or in the wrong order, though they can only be understood when they are kept separate or are expressed in the right order. For example, the telegram BOB ILL COMING MARY is confused because it is impossible to tell from this telegram whether Bob is coming or Mary (who sent the telegram) is coming, or both of them are coming. A writer's use of a word is confused when the word has two or more meanings and his context does not make it clear which of these meanings he wants to express.

A person's ideas (on a particular subject) are confused when he has two or more ideas which a person cannot possibly have at the same time, according to standards of truth, logic, etc.; or when he mixes up causes and effects, general facts and examples, etc., so that he does not really understand his own ideas and nobody else can understand them. A person's feelings (e.g. sympathy and self-interest) may be confused in such a way that he does not know what to do or why he is doing something. In this case he is c_____ed because these feelings are mixed and he is unable to separate them. But without separating them and knowing what they are, he will either be unable to act or he will act without knowing the cause of his action.

A person may be c____sed, or feel con___ed, for various reasons. A student will be conf__ed if a teacher gives him a sentence-pattern to learn that looks very like the sentence-pattern he had to learn the day before, but is also different in some important way. A student feels c_____d in this situation because when things are alike it is easy to get them mixed up and confuse them. For

* **Note:** A type is never used to refer to a scientific classification of plants or animals.

1.2 WORD STUDY

example, when John looks very much like Peter, we sometimes c____se John with Peter. Students often c____se words which look alike and are alike in meaning, for example the noun ADVICE and the verb ADVISE. They c____se ADVICE with ADVISE. The spelling of these two words is often con___ed in students' minds.

A person will be confused, or feel c_____d, if he is given a c_____ed message, explanation, etc. He will also be c_____ed if he is given c_____ed instructions, and will not know what to do. For example, if a mother sometimes tells her child not to talk when grown-up people are talking and at other times tells him that he should talk to grown-up visitors, the child may feel c_____ed and may not know what he should do. The situations are alike but the instructions are different, so the child is c_____ed.

People are c_____ed or feel c_____d when they receive c_____ed instructions, messages, explanations, etc.

Con___ed instructions, messages, explanations, etc. cause *confusion* or produce confusion in people's minds. Things, faces, words, etc. which look alike but which are not really alike may also be a cause of mental c_____n.

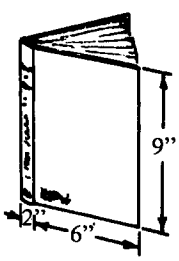
A c_____ed noise is a noise in which separate sounds cannot be distinguished. A c____sed battle is a battle in which friends cannot be distinguished from enemies and so nobody knows who is winning and who is losing. In a battle of this kind everything is in confusion. We also say that a room is in c_____ion when everything in it is mixed up and nothing is in its proper place. A class is in c_____ion when the students are not learning, the teacher is not teaching, everyone is making a noise and nobody is paying any attention to anyone else. In a class like this no one can say what is happening.

smooth
smoothly

A surface is *smooth* when it is free from roughness, like the surface of glass. A smooth surface can usually be polished. A surface can often be made smoother by polishing. A smooth liquid is well mixed and does not have bits of solid floating in it. When something (e.g. a car) moves or goes sm____ly, it moves quietly without a break in its movement, without shaking from side to side or up and down.

Examples: The sea was as s___th as a mirror. The roads in our district are not very s___th. This paint is not s___th and should be mixed again. To make a cake, you must first combine the butter and sugar s_____ly. My car is not running s_____ly today; there must be something wrong with the engine. This pen does not write s_____ly, because the tip is bent.

thick
thickness



Here is a book. Its length is nine inches. Its width is six inches. Its *thickness* is two inches. It is nine inches long. It is six inches wide. It is two inches *thick.* Here the adjective thick and the noun thickness refer to a *dimension* of the book, the dimension which is usually the smallest. The word thick comes after the measurement (e.g. "two inches thick"), and enables us to distinguish this dimension from the other two dimensions.

But we can also say that this is a **thick book.** When we say this we are giving a second meaning to thick, which should not be confused with the first. When we say that this is a th___ book, or that this book is th___, we mean that its thickness is greater than the average th____ness of a book. Any book which is more than one inch th___ is a thick book, because most books are thinner than this.

What about a th___k piece of paper? Will it be more than one inch th___? Of course not! It will be less than one-inch thick. A piece of paper which is 1/60 inch th___ (or more) is a th___ piece of paper, because the average thickness of paper is usually less than this.

1.2 WORD STUDY

Here is a thin line. ———————————————

Here is a thick line. ▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬

Is this a thick line? ▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮

No, it is not a line at all! It is a narrow black rectangle drawn on the paper.

We can compare thin wires with th___ wires. But if the thickness of a wire is very much greater than the average, we will probably not refer to it as a wire any more. We will call it a cable, or a rod, or a cylinder. A th___ wire is thinner than a thin metal rod and a thick rod is th___er than a metal cylinder. A thin book is certainly th___er than a thick piece of paper.

Do not confuse the two meanings of thick. The words *long, wide, deep, high,* also have two meanings in the same way. This skirt is 48 inches *long.* It is a *long* skirt. But we can also say that another skirt is 14 inches *long,* though it is a short skirt.

This table is five feet *wide.* It is a w___ table. But we can also say that another table is 12 inches *wide,* though it is not a w___ table but a n___w one.

This hole is 40 feet *deep.* It is a d__p hole. But we can also say that another hole is two feet *deep,* though it is not a d__p hole but a shallow one.

This building is a hundred feet *high.* It is a h___ building. But we can also say that another building is 12 feet h___, though it is not a *high* building but a l__ one.

inner
outer

Inner means "nearest to the middle or to the inside of a thing; belonging to the inside; used for the inside; or hidden, not appearing on the surface."

Outer means "farthest away from the middle or inside of a thing; belonging to the outside of a thing; or used for the outside part of a thing."

These two adjectives are often used to make a distinction between two parts or surfaces of the **same thing.** (Outer should **not** be used to describe what is completely outside a thing or a person and does not belong to it, or to him.)

Here is a cup. A cup has an i___r and an o__er surface. The inner surface of this cup is bl___. The outer surface is wh___.

A bicycle tire has two tubes. The i____ tube is made of smooth, thin, elastic rubber and is filled with air at high pressure. The o___r tube has to be stronger because it touches the rough surface of the road. It is made of thicker material.

The stars in o____ space beyond the solar system are very far away from us. (Here "outer" space means the part of space which is beyond the solar system.)

The London underground railway has an i___r circle and an o__er circle.

I do not understand the meaning of this poem. Perhaps it has an i___r meaning. (An inner meaning is a hidden or secret meaning which does not appear on the surface.)

(an) advance (countable or uncountable)
advance
advanced

When an army *advances,* it moves forward towards the enemy's positions or towards the enemy's land. When important scientific discoveries are made which add to human knowledge and which help our knowledge to move forward to further discoveries, we say that science advances. *To advance* is to move forward or cover fresh ground.

Advance (uncountable noun) is progress or forward movement in general, movement towards the future or towards a better situation, better conditions, further knowledge, etc.

1.2 WORD STUDY

An advance (countable noun) is a movement forwards in a particular direction or in a particular field of study, towards a better situation, better conditions, further knowledge, etc.

Advanced studies, courses or ideas are those which require a long preparation or training before they can be studied, learned or understood.

Examples: Yesterday the sixth army ad_____ed two miles. Our preparations for the holiday have not ad_____ed very far.

The nineteenth century was an age of scientific and technological ad_____. A_____ in human society is not possible unless people learn to respect those whose ways of life, customs and forms of society are very different from their own.

A_____s in medical science have lengthened human life. The country's industrial a_____ce has been rapid. Nothing can stop the enemy's a_____ce.

He will take an a_____ced course in physics next year. This textbook is too a_____d for you. His ideas are a_____d, and only a few people can understand them.

a technique

A technique is a skill or a method (practical, mechanical or artistic) of a special kind, required for a particular job, operation or activity. People often acquire *techniques* as a result of special training.

Examples: Engineering techn_____s can be acquired either by studying at a university or an institute, or by working in a factory.

Modern artists use a great variety of t_____s. Some of the new tech_____s in art are necessitated by new materials and new instruments.

Someone has invented a new t_____e for keeping babies dry at night.

technology (uncountable)
technological

Technology is the study or science of industrial methods and techniques. The most famous *technological* institute is probably M.I.T., the Massachusetts Institute of Technology. We live in a period of tech_____l advance. Nowadays farmers need t_____l training. My son is studying computer tech_____gy.

technical

We describe something as *technical* when it relates to, refers to, or requires special methods or techniques (mechanical, industrial or artistic), or a type of practical knowledge which must be specially acquired and is not possessed by everybody.

A technical word is a word referring to something studied as part of a special field of knowledge, and is not well understood by a person who has no knowledge of that branch of study.

Examples: An engineer must learn mathematics and physics as well as t_____l skills. The t_____l problem of bringing a space-ship back from the moon has been solved. The last fifty years has been a period of rapid t_____ advance in all branches of technology.

The advanced vocabulary course does not contain many technical words, because these are best taught in scientific and technical courses. "Isotope" is a t_____l word, which will probably be understood only by those of you who have studied physics or chemistry. "Mullion" is a t_____l term in architecture and "starboard beam" is a t_____l term for part of a ship; sailors will know what it means.

create
created

Create may mean **cause, produce, cause to exist.** When it has this meaning, the subject of this verb may be either a person or a thing. **(Note** that when the verb is used in this sense it is often followed by a noun like "trouble," "interest," "problem," "difficulty," "confusion," "opportunity," referring to the psychological features of a situation.)

Create may mean **make something new or original.** When it has this meaning, the subject of this verb is a person or people. **Note** that when the verb is used in this sense it is often followed by a

1.2 WORD STUDY

noun referring to something which can be made or formed by a **decision**, for example an organization, a post or an institution.

Examples: God c___ted the world. The use of pictures and games helps to c____e interest in a class. She c____es trouble for her teachers. The new outbreak of foot-and-mouth disease has cr__ted serious problems.

Several new states have been c___ted in Africa. To house all the people we must c___te new towns and cities. New universities must be cr__ted to educate all these young people. Several new posts have been c___ted in our College. If we want people to co-operate, we must c____e the conditions under which they can co-operate. New opportunities for training should be cr___ed.

Exercise on CREATE meaning CAUSE or PRODUCE

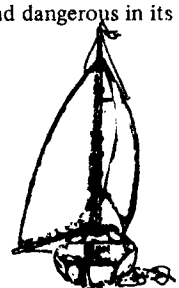
Make **sensible** sentences from the following table.

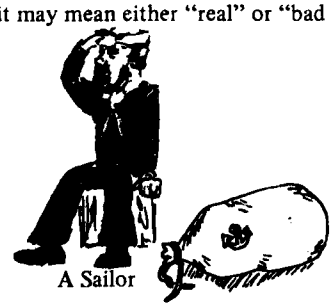
I	II	III	IV	V
This	will create	a lot of	difficulties	
This situation	may create	further	problems	
Her arrival	has created	real	trouble	
His absence		great	interest	
Their action		widespread*	confusion	
Your book		serious**	violence	
The Queen's visit			unhappiness	
The housing plan			dissatisfaction	
The new law				
The economic crisis				
The President's speech				
The new traffic system				
The increase in population				
The arrival of the Beatles				
The reorganization of the timetable				

* **widespread** should be used only before uncountable nouns.

** The meaning of **serious** depends on the context. In these contexts it may mean either "real" or "bad and dangerous in its (or their) effect." (See Section 4.)

a sail
sail
a sailor





A Sailor

This is a *sailing*-boat. It has *sails.* Sails are sheets of cloth which enable boats and ships to travel by using wind power.

In earlier times to sail meant "to travel in a boat or ship which had sails." Nowadays large ships do not have sails, and the verb sail has now come to mean **travel by water**. It can now be used for any boat or ship, even one which goes by steam. A *sailor* is a man who works on a ship or on a boat.

Examples: In 1492 Columbus s___ed to America. When does your ship s__l? He sailed for New York on July the 27th. Mr. Alec Rose s___ed round the world alone in a small boat.

Note: He sailed **to** America = he **reached** America on a ship.

1.2 WORD STUDY

He sailed **for** America on July the 27th = he **started** his journey by ship to America on July the 27th.

Make sentences from the following table. *All* sentences will be correct.

I	II	III	IV	V	VI
He	left	for	Spain	on Monday	
Mr. Smith	started		Sydney	on April the first	
The President	sailed		England	on February the eighteenth	
The Beatles	set off		New York	last week	
Mr. Chichester			Singapore	yesterday	
My aunt			Bangkok	two days ago	
			Capetown	a few days ago	
			Europe	this morning	
				last night	

westwards
eastwards
northwards
southwards
-wards
towards

The suffix *-wards* shows *direction*, as in the adverbs *upwards, downwards, backwards, forwards, inwards, outwards.* The preposition *towards* also shows direction.

When a ship sails *westwards*, it sails *towards the west.*

Examples: In 1492 Columbus sailed w_____s. My plane flies e_____s as far as Singapore, then it changes its direction and goes s_____s. A pendulum moves b_____s and f_____s. This door opens in_____s, but the other doors open o_____s. Rivers flow d_____s to_____s the sea.

a sound

A *sound* is anything which is heard or which can be heard.

Examples: We heard the s___d of voices in the next room. These s_____'s are difficult for you; you must practice them. S_____ waves travel more slowly than light waves.

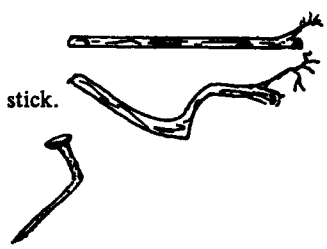
bend
bend
bent

We *bend* a straight thing (e.g. a rod) when we force it into the shape of a curve or an angle. A straight thing, for example a metal rod or a sheet of metal, *bends* when it curves or takes a shape which is not straight or flat. Then it is *bent.*

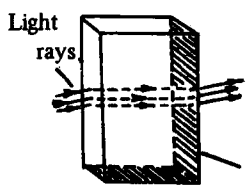
This is a straight stick.

This stick is b__t. It is a b__t stick.

This nail is b____.



When rays of light pass through a piece of glass, the rays b__d.



This diagram shows how rays of light b__d when they pass through a rectangular piece of glass.

1.2 WORD STUDY

transparent
visible

A substance or an object is ***transparent*** when light can pass through it so that objects on the other side are ***visible*** (= can be seen) or partly visible. (The Latin word "trans-" means "through," or "from one place to another.")

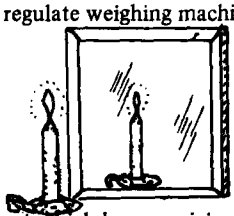
Examples: Glass is a tr_____ent substance. We can see things through glass. The things on the other side of a glass window are v_____le, because glass is t_____t. Some kinds of plastic are t_____t. Not many solid substances are t_____, but many liquids are t_____.

as well as

= in addition to

Examples: He gave me money __ _____ __ advice. His factory employs women __ _____ __ men. He paid for my ticket __ _____ __ for his own. Success in an examination depends on luck __ _____ __ on hard work. To be a good doctor you need experience __ _____ __ training. Pendulums can be used to regulate weighing machines __ _____ __ clocks.

absorb
reflect
a reflection
a ray
an image



A smooth, polished surface reflects light.

A ***ray*** is a line of light or heat which has an origin and a direction. The sun sends out r__s of light and heat continuously.

When r__s of light or heat strike an object, three things may happen to them. The r__s may pass through the object, they may be ***absorbed*** by the object, or they may be ***reflected*** from its surface.

R___ of light can only pass through t_____ent things. R___ of heat can pass through many substances, but there are some substances which do not allow much heat to pass through them. (We will read about these in a later passage in these workbooks; they are called insulating materials.)

What do we mean when we say that one thing can **absorb** another? You will understand this from examples. Dry sand can ab____ water. Some kinds of paper can a____b water. Take a small bowl of water and push a towel into the water. Press the towel into the water and move it about in the water. Soon all the water will be ab____ed by the towel. You will not see any water in the bowl. The towel can take the water and hold it.

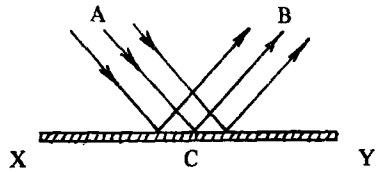
A solid object or a solid substance a_____s a liquid when it takes the liquid into itself and holds it, without itself changing into a liquid.

Most solid objects a____b some of the light and heat which reach them, just as a towel a_____s water. This means that they take in light and heat. They a____b rays of light and heat.

Dark or black objects, especially those with a rough surface, a____b a large amount of the light and heat which reach them. Smooth, polished surfaces and white surfaces do not a_____ much heat or light. Instead, they ***reflect*** rays of heat and light which strike them.

What do we mean when we say that surfaces r____ct rays? When a boy throws a ball at a wall, the ball strikes the wall and comes back to him. In the same way, r___ which are ref____ed strike an object and come back again, instead of being absorbed.

Here is a diagram of a smooth surface, for example a mirror, which re____ts rays of light.



XY is a smooth surface. Rays of light coming from the direction of A strike the surface at C and are ref____ed towards B. The surface XY re____s the rays.

1.2 WORD STUDY

When I look at a mirror I see myself. Actually, of course, I do not see myself, what I see is not my own face but *an image* of my face. An im___e of an object or of a person is a likeness or copy; it is something which looks like that object or that person. The im___e of myself that I see in the mirror is produced by re_____ed light. It is therefore called a *reflection.*

We can see im___s of this kind in many places. When the sea is calm and smooth, it is like a mirror. You can see re_____ions of ships on the surface of the water. You can see the r_____s of houses and trees in the water. At night you can see the r_____n of the m___n in the water. Polished surfaces also r_____t objects, because they r_____t light. A shining silver plate or a polished steel spoon will r_____t your face when you look at it. A smooth, highly polished table r_____ts all the objects which stand on it. At night, when your room is brightly lit and the window is shut, you cannot see the objects outside the window. They are not visible. They are *invisible.* You can see only the re_____n of your room in the glass window. One of the reading passages in this section explains why this happens.

a principle
on principle

This noun has three important meanings.

A *principle* = a basic truth or general law of science, especially one which guides further study in a subject. The basic principles of physics are often given as mathematical relationships or formulas.

A *principle* = a basic physical law through which a machine or instrument operates. In this connection a principle sometimes means the **general** way in which a whole class of machines or a whole class of instruments operates. (Thus we can speak of the principle of the lever or the principle of the steam engine.)

A *principle* = a general rule or standard for human action, especially the kind of action that can be considered right or wrong.

Examples: You cannot solve problems in mathematics if you do not know the basic pr____ples. To find the volume of an irregular solid you must apply Archimedes' pr_____le. One of the p_____s of modern economics is the p_____le of competition for scarce goods and values. Anthropologists have not reached agreement about the basic p_____s of anthropology.

Many kitchen tools, such as scissors and carving knives and can openers, are based on the pr_____e of the lever. Newcomen and Trevethick discovered the p_____e of the steam engine, which is the use of pressure of steam to drive a piston. The p_____e of the crank enables us to convert an up-and-down movement into a circular movement.

He is untrustworthy, because he has no p_____s. The p_____ that we should respect our neighbors is not very useful unless we understand what they mean by "respect." In human friendship an important p_____le is "Forgive and forget." He is a vegetarian (i.e. he eats only vegetable food) on p_____e.

fit
(non-personal subject)
loose
tight
fit
loosely
tightly

A coat *fits* a man well when he can move his legs and arms comfortably inside it, when it is neither too big nor too small for him. If his coat is too small, it will be *tight*; it will not allow him freedom to move. If it is too large it will be *loose*; there will be too much space in it and it will look funny.

Coats, trousers, dresses and shoes should f___ people well. They should not be too l____ or too t____. They should allow people to move freely, but should not have a lot of unnecessary material.

If a key does not ____ a lock it will not open the lock. In order to turn the inside part of the lock and open the door, the key must *fit into* the lock precisely.

I had a space for a refrigerator in my kitchen, and I went to town and bought a refrigerator. But when it arrived and I moved it into the kitchen, I found the refrigerator was too large! It did not ____ into the space. I was stupid not to measure the space before I bought the refrigerator.

1.2 WORD STUDY

There are some things which should be fixed as *tightly* as possible, for example the screws which keep the wheels of a car in their places or the bars of an electric fire. There are some things which should be kept t____t when we use them but which should be kept l___se when we are not using them, like the strings of certain musical instruments, or the stretched surface of a drum.

fit + together (personal subject)

When a boy *constructs* a toy airplane, he *fits* pieces of metal or plastic together in the right way to make the plane. When a man c_____ts a house, he takes bricks or pieces of wood or blocks of stone and f____ them to_____r in their right positions to build the house. When you co_____t an English sentence, you choose a subject, a verb, and other parts of speech and f___ them together in their right order to make a sentence.

(a) construction

A person who *constructs* something makes it or builds it by fitting its parts together in the right way or in the right order.

A *well-constructed* novel has a story which is well-designed, with characters and events that f___ to_____r in a meaningful way. The *construction* of a novel is the way the characters and events in the story are related to each other. The cons_____n of a building is the process of building it or the way in which it is designed, the parts it has and the visible relations between them. The c_____n of a sentence is the parts of speech which are used to c_____t it and the order in which they are used, or the act of constructing it.

We can see from these examples that one meaning of construction is **the process of constructing**; another meaning is **the parts which a thing has** and **the visible relations between these parts**, the way in which they are joined or fitted or connected together.

Here are two things which are obviously **very different in construction** (in both senses of the word!).

The first is a zig-zag path going up a hillside.

The second is an ordinary screw.

The zig-zag path is made of earth and stones, or perhaps cement. The man who constructed it had to make the ground smooth; then he covered it with small stones or perhaps with cement. The path forms part of the surface of the hillside. It is a narrow path with many turns or bends.

The screw is a small metal object, made by a machine. It is pointed at one end and has a round head at the other, into which a screwdriver can fit. It is made in one piece, but has a thin spiral line cut into it and running from the top to the bottom.

a screw

In their construction these two things are very different. But they are both based on the same *principle.* This may seem strange, but physicists and engineers will tell you that it is true. When you walk up a zig-zag path and when you turn a screw with a screwdriver you are producing an example of the **same basic physical law**, because you are saving energy in basically the same way.* You will learn more about simple mechanical principles later in these workbooks.

a principle (a mechanical principle)

Do not confuse the construction of a thing with the principle on which it is based. The example of the zig-zag path and the screw will help you to avoid this confusion. When engineers learn practical engineering, they learn about the construction of many different kinds of machines. When they study physics, they learn about the mechanical principles on which machines are based.

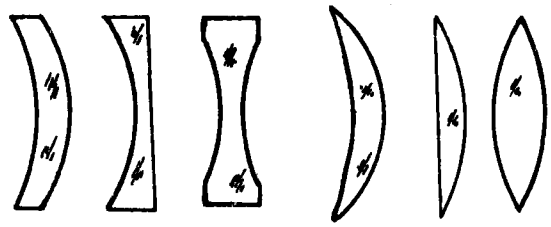
* The zig-zag path and the screw are both based on the principle of the inclined plane.

1.2 WORD STUDY

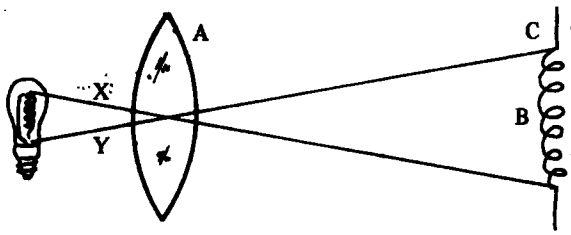
a lens
pl. lenses

A lens (singular noun) is usually made of glass, but can be made of any transparent material. It has a smooth surface and is curved on one side or on both sides.

Here are six lenses of different shapes.



a screen
an image
visible
invisible
a microscope
magnify
enlarged
microscopic



This diagram shows how a *lens* can throw an *image* of an object on a *screen* (= a white sheet of cloth, paper, or other smooth material) and can *magnify* it (make it appear larger).

In this diagram A is the lens, C is the screen, and B is the image of a lamp thrown on the sc_____. X and Y are rays of light which pass through the lens and form an i_____ on the s_____.

The fact that a l___ can throw mag___ied i___es on a screen enables us to use lenses for practical purposes. We can use a l___ to show mag_____ed i___es on a screen in a movie. The moving picture that we see on a movie s_____n is an *enlarged* i_____ of a transparent picture which is unwound on the other side of a lens.

Lenses are also used in a scientific instrument called a *microscope*, which is used to m_____fy very small things. Here is a micros_____.

A m_____pe enables us to see things which are so small that they are usually *invisible*. The human eye itself contains a l__s, but to see very distant objects or very small objects the eye requires the help of mag_____ing lenses. A *telescope* helps to make distant objects v_____le to us. Even a small tel_____e can make some of the features of the moon v_____le. A microscope can make the smallest living things v_____; in this way mi_____es enable scientists to discover the living things which cause certain diseases, things which are in_____le to the eye alone. Things which are so small that they can only be seen under a m_____pe may be called *microscopic*.

A microscope

energy
(uncountable)

Energy **is the ability to do work** possessed by a body or a system of bodies. According to scientists, en__gy is one of the two basic things in the physical universe. (The other is **mass**, which we will discuss in Section 4.)

E_____y is found in various forms. A man gets his e_____y to do work from the food he eats, which creates heat in his body. This heat can be converted into movement by processes in the body. Heat is one form of e_____y; movement (or motion) is another form of en____y. A steam engine can convert one kind of e_____ into another kind.

1.2 WORD STUDY

The ordinary meaning of the word energy is not very far from the scientific one. We say that a man has a lot of e_____y when he can do a lot of work. But the meaning of "work" in science is a little different from the ordinary meaning. In ordinary speech we make a distinction between work and play. For scientists there is no such distinction. According to the scientific idea of work, a man kicking a football or climbing a mountain is doing work, probably more work than a man sitting in an office or a girl looking after a machine in a factory.

a function
perform

A function, in the case of a tool, a machine, or part of a machine, is the kind of useful activity or operation it can perform or is expected to perform. In the case of a useful object (like a chair or a hat), its function is the use it is designed for or expected to have. In the case of a part of a living body, or any part of a system, its function is its activity or serviceability in relation to that system, or the features which make it necessary for that system. In the case of a person, his (or her) function is the kind of activity or work or usefulness expected of him (or her), especially in relation to other people or to a social group.

A thing (e.g. a machine, a tool, part of a body, etc.) **performs its function** when it does what it is expected to do, or is useful in the way in which it is expected to be useful, or serves the purpose which it is expected to serve. A person performs his function (in society) when he does what he is expected to do (e.g. as a father, as a doctor, as a taxpayer, and so on).

To *perform* an operation, or a task, is to do it and finish it completely.

Examples: The f_____n of the root of a plant is to fix the plant in its place and to take in water and the food substances present in the earth through the ends of its branches.

Language has many f_____s. One of its f_____ns is to share and exchange useful information. Every part of a sentence has a special f_____n in relation to the whole sentence.

The function of the father of a family differs in different societies. In some societies the father's f_____n is to go out to work and earn money to support his family. In some societies his f_____n is to watch his wives and daughters working in the fields and to see that they do their work properly.

The f_____n of a pair of scissors is to cut things without waste of energy. It cannot pe___rm this f_____n properly if its two parts are separated from each other.

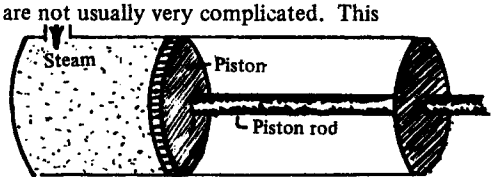
The root of a plant cannot p_____m its function if it is diseased or if there is no water in the earth in which the plant grows.

There are some people in human society who do not p_____m any useful f_____n. There are also people in society who believe that the f_____s which society expects them to p_____m are not very useful, so they try to create new or better f_____ns for themselves.

The operations which a factory worker has to p__form are not usually very complicated. This morning Dr. Green p_____med two heart operations.

a cylinder
a piston
a piston rod

A *cylinder* is an object which has this shape. It may be solid or it may be empty, like a tube. In a steam engine a *piston* is the part of the engine which is driven (= pushed) backwards and forwards by the pressure of steam on one side and the pressure of the working parts on the other side. The f___tion of the p__ton is to make the working parts do their work by pushing them. The p_____n is shaped like a thick, flat plate or very short cylinder and is fixed to a rod called the *piston rod.*



A diagram of the steam-engine cylinder designed by Trevithick and Watts.

The diagram shows the p_____n, fixed to the piston rod, inside the cy_____r of a steam engine.

In a steam engine, the p_____n must fit the cy_____r, so that it has just enough space to move smoothly inside the c_____r. It must not be too loose or too tight.