DESCRIBE THE SHAPES

A

unit 1
drills
drill 4

drill 4

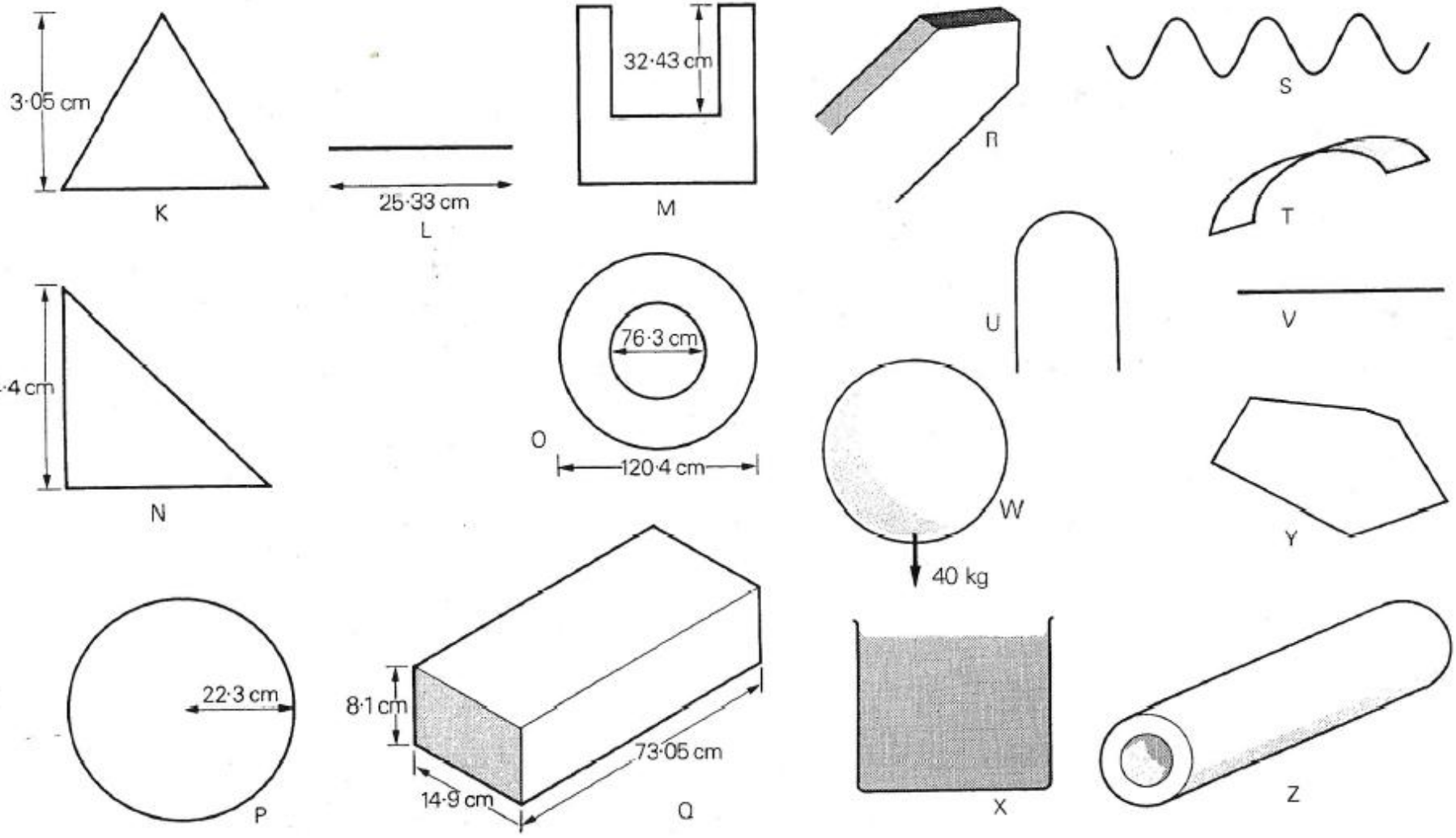
What's the depth of **M**?
Thirty-two point four three centimetres.

What's the radius of **P**?
Twenty-two point three centimetres.

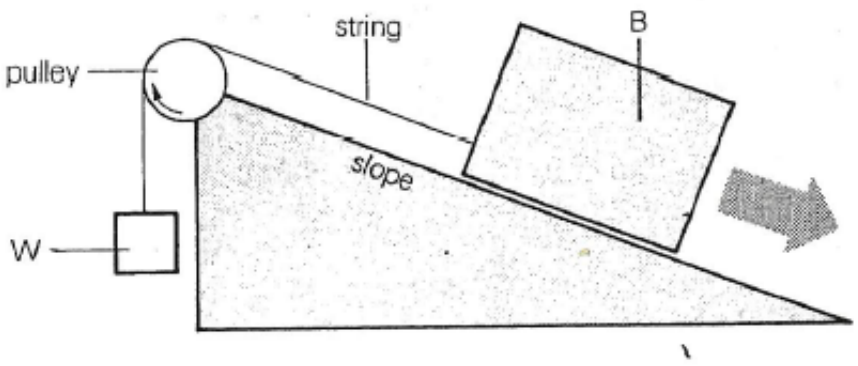
drill 5

Is **R** pointed?
Yes, it is.

Is **T** flat?
No, it isn't; it's curved.



B Look at this diagram and description:



The block B rests on a slope. A string is attached to one end of the block and passes over a pulley at the top of the slope. A weight W is suspended from the end of the string.

Write out these descriptions, filling in the missing words.

When the block _____ down the slope, it _____ the string and _____ the weight. At the same time, the pulley _____ in a clockwise direction.

We can say:

1 The block _____ the string.
2 The string _____ the pulley.
3 The string _____ the weight.

Or we can say:

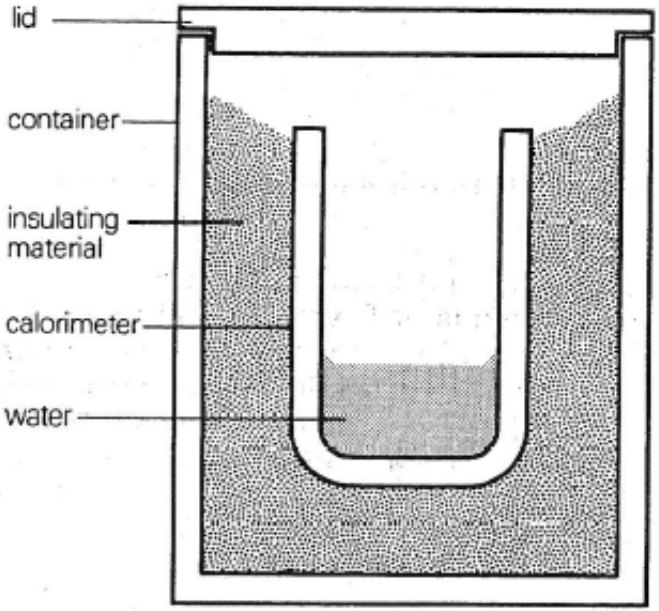
4 The string _____ by the block.
5 The pulley _____ by the string.
6 The weight _____ by the string.

Sentences 1, 2 and 3 are in the **active** voice.
Sentences 4, 5 and 6 are in the **passive** voice.
The passive voice is used a great deal in scientific description.

unit 3
classwork
section 2

E Read the following description of the apparatus in the diagram carefully.

The apparatus below is used for measuring quantities of heat energy. The apparatus consists of a calorimeter, which is made of aluminium or copper, inside a container. The calorimeter holds a quantity of water. There is a space between the inner calorimeter and the outer container, which is filled with insulating material. The top of the apparatus is covered by a lid. The inner calorimeter is therefore completely enclosed by the outer container, and is surrounded by insulating material.



Ask questions and make statements about the position of these parts of the apparatus:

1 lid
2 calorimeter
3 insulating material
4 container
5 space
6 water

D Use these notes and diagrams to help you describe the action of a cylinder lock.

1 correct key/push/lock

2 all pins/raise/therefore/cylinder/can/rotate

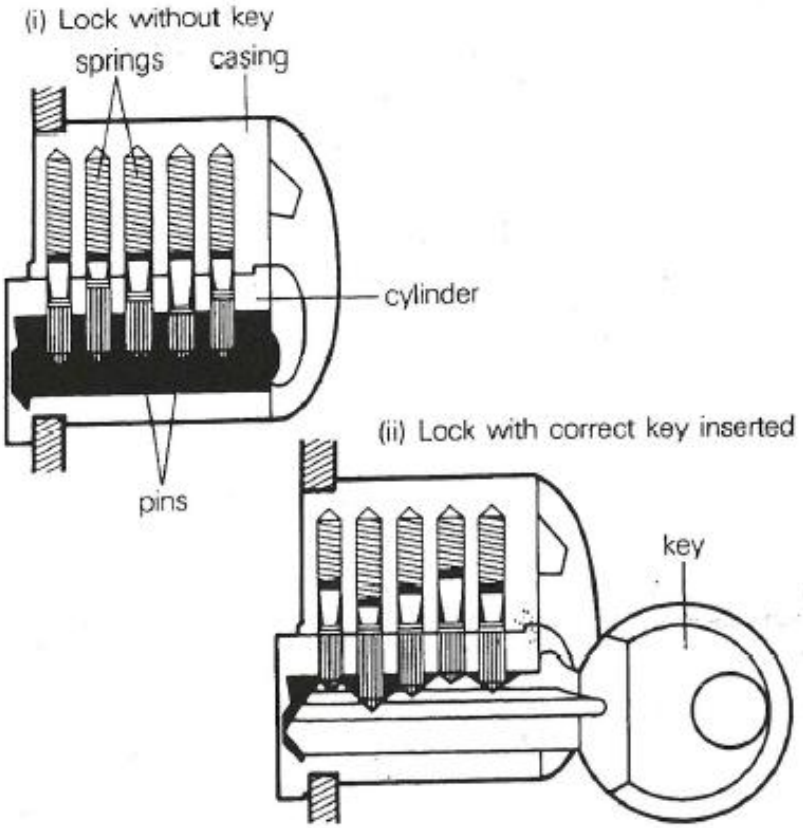
3 when/cylinder/turn/by/key/lock/open

4 when/lock/open/key and cylinder/rotate/back/original position

5 key/pull/lock

6 when incorrect key/use/pins/not raise/correct height

7 cylinder/therefore/cannot/rotate



exercise 2 Describe the action of a cylinder lock. Use the verbs *pull, push, raise, turn, rotate* in either the **active** or **passive** forms. Do not look back in your book.

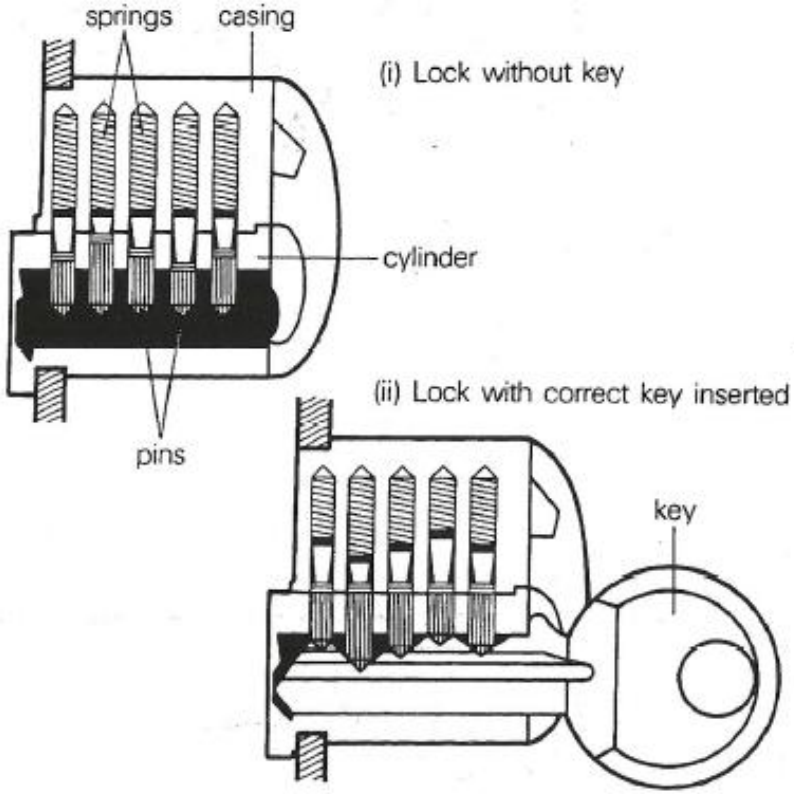
1 The correct key _____ into the lock. This _____ the pins, and the cylinder can _____

2 When the cylinder _____ by the key, the lock opens.

3 The key and the cylinder then _____ back to their original position.

4 The key _____ out of the lock.

5 When an incorrect key is used, the pins _____ (not) to the correct height, and the cylinder cannot _____.



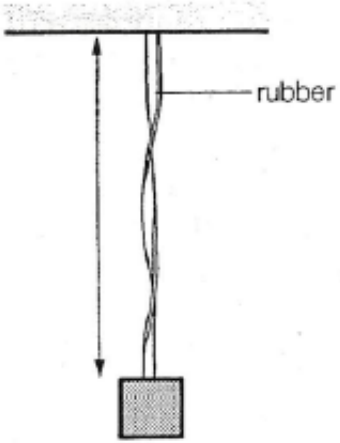
When substances _____ their dimensions (volume, area or length) when they are heated, they are said to _____. This phenomenon is known as _____. When a substance decreases in length, area or volume, it is said to _____. This phenomenon is known as _____.

Make sentences from this table. For example,

If water is heated, it will expand.

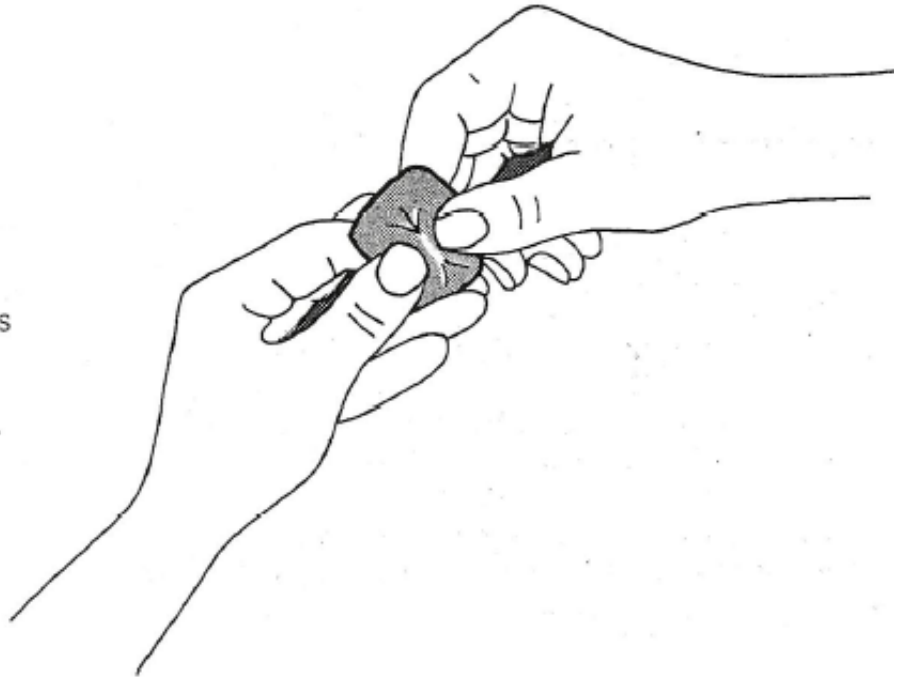
If	water steel mercury alcohol	heat cool		expand. contract.

C The following description contains statements of effect, and defines several terms. Find suitable words to complete the description.



A material is said to be **in tension** when the forces applied to it tend to _____ the material. For example, if a mass is hung on the end of a length of rubber, the rubber will be in tension. A force which _____ tension is known as a **tensile** force. A tensile force will _____ the length of the material on which it acts.

A material is said to be **in compression** when the forces applied to it tend to _____ or _____ the material. For example, if a rubber eraser is _____ between the fingers, the rubber will be in compression. A force which _____ compression is known as a **compressive** force. A compressive force will _____ the length of the material on which it acts.

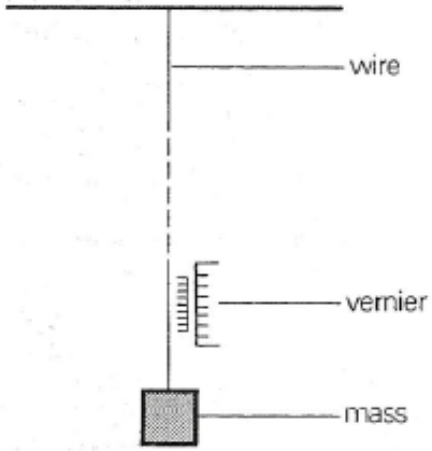


If a force is applied to a metal wire which is _____ vertically, the wire will _____ in length, according to the magnitude of the force. The wire is then said to _____, and the increase in length is said to be the _____.

D Read this passage carefully, and then answer the questions after it.

The relationship between the load applied to the wire and the extension of the wire may be investigated as follows.

A wire of the material under test is fixed at one of its ends, and a number of masses are added to the free end. A force therefore acts vertically down the wire. The masses are added to the wire so that the force is increased regularly. The length of the wire is measured carefully for each value of the load. This is done by means of a vernier scale, which allows accurate measurements to be made easily.

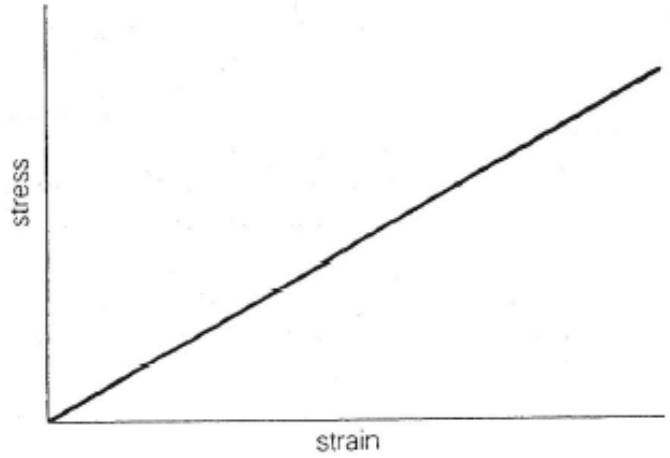


If the load is not too great, the wire will return to its original length when the load is removed. The wire is then said to be **elastic**.
From the values of load and extension, the values of stress and strain can be calculated as follows:

$$\text{stress} = \frac{\text{load}}{\text{cross-sectional area of wire}}$$

$$\text{strain} = \frac{\text{extension}}{\text{original length}}$$

If a graph of these values is plotted, it will be found to be a straight line.



If the load applied is too great, the wire will not return to its original length when the load is removed. If this happens, the graph will not be a straight line. The maximum stress that can be applied for stress to be proportional to strain is known as the **elastic limit**. If the elastic limit is exceeded, the wire will not return to its original length. This is summarized by Hooke's Law, which states that:

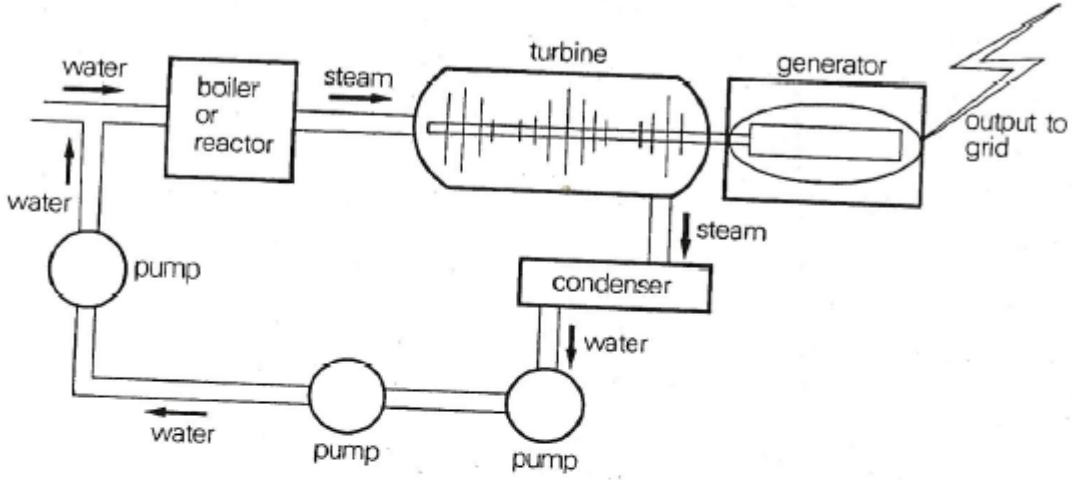
Within the elastic limit, the strain is directly proportional to the stress producing it.

Make sentences from these notes. (Think carefully about the meaning of what you are saying, as you may have to change the order of the phrases.) For example,

wire extended—load applied to wire
If a load is applied to the wire, the wire will be extended.

SECTION 3 **description of a process**

A Study this description of a process. (The passage describes the different _____ in the process of generating electricity.)



Steam is produced in either a boiler or a nuclear reactor. In the case of a boiler, this may be fuelled by either coal or oil.

The steam travels along pipes to a turbine, where it drives the shaft at high speed. The shaft of the turbine is coupled to the rotor of the generator, and the rapid revolution of the rotor induces an electric current in the outer part of the generator, which is known as the stator. This electricity is then fed into the electricity grid system.

When it has passed through the turbine, the steam enters the condenser. Here it is passed over tubes containing cooling water. The steam is therefore cooled, and it condenses back to water. The water is then returned to the boiler by means of a series of pumps.

Now use only the diagram on the previous page and the notes below to help you write your own description of the process of generating electricity. Describe each step separately, and introduce each step with *first, then, next*, etc.

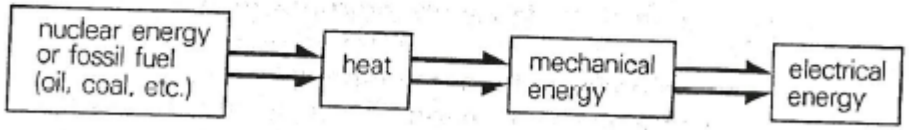
1 steam produced in boiler or reactor
2 steam→turbine, drives shaft at high speed—this drives generator
3 steam→condenser, cooled, becomes water
4 water→back to boiler, by means of pumps
5 electricity produced by generator→into grid system

B The sequence of stages in the process of generating electricity can be represented in the following way:

water heated→steam→steam drives turbine→turbine drives generator→generator produces electrical power

Describe in full the sequence of stages outlined above.

C The process of generating electricity involves a _____ of energy.



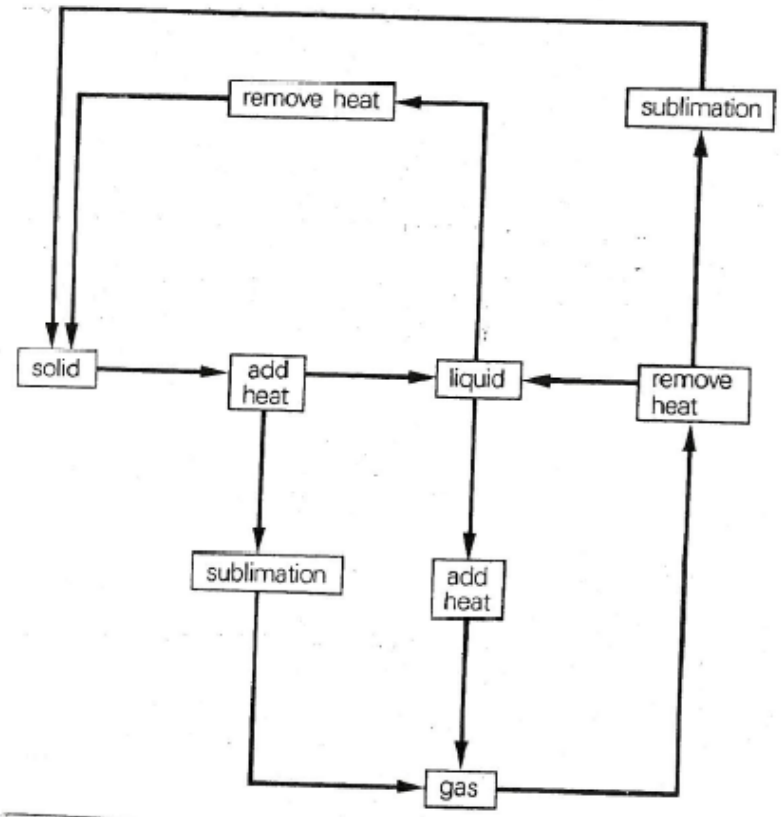
Complete this description of the process shown above:

Nuclear or fossil fuel is used to _____ heat. This heat is used to _____ steam, which in turn _____ mechanical energy in the turbine. The mechanical energy is _____ into electrical energy by means of a generator.

D When matter changes state, it does so in stages. Here is a diagram which sets out these stages. Use it to describe the stages of change when ice melts, when sulphur is heated, when water is used in an electricity generator, etc. The following words will be useful:

melt	vaporize
liquefy	condense
evaporate	freeze
sublimate	solidify

Use also words of sequence: *first, then, next,* etc.



E When we describe the steps in a process, instead of always saying *first steam passes through the turbine and then it enters the condenser,* we often say:

After the steam has passed through the turbine, it enters the condenser.

or:

Once the steam has passed through the turbine, it enters the condenser.

We can also say:

After passing through the turbine, the steam enters the condenser.

These three statements all have the same meaning. They are **alternative** ways of expressing the same idea.

Re-write the following statements in the three ways outlined above, using *after* and *once*.

1 The steam leaves the boiler or reactor and then enters the turbine.
2 The steam condenses and then it is pumped back to the boiler.

F From the description of this process, we know that if more steam is used, the turbine will turn faster. If the turbine turns faster, the generator rotor will also turn faster and therefore more electricity will be produced. We can therefore say:

The more steam that is used the faster the turbine will rotate.

and:

The faster the turbine rotates, the more electricity will be generated.

We often express this sort of relationship by saying:

The speed of the turbine _____ _____ the amount of steam used.

The amount of electricity produced _____ _____ the speed of the turbine.

The amount of steam used _____ _____ the amount of electricity required.

Now do the same with these:

1 ions—can be negatively charged
can be positively charged
(*either . . . or*)

2 steel—can be hardened
can be tempered
(*not only . . . but also*)

3 hydrogen—can be produced by iron and hydrochloric acid
can be produced by zinc and hydrochloric acid
(*both . . . and*)

4 metals—can be ferrous
can be non-ferrous
(*either . . . or*)

5 electric current—can be alternating current
can be direct current
(*either . . . or*)

6 electricity—can heat a wire
can have a magnetic effect
(*both . . . and*)

7 energy—cannot be created
cannot be destroyed
(*neither . . . nor*)

8 vector quantities—have magnitude
have direction
(*not only . . . but also*)

9 gold—not cheap
not common
(*neither . . . nor*)

10 paper—not strong
not rigid
(*neither . . . nor*)

drills

drill 1

Why is alcohol often used in thermometers?
Because it is less expensive than mercury.

Why are copper and aluminium used for electrical connections?
Because they are good conductors.

1 less expensive/mercury
2 good conductors
3 extremely brittle
4 high boiling point
5 very resilient
6 absorb heat energy
7 only strike against special surfaces
8 react chemically
9 very ductile
10 good insulators

drill 2

What will dropping a piece of glass do?
It will cause it to break.

What will stretching a length of copper wire do?
It will cause it to extend.

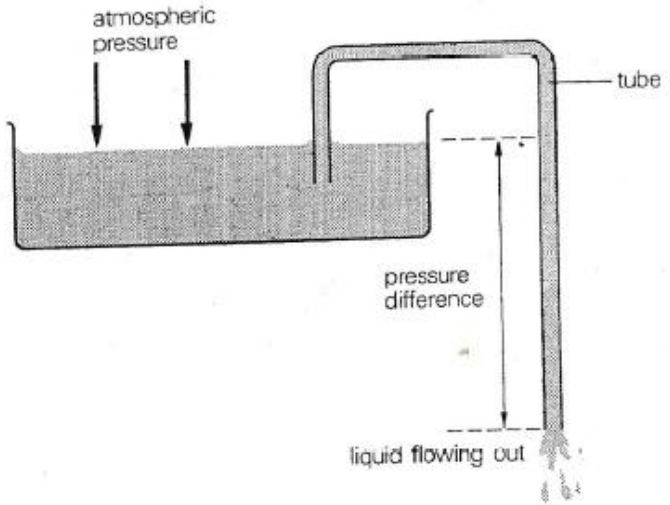
drill 3

Are both rubber and glass resilient?
No, rubber is resilient, whereas glass is brittle.

Are air and oxygen both mixtures?
No, air is a mixture, but oxygen is an element.

1 whereas
2 but
3 while
4 whilst
5 but
6 whereas
7 but
8 while
9 whereas
10 but

exercise 1 Study this description of the action of a siphon, and then answer the questions.



Atmospheric pressure can be used to cause a liquid to flow along a tube, out of a container. One end of the tube is inserted into the liquid, and the other end of the tube is placed outside the container, but with its end below the level of the liquid in the container. Air is removed from the tube, and this causes the liquid to rise up the tube and travel along it. It does this because the atmospheric pressure acting down on the liquid is greater than the pressure inside the tube. Because the end of the tube outside the container is below the level of liquid inside it, there is a difference in pressure between the end of the tube and the surface of the liquid. This difference in pressure causes the liquid to continue to flow out of the tube. If the end of the tube is raised to the level of the liquid inside the container, this will result in the liquid ceasing to flow along the tube.

1 What can be used to cause a flow of liquid out of a container?
2 What is used for the liquid to travel along?
3 What is done to cause the liquid to rise up the tube?
4 Why does the liquid rise up along the tube?
5 Why is there a difference in pressure between the end of the tube outside the container and the surface of the liquid?
6 What does this difference in pressure cause?
7 What will be the result of raising the end of the tube to the level of the liquid?

exercise 2 Study this table which compares the properties of aluminium and copper. Use it to help you answer the questions on these materials. Use the words you are given in the brackets.

Aluminium	Copper
light	not very light
fairly strong	very strong
good conductor	very good conductor
fairly cheap	not very cheap
fairly low resistance	very low resistance
very high corrosion resistance	fairly high corrosion resistance
not very easy to solder	very easy to solder

example:
Are aluminium and copper both light? (*whereas*)
Aluminium is light, whereas copper is not very light.

1 Are aluminium and copper both strong? (*whilst*)
2 Are aluminium and copper both cheap? (*whereas*)
3 Are aluminium and copper both easy to sol (*however*)
4 Is copper very light and very strong? (*although*)
5 Is aluminium cheap and easy to solder? (*though*)
6 Is copper both very cheap and a very good conductor? (*although*)
7 Does copper have a very low resistance? Is very light? (*however*)
8 Are aluminium and copper both good conductors? (*while*)
9 Do both aluminium and copper have a low resistance? (*but*)
10 Do both copper and aluminium have a high resistance to corrosion? (*whereas*)

exercise 3 Use these notes to help you make sentences using:

either ... or
neither ... nor
not only ... but also
both ... and

example:
energy—cannot be created
cannot be destroyed
(*neither ... nor*)
Energy can be neither created nor destroyed.

SECTION 2 **comparison and contrast**

A You know that we can make statements such as: *Rubber is flexible, but glass is brittle.* Statements like this make a **comparison** between two things. There are other words we can use to **compare** things. For example, we can say:

Rubber is flexible, **whereas** glass is brittle.
Carbon is an element, **while/whilst** carbon dioxide is a compound.

Make comparisons in the same way, using these notes. You can use either *whereas, while* or *whilst.*

1 Copper is a conductor, _____ glass ...
2 Iron is a solid, _____ mercury ...
3 Carbon is an element, _____ carbon dioxide ...
4 Iron is cheap, _____ guld ...
5 Water is colourless, _____ sulphur ...
6 Zinc is a solid, _____ hydrogen ...
7 Aluminium is light, _____ lead ...
8 Paper is weak, _____ steel ...
9 Wool is soft, _____ wood ...
10 Protons are positively charged, _____ electrons ...

In these sentences, we are not only comparing, but also **contrasting**, because we are stating the **differences** between two things.

B If we want to ask about the difference between two things, we can do this in two ways. We can say:

What is the difference between ... and ... ?
or:
How do ... and ... differ?

Example:
What's the difference between iron and mercury?
or:
How do iron and mercury differ?

We can then make the statement:

Iron is a solid, whereas mercury is a liquid.

When we compare things in this way we can obviously state not just one difference between them but many. For example,

glass/wood
What's the difference between glass and wood?
How do glass and wood differ?
Glass is transparent, whereas wood is opaque.
Glass is brittle, but wood isn't.
Wood is a natural material, whilst glass is a manufactured material.

Ask about the difference between these things, and give as many differences as you can think of.

1 polythene/glass
2 air/oxygen
3 copper/porcelain
4 rubber/copper
5 water/hydrogen
6 iron/steel
7 mercury/alcohol
8 protons/neutrons

C Now look at this sentence:

Mercury is a metal, but it is liquid at room temperature.

This statement tells us something that is unusual. All other metals are solid at room temperature. Mercury is the only metal which is liquid at room temperature. Mercury is an **exception** to the rule that metals are solid at room temperature. We can change the structure of the sentence above to emphasize that mercury is different from other metals:

Although mercury is a metal, it is liquid at room temperature.

Look at these examples:

Copper and aluminium are both good conductors, but aluminium is used in overhead transmission cables because it is far lighter.
Although copper and aluminium are both good conductors, aluminium is used in overhead transmission cables because it is far lighter.

Iron and aluminium are both metallic elements. They are both found naturally in ores, or compounds, which are chemically similar, but it is far more difficult to extract pure aluminium from its ore than it is to extract pure iron.
Although iron ore and aluminium ore are chemically similar, it is far more difficult to extract pure aluminium than it is to extract pure iron.

As well as the word *although*, we can also say *though* or *even though*. For example,

Although/Even though/though mercury is a metal, it is liquid at room temperature.

D Use this table to make sentences beginning with *although, even though* or *though*. (There is only one correct sentence possible in each line.)

	carbon dioxide is a colourless and odourless gas		is widely used as a conductor.
	steel is brittle when hardened		can be toughened by tempering.
Although	glass is brittle	it	can be detected with lime water.
Even though	copper is expensive	they	are not widely used for laboratory work.
Though	alcohol thermometers are inexpensive		cannot be created or destroyed.
	energy can be converted into other forms		can be made more resilient by toughening.

E It is possible to change the order of the words in those statements. Instead of saying:

Although/Even though/Though mercury is a metal, it is liquid at room temperature
we can say:
Mercury is liquid at room temperature, **although/even though/though** it is a metal.

On the same way, we can say:

A complete atom has no electrical charge, **although/even though/though** many of its particles are charged.

Now look at the table in **D** again. Use it to make sentences like these. For example,

Carbon dioxide can be detected with lime water, even though it is a colourless and odourless gas.

F Let us look again at the first statement we studied: *Rubber is flexible but glass is brittle.* Here we are making a contrast, so we can say:

Rubber is flexible. H_____, glass is brittle.
Mercury is a metal. H_____, it is liquid at room temperature.

Make pairs of sentences in the same way, using these words:

1 mercury/metal
liquid at room temperature
2 copper/ductile
break/if subjected to/high tensile force
3 glass/extremely brittle
can be toughened/using/special process
4 particles/of/atom/charge
complete atom/not/have/charge
5 in/simple cell/sulphate ions/and/copper ions/discharge
copper ions/discharge/more easily than/sulphate ions
6 metals/contract/when/cool/to/0°C
water/expands/when/cool/from 4°C/to 0°C
7 air/not/conduct heat very well
air/can/heat/by/convection
8 atom/extremely small
consist of/much smaller particles

In the sentences you have just made, *however* is placed first. It can, if you wish, come later. For example, instead of saying:

Rubber is flexible. However, glass is brittle.
Mercury is a metal. However, it is liquid at room temperature.

we can say:

Rubber is flexible. Glass, however, is brittle.
Mercury is a metal. It is, however, liquid at room temperature.

Now go back over the last exercise and use *however* in this way, putting it later in the sentence.

G You now know that there are these ways of making a comparison or a contrast between things:

Carbon is an element, **but/while/whilst/whereas** carbon dioxide is a compound.
Although/Even though/Though mercury is a metal, it is liquid at room temperature.
Copper is very ductile. **However,** it will break if subjected to a high tensile force.

Use suitable words from the above examples to complete these descriptions of (1) the carbon dioxide cycle and (2) the nitrogen cycle.

1 _____ the quantity of carbon dioxide in the earth's atmosphere is relatively small, the gas is essential for supporting life. Plants require carbon dioxide, and they remove it from the air in a process known as photosynthesis. _____ carbon dioxide is therefore being removed from the atmosphere continuously, it is _____ continuously replaced by animal and plant respiration and decay.

2 Nitrogen is essential for life, since it is needed in the formation of proteins, which are vital constituents of animal and plant cells. _____, atmospheric nitrogen cannot be used directly by plants and animals, _____ it is an essential element. Men and animals obtain their nitrogen by eating plants and other animals, _____ plants absorb soluble nitrogen compounds from the soil, through their roots.

SECTION 3 **similarity**

A In Section 2 we looked at how things can be contrasted, or how the difference between things can be stated. However, we often want to state that two things are **similar**. For example, carbon dioxide is a gas and hydrogen is a gas. We can therefore state the **similarities** between carbon dioxide and hydrogen:

Both carbon dioxide and hydrogen are gases.
or:
Carbon dioxide and hydrogen are both gases.

In the same way, we can say:

Both copper and aluminium are metals.
Copper and aluminium are both metals.

But there are other similarities:

Both copper and aluminium are ductile.
Copper and aluminium are both good conductors.
They are both resistant to corrosion.

Make statements giving the similarities between these things:

water	sulphuric acid
rubber	polythene
glass	perspex
salt	chalk
helium	hydrogen
paper	cardboard
china	porcelain
iron	steel
zinc	lead
polythene	nylon

B We can use *both ... and ...* to **list** the qualities or attributes of things. For example,

Copper is both malleable and ductile.
Water is both colourless and odourless.

Make similar statements using these notes:

1 aluminium/strong/light
2 copper/good conductor of heat/good conductor of electricity
3 solids/definite shape/definite volume
4 nylon/tough/inexpensive
5 electric current in a wire/heating effect/magnetic effect
6 nucleus of an atom/protons/neutrons
7 vector quantity/direction/magnitude
atom/consists of/negatively charged particles/positively charged particles

It is also possible to state this relationship in other ways:

Copper is **not only** malleable, **but** ductile **as well**.
Water is **not only** colourless, **but** odourless **as well**.
or:
Copper is **not only** malleable, **but also** ductile.
Water is **not only** colourless, **but also** odourless.

Use these two alternative forms of expression to make statements using the notes in 1–7. For example,

Aluminium is not only strong, but light as well.
Aluminium is not only strong, but also light.

C Look at these statements:

Copper and aluminium are both good conductors. Therefore, **either** copper **or** aluminium can be used in electrical wires.
Solids have definite volume and shape. However, gases have **neither** definite volume **nor** definite shape.

Either ... or are used where there are different possibilities or alternatives.
Neither ... nor are used where there are no alternatives.
Both of these constructions can be used to list several things:

Insulators can be made of either glass or porcelain or mica, or different forms of plastic.
Neither copper nor zinc nor tin are alloys of other metals.

Make statements with *either ... or* or *neither ... nor* from these notes.

1 elements—solids, liquids, gases
2 air, carbon dioxide, water—not elements
3 liquids, gases—no definite shape
4 copper and zinc, carbon and iron—electrodes in a cell
5 atoms, neutrons—no electrical charge
6 copper, lead—not magnetic
7 glass, porcelain, mica—used as insulators
8 iron and hydrochloric acid, zinc and hydrochloric acid—produce hydrogen

D Now we can see how all these expressions of comparison and contrast can be used to express similarities and differences between things.
Here is a passage about the three states of matter: solid, liquid and gas. It compares the properties of matter in these three states. Study the passage carefully.

In the solid state, a material has both definite shape and definite volume (at a given temperature).

In the liquid state, the material has no definite shape, although it has definite volume (at a given temperature).

In the gaseous state, a material has neither definite shape nor definite volume, and will completely fill the container in which it is placed, although its concentration will decrease as the volume of the container is increased.

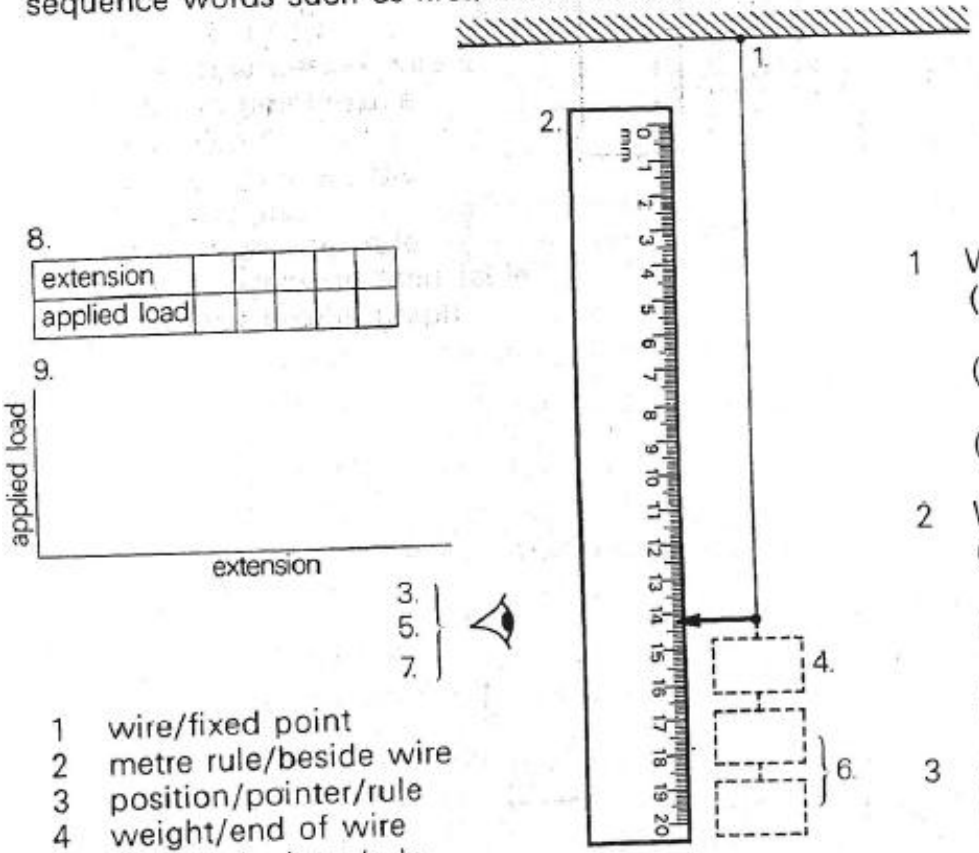
Different materials exist naturally in each of these three states. (eg iron is normally in the solid state, water in the liquid state and oxygen in the gaseous state.) However, it is possible to change the state of materials by changing their temperature.

For example, when the temperature of water is lowered, the water will solidify as ice, whilst when it is heated, it will boil and form steam. Therefore the state of water can be changed either by heating or cooling.

However, the temperatures at which changes of state occur for different materials are widely different. For example, a very low temperature is required to change a gas into the solid state, whereas an extremely high temperature is normally required to change a metal into the liquid state.

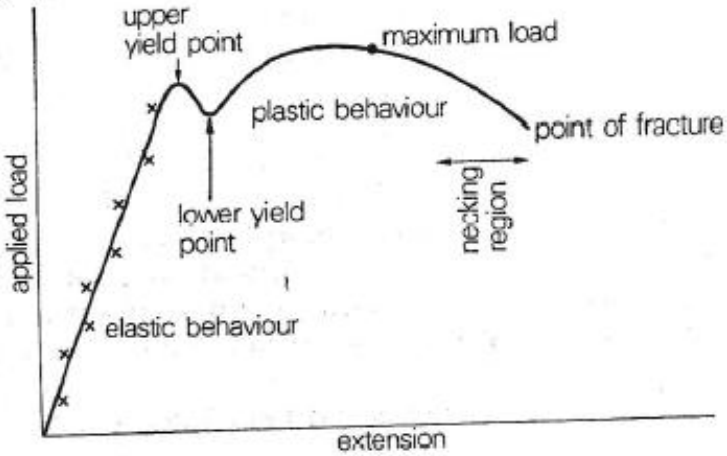
SECTION 3 **giving instructions, interpreting results, describing attributes**

A Below is a diagram of the apparatus used to investigate the behaviour of a material when an increasing force is applied to it.
Using the diagram and the notes, write a series of instructions on how to carry out the experiment to investigate the properties of a metal wire. Use sequence words such as *first, next, then* etc.



1 wire/fixed point
2 metre rule/beside wire
3 position/pointer/rule
4 weight/end of wire
5 position/pointer/rule
6 more weights
7 position/pointer/rule
8 values/extension/load/table
9 tabulated results/graph

B Here is a graph drawn from a set of results of an experiment like the one you have written instructions for in **A**. Study the graph carefully and then do the exercises.



1 Which is the correct statement?
(a) The wire continued to extend uniformly throughout the experiment.
(b) The wire extended uniformly up to a certain point.
(c) The wire did not extend uniformly at all during the experiment.

2 Which is the correct statement?
(a) The upper yield point occurred at a higher load than the lower yield point.
(b) The upper yield point occurred at a lower load than the lower yield point.
(c) The lower yield point occurred before the upper yield point.

3 During the plastic behaviour,
(a) a very large load produced a fairly small extension.
(b) a fairly small load produced quite a large extension.
(c) a fairly small load produced a very small extension.

4 After the maximum load was applied,
(a) the material continued to extend.
(b) the material ceased to extend.
(c) the material began to contract.

5 The 'necking region' occurs
(a) before the maximum load is applied.
(b) after the plastic behaviour.
(c) at the point of fracture.

C Complete these statements of the attributes of various substances, using appropriate adjectives (eg *strong*), nouns (eg *strength*) or verbs (eg *strengthen*).

1 Glass is a b_____ t_____ solid which usually has a s_____ surface. Although it is not usually very s_____, it can be t_____ in order to make it more r_____ so that it can be used, for instance, in car windscreens. However, in the liquid state, glass is extremely d_____ and can be formed into almost any shape. It only becomes b_____ when it h_____

2 Copper is very ductile and malleable, and usually has a s_____ yellow-orange appearance. Its s_____ allows it to be formed into a variety of shapes, often without the need to heat it. However, where s_____ is necessary, it is often alloyed with other metals such as cadmium in order to s_____ it.

3 Polythene is an extremely r_____ material, and is often used where high s_____ combined with f_____ is required. It can be made either t_____, t_____ or o_____ according to whether it is required to see through it. Although usually very s_____, it does become much w_____ when heated, and will melt at relatively low temperatures.

4 Wood is a relatively w_____ substance, but its s_____ depends on its thickness and variety. Some wood is extremely p_____ when in the form of thin sheets, while other wood is extremely h_____ and s_____, particularly when it is old. It is an o_____ substance, and in its natural form its surface is rather r_____, although for most uses it is first s_____ before being used.

D Now make similar statements about the following metals, using the notes.

1 **Aluminium** ductile, light, very good electrical conductor, very good thermal conductor, very good corrosion resistance, soft, weak in pure state, mostly extracted from bauxite.

2 **Lead** heavy, grey, weak, soft, high corrosion resistance, mostly obtained from lead sulphide (PbS) called galena.

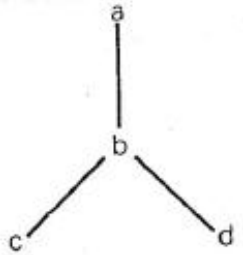
3 **Tin** expensive, weak, high corrosion resistance, mostly used as coating for other metals (*tinplate*), nearly always found as SnO_2 (cassiterite).

From the following notes, state what a **mineral** and an ore is.

4 **Mineral** substance/occur/naturally/earth/often/contain/elements/compound form

5 **Ore** mineral/contain/metal/(sometimes non-metal—eg sulphur)/used/source/obtain/metal

E Using statements 4 and 5 from **D**, draw this diagram and insert the words *ore*, *metal*, *non-metal*, *mineral* in the appropriate places so as to show the relationship between them.



D Study this description of the pendulum action of a clock.

The weight *W* acts d_____, and this force is transmitted to the circumference of the spindle. This force t_____ the spindle and the toothed wheel in a c_____ direction. However, the wheel cannot t_____ continuously because of the anchor. The ends of the anchor are alternately r_____ and l_____ by the pendulum, as it s_____ from side to side. When the pendulum is vertical, the anchor allows the wheel to t_____. When the pendulum is at the end of its swing, one end of the anchor is l_____ and the wheel cannot t_____. The time the pendulum takes to make one swing can be adjusted by moving the bob u_____ or d_____.

Say which way these parts move:

1 The weight.
2 The spindle.
3 The pendulum.
4 The ends of the anchor.
5 The toothed wheel.

E Now describe the pendulum action yourself. Use these notes but do not look at the previous exercise.

1 weight *W*/act/downwards
2 force/transmit/to/circumference/of/spindle
3 this force/turn/spindle/and/toothed wheel/in/clockwise direction
4 however,/wheel/not turn/continuously/because of/anchor
5 this/raise/and/lower/by/pendulum/which/swing/from/side to side
6 when/pendulum/is/vertical,/anchor/lift/and/wheel/turn
7 when/pendulum/is/at/end of its swing/anchor/lower/and/wheel/cannot/turn
8 time/pendulum/take/to make one swing/can/adjust/by/move/bob/up or down