Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

COMBINED SCIENCE **0653/32**

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.

DC (WW/CT) 338203/3

[Turn over

1 **(a)** Fig. 1.1 shows the alimentary canal and associated organs of a human.

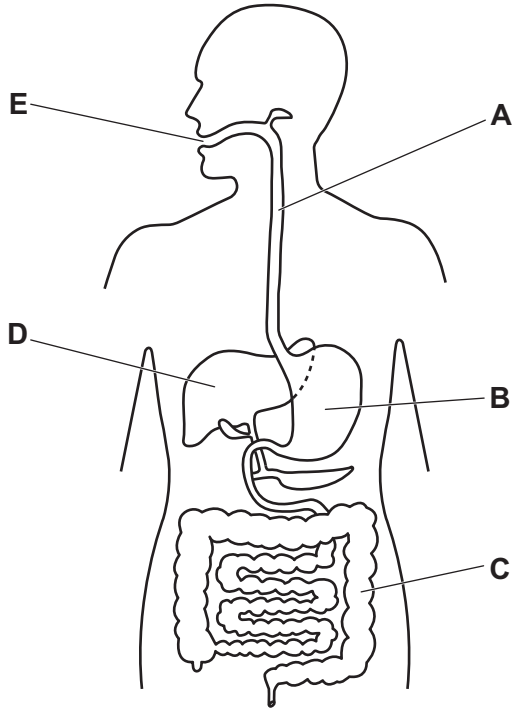

Fig. 1.1

(i) State the letter in Fig. 1.1 that identifies the:

liver .....

oesophagus. .....

[2]

(ii) Circle the function of the part labelled **E** in Fig. 1.1.

egestion **excretion** **ingestion** **reproduction**

[1]

(b) Enzymes are found in the alimentary canal.

(i) Complete the definition of enzymes.

Enzymes are ..... that function as

biological ..... .

[2]

(ii) Fig. 1.2 is a graph showing the effect of temperature on an enzyme.

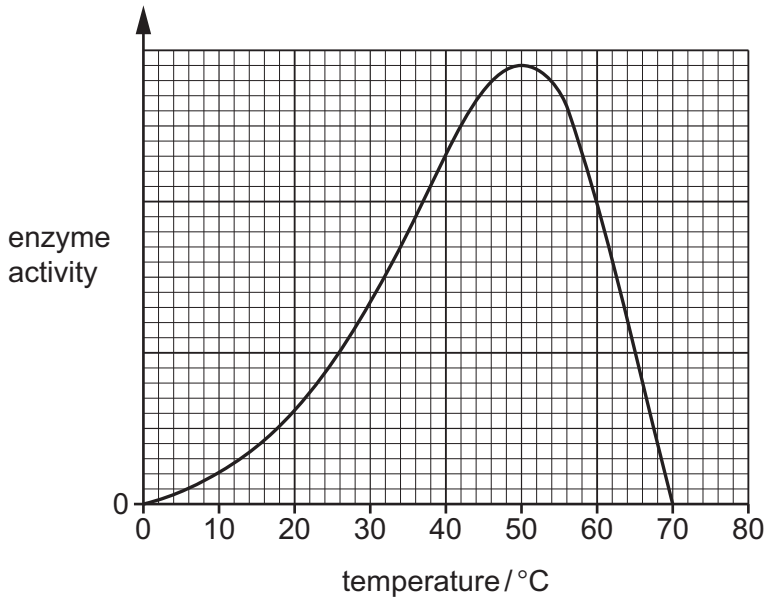

Fig. 1.2

Describe the effect of temperature on enzyme activity shown in Fig. 1.2.

Include data in your answer.

.....

.....

.....

..... [2]

(c) Fats are digested in the alimentary canal.

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

bread **cheese** **oranges** **tomatoes**

[1]

(ii) Use **two** words to complete the sentence.

The name of the test for fats is the ....

test.

[1]

[Total: 9]

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2 A student investigates the rate of reaction between pieces of calcium metal and dilute hydrochloric acid.

The mass is recorded every 30 s during the reaction.

Fig. 2.1 shows the apparatus.

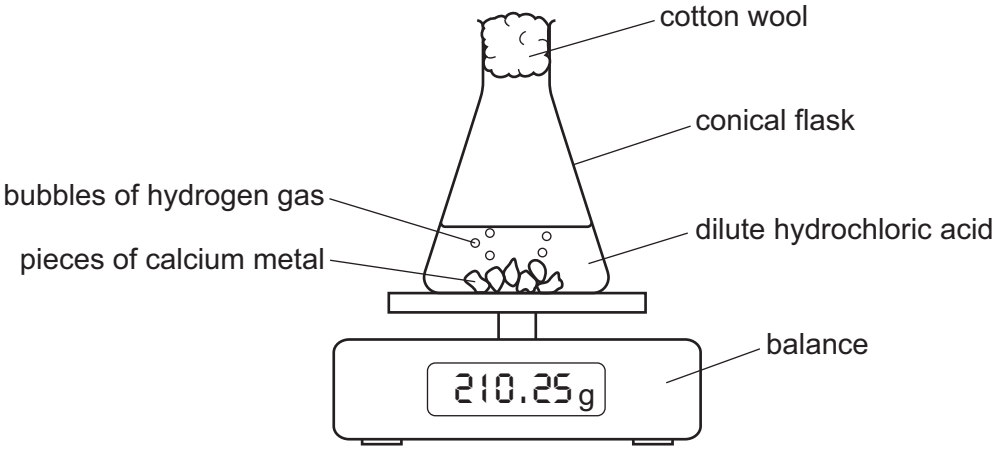


Fig. 2.1

(a) The reaction produces hydrogen gas.

(i) Complete the word equation for this reaction.

	+		→		+	hydrogen

[2]

(ii) Describe the test for hydrogen gas.

State the observation for the positive result.

test .....

observation .....

[2]

(iii) The conical flask becomes hot during the reaction.

State the term for chemical reactions that release heat.

..... [1]

(b) The student repeats the experiment using iron, magnesium and zinc instead of calcium.

The pieces of metal used are all the same size.

The dilute hydrochloric acid is in excess.

Table 2.1 shows the results.

Table 2.1

time / s	mass of conical flask + acid + metal / g			
	calcium	iron	magnesium	zinc
0	210.25	211.55	212.50	209.50
30	209.35	211.25	211.80	209.10
60	208.30	210.85	210.90	208.70
90	207.20	210.50	210.15	208.35
120	206.30	210.15	209.40	207.80

(i) Table 2.2 shows the change in mass for three of the metals.

Complete Table 2.2 by calculating the change in mass for zinc.

Table 2.2

metal	change in mass / g
calcium	3.95
iron	1.40
magnesium	3.10
zinc	

[1]

(ii) Use the information in Table 2.1 and Table 2.2 to identify the **least** reactive metal.

Explain your answer.

metal .....

explanation .....

.....

[2]

(c) Iron is a transition element.

(i) State **two** physical properties of iron.

1 .....

2 .....

[2]

(ii) Iron is used to make alloys.

Suggest why alloys are used instead of pure metals.

.....

..... [1]

[Total: 11]

3 **(a)** Fig. 3.1 shows the electrical symbol for a circuit component.

Fig. 3.1

State the name of the component.

..... [1]

(b) Fig. 3.2 shows a circuit used to determine the resistance of resistor **X**.

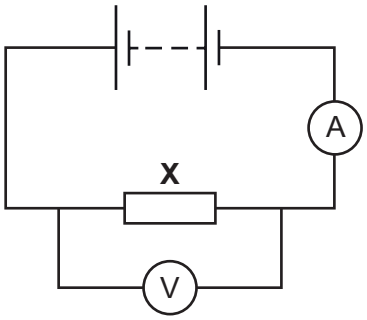


Fig. 3.2

The reading on the ammeter is 0.16A.

The reading on the voltmeter is 2.4V.

Calculate the resistance of resistor **X**.

Give the unit of your answer.

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

(c) (i) Resistor **Y** is connected in series with resistor **X**, as shown in Fig. 3.3.

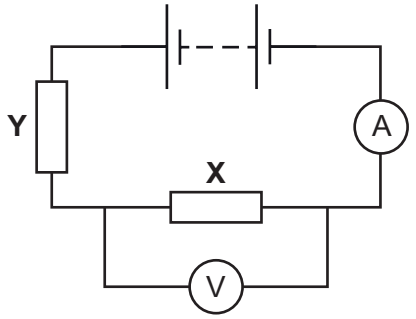


Fig. 3.3

Describe how the reading on the ammeter in Fig. 3.3 compares with the reading on the ammeter in **(b)**. Give a reason for your answer.

reading .....

reason .....

.....

[1]

(ii) Resistor **Y** is now connected in parallel with resistor **X**, as shown in Fig. 3.4.

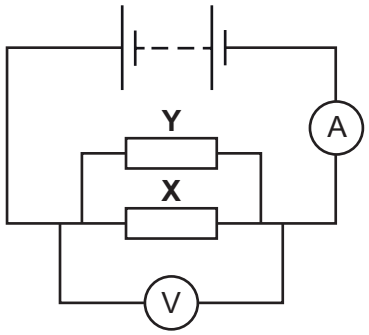


Fig. 3.4

Describe how the reading on the ammeter in Fig. 3.4 compares with the reading on the ammeter in **(b)**. Give a reason for your answer.

reading .....

reason .....

.....

[2]

[Total: 7]

4 **(a)** Fig. 4.1 is a diagram of the circulatory system in humans where the arrows show the direction of blood flow.

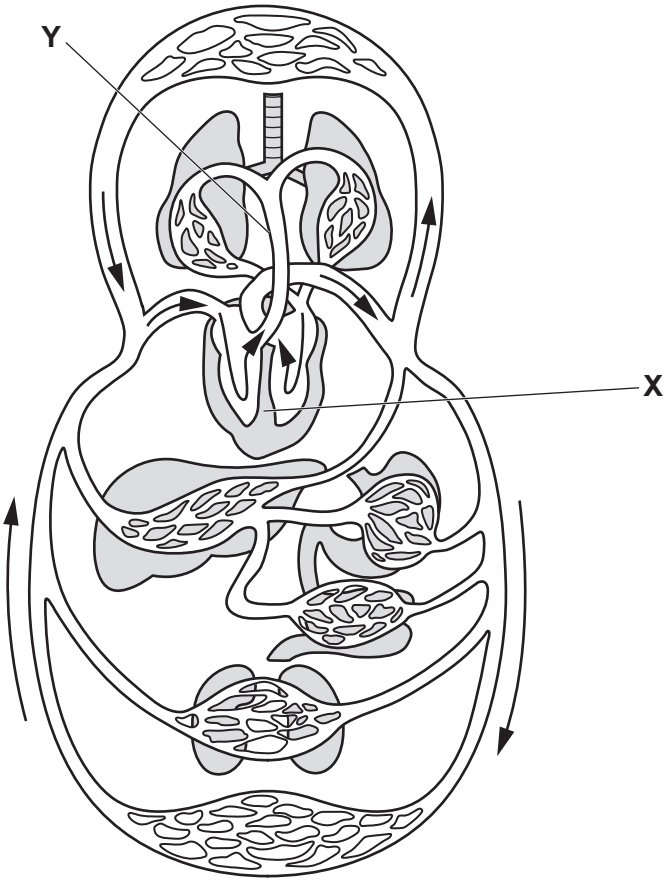


Fig. 4.1

(i) Identify the part of the heart labelled **X** in Fig. 4.1.

..... [1]

(ii) A student states that the part labelled **Y** in Fig. 4.1 is the pulmonary artery.

Describe evidence from Fig. 4.1 that supports this statement.

.....

.....

..... [2]

(iii) Describe what happens to the flow of blood through the circulatory system during increased physical activity.

.....

..... [1]

(b) Two components of blood are red blood cells and plasma.

State **one** similarity between the function of red blood cells and the function of plasma and **one** difference.

similarity .....

.....

difference .....

.....

[2]

(c) White blood cells are another component of blood.

(i) State the name of **one** structure found in a plant cell but **not** found in a white blood cell.

..... [1]

(ii) Describe how water moves into a cell.

.....

.....

..... [2]

[Total: 9]

5 **(a)** Complete the sentences about air.

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

compound **methane** **mixture** **nitrogen** **oxygen**

- Air is a ..... .
- The gas with the largest percentage in clean air is ..... .
- 21% of clean air is ..... .

[3]

(b) Fig. 5.1 shows models of the molecular structures of two air pollutants, **A** and **B**.

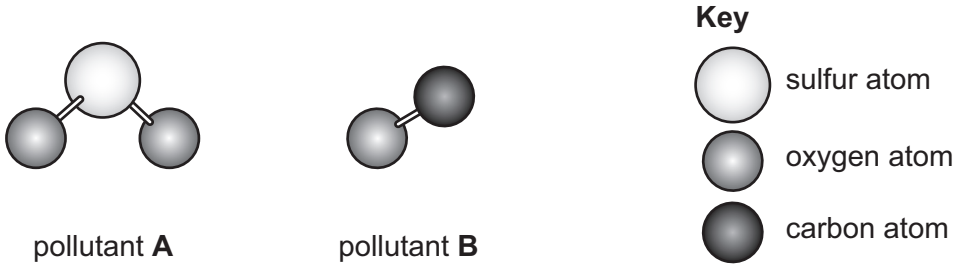


Fig. 5.1

(i) State the name of pollutant **A**.

..... [1]

(ii) Pollutant **B** is carbon monoxide.

State **one** effect of carbon monoxide on human health.

..... [1]

(c) Methane is a greenhouse gas.

Fig. 5.2 shows the molecular structure of methane.

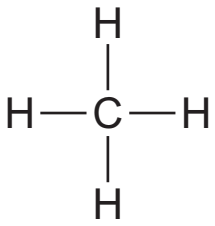


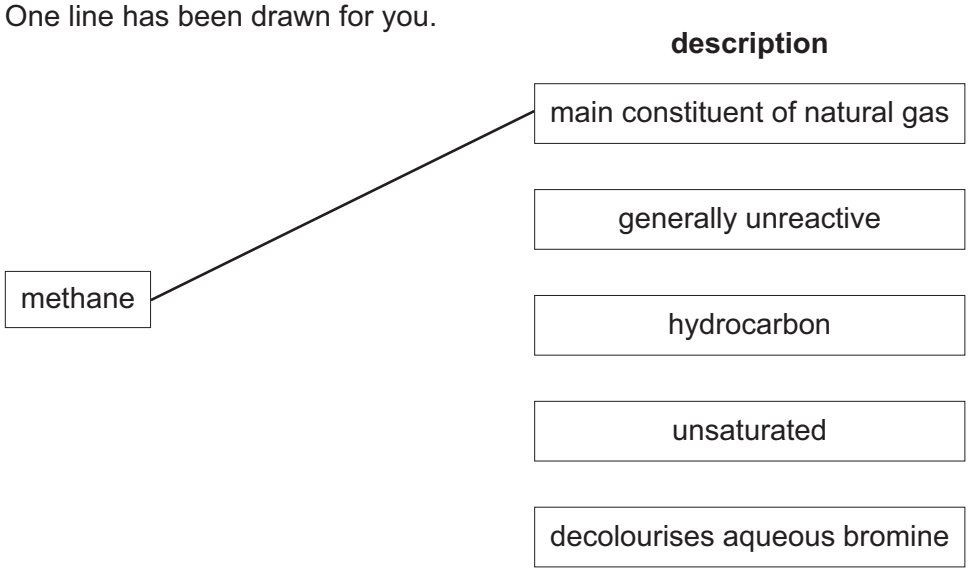
Fig. 5.2

(i) State the group of hydrocarbons to which methane belongs.

..... [1]

(ii) Draw lines to show which descriptions are true for methane.

One line has been drawn for you.



[2]

(iii) Complete the dot-and-cross diagram in Fig. 5.3 to show the bonding in a methane molecule, CH_4.

Show **all** the outer shell electrons.

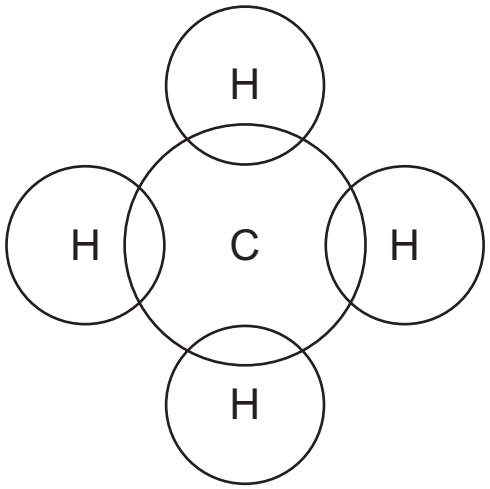


Fig. 5.3

[1]

[Total: 9]

6 Fig. 6.1 shows a horse pulling a cart along a flat, horizontal road.

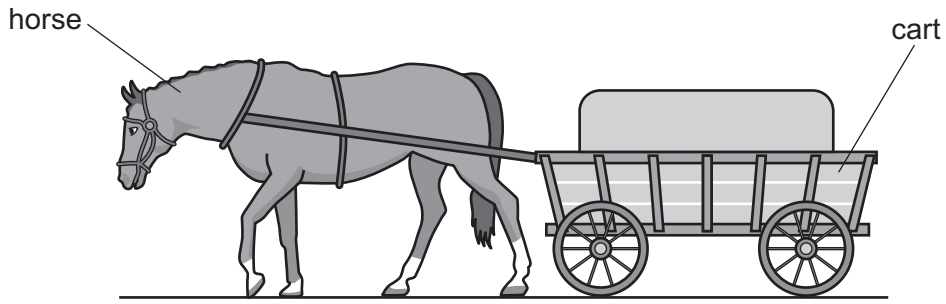


Fig. 6.1

The horse and cart move forward at a constant speed of 3.2 km / h.

(a) Complete the sentences about the horse using **one** word in each gap.

The horse is moving at constant speed, so the ..... energy of the horse must be constant.

The horse is moving along a flat, horizontal road, so the ..... potential energy of the horse must be constant.

The ..... of the horse is related to the work done by the horse and the time taken to do the work.

[3]

(b) Calculate the time taken, in hours, for the horse and cart to move a distance of 4.0 km.

time = ... h [2]

(c) The horse pulls the cart forward with constant force **F**.

Fig. 6.2 shows force **F** acting on the cart.

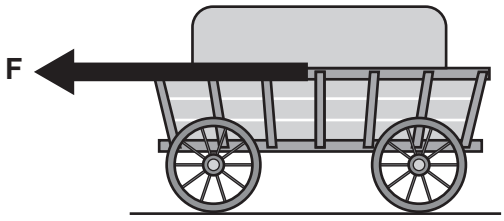


Fig. 6.2

Force **F** keeps the cart moving at constant speed.

Suggest why force **F** does **not** increase the speed of the cart.

.....

.....

..... [2]

(d) The hearing range of the horse is different from the hearing range of a healthy human.

The range of audible frequencies for the horse is 55 Hz to 33.5 kHz.

(i) State what is meant by a frequency of 55 Hz.

.....

..... [1]

(ii) Use data to describe how the hearing range of the horse is different from the hearing range of a healthy human.

.....

.....

.....

..... [2]

[Total: 10]

7 Plants manufacture carbohydrates by the process of photosynthesis.

The carbohydrates are then stored as starch in the leaves.

(a) Three plants of the same type, **A**, **B** and **C**, are placed in different conditions.

After two days, a leaf from each plant is tested with iodine solution.

Table 7.1 shows the results.

Table 7.1

plant	conditions	colour of iodine solution
A	carbon dioxide available but no light	orange
B	carbon dioxide and light available	blue-black
C	light available but no carbon dioxide	orange

(i) Explain why the result for plant **B** is different from the results for plants **A** and **C**.

.....

.....

.....

..... [2]

(ii) Plants need chlorophyll for photosynthesis.

Circle the mineral ion needed by plants for making chlorophyll.

calcium **magnesium** **potassium** **sodium** **zinc**

[1]

(iii) Water is a raw material for photosynthesis.

Complete these sentences about the movement of water in a plant.

- Water enters the roots through root ..... cells.
- Water is transported from the roots to the leaves in ..... vessels.
- Water is then lost from the leaves through pores (holes) called ..... .

[3]

(b) Plants are the producers in a food chain.

Fig. 7.1 shows information about organisms in one food chain.

- butterflies feed on parts of flowers
- frogs eat the butterflies
- herons eat the frogs

Fig. 7.1

(i) Construct a food chain using **all** the organisms in Fig. 7.1.

..... [2]

(ii) Identify the primary consumer in Fig. 7.1.

..... [1]

[Total: 9]

8 Fig. 8.1 shows apparatus for the electrolysis of dilute sulfuric acid using inert electrodes.

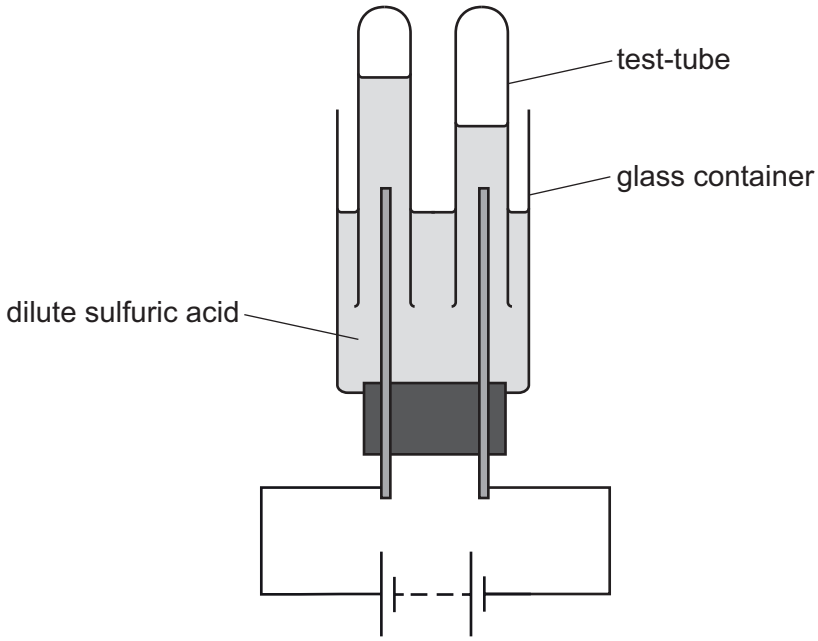


Fig. 8.1

(a) **(i)** Label the cathode on Fig. 8.1. [1]

(ii) State the name of the product formed at the:

positive electrode .....

negative electrode. .....
[2]

(iii) State the name of an element used to make inert electrodes.

..... [1]

(b) State the formula of sulfuric acid.

..... [1]

(c) Dilute sulfuric acid is the electrolyte in this electrolysis.

Complete the sentence about electrolytes.

Electrolytes must be in aqueous solution or ..... for electrolysis to occur.
[1]

[Total: 6]

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9 Fig. 9.1 shows a candle made of wax.

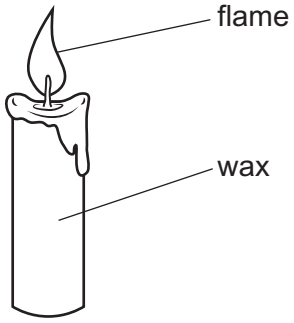

Fig. 9.1

(a) (i) On Fig. 9.1, draw and label a force arrow to show the weight of the candle. [1]

(ii) The mass of the candle is 12 g.

Calculate the weight of the candle.

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

weight = ... N [3]

(b) The flame of the candle emits visible light and infrared radiation.

Fig. 9.2 shows an incomplete electromagnetic spectrum.

On Fig. 9.2, write infrared in the correct place.

← increasing frequency						
gamma rays			visible light			

Fig. 9.2

[1]

(c) The candle is made of wax.

Wax melts at a temperature about half-way between room temperature (20 °C) and the boiling point of water.

Estimate the melting point of the wax. Show your working.

melting point = ... °C [2]

(d) When wax melts, the volume of the wax increases.

State the effect this has on the density of the wax.

Explain why the density changes in this way. Use ideas about particles in your explanation.

effect on density .....

explanation .....

.....

.....

[3]

[Total: 10]

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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.).