Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

COMBINED SCIENCE **0653/32**

Paper 3 Theory (Core) **February/March 2025**

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.
- Take the weight of 1.0 kg to be 9.8 N (acceleration of free fall = 9.8 m / s^2).

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. Any blank pages are indicated.

DC (PQ/FC) 344343/3

[Turn over

1 **(a)** Fig. 1.1 shows the main organs of the digestive system.

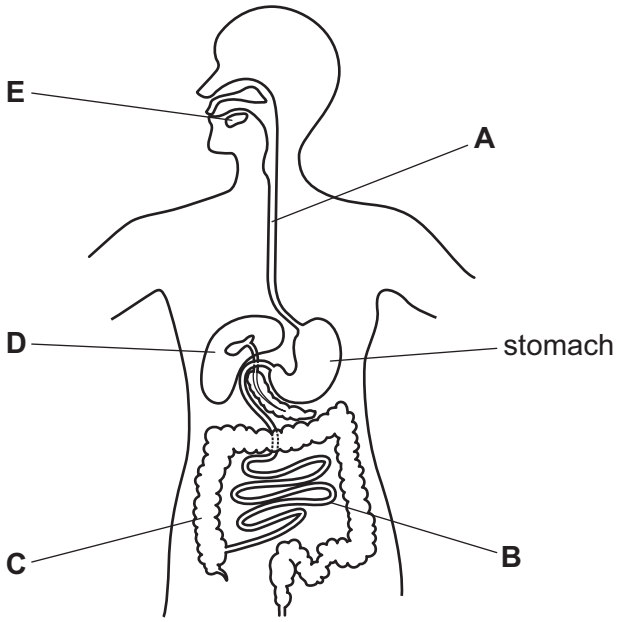

Fig. 1.1

State the letter on Fig. 1.1 that identifies:

the large intestine .....

the salivary gland. .....

[2]

(b) Proteins are digested in the stomach.

(i) Describe the importance of proteins as part of a balanced diet.

.....

..... [1]

(ii) Circle the name of the smaller molecules that proteins are made from.

amino acids **glucose** **fatty acids** **glycerol**

[1]

(c) Fig. 1.2 shows a food web that includes humans.

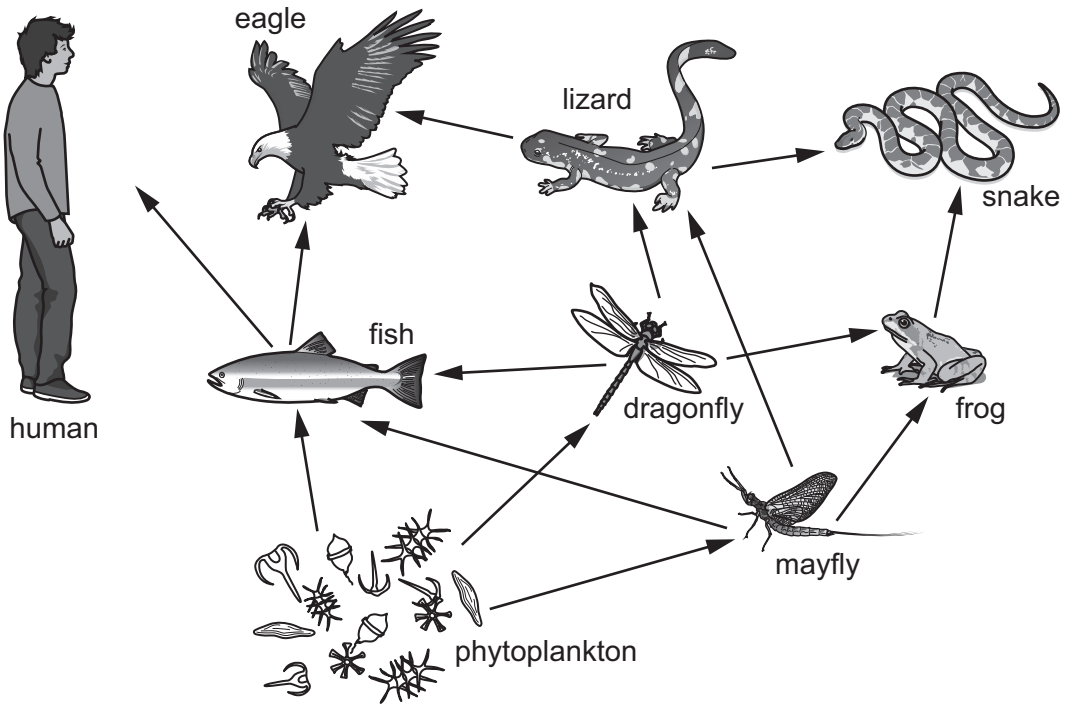

Fig. 1.2

(i) Identify the food source for the human in Fig. 1.2.

..... [1]

(ii) Identify the producer in Fig. 1.2.

..... [1]

(iii) Explain why the frog in Fig. 1.2 is a carnivore.

.....

..... [1]

(d) In some parts of the world, eagles are endangered.

Suggest **two** reasons why eagles may become endangered.

1 .....

.....

2 .....

.....

[2]

[Total: 9]

2 **(a)** Fig. 2.1 shows the structure of an insect-pollinated flower.

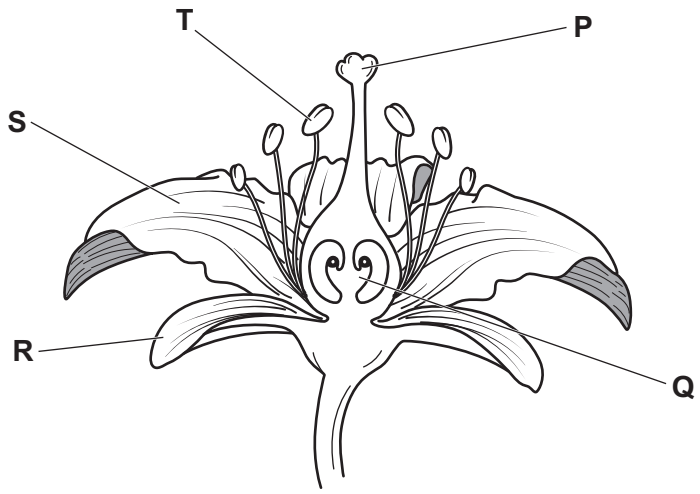

Fig. 2.1

The flower in Fig. 2.1 can self-pollinate. This means pollen grains made by the flower are used to pollinate the same flower.

Using letters **P**–**T**, complete these sentences about the flower in Fig. 2.1.

Pollen grains are made on the part labelled ..... .

Insects are attracted to the flower by the part labelled ..... .

The insects then transfer the pollen grains to the part labelled ..... .

[3]

(b) Pollen grains are the male gametes in plants.

State the name of the male gametes in humans.

..... [1]

(c) Some plant seeds are left to germinate in different conditions. All the seeds are given the same volume of water.

Table 2.1 shows the different conditions and the number of seeds that germinate.

Table 2.1

number of seeds	description of different conditions	number of seeds that germinate	percentage of seeds that germinate
40	warm temperature with light	38	95
40	warm temperature with **no** light	36	
40	cold temperature with light	2	5
40	cold temperature with **no** light	4	10

(i) Calculate the percentage of seeds that germinate in a warm temperature with **no** light.

percentage of seeds that germinate = ... [2]

(ii) Seeds need a suitable temperature to germinate, but they do **not** need light to germinate.

Describe evidence from Table 2.1 that supports this statement.

.....

.....

.....

..... [2]

(d) Plants take in water from the soil.

(i) State the name of the type of plant cells that absorb water from the soil.

..... [1]

(ii) Water moves into cells through a partially permeable membrane by a type of diffusion.

State the name of this type of diffusion.

..... [1]

[Total: 10]

3 **(a)** Blood contains different components.

(i) Circle the component of blood that transports urea and nutrients.

plasma **platelets** **red blood cells** **white blood cells**

[1]

(ii) State the type of blood vessels that return blood to the heart.

..... [1]

(iii) State the name of the structure that separates the left and right ventricles of the heart.

..... [1]

(b) Some pathogens are transmitted by direct contact through blood.

(i) Describe what is meant by pathogen.

.....

..... [1]

(ii) Describe **one** way that a pathogen is transmitted indirectly.

.....

..... [1]

(iii) Blood is one of the body's defences against pathogens.

State **one** of the body's other defences against pathogens.

..... [1]

(c) Blood transports oxygen to the muscles.

Complete these sentences.

Choose words from the list. You may use each word once, more than once or not at all.

breakdown **contraction** **division**

flow **release** **synthesise**

The muscles use oxygen to ..... energy from glucose by the process of aerobic respiration.

The energy is then used for muscle ..... to move the body.

[2]

[Total: 8]

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4 Lithium, sodium and potassium are elements in Group I of the Periodic Table.

(a) Melting point and boiling point are properties of the elements in Group I.

These properties show a trend down Group I.

State **two** other properties that show a trend down Group I.

1 .....

2 .....

[2]

(b) A mixture of sodium and potassium is used as a coolant in nuclear reactors.

(i) Circle the word that describes a mixture of metals.

alloy **brass** **compound** **element**

[1]

(ii) The melting point and boiling point of a mixture of sodium and potassium are shown in Table 4.1.

Table 4.1

	melting point / °C	boiling point / °C
mixture of sodium and potassium	–13	785

Room temperature is 25 °C.

Deduce whether the mixture of sodium and potassium is a solid, a liquid or a gas at room temperature.

Use Table 4.1 to explain your answer.

solid, liquid or gas .....

explanation .....

.....

[2]

(c) The arrangement of particles in an atom of lithium is shown in Fig. 4.1.

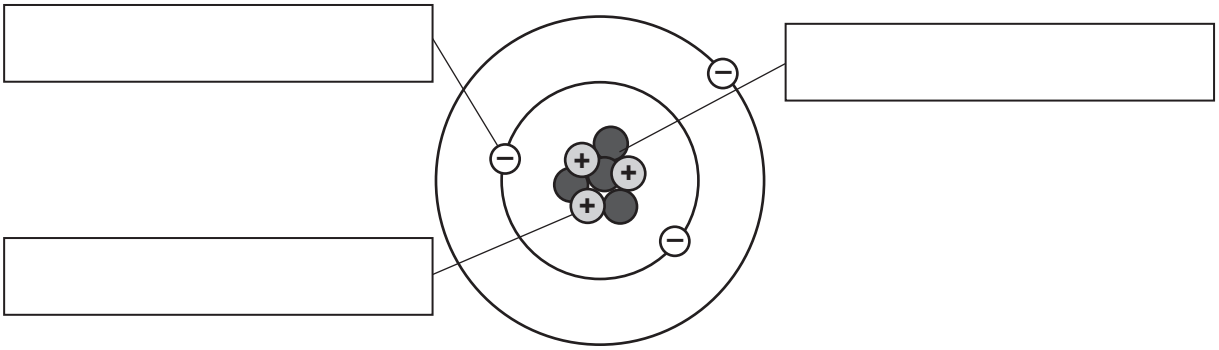

Fig. 4.1

Complete the labels in Fig. 4.1 with the name of each particle in the atom. [3]

[Total: 8]

5 Table 5.1 shows the percentage of gases in a sample of natural gas.

Table 5.1

gas	percentage
methane	83
ethane	9
propane	5
butane	2
nitrogen	0.5
other gases	

(a) (i) Use the data in Table 5.1 to calculate the percentage of other gases in the sample of natural gas.

percentage of other gases = ... [1]

(ii) State the named gas in Table 5.1 that is in clean air.

..... [1]

(b) Name the **two** products of the complete combustion of methane.

1 .....

2 .....

[2]

(c) Propane and butane are in the refinery gas fraction obtained from petroleum.

Tick (✓) **one** use of refinery gas.

added to water to kill microbes ☐

fuel used for heating and cooking ☐

fuel used in diesel engines ☐

used to make road surfaces ☐

[1]

(d) Fig. 5.1 shows the structure of ethane.

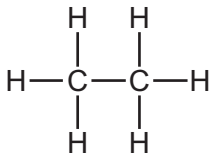

Fig. 5.1

(i) Use Fig. 5.1 to explain why ethane is a saturated molecule.

.....

..... [1]

(ii) State the number of electrons shared between the carbon atoms in a molecule of ethane.

..... [1]

[Total: 7]

6 Table 6.1 shows the products and observations at the electrodes in the electrolysis of three electrolytes.

Table 6.1

electrolyte	negative electrode		positive electrode	
	product	observation	product	observation
molten lead(II) bromide	lead	grey liquid	.....	bubbles of red-brown gas
concentrated aqueous sodium chloride	hydrogen	bubbles of colourless gas	chlorine	bubbles of green gas
dilute sulfuric acid	.....	bubbles of colourless gas	.....	bubbles of colourless gas

(a) Complete Table 6.1. [3]

(b) Explain why the mass of concentrated aqueous sodium chloride decreases during electrolysis.

.....

..... [1]

(c) Use Table 6.1 to explain why electrolysis is a chemical change.

.....

..... [1]

(d) Inert electrodes are used in each electrolysis.

Name **one** substance used as inert electrodes.

..... [1]

(e) State the name of the negative electrode.

..... [1]

(f) Electrolysis is an endothermic process.

State the meaning of endothermic.

.....

..... [1]

(g) Draw **one** straight line from each description to the correct substance.

description	substance
salt that contains ionic bonds	chlorine
compound with a pH less than 7	dilute sulfuric acid
Group VII element	hydrogen
	lead
	lead(II) bromide

[3]

[Total: 11]

7 An electric motor is connected to a battery. The motor lifts a mass through a vertical distance, as shown in Fig. 7.1.

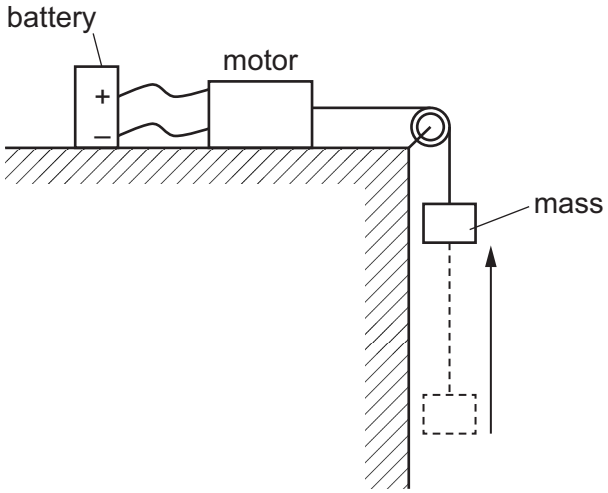

Fig. 7.1

(a) Fig. 7.2 shows a speed–time graph for the motion of the mass.

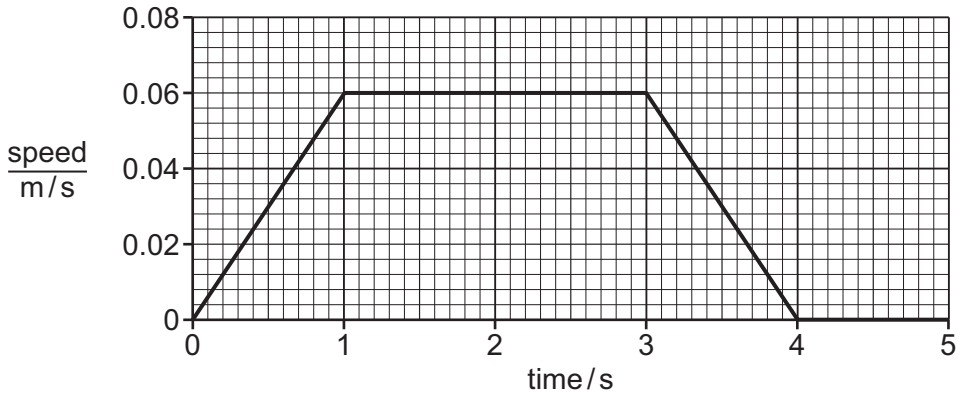

Fig. 7.2

Draw **one** straight line from each time to the correct description of the motion of the mass at that time.

time	**motion of the mass**
0.5 s	accelerating
2.5 s	at rest
4.5 s	moving at constant speed

[2]

(b) The mass is lifted through a vertical distance of 18 cm in a time of 4.0 s.

Calculate the average speed, in metres per second, of the mass.

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

(c) The mass is lifted through a vertical distance.

Complete the sentence about the main energy transfer that occurs.

The energy in the ..... store of the battery transfers to the

.... store of the mass.

[2]

(d) The power output of the motor is 80 W.

Calculate the energy output from the motor in 4.0 s.

energy = ... J [2]

[Total: 9]

8 **(a)** Fig. 8.1 shows three diagrams, **A**, **B** and **C**, of particles in the three states of matter.

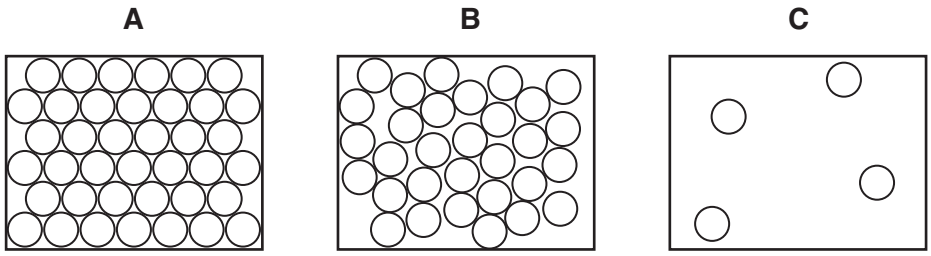

Fig. 8.1

(i) State which diagram, **A**, **B** or **C**, shows the particles in a gas.

Give **two** reasons for your answer.

diagram .....

reason 1 .....

reason 2 .....

[2]

(ii) Give the term for the change in state from a gas to a liquid.

..... [1]

(iii) Describe how the motion of particles in cold water is different from the motion of particles in hot water.

.....

..... [1]

(b) Table 8.1 shows the approximate frequency ranges for the different regions of the electromagnetic spectrum.

Table 8.1

gamma radiation	X-rays	ultraviolet	visible light	infrared	microwaves	radio waves
above 1.0×10^{19} Hz	1.0×10^{16} Hz to 1.0×10^{19} Hz	8.0×10^{14} Hz to 1.0×10^{16} Hz	4.0×10^{14} Hz to 8.0×10^{14} Hz	1.0×10^{11} Hz to 4.0×10^{14} Hz	1.0×10^{9} Hz to 1.0×10^{11} Hz	below 1.0×10^{9} Hz

(i) State the **colour** of visible light with the lowest frequency.

..... [1]

(ii) Identify the region of the electromagnetic spectrum which has waves with a frequency of 3.0×10^{9} Hz.

State **one** application for this region of the electromagnetic spectrum.

region .....

application .....
[2]

(iii) The speed of light is 3.0×10^{8} m/s.

Calculate the wavelength of visible light with a frequency of 5.0×10^{14} Hz.

wavelength = ... m [2]

[Total: 9]

9 A spacecraft travels through space from Earth to Mars.

(a) Earth and Mars are planets in the Solar System.

(i) State how many planets there are in the Solar System.

..... [1]

(ii) State the name of the galaxy that contains the Solar System.

..... [1]

(b) The spacecraft contains electrical equipment powered by batteries.

Suggest a suitable energy resource for recharging the batteries of the spacecraft in space.

..... [1]

(c) Fig. 9.1 shows a circuit diagram for an electrical circuit on the spacecraft.

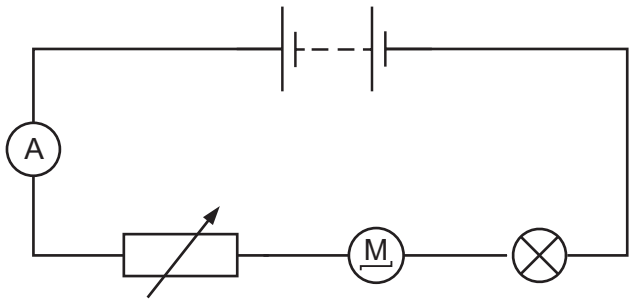

Fig. 9.1

(i) Name the component represented by the symbol shown.

..... [1]

(ii) On Fig. 9.1, draw a voltmeter connected to measure the voltage across the lamp. [2]

(iii) The voltage across the lamp is 6.5 V.

The reading on the ammeter is 1.3 A.

Calculate the resistance of the lamp.

resistance = ... Ω [2]

(iv) The resistance of the variable resistor in Fig. 9.1 is increased. The voltage across the variable resistor increases.

Explain why the voltage across the lamp decreases.

.....

..... [1]

[Total: 9]

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.).