Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

COMBINED SCIENCE **0653/31**

Paper 3 Theory (Core) **October/November 2024**

1 hour 15 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].
- The Periodic Table is printed in the question paper.

This document has **24** pages. Any blank pages are indicated.

[Turn over

1 **(a)** Fig. 1.1 shows the flower of a plant.

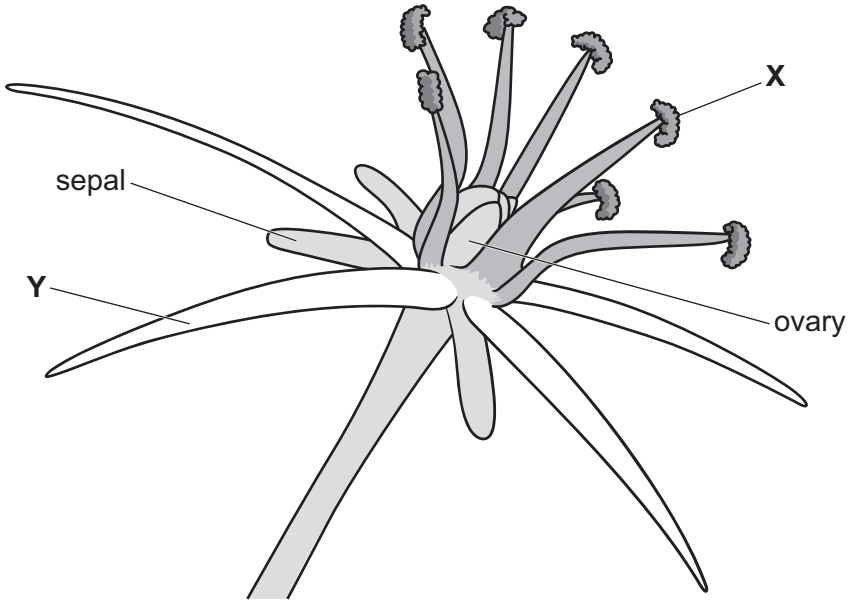

Fig. 1.1

(i) State the name of the part labelled **X** on Fig. 1.1.

..... [1]

(ii) State the name and function of the part labelled **Y** on Fig. 1.1.

name .....

function .....

[2]

(iii) Complete the description of what happens in the ovary of the flower.

The ovary is where the process of ..... takes place.

The nucleus of a ..... grain fuses with the nucleus of an ..... .

[3]

(b) Fig. 1.2 shows a food web.

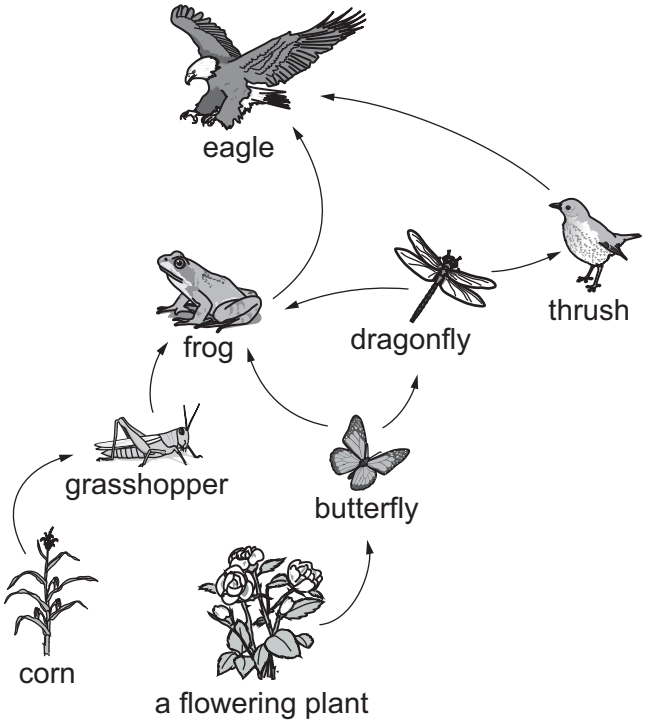

Fig. 1.2

Table 1.1 shows some terms that can be used to describe some of the organisms in Fig. 1.2.

Tick (✓) the boxes in Table 1.1 to show **all** the terms used to describe each organism.

Table 1.1

organism	carnivore	herbivore	primary consumer	producer
butterfly				
corn				
thrush				

[3]

[Total: 9]

2 A student investigates the rate of reaction between solid magnesium carbonate and dilute hydrochloric acid.

Fig. 2.1 shows the apparatus.

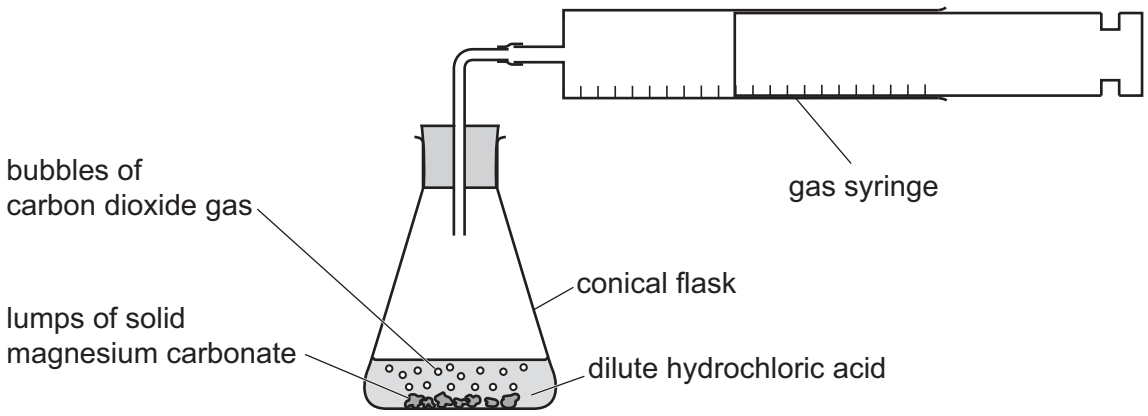

Fig. 2.1

(a) Complete the word equation for the reaction shown in Fig. 2.1.

	+		→		+ water +	carbon dioxide

[2]

(b) The student investigates this reaction using three different concentrations, **A**, **B** and **C**, of dilute hydrochloric acid. All other variables are kept constant.

Fig. 2.2 shows the volume of carbon dioxide gas produced over a period of 100 s.

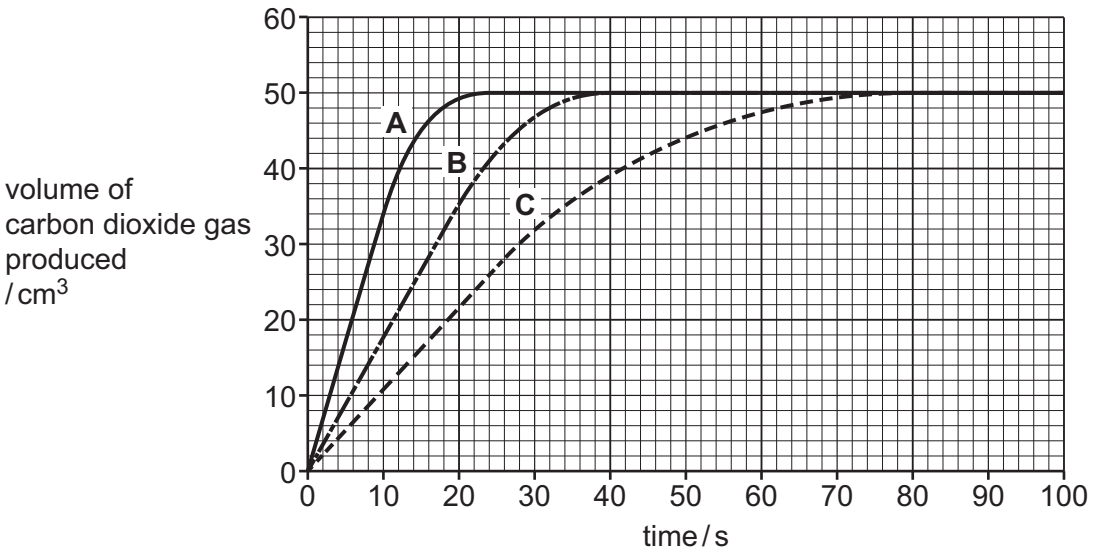

Fig. 2.2

(i) Identify the time at which the acid with concentration **B** stops reacting.

time = ... s [1]

(ii) Use Fig. 2.2 to identify which concentration, **A**, **B** or **C**, is the lowest concentration of dilute hydrochloric acid.

Explain your answer.

concentration .....

explanation .....

.....

.....

[2]

(iii) Changing the concentration of dilute hydrochloric acid affects the rate of reaction.

State **two** other ways of affecting the rate of reaction.

1 .....

2 .....

[2]

(c) The reaction between dilute hydrochloric acid and magnesium carbonate produces water.

(i) State the name of the type of chemical bonding in a water molecule.

..... [1]

(ii) Complete the dot-and-cross diagram in Fig. 2.3 to show the bonding in a water molecule, H_2O.

Show **all** the outer-shell electrons.

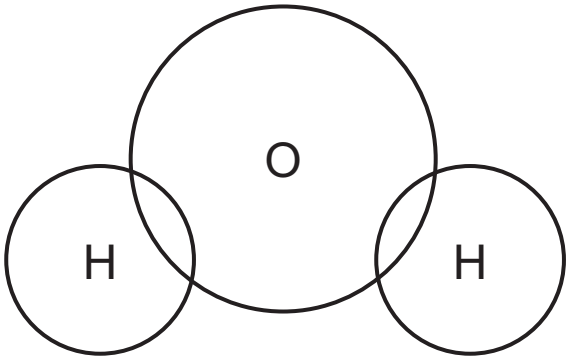

Fig. 2.3

[2]

[Total: 10]

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3 Fig. 3.1 shows a block of wood.

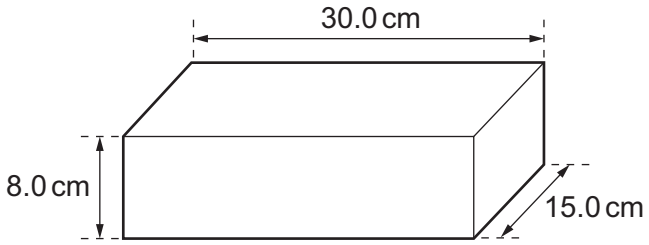


Fig. 3.1

The mass of the block of wood is 2.7 kg.

(a) (i) Calculate the weight of the block of wood.

The gravitational force on unit mass is 10 N / kg.

weight = ... N [2]

(ii) Show that the volume of the block is 0.0036 m^3.

[2]

(iii) Calculate the density of the wood.

density = ... kg/m^3 [2]

(b) Fig. 3.2 shows the block of wood on the bottom shelf (shelf 1) of some bookshelves.

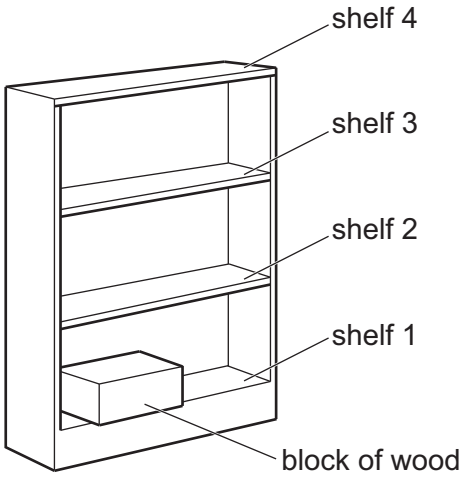


Fig. 3.2

(i) A student lifts the block from shelf 1 to shelf 2.

At the beginning of this event, the block is at rest on shelf 1.

At the end of this event, the block is at rest on shelf 2.

Circle the type of potential energy that increases as a result of this event.

chemical **elastic** **electrical** **gravitational**

[1]

(ii) The student now lifts the block of wood from shelf 2 to shelf 4.

Complete the sentences about work done. Use **one** word in each gap.

Work done is related to both the magnitude of a force and the

..... moved in the ..... of

the force.

Therefore, the work done lifting the block from shelf 2 to shelf 4 is

..... than the work done lifting the block from shelf 1 to

shelf 2.

[3]

[Total: 10]

4 Anaemia is caused by a deficiency of iron in the diet.

(a) Fig. 4.1 shows diagrams of the blood of a person **without** anaemia and the blood of a person **with** anaemia.

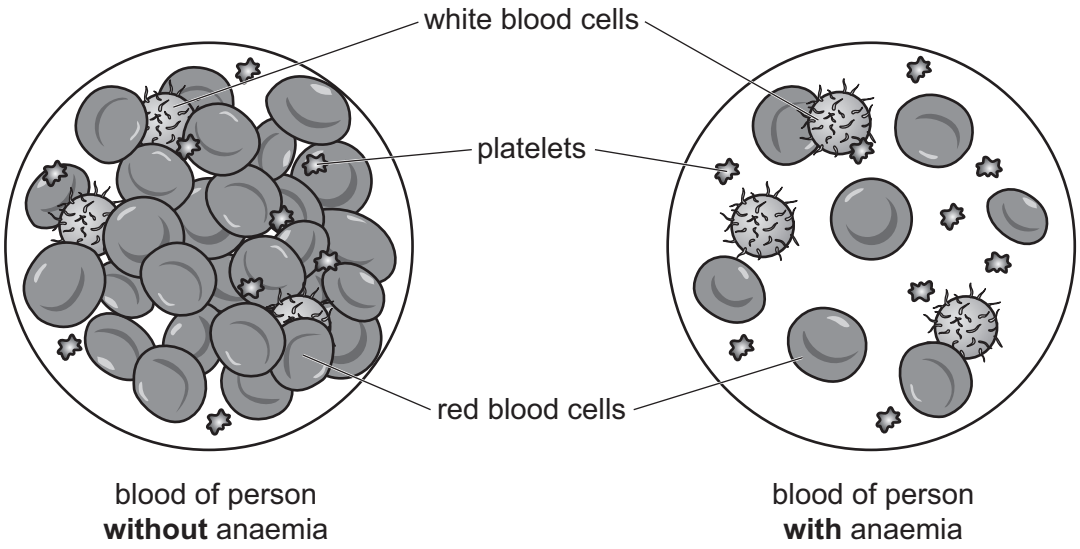


Fig. 4.1

(i) Describe **one** visible difference between the two types of blood shown in Fig. 4.1.

.....

..... [1]

(ii) The boxes on the left show the components of blood labelled in Fig. 4.1.

The boxes on the right show the functions of the components.

Draw **one** straight line from each component to its function.

component	function
platelets	transportation of oxygen
red blood cells	phagocytosis
white blood cells	blood clotting

[2]

(b) Foods containing iron are needed as part of a balanced diet.

(i) Circle **one** food that is a principal source of iron.

apples **bread** **meat** **rice**

[1]

(ii) State what is meant by the term balanced diet.

.....

..... [1]

(iii) Protein is part of a balanced diet.

All proteins contain the elements carbon, hydrogen and oxygen.

State **one** other element contained in **all** proteins.

..... [1]

(c) Fig. 4.2 shows the pulse rate of a person before, during and after physical activity.

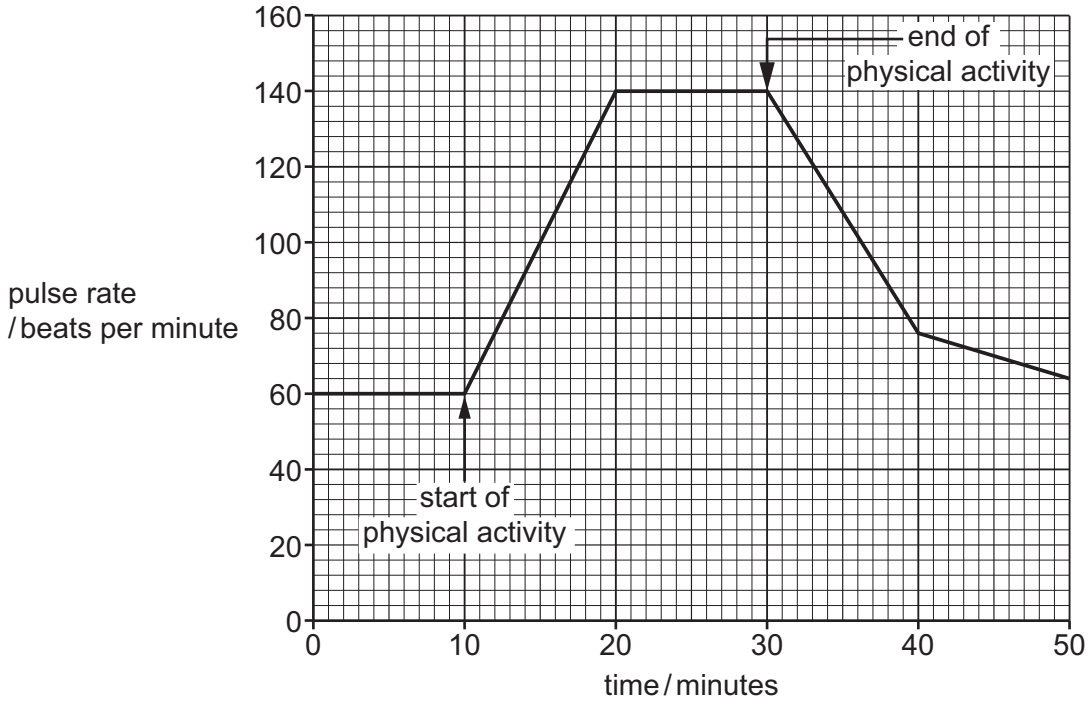


Fig. 4.2

(i) Calculate the percentage increase in pulse rate of the person between the start and end of physical activity.

pulse rate at start of physical activity = ... beats per minute

pulse rate at end of physical activity = ... beats per minute

change in pulse rate = ... beats per minute

percentage increase in pulse rate = ... %
[3]

(ii) During exercise, muscles need more oxygen for respiration.

Define the term respiration.

.....

.....

..... [2]

[Total: 11]

5 Fig. 5.1 shows the first four periods of the Periodic Table with the data for the elements removed.

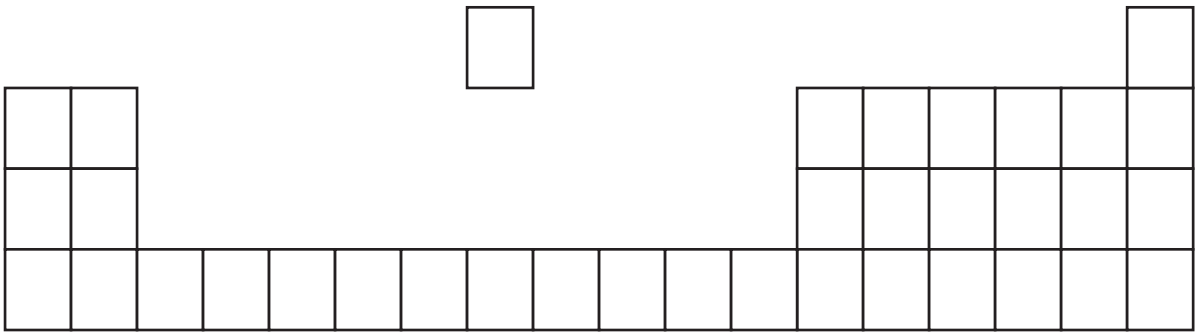


Fig. 5.1

(a) Element **Q** has proton number 4.

Element **R** is 21% of clean air.

Element **T** is a soft metal at the top of its group.

Identify the positions of elements **Q**, **R** and **T** in the Periodic Table by writing the letters in the boxes in Fig. 5.1. [3]

(b) The noble gases are a group of monoatomic elements in the Periodic Table.

(i) State the group number of the noble gases.

..... [1]

(ii) Explain why the noble gases are monoatomic.

.....

..... [1]

[Total: 5]

6 Copper is a metal.

(a) Copper is used to make wires for electrical circuits.

State **one** property of copper that makes it suitable for use as a wire for electrical circuits.

..... [1]

(b) **(i)** Complete the sentences about copper. Use **one** word in each gap.

Copper is a solid at a room temperature of 21 °C.

The ..... point of copper is 1080 °C. At this temperature, copper changes state from a solid to a liquid.

The ..... point of copper is 2560 °C. At this temperature, copper changes state from a liquid to a gas.

[2]

(ii) Describe how the arrangement and the separation of molecules in a solid differ from the arrangement and the separation of molecules in a gas.

arrangement .....

.....

separation .....

.....

[2]

(c) A smooth piece of copper is used as a plane mirror.

Fig. 6.1 shows a ray of light incident on the copper mirror.

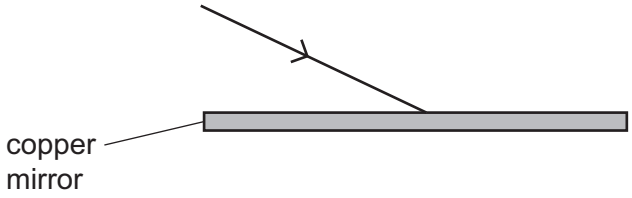


Fig. 6.1

On Fig. 6.1, draw:

- the normal
- the angle of incidence i
- the reflected ray of light.

[3]

[Total: 8]

7 **(a)** Fig. 7.1 shows a student's drawing of a cross-section of a leaf.

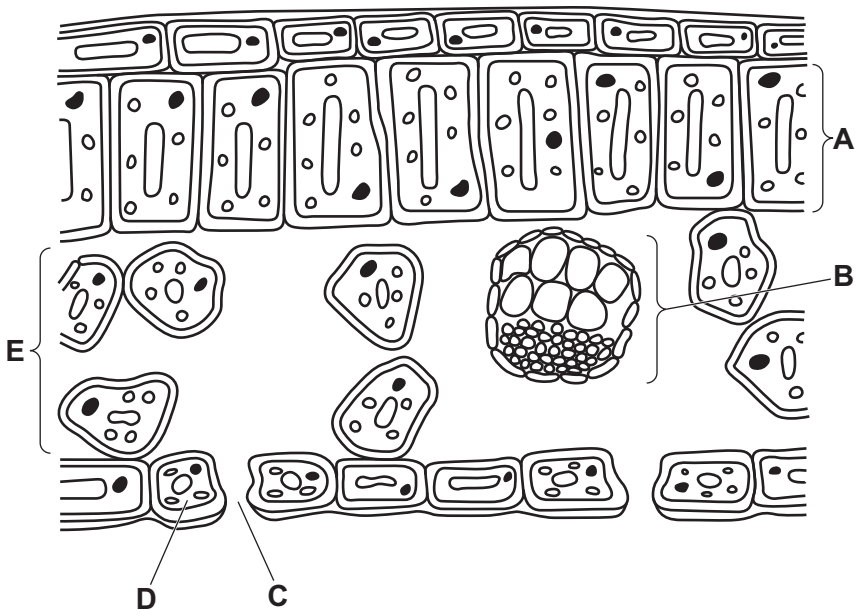


Fig. 7.1

(i) State the letter in Fig. 7.1 that identifies:

a guard cell .....

a vascular bundle .....

where water vapour diffuses out from the leaf. .....

[3]

(ii) Use a label line and the letter **X** to identify a cuticle in Fig. 7.1. [1]

(b) Fig. 7.2 shows the pathway taken by water from the soil to the leaves.

Complete Fig. 7.2.

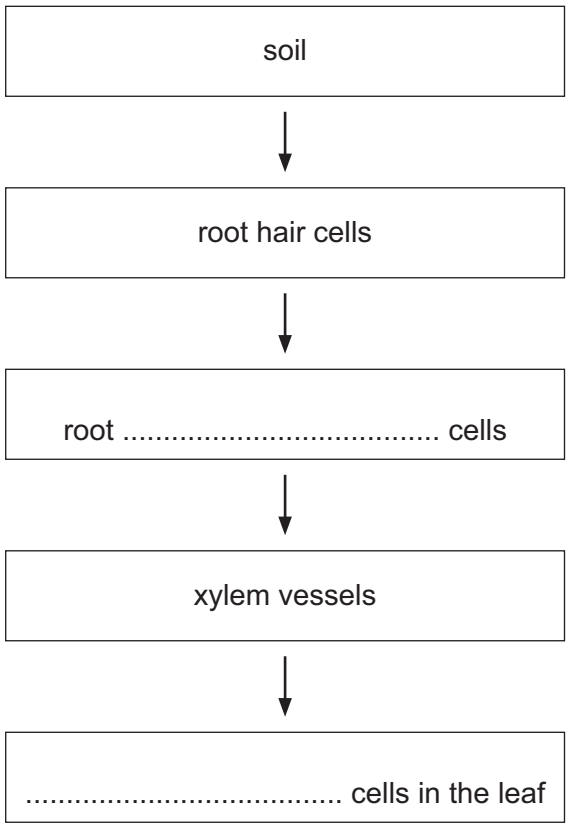


Fig. 7.2

[2]

(c) Plants are an important part of the carbon cycle.

Circle the process that **decreases** the amount of carbon dioxide in the atmosphere.

combustion **decomposition** **photosynthesis**

respiration **transpiration**

[1]

[Total: 7]

8 **(a)** Complete the sentences about fuels.

Use words from the list. Each word may be used once or not at all.

bitumen **fossil** **hydrocarbon** **methane** **petroleum**

Coal, ... and natural gas are ..... fuels.

The main constituent of natural gas is ..... .

[3]

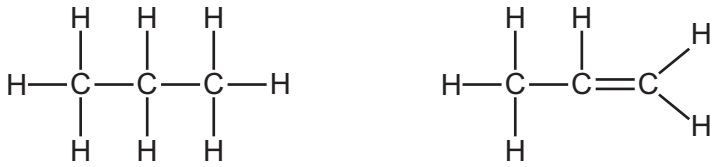
(b) Petroleum is separated into useful fractions by fractional distillation.

Draw **one** line from each fraction to its use.

fraction	**use**
refinery gas	fuel in cars
naphtha	road surfaces
bitumen	chemical feedstock
	heating and cooking

[3]

(c) The diagrams in Fig. 8.1 show the structures of compound **F** and compound **G**.



compound **F** compound **G**

Fig. 8.1

(i) State the name of the group of hydrocarbons to which compound **F** belongs.

..... [1]

(ii) Compound **G** is an unsaturated hydrocarbon.

Describe what is meant by unsaturated.

.....

..... [1]

(iii) Describe **one** chemical test to distinguish between compounds **F** and **G**.

State the observation for each compound.

test .....

compound **F** .....

compound **G** .....

[3]

[Total: 11]

9 Fig. 9.1 shows an electrical circuit used to investigate the resistance of a lamp.

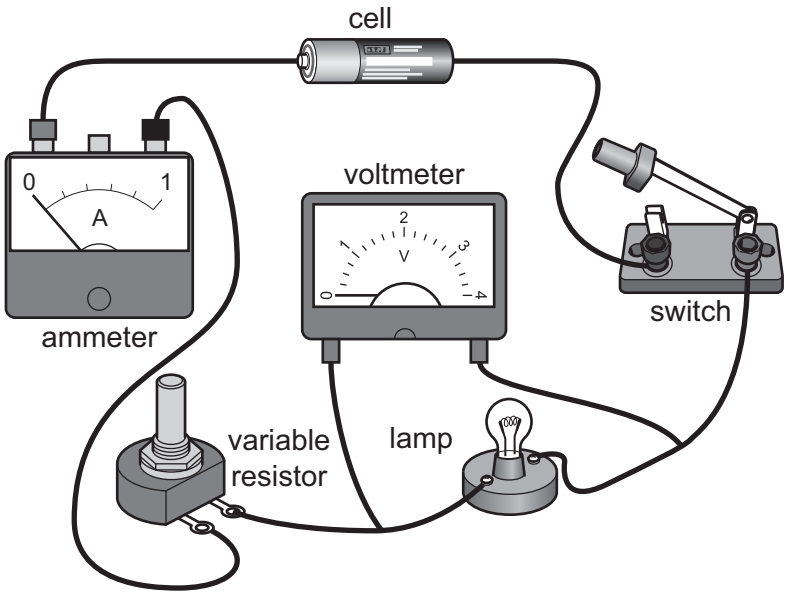


Fig. 9.1

(a) Complete Fig. 9.2 to show the circuit diagram for the electrical circuit in Fig. 9.1.

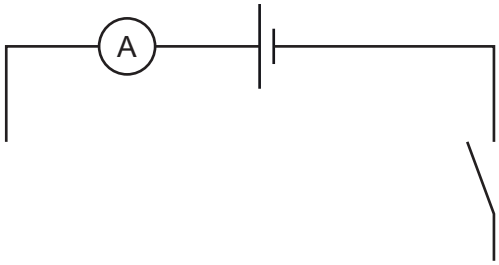


Fig. 9.2

[3]

(b) State the name of the component in the circuit that:

- is used to change the current in the circuit .....
- measures potential difference (p.d.) .....
- provides an electromotive force (e.m.f.) for the circuit. .....

[3]

(c) The switch is closed.

The reading on the voltmeter is 1.3 V. The reading on the ammeter is 0.38 A.

Calculate the resistance of the lamp.

Give the unit of your answer.

resistance = ... unit ..... [3]

[Total: 9]

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The Periodic Table of Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group VIII
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9											5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24											13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium –	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89–103 actinoids	104 Rf rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –	113 Nh nihonium –	114 Fl flerovium –	115 Mc moscovium –	116 Lv livermorium –	117 Ts tennessine –	118 Og oganesson –

Key

atomic number
atomic symbol
name
relative atomic mass

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).