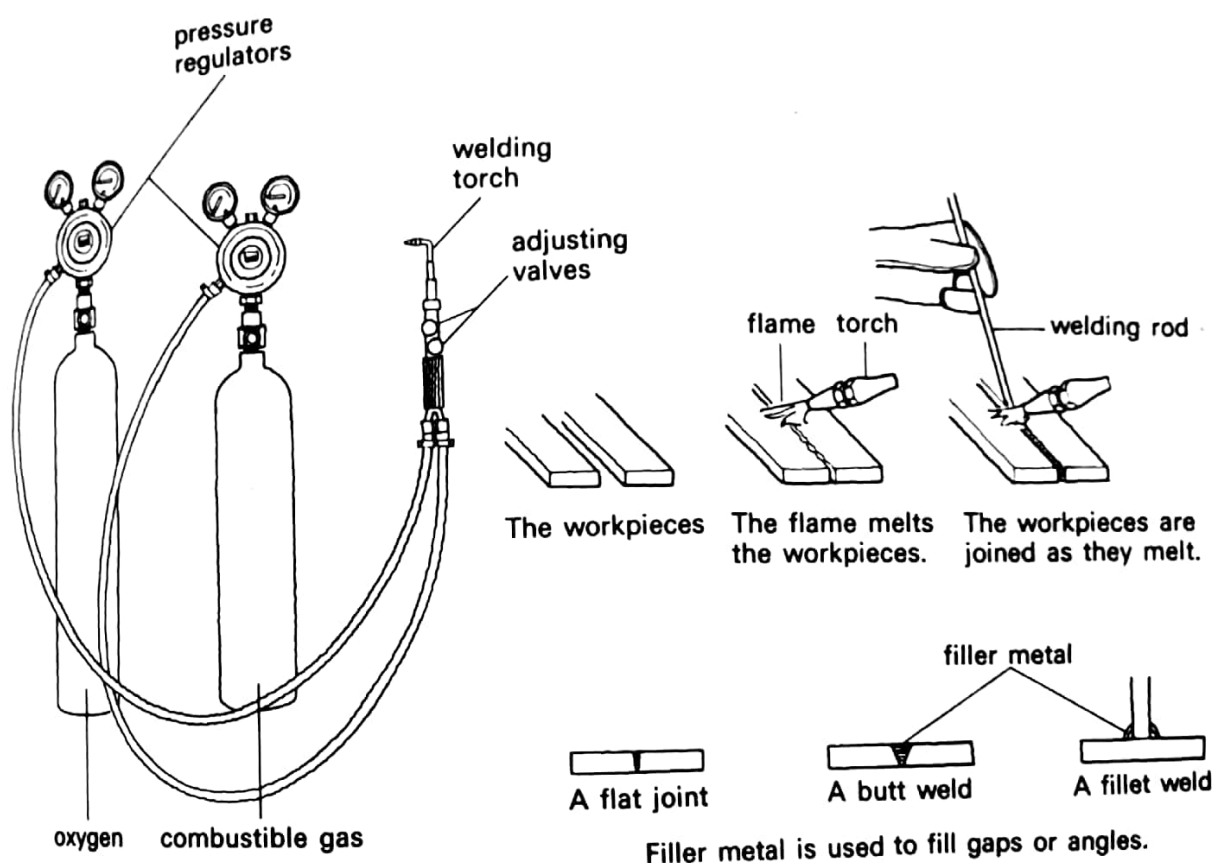


UNIT SEVEN

Welding

SECTION A: GAS WELDING



In gas welding, it is necessary to use a mixture of two gases. To create a hot enough flame, a combustible gas must be mixed with oxygen. Although acetylene (C_2H_2) is normally used, the combustible gas need not be acetylene. Hydrogen or petroleum gases (propane, for example) can also be used.

Oxygen can be stored at very high pressure (120 atmospheres). It is dangerous to compress gaseous acetylene in the same way and so it is dissolved under pressure in liquid acetone but at a much lower pressure than oxygen (about 15 atmospheres). To create a suitable flame, the gases must be supplied to the welding torch at low pressure. Pressure regulators are therefore used to regulate the gas flow from the cylinders. They are screwed into the top of each cylinder.

Gas welding is normally used to join steel to steel. To make a very strong joint, the workpieces must be composed of the same metal. Welding rods are used to provide filler metal. In gas welding, these rods are generally composed of steel. Bronze or brass rods may sometimes be used. When bronze or brass filler metal is used the process is called brazing.

CAUTION: To light the welding torch, the combustible gas must be turned on first. The oxygen must not be turned on before the flame is lit. The oxygen supply must be adjusted to give the correct flame.

Exercise 1 Are these statements true or false? If they are false, write a true statement.

1. Acetylene must be used in gas welding.
2. To create a hot enough flame, acetylene must be mixed with hydrogen or a petroleum gas.
3. Petroleum gases are combustible.
4. Oxygen and acetylene can be stored at high pressure.
5. High gas pressures must be used for gas welding.
6. Pressure regulators are used to regulate gas pressures.
7. Welding rods must be composed of the same metal as the workpieces.
8. Steel welding rods are used for brazing.
9. To light the welding torch, the combustible gas must be turned on before the oxygen.
10. The acetylene supply is adjusted to give the correct flame.

Exercise 2 Make eight true sentences from this table.

In gas welding,	two gases a combustible gas oxygen acetylene pressure regulators steel welding rods low pressures high pressures	must must not need not	be used.
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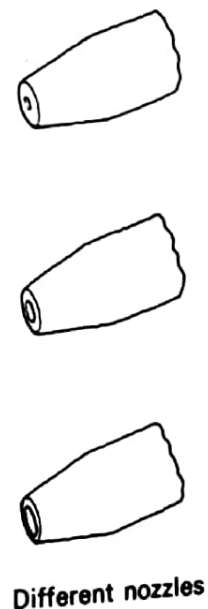
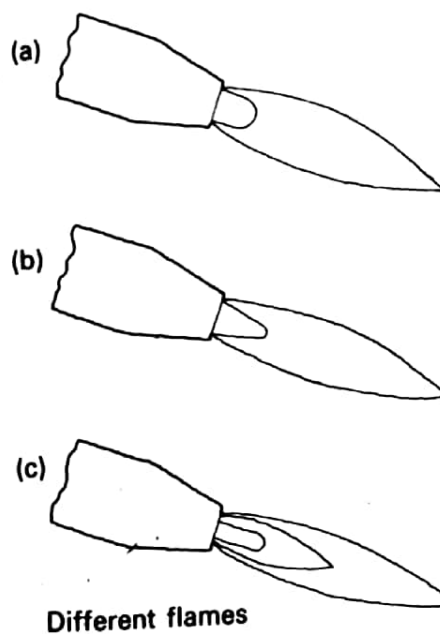
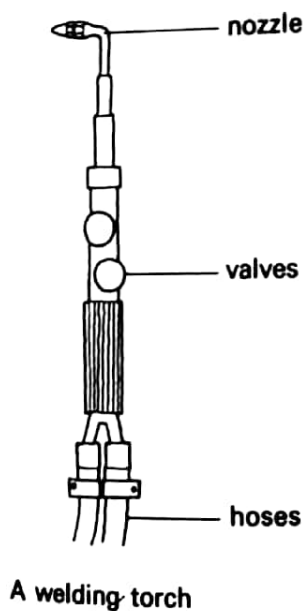
Exercise 3 Make six true sentences from this table.

A welding torch Gas welding Oxygen Pressure regulators Adjusting valves Welding rods	is are	used to	adjust the welding flame. join steel to steel. melt the workpieces. provide a hot enough flame. regulate the gas pressures. supply filler metal.
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And now make five true sentences from the following table.

To adjust the welding flame, To create the welding flame, To compress acetylene, To light the welding torch, To make a very strong joint,	it is dissolved in acetone. it is necessary to mix two gases. the combustible gas must be turned on first. the oxygen pressure can be adjusted. the workpieces must be composed of the same metal.
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Exercise 4 Study the diagrams below carefully and then complete the paragraphs from the wordlist.



contains
 created
 determines
 different
 flame

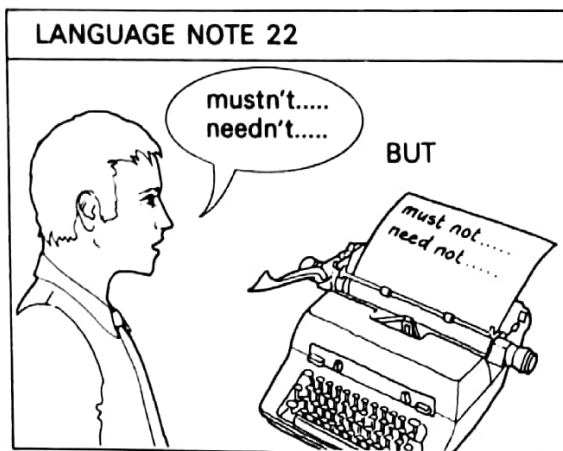
larger
 mixture
 necessary
 regulate
 supplied

types
 to
 welded
 welding
 work

The welding gases are supplied the blowpipe through separate hoses. The blowpipe has two valves to the flow of each gas to the nozzle. In gas welding, three different of flame may be used:

- a) a *neutral* flame – a neutral flame is by a mixture of equal amounts of oxygen and acetylene. This type of flame is used in most construction
- b) an *oxidizing* flame – this is caused by an excess of oxygen in the gas An oxidizing flame is generally used for brass or copper workpieces.
- c) a *carburizing* flame – when the gas mixture an excess of acetylene, a carburizing flame is produced. The excess of acetylene produces molecules of carbon in the joint. This type of is only used for welding high carbon steels.

Welding torches are with several different nozzles. These nozzles have diameters. The diameter the length and the width of the flame. It is to fit the correct nozzle before welding. The thicker the workpieces, the the required nozzle.



WELDING TERMINOLOGY	
a welding torch	neutral
a regulator	oxidizing
a cylinder	carburizing
a valve	brazing
a hose	acetylene
a nozzle	propane
a workpiece	acetone
a flat joint	
a butt weld	
a fillet weld	
filler metal	

a flow
an excess

petroleum

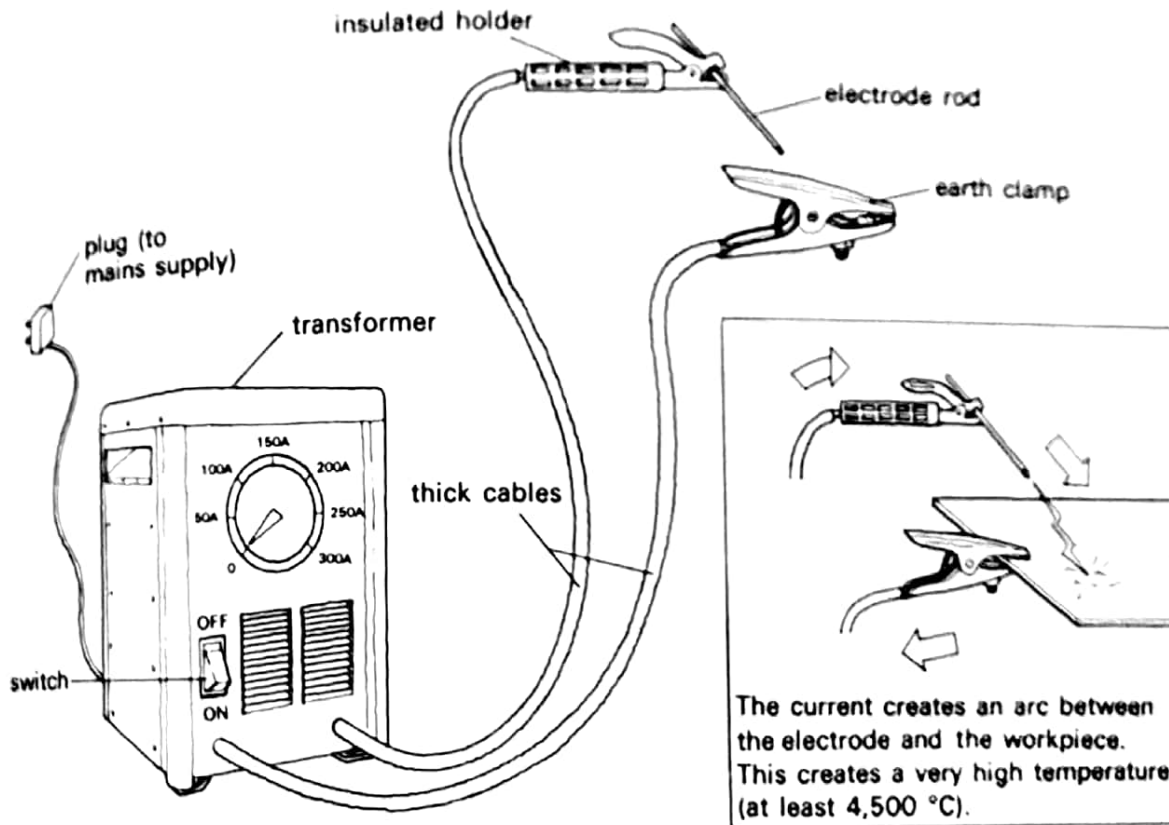
caution

an atmosphere
(unit of pressure)

create
compress
regulate
light

combustible
gaseous

SECTION B: ARC WELDING



In arc welding the workpieces are not melted by a flame. They are melted by an electric arc. In order to create the arc, a powerful electric current must be provided. The current must be at least 60 A or else the arc will not create enough heat. For thicker workpieces, the current may be 250 A or more. (*Note: An electric light bulb operates at a maximum of 1 A.*) In order to carry this current, the cables from the transformer must be quite thick or else they will overheat. In order to protect the operator, the electrode holder and the cables must be well insulated. The welding current must be provided at a low voltage in order to prevent the danger of electrocution.

A transformer is used to supply the necessary current. An earth clamp must be used in order to complete the electric circuit. The earth clamp must be attached to the workpiece or else the current cannot flow around the circuit and the arc will not appear. It must be securely attached or else an arc will appear between the clamp and the workpiece.

To strike the arc, the transformer must be switched on first. The electrode holder must contain an electrode rod in order to provide the filler metal to join the workpieces. When the arc is struck the electrode must brush against the workpiece or the current cannot flow. The electrode must then be withdrawn or it will become attached to the workpiece. It must not be withdrawn too far or the arc will disappear again. It must be held approximately 4 mm from the surface of the workpiece.

As the current flows between the electrode and the workpiece, the tip of the electrode will melt and fall onto the workpiece. If the electrode is left too long in the same position, it will become attached to the workpiece. It must be moved across the joint continuously. However, if it is moved too quickly, neither the electrode nor the workpiece will melt.

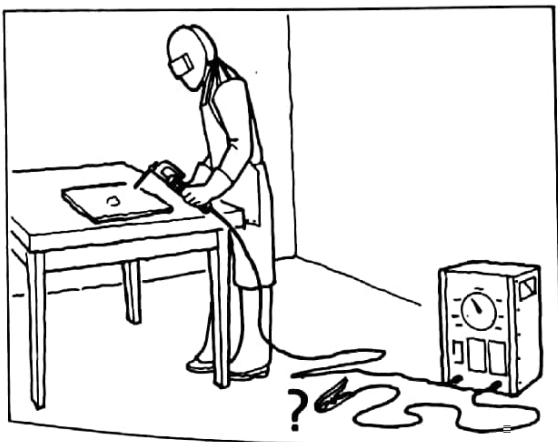
Exercise 5 Answer these questions.

1. How are the workpieces melted in arc welding?
2. How is the arc created?
3. Does an electric light bulb need a powerful current?
4. Why must thick cables be used?
5. Why must the electrode holder be well insulated?
6. What is the electrode rod for?
7. What is the transformer for?
8. What is the earth clamp for?
9. What will happen if the earth clamp is not securely attached?
10. Describe how to strike an arc and how to use the electrode correctly. (There are at least *five* points to remember.)

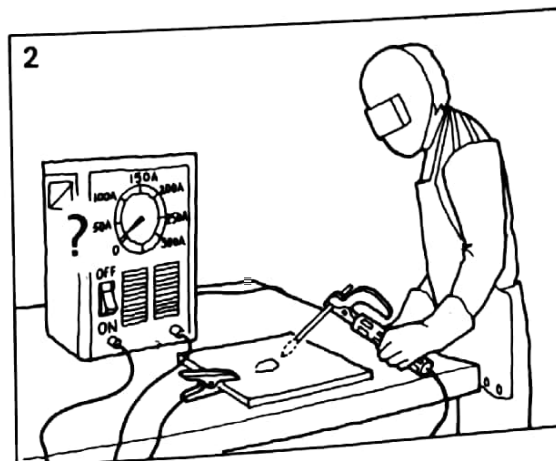
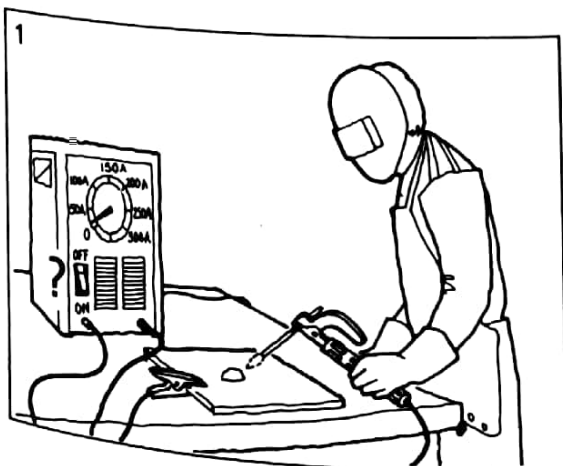
Exercise 6 Make eight true sentences from the following table.

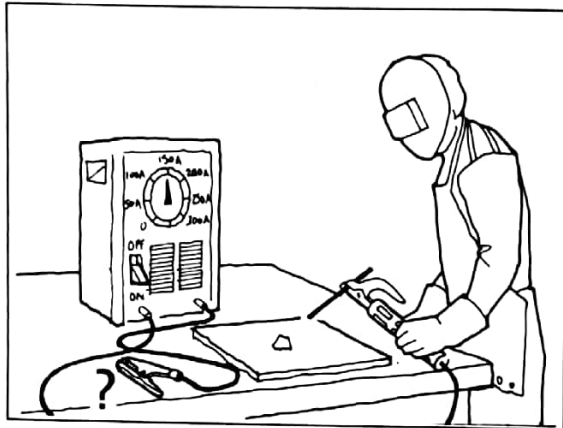
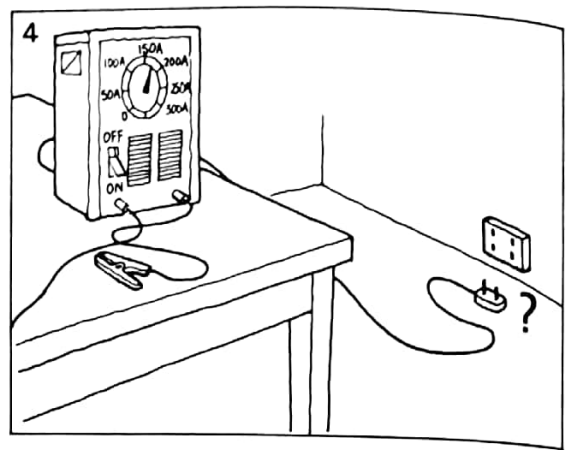
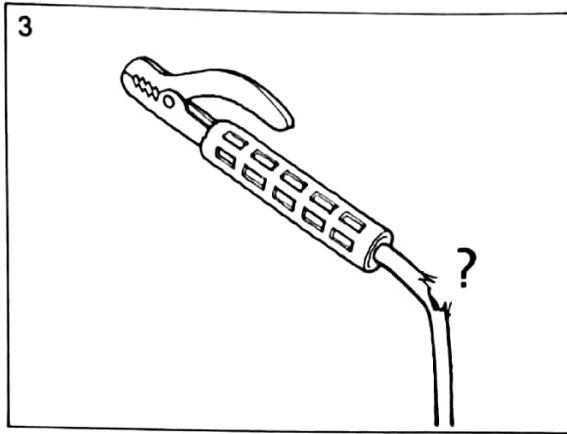
<p>The current must be above 60 A</p> <p>The cables must be thick</p> <p>The electrode must not be moved too quickly</p> <p>An earth clamp must be attached to the workpiece</p> <p>The clamp must be attached securely</p> <p>The welding current must be at a low voltage</p> <p>The electrode must not be withdrawn too far</p> <p>The electrode must be moved across the joint continuously</p>	<p>or else</p>	<p>they will overheat.</p> <p>the current will not flow.</p> <p>arcs will appear in the wrong place.</p> <p>the electrode will not melt.</p> <p>there is a danger of electrocution.</p> <p>the arc will not be strong enough.</p> <p>it will become attached to the workpiece.</p> <p>the arc will disappear.</p>
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Exercise 7 Look at the drawings and make sentences like the examples.

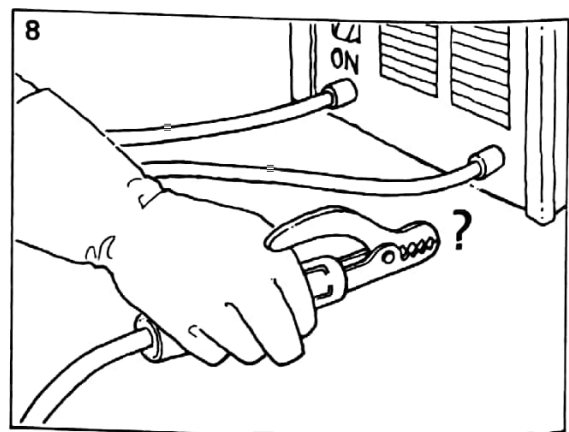
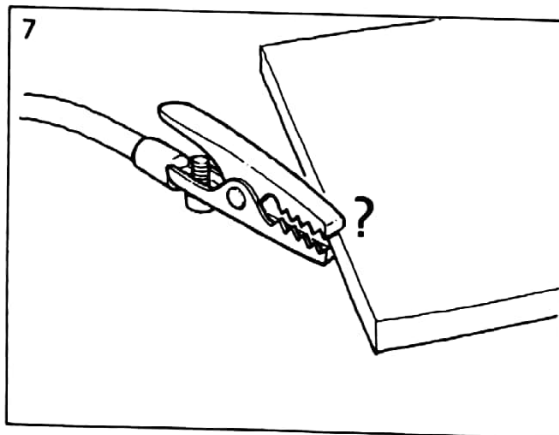
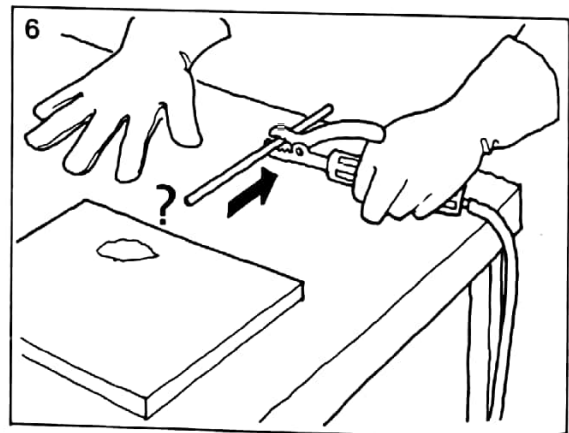
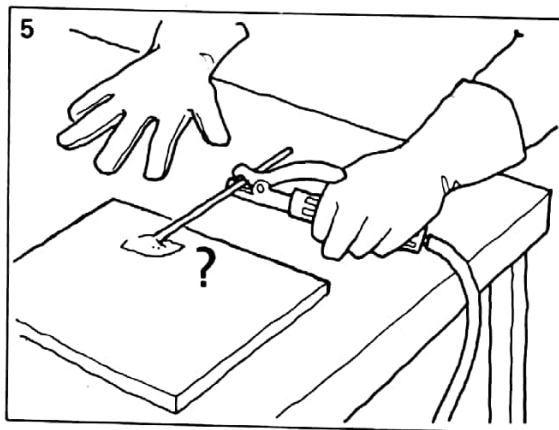


The earth clamp must be attached to the workpiece (*in order*) to complete the circuit.



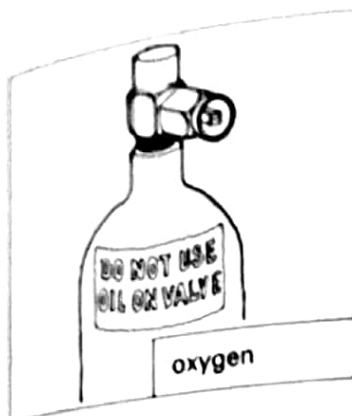


The earth clamp must be attached to the workpiece *or (else)* the current cannot flow.

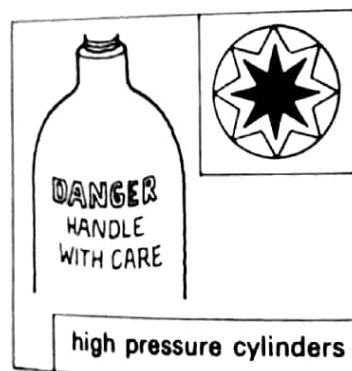
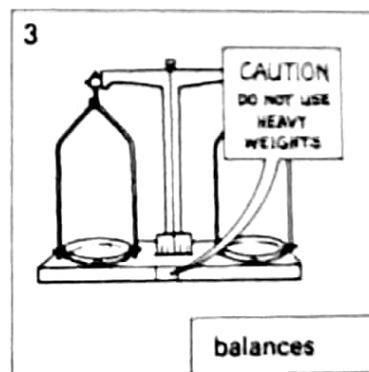
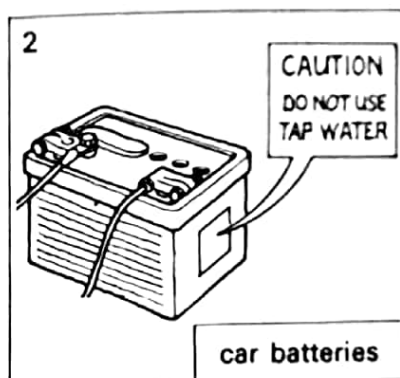
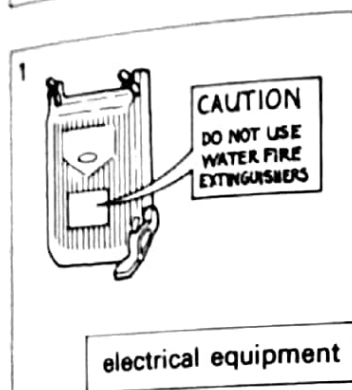


Exercise 8

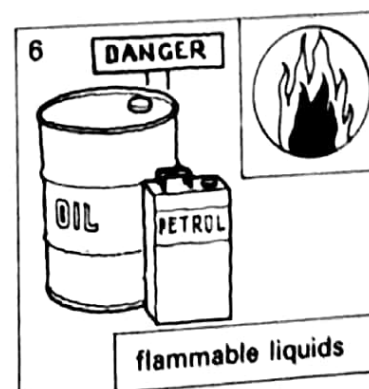
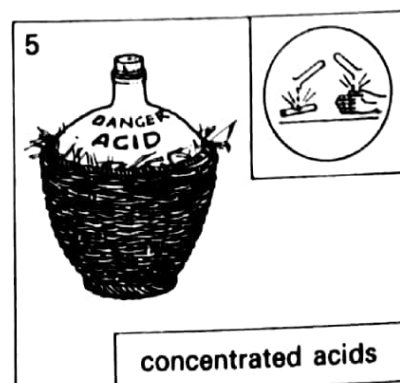
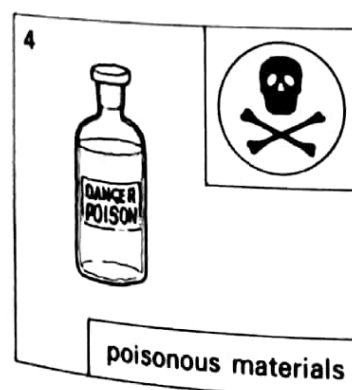
Look at the examples and then make similar sentences from the drawings.



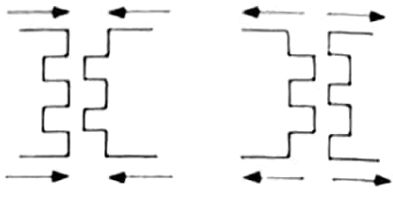
Oil must not be used with oxygen.



High pressure cylinders are dangerous and must be handled with care.



LANGUAGE NOTE 23	
volt (V)	amp(ere) (A)
voltage	amperage
voltmeter	ammeter

LANGUAGE NOTE 24	
<u>over</u> heat <u>over</u> flow	
	<u>attach</u> <u>detach</u>

ELECTRICAL TERMINOLOGY
an amp(ere) an arc a cable a transformer (an) earth a circuit

an operator

(an) injury

a tip

a sign

a drawing

electrocution

danger

poison

poisonous

concentrated

securely

in order to

or else

carry

overheat

protect

prevent

detach

injure

strike

brush

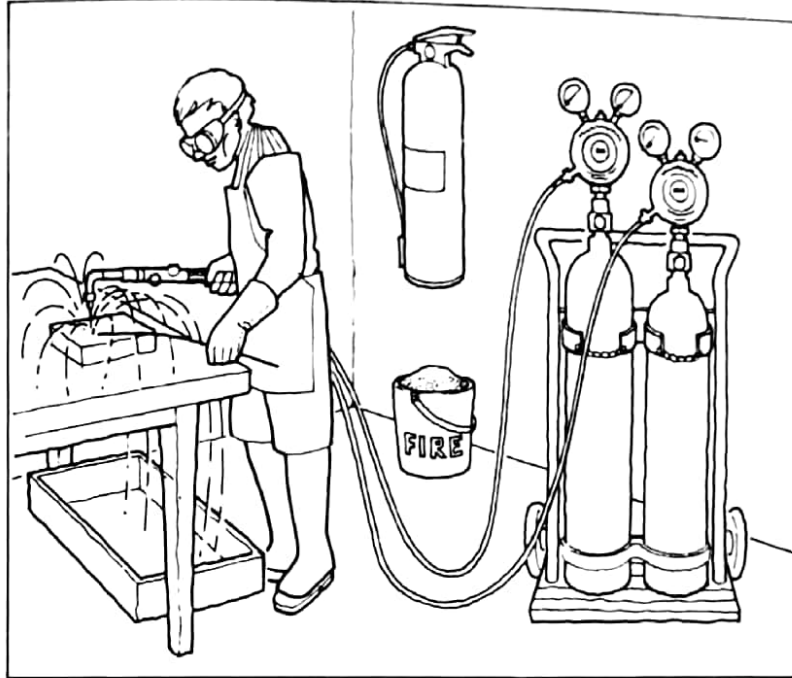
withdraw

disappear

mean

handle

SECTION C: SAFETY PRECAUTIONS



Gas Welding

You must wear goggles to protect your eyes.

Gas cylinders should be used in a vertical position.

Your clothes should not be oily or greasy. Oxygen can combine with oil or grease to cause an explosion.

You should wear long sleeves so that you do not burn your arms.

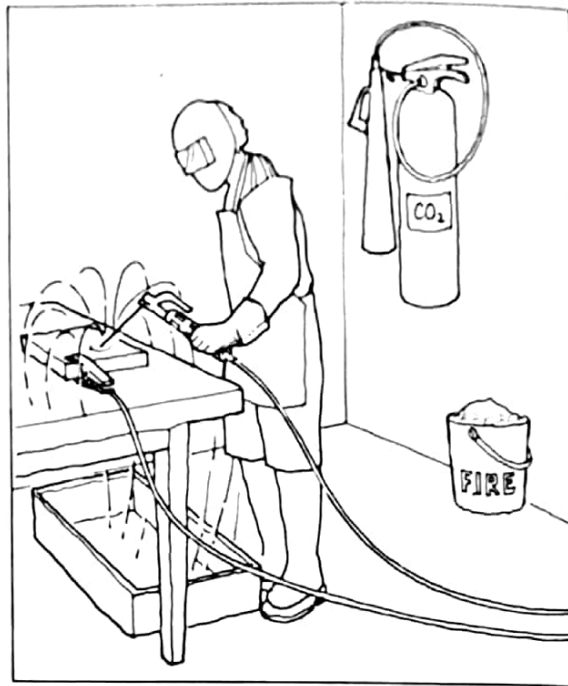
You should wear thick shoes so that you will not burn your feet.

You should wear gloves so that the sparks will not burn your hands.

Allow the sparks to fall into a metal container so that they don't burn the floor.

There must be fire extinguishers in the workshop so that any fires can be extinguished immediately.

After welding, turn off all valves so that no gases can escape.



Arc Welding

A face mask must be used or your face and eyes will not be protected.

The workshop floor should be dry and clean so that it cannot conduct electricity.

The floor should be made of concrete so that it cannot be burnt.

Your clothes should be dry and clean so that they cannot conduct electricity.

Overalls with long sleeves should be worn.

Thick shoes should be worn to protect your feet.

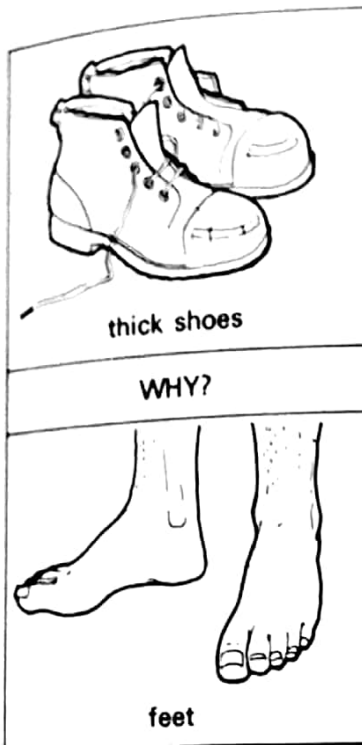
Welding gloves should be worn so that your hands are protected from sparks.

Allow the sparks to fall into a metal container so that they don't burn the floor.

CO₂ fire extinguishers should be provided in the workshop so that any electrical fires can be immediately extinguished.

After welding, all switches must be turned off to prevent accidents.

Exercise 9 Study the first example.



You ^{should} _{must} wear thick shoes.

OR

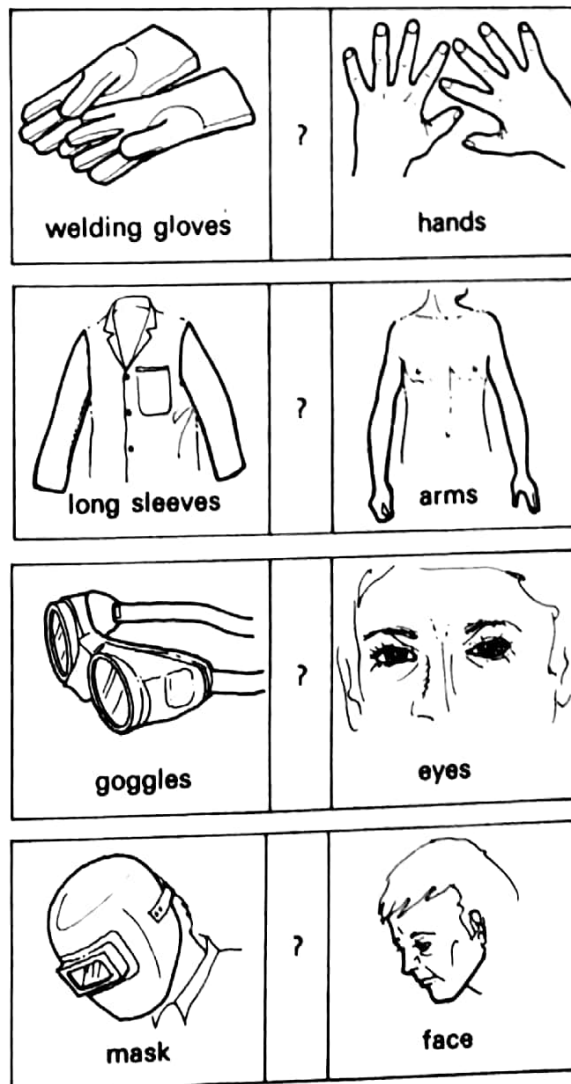
Thick shoes ^{should} _{must} be worn.

To protect your feet.

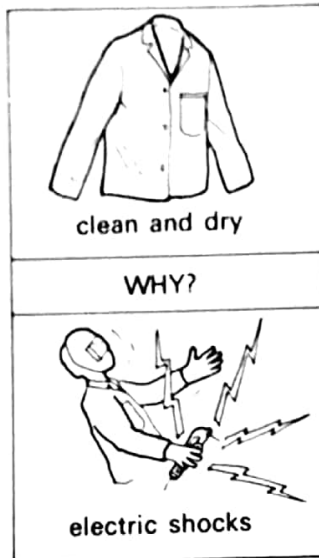
OR

So that your feet are protected.

Make similar sentences from the pictures below.



Now study the second example.



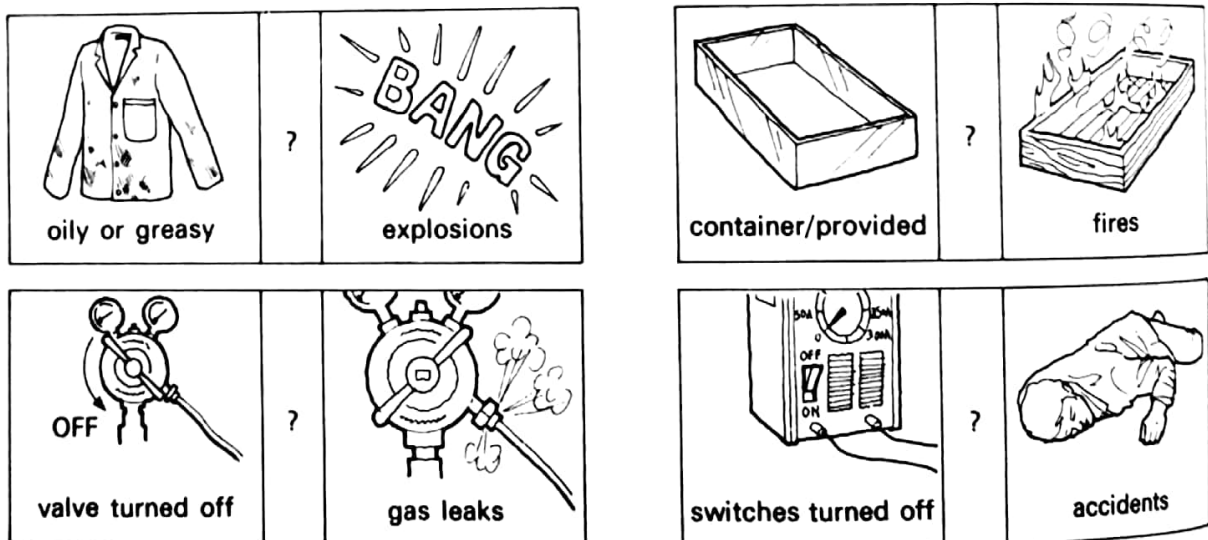
Your clothes should be clean and dry.

To prevent electric shocks.

OR

So that electric shocks are prevented.

Make similar sentences from the pictures below.



Exercise 10 Read the example carefully.

STATEMENT	
Long sleeves will protect your arms from burns.	
PRECAUTION	
Long sleeves should be worn	to protect your arms from burns.
	so that your arms are protected from burns.

Make similar PRECAUTION sentences from the following STATEMENTS. Use *to* or *so that*.

1. Thick shoes will protect your feet from sparks.
2. Goggles will protect your eyes from sparks.
3. Dry clothes will prevent injuries from electrical equipment.
4. A face mask will protect your eyes from the arc light.
5. A metal container will protect the floor from burns.
6. CO₂ extinguishers will prevent damage from electrical fires.

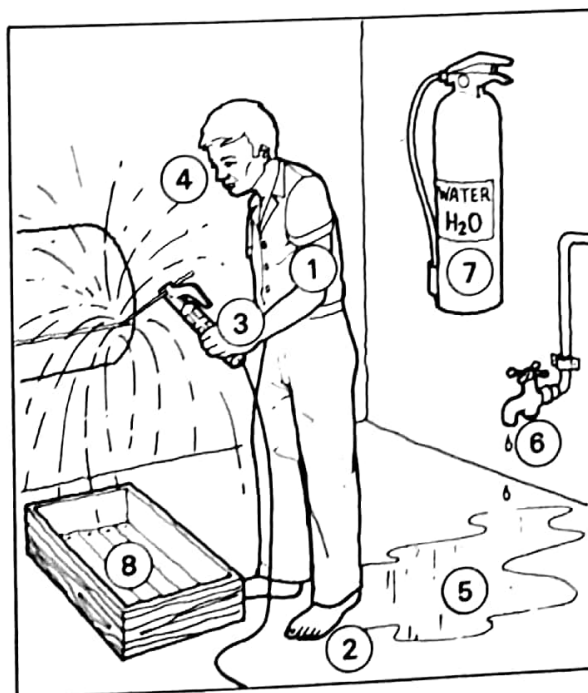
Now read the next example:

metal container/used/fires
a) A metal container should be used <i>to prevent fires</i> . b) A metal container should be used <i>or fires may be caused</i> .

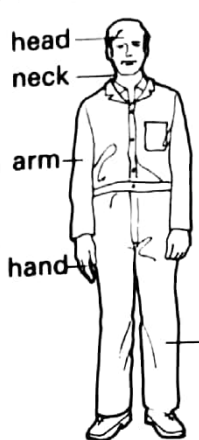
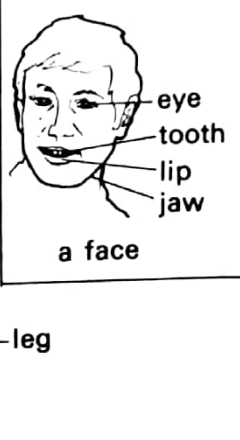
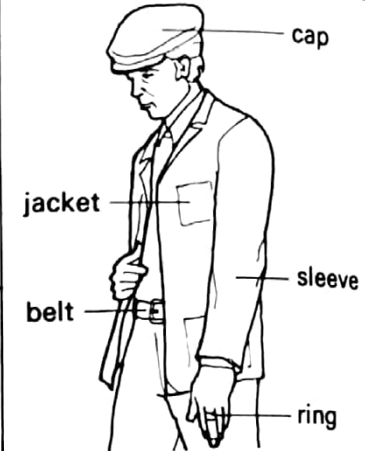
Make similar a) and b) sentences from the words below.

7. all valves/turned off/gas leaks
8. clean clothes/worn/an explosion
9. all switches/turned off/accidents
10. the correct precautions/followed/injuries

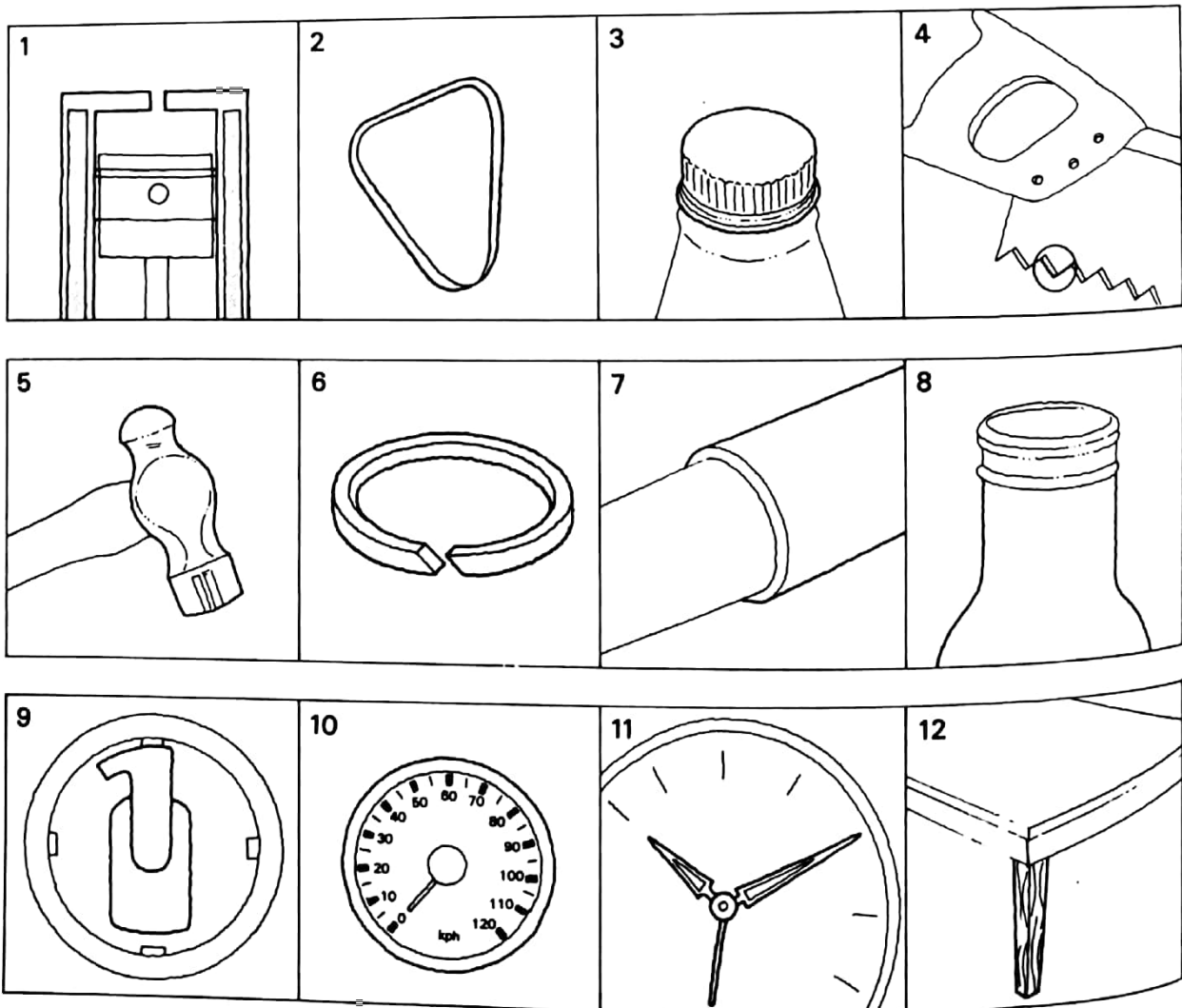
Exercise 11 This welder does not know the safety precautions for arc welding. Write eight instructions for him.

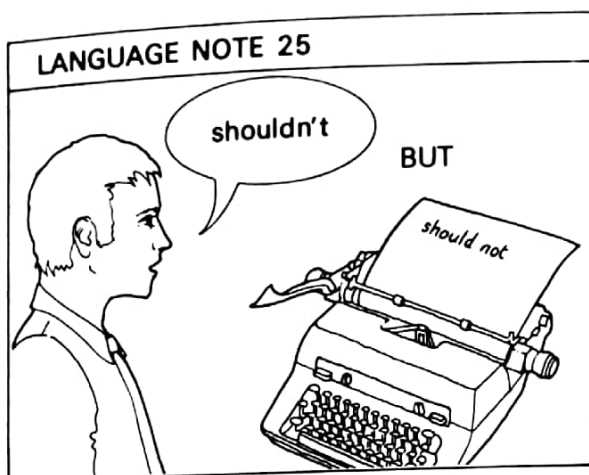
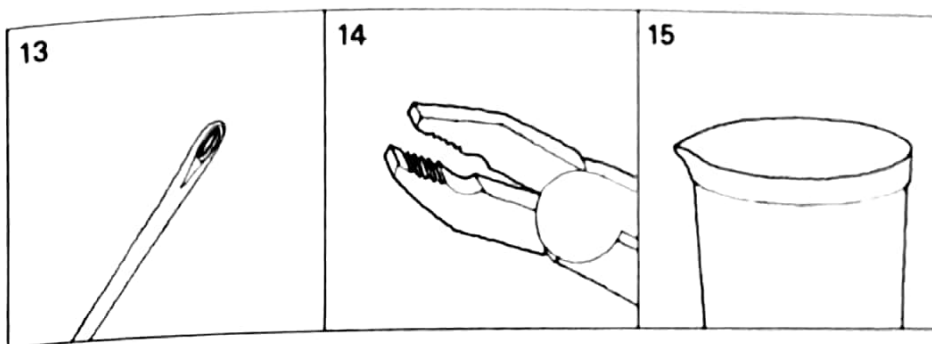


Exercise 12 PARTS OF THE BODY and NAMES OF CLOTHES are often used to describe different objects in engineering. Look at these two diagrams.

PARTS OF THE BODY		NAMES OF CLOTHES
		

Use the fifteen words above (ten *parts of the body* and five *names of clothes*) to describe the fifteen objects below.





LANGUAGE NOTE 26		
oil	→	oily
grease	→	greasy
dirt	→	dirty
sand	→	sandy
dust	→	dusty

clothes
goggles
overalls

a sleeve
a shoe
a glove
a mask

an arm
a foot
an eye
a face
a lip
a jaw
a neck
a leg

a burn
an explosion
a floor
an accident
an electric shock
a leak
a statement
a precaution

so that

oily
greasy
clean

immediately

wear
follow
combine