Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

COMBINED SCIENCE **0653/33**

Paper 3 Theory (Core) **October/November 2020**

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 **20** pages. Blank pages are indicated.

DC (ST/JG) 194548/3

[Turn over

1 **(a)** Fig. 1.1 shows a diagram of muscle cells.

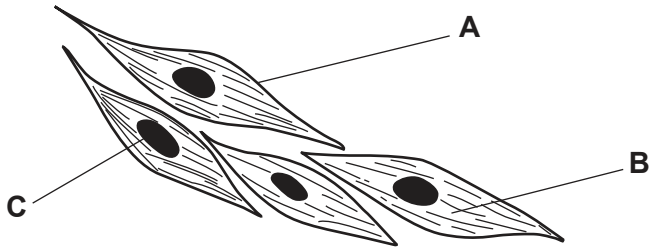


Fig. 1.1

(i) Complete Table 1.1 for the structures **A**, **B** and **C**.

Table 1.1

structure	name	function
A	.....	controls which substances pass in and out of the cell
B	cytoplasm	.....
C	.....	controls the activity of the cell

[3]

(ii) Muscles are needed in humans for one of the characteristics of living organisms.

Name this characteristic.

..... [1]

(iii) Muscles need energy to work.

The energy is released by a different characteristic of living organisms.

Name this characteristic.

..... [1]

(b) Anaemia is a medical condition. A person with anaemia has fewer red blood cells than normal.

Suggest why anaemia can cause a person to have less energy.

.....

.....

.....

..... [2]

(c) The heart is made of muscle tissue.

Fig. 1.2 is a diagram of the heart.

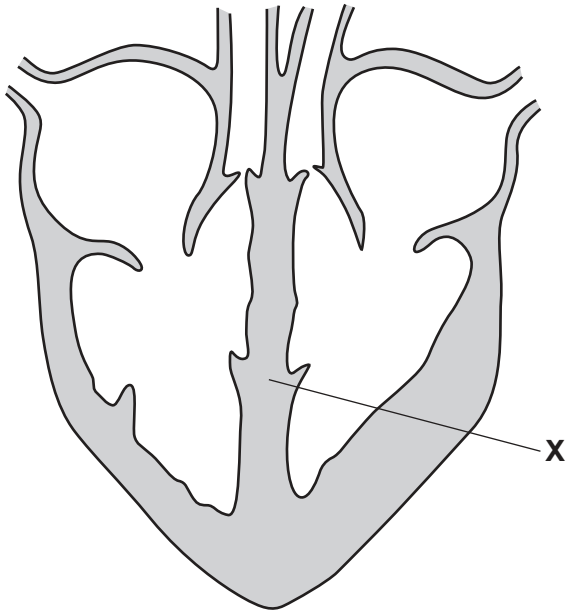


Fig. 1.2

(i) Identify structure **X** on Fig. 1.2.

..... [1]

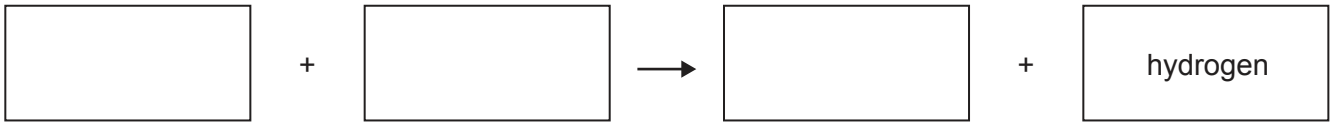
(ii) On Fig. 1.2, use a label line and the letter **Y** to identify a structure that prevents the backwards flow of the blood. [1]

[Total: 9]

2 A student investigates the rate of reaction between a piece of magnesium and excess dilute hydrochloric acid.

(a) During this reaction, hydrogen is produced.

(i) Complete the equation for this reaction.



[2]

(ii) Describe the chemical test for hydrogen and state the positive result.

test .....

result .....

[2]

(b) The reaction between magnesium and dilute hydrochloric acid is exothermic.

State the meaning of *exothermic*.

.....

..... [1]

(c) **(i)** Describe the effect of increasing the concentration of the acid on the rate of reaction.

..... [1]

(ii) Describe the effect of decreasing the temperature of the acid on the rate of reaction.

..... [1]

(d) The student repeats the experiment but uses a piece of zinc instead of a piece of magnesium.

The piece of zinc has the same surface area as the piece of magnesium.

Suggest the effect that using zinc instead of magnesium has on the rate of the reaction.

Explain your answer.

effect .....

explanation .....

.....

[2]

[Total: 9]

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3 Fig. 3.1 shows a climber moving up a rock face.

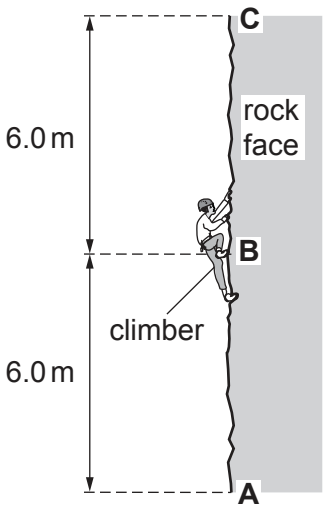

Fig. 3.1

(a) The mass of the climber is 64 kg.

The gravitational field strength *g* is 10 N / kg.

(i) Calculate the weight of the climber.

weight = ... N [1]

(ii) State the source of the gravitational field.

..... [1]

(b) The climber moves up the rock face from **A** to **B** at a constant speed.

(i) State the type of energy the climber has that is due to the climber's motion.

..... [1]

(ii) State the type of energy the climber has that increases due to the climber's change in position above the ground.

..... [1]

(c) The climber takes 120 seconds to move up the rock face from **A** to **B**.

The climber takes 60 seconds to move up the rock face from **B** to **C**.

(i) Calculate the average speed of the climber for the 12 m climb from **A** to **C**.

average speed = ... m/s [3]

(ii) Explain why the useful work done against gravity by the climber moving from **B** to **C** is the **same as** the useful work done against gravity by the climber moving from **A** to **B**.

.....

..... [1]

(iii) Explain why the useful power developed by the climber moving from **B** to **C** is **greater than** the useful power developed by the climber moving from **A** to **B**.

.....

..... [1]

[Total: 9]

4 **(a)** Fig. 4.1 shows plant cells as seen with a microscope.

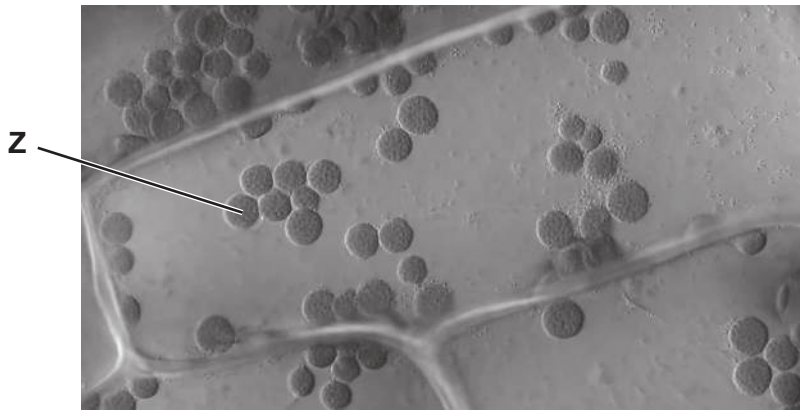

Fig. 4.1

(i) The structure labelled **Z** in Fig. 4.1 contains chlorophyll.

Name the structure labelled **Z** in Fig. 4.1.

..... [1]

(ii) Complete the word equation for photosynthesis.

	+		→	glucose	+	

[2]

(iii) Glucose is a carbohydrate.

Circle the **three** elements that make up carbohydrates.

calcium **carbon** **hydrogen** **iron**

magnesium **nitrogen** **oxygen**

[1]

(b) Glucose from photosynthesis is stored in the part of the leaf where it is made. The glucose is stored as starch.

A student investigates the need for chlorophyll in photosynthesis.

The student:
- uses a plant with leaves that are green and white
- puts the plant in a room with plenty of light
- waits for three days
- tests the leaves for starch.

Fig. 4.2 shows a leaf before and after testing for starch.

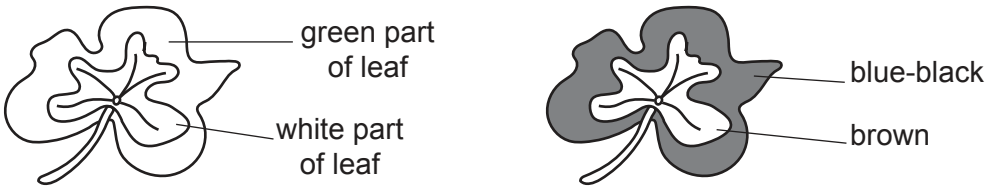

Fig. 4.2

(i) State the name of the solution used to test for the presence of starch.

..... [1]

(ii) The white parts of the leaf do **not** contain chlorophyll.

Explain the results shown in Fig. 4.2.

.....

.....

.....

..... [2]

(c) Plants reproduce using flowers.

Name the part of the flower that produces pollen.

..... [1]

[Total: 8]

5 **(a)** The water tap shown in Fig. 5.1 is made of brass.

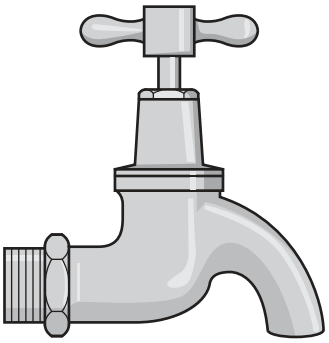

Fig. 5.1

Brass is made by mixing molten copper with molten zinc. The mixture is then allowed to cool to form solid brass.

(i) State how solid copper is changed into molten copper.

.....

..... [1]

(ii) Describe **two** differences between the arrangement of atoms in solid copper and the arrangement of atoms in molten copper.

1 .....

.....

2 .....

.....

[2]

(iii) State whether this process of making brass is a chemical change or a physical change.

Explain your answer.

change .....

explanation .....

.....

[1]

(b) Copper is a transition element.

Sodium is a Group I metal.

(i) Describe **two** physical properties of copper that are **not** properties of sodium.

1 .....

2 .....
[2]

(ii) Describe **one** physical property of copper that is **also** a property of sodium.

..... [1]

(c) Group I is on the left of the Periodic Table.

Transition elements are found in the middle of the Periodic Table.

Describe the change in the character of elements across a period, from left to right.

..... [1]

[Total: 8]

6 **(a)** Gamma rays are a type of electromagnetic radiation.

Fig. 6.1 shows a space telescope that is used for detecting gamma radiation from distant stars.

Fig. 6.1

Fig. 6.2 shows an incomplete electromagnetic spectrum.

On Fig. 6.2, write **gamma radiation** in the correct position.

		ultraviolet	visible light		microwaves	

Fig. 6.2

[1]

(b) An astronomer uses a telescope to produce an image of a star.

Fig. 6.3 shows visible light rays from the star entering a thin converging lens in the telescope.

(i) On Fig. 6.3, complete the ray diagram to show how the lens focuses the rays to produce a real image on the screen.

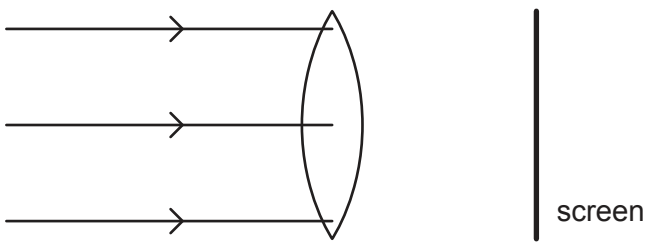

Fig. 6.3 [2]

(ii) State the name of the distance from the lens to the screen in Fig. 6.3.

..... [1]

(iii) Light waves from a star slow down as they enter the Earth's atmosphere. This causes them to change direction, as shown in Fig. 6.4.

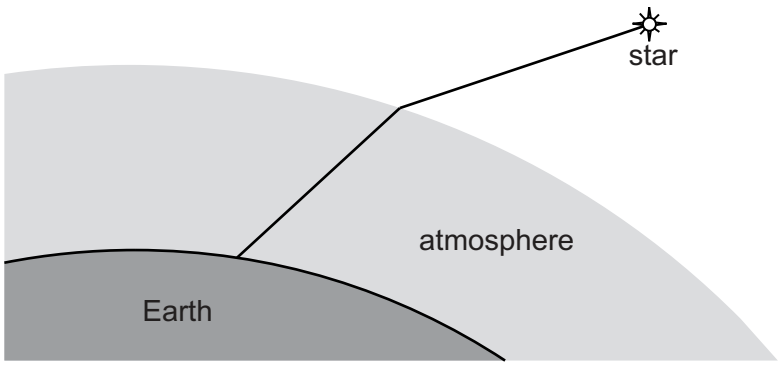

Fig. 6.4

State the name of the effect shown in Fig. 6.4.

..... [1]

(c) Stars can emit radiation at all frequencies of the electromagnetic spectrum.

(i) State a useful application of microwave radiation.

.....

..... [1]

(ii) Explain why stars **cannot** lose energy by conduction or convection.

.....

..... [1]

[Total: 7]

7 **(a)** Fig. 7.1 shows a picture of a sloth and some information about sloths.

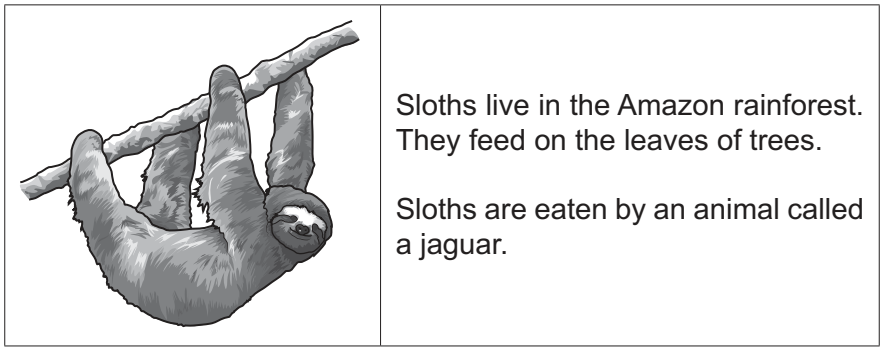

Fig. 7.1

(i) Use the information in Fig. 7.1 to construct the food chain for the sloth.

..... [2]

(ii) Complete this sentence about the sloth.

The sloth is a ..... consumer because it eats the producer. [1]

(b) Rainforests are being destroyed by deforestation.

Fig. 7.2 shows the area of deforestation each year in the Amazon rainforest.

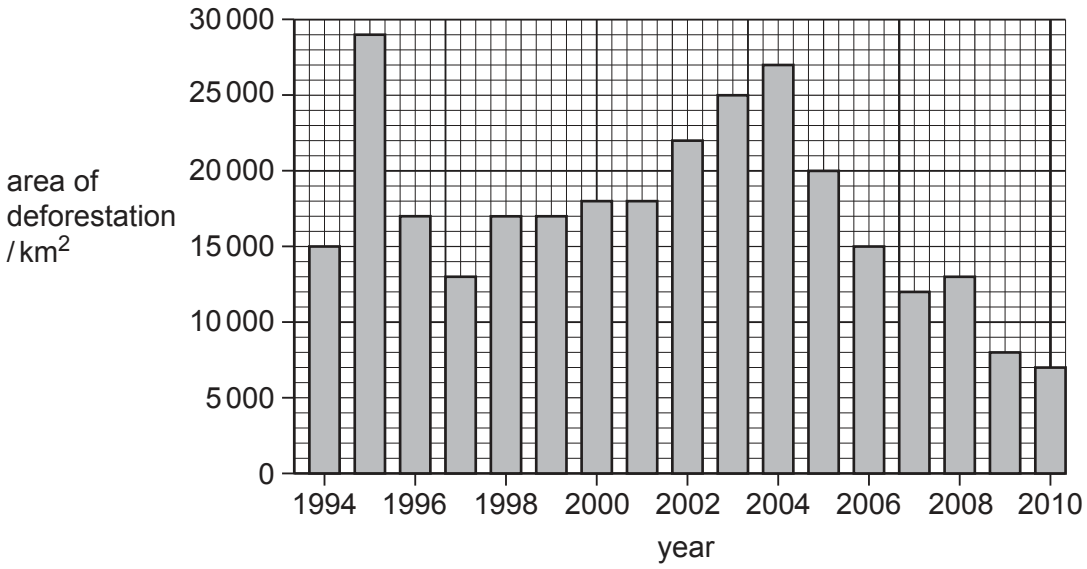

Fig. 7.2

(i) State the year that had the **greatest** amount of deforestation.

..... [1]

(ii) Explain why the trend seen in deforestation between 2004 and 2010 benefits sloths.

.....

.....

.....

..... [2]

(c) Plants in the rainforest take up water and mineral ions from the soil.

Fig. 7.3 is a diagram showing some of the cells in the root of a plant.

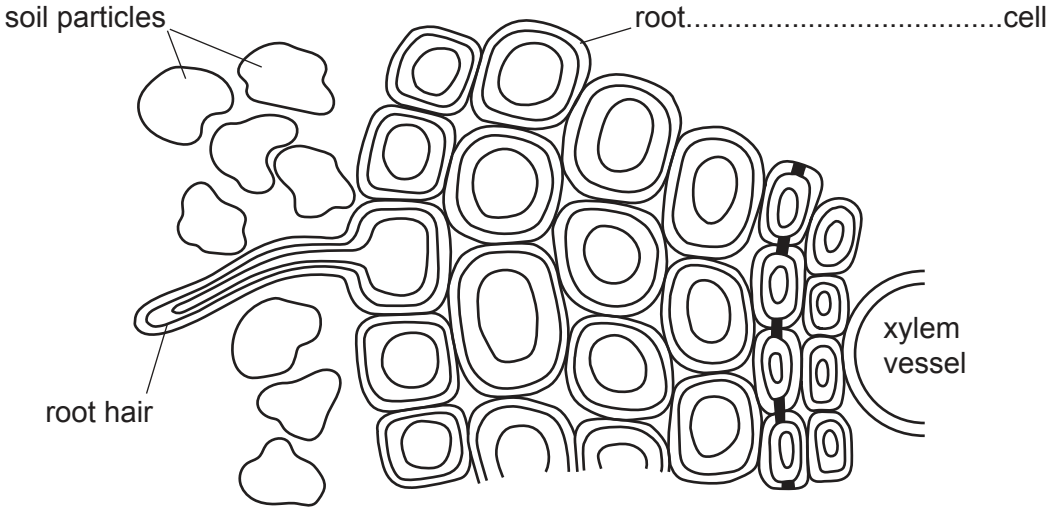

Fig. 7.3

(i) Complete the label on Fig. 7.3 to identify the cells between the root hair and the xylem vessels. [1]

(ii) Draw **one** arrow to show the pathway taken by water from the soil into the root. [1]

(iii) Describe how water moves in and out of cells.

.....

.....

..... [2]

[Total: 10]

8 **(a)** A molecule of methane is represented in Fig. 8.1.

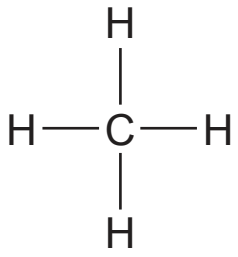

Fig. 8.1

(i) Name the type of chemical bond present in this molecule.

..... [1]

(ii) Describe how the bonds in this molecule form.

Use ideas about electrons in your answer.

.....

..... [1]

(iii) State the formula of methane.

..... [1]

(b) During the complete combustion of methane, two gases are produced.

Gas **A** changes blue cobalt(II) chloride paper to pink.

Gas **B** turns limewater milky.

(i) Identify the gas in the air which is required for the complete combustion of methane.

..... [1]

(ii) Identify gas **A** and gas **B**.

gas **A** .....

gas **B** .....
[2]

(c) Methane is a common component of refinery gas.

(i) Name the mixture from which refinery gas is separated.

..... [1]

(ii) Name the process by which refinery gas is separated.

..... [1]

(iii) Identify **one** use for refinery gas.

..... [1]

[Total: 9]

[Turn over

9 **(a)** In the box in Fig. 9.1, draw the arrangement of particles in a gas. One particle has been drawn for you.

Draw 6 more particles.

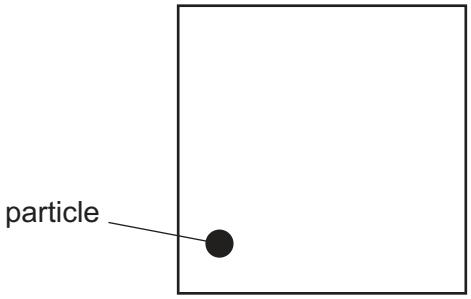

Fig. 9.1

[1]

(b) Fig. 9.2 shows an extractor fan in the wall of a bathroom. The extractor fan has a small lamp to show when it is switched on.

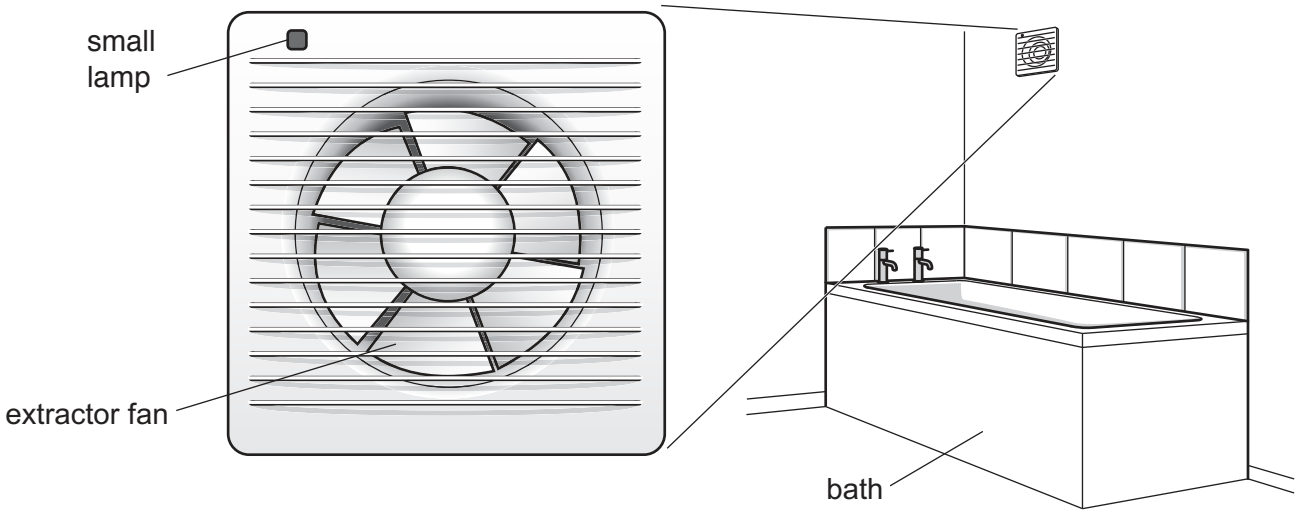

Fig. 9.2

The extractor fan is used to remove damp (wet) air from the bathroom.

(i) Hot water in the bath makes the air in the bathroom damp.

Name the process that occurs at the surface of the water in the bath to make the air in the bathroom damp.

..... [1]

(ii) Explain why this process cools the remaining water in the bath.

.....

.....

..... [2]

(c) The circuit for the extractor fan contains:

- an electric motor to turn the fan
- the small lamp connected in parallel with the electric motor
- one switch to control both the electric motor and the small lamp
- one fuse to protect both the electric motor and the small lamp.

Fig. 9.3 shows an incomplete circuit diagram for the extractor fan.

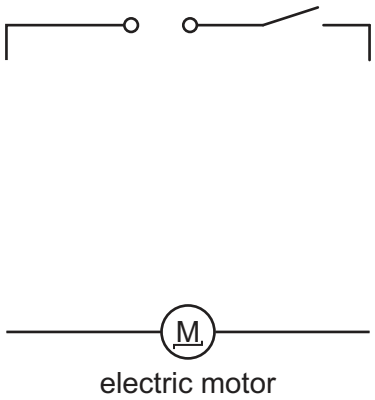

Fig. 9.3

On Fig. 9.3, complete the circuit diagram with:

- the small lamp
- the fuse. [4]

(d) The resistance of the electric motor is 3000 Ω.

The current in the motor is 0.08 A.

Calculate the potential difference across the motor. State the unit of your answer.

potential difference = ... unit ..... [3]

[Total: 11]

The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	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 –		114 Fl flerovium –		116 Lv livermorium –		

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.).