Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

5551988657

COMBINED SCIENCE **0653/43**

Paper 4 (Extended) **October/November 2018**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.
A copy of the Periodic Table is printed on page 24.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **21** printed pages and **3** blank pages.

CAMBRIDGE International Examinations

1 **(a)** Fig. 1.1 is a diagram of a cell which lines the human airway.

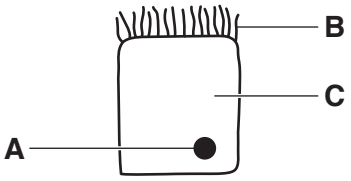


Fig. 1.1

Table 1.1 shows the names and functions of parts of the cell shown in Fig. 1.1.

Complete Table 1.1.

Table 1.1

letter	name	functions
A	nucleus	controls the activities of the cell
B		
C		

[4]

(b) Fig. 1.2 shows a drawing of a wind-pollinated flower.

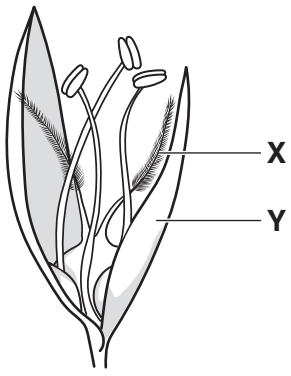


Fig. 1.2

(i) Describe how the structure of **X** is adapted to its function.

.....

.....

.....[2]

(ii) Structure **Y** is not brightly coloured.

Explain why a bright colour is not necessary for structure **Y**.

.....

.....

.....[2]

2 **(a)** Carbon dioxide is a product of the thermal decomposition of calcium carbonate.

(i) Complete the dot-and-cross diagram of a molecule of carbon dioxide to show the bonding electrons between atoms.

O C

[2]

(ii) Name this type of chemical bonding.

.....[1]

(iii) Describe a chemical test for carbonate ions in an aqueous solution.

State the observations that show a positive result.

test:

step 1 .....

step 2 .....

observations .....

.....

[2]

(iv) The thermal decomposition of calcium carbonate is an endothermic change.

Describe what is meant by *endothermic*.

Use ideas about chemical energy and heat (thermal energy) in your answer.

.....

.....[1]

(b) The atomic number of calcium is 20.

(i) Complete Fig. 2.1 to show the electronic structure of a calcium atom.

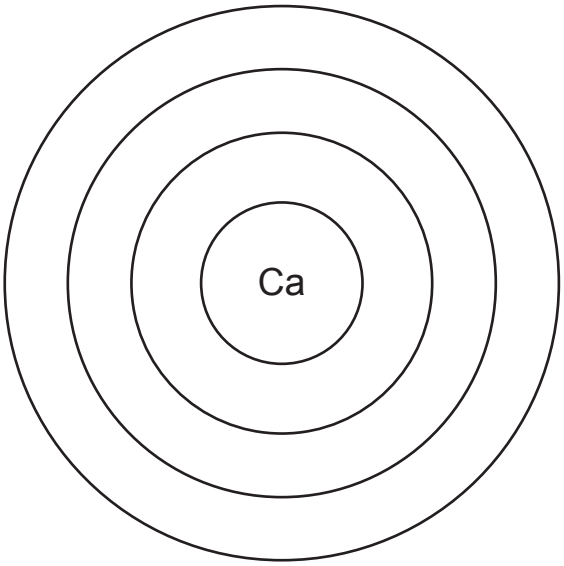


Fig. 2.1

[1]

(ii) The symbol of a calcium ion is Ca^{2+}.

Describe, in terms of electrons, how this ion is formed from a calcium atom.

.....

.....[2]

3 Fig. 3.1 shows a man pushing a shopping trolley.

Fig. 3.1

Fig. 3.2 shows a speed–time graph of the trolley as the man pushes it to the checkout.

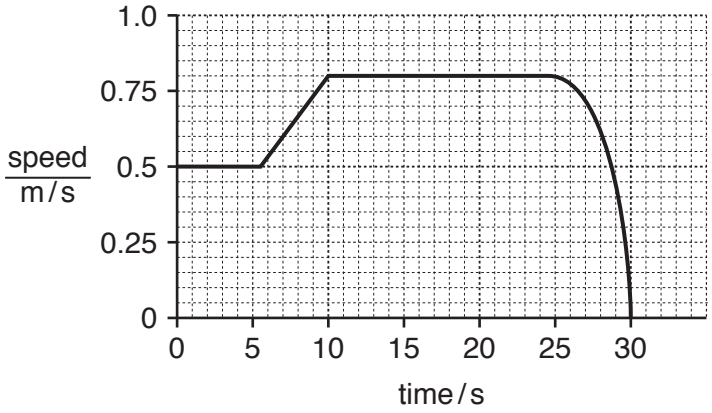


Fig. 3.2

(a) (i) On Fig. 3.2, label with a letter **C** a point in the journey when the trolley is travelling with constant acceleration. [1]

(ii) The trolley travels 20 m to the checkout.

Use information from the graph to calculate the average speed of the trolley on this journey.

Show your working.

average speed = ... m / s [2]

(b) Fig. 3.3 shows the four forces acting on the trolley as it moves.

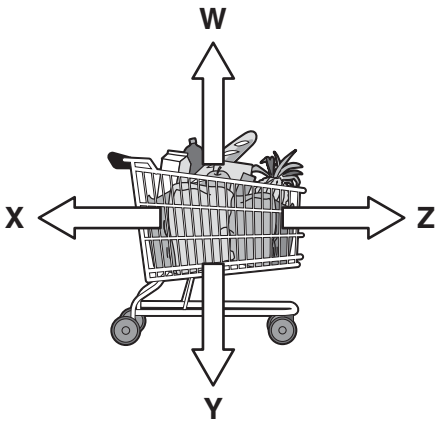


Fig. 3.3

(i) State the letter corresponding to the force exerted by the man on the trolley.

.....[1]

(ii) Use Fig. 3.2 to describe how the relative sizes of forces **X** and **Z** change between 20 s and 30 s.

.....

.....[2]

(c) The man provides the energy to push the trolley to the checkout. The trolley and its contents have a mass of 20 kg.

Calculate the kinetic energy of the trolley between 10 s and 25 s.

State the formula you use and show your working.

formula

working

kinetic energy = ... J [2]

(d) As the trolley is moved to the checkout, 2400 J is required to do work against forces resisting the motion.

The efficiency of the man's body providing this energy to the trolley is 20%.

Calculate the total energy used by the man's body to do this work.

State the formula you use and show your working.

formula

working

energy = ... J [2]

BLANK PAGE

4 Rainforest is often cleared for agriculture by cutting down the trees and burning them. This process is called 'slash and burn'. The burning of the trees produces a smoky haze made from very small carbon particles suspended in the air.

Fig. 4.1 is a picture of clearing land by slash and burn.

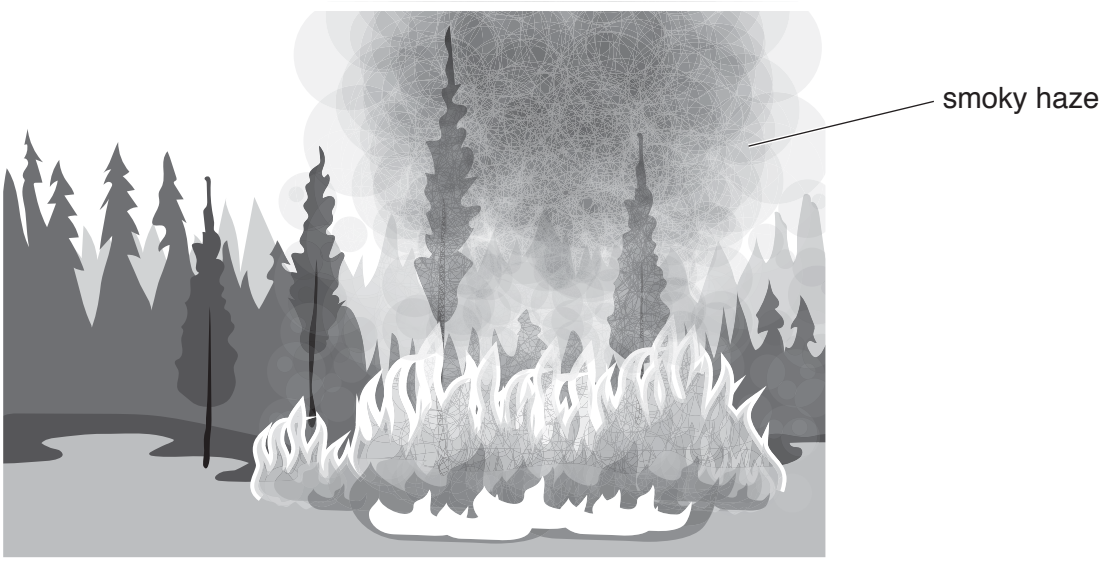


Fig. 4.1

(a) Suggest how the gas exchange system of a human could be affected by inspiring a large volume of the air containing the carbon particles.

.....

.....[1]

(b) **(i)** Some of the suspended carbon particles land on the leaves of crops and trees covering them with a thin layer of carbon.

Suggest **and** explain how this layer of carbon affects the function of chlorophyll in the leaves.

.....

.....

.....

.....[3]

(ii) The concentration of oxygen in the atmosphere decreases in the area where slash and burn is taking place.

Suggest **two** reasons why this happens.

1. .....

.....

2. .....

.....

[2]

(c) Some human activities cause the concentration of carbon dioxide in the atmosphere to increase.

Use words or phrases from the list to complete the sentences about how this can affect the environment.

Each word or phrase may be used once, more than once or not at all.

acid rain **argon** **gamma** **global warming** **infra-red**

methane **nitrogen** **oxygen** **ultraviolet**

Greenhouse gases such as carbon dioxide and ..... absorb ..... radiation given out from the Earth.

When the concentration of carbon dioxide in the atmosphere increases, more of this radiation is absorbed and eventually released into the atmosphere. This increases ..... .

[3]

5 (a) A student investigates the reactivities of four metals, **A**, **B**, **C** and **D**.

He uses pieces of metal which are the same size.

A gas is produced when the metals react with dilute hydrochloric acid.

He uses the apparatus shown in Fig. 5.1 to measure the time taken to collect 25 cm^3 of the gas.

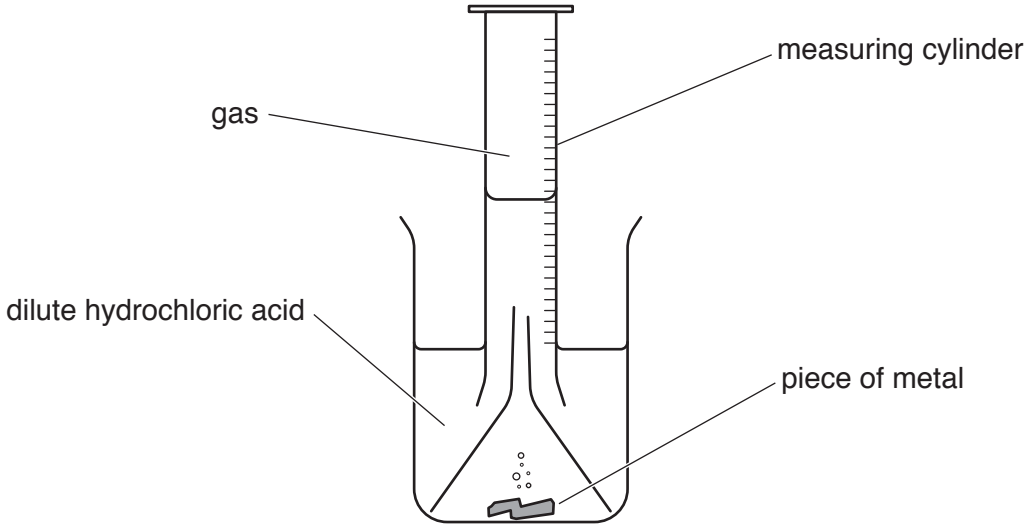


Fig. 5.1

The results of the investigation are shown in Table 5.1.

Table 5.1

metal	time / s
A	25
B	115
C	73
D	305

(i) Using letters **A**, **B**, **C** and **D**, state the order of reactivity of these metals, from most reactive to least reactive.

..... most reactive

.....

.....

..... least reactive

[1]

(ii) Describe and explain the effect of increasing the temperature on the rate of a reaction.

Use ideas about particle movement and particle collisions in your answer.

effect .....

explanation .....

.....

.....

.....

[3]

(b) Iron is extracted from iron ore by reduction in a blast furnace.

Limestone is added to the blast furnace to separate impurities from the iron.

(i) Name **two other** raw materials which are added to the blast furnace.

1. .....

2. .....

[2]

(ii) Explain what is meant by *reduction*.

.....

.....[1]

(c) Aluminium cannot be extracted from its ore by reduction in a blast furnace.

(i) Explain why reduction in a blast furnace cannot be used to extract aluminium from its ore.

.....

.....[1]

(ii) Name the method of extraction of aluminium from its ore.

.....[1]

6 **(a)** The density of water, a liquid, is very different from the density of steam, a gas.

Explain in terms of distances and forces between molecules, and their motion, why the density of water is so much greater than the density of steam.

.....

.....

.....

.....[3]

(b) Fig. 6.1 shows an insulated container of boiling water left to cool on a balance.

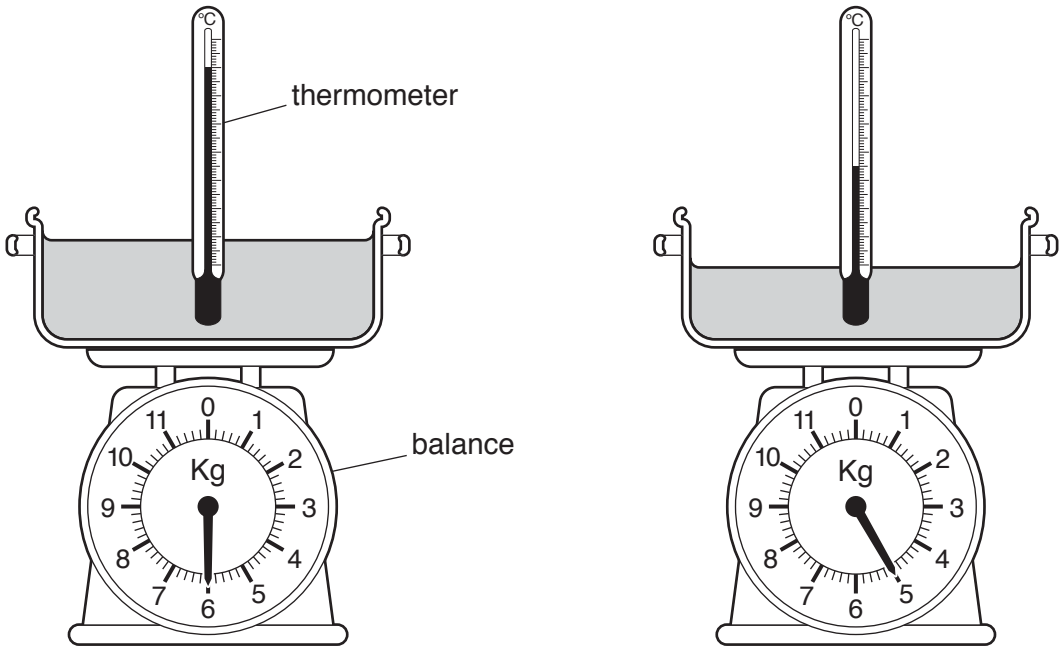


Fig. 6.1

After several hours, the reading on the scale of the balance is shown in Fig. 6.1.

(i) Describe how the evaporation of water from the container is the cause of the cooling of the water.

.....

.....

.....

.....[2]

(ii) The experiment in Fig. 6.1 is repeated with the same volume of boiling water but using the insulated container shown in Fig. 6.2.

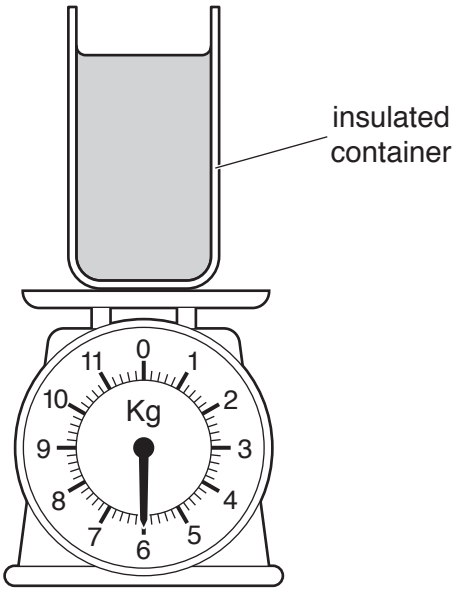


Fig. 6.2

Predict how the results of the second experiment will differ in terms of temperature change **and** mass loss compared with the first experiment.

Give a reason for your answer.

predictions .....

.....

reason .....

.....

[2]

(c) An observer is measuring the temperature of the water in the pan in **(b)**. He says the thermometer looks bent where it goes into the water. He says the thermometer bulb is at **X** on Fig. 6.3.

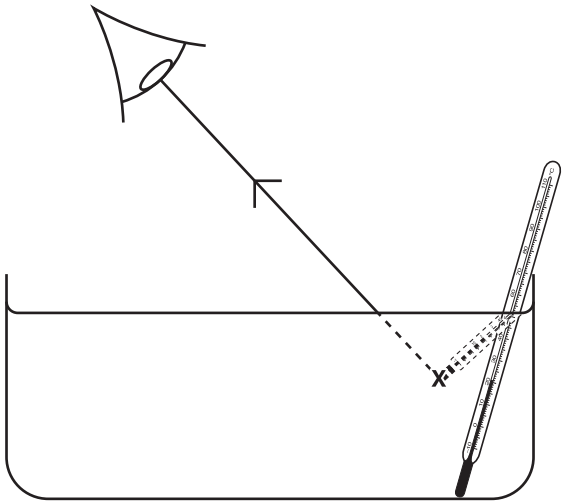


Fig. 6.3

(i) Rays of light change direction when they pass through the surface of the water.

Name this effect .....[1]

(ii) Fig. 6.3 shows where the observer thinks the ray is coming from.

On Fig. 6.3 complete the ray diagram to show where the ray is actually coming from. [1]

7 **(a)** Fig. 7.1 shows the external structures of the heart.

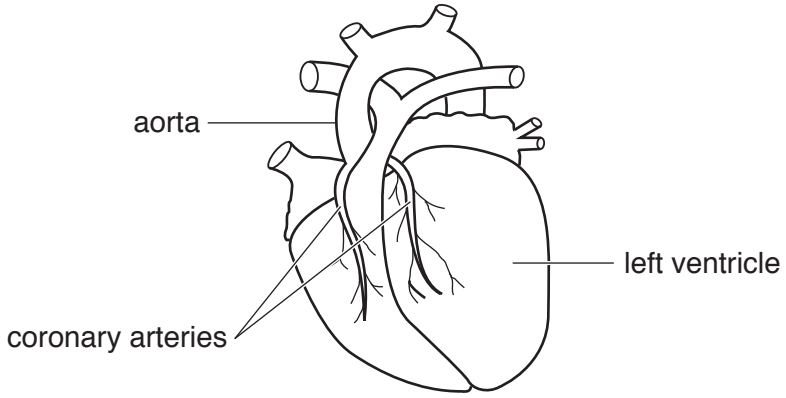


Fig. 7.1

(i) Describe the function of the coronary arteries.

.....

.....[2]

(ii) Coronary heart disease (CHD) occurs when the coronary arteries become narrow.

Describe what causes the narrowing of the arteries.

.....[1]

(iii) Describe **two** ways in which a person can reduce the risk of developing CHD.

1. .....

2. .....

[2]

(b) During exercise energy is released in the muscles by aerobic respiration.

(i) State the balanced symbol equation for aerobic respiration.

.....[2]

(ii) State how the energy released by respiration is used by the muscles.

.....[1]

(iii) State **two** reasons why an increased heart rate is needed for respiration in the muscles during exercise.

1. .....

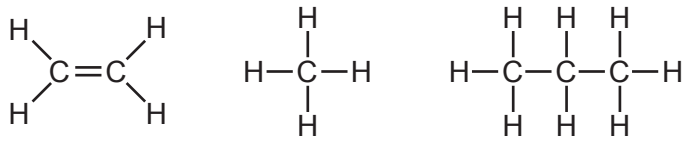
.....

2. .....

.....

[2]

8 Fig. 8.1 shows the structures of three hydrocarbon molecules, **A**, **B**, and **C**.



A **B** **C**

Fig. 8.1

(a) **(i)** Name hydrocarbons **A** and **B**.

A .....

B .....
[2]

(ii) Describe the changes, if any, that are observed when bromine water is added separately to samples of hydrocarbons **A** and **B**.

A .....

B .....
[2]

(iii) Deduce the balanced equation for the complete combustion of hydrocarbon **C**.

..... + ... ⟶ ..... + ... [2]

(b) Hydrocarbon **A** is made in process **Y**, as shown in Fig. 8.2.

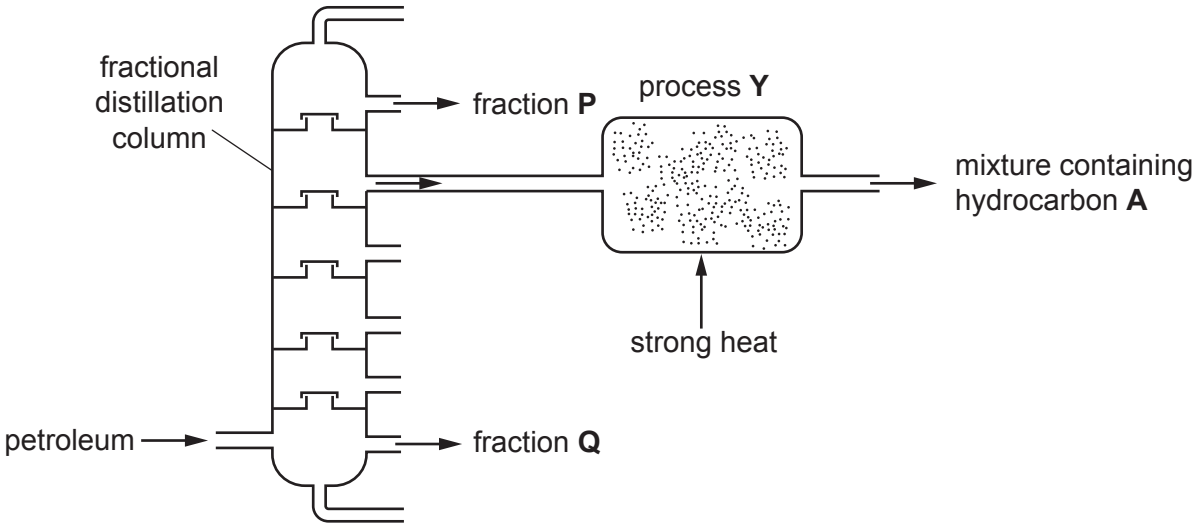


Fig. 8.2

(i) Name process **Y**.

.....[1]

(ii) Describe the difference in the boiling points of fraction **P** and fraction **Q**.

Explain this difference in terms of the sizes of molecules and of intermolecular attractive forces.

difference .....

explanation .....

.....

.....
[2]

9 Fig. 9.1 shows a display refrigerator for storing cold drinks in a shop.

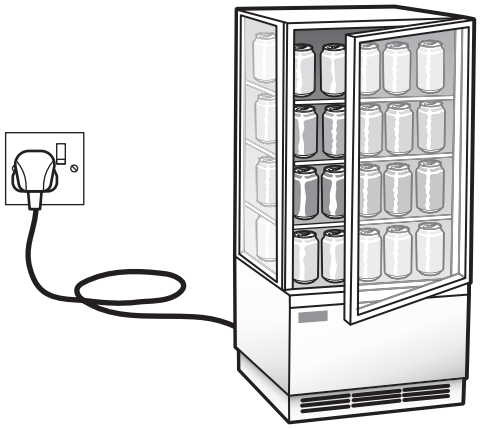


Fig. 9.1

The refrigerator uses electrical energy

- for a lamp to light up the inside of the refrigerator
- to power an electric motor to run the cooler in the refrigerator.

The circuit symbol for an electric motor is: 

Fig. 9.2 shows part of the circuit diagram for the refrigerator.

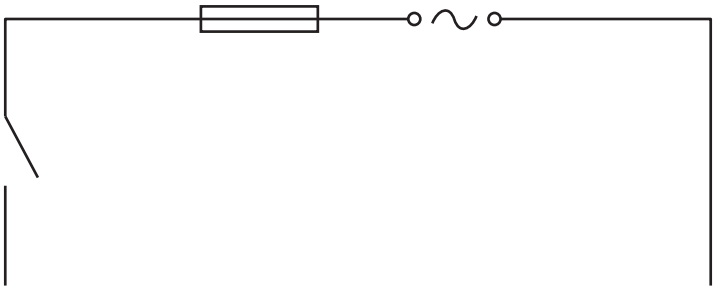
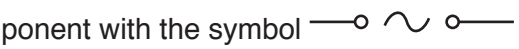


Fig. 9.2

(a) When the shop is closed, the lamp is switched off, but the electric motor needs to continue to run the refrigerator to keep the contents cool.

(i) On Fig. 9.2 complete the circuit diagram for the refrigerator that will allow the lamp to be switched off while the electric motor remains on. [3]

(ii) Name the circuit component with the symbol 

.....[1]

(b) The potential difference across the lamp is 240 V, and its power consumption is 40 W.

The potential difference across the motor is 240 V and its power consumption is 300 W.

Calculate the total current from the supply through the refrigerator.

State the formula you use and show your working.

formula

working

current = ... A [3]

BLANK PAGE

BLANK PAGE

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.).