GradeMax

Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

2939471867

COMBINED SCIENCE **0653/32**

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

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[Turn over

1 **(a)** The boxes on the left show the names of some structures found in cells.

The boxes on the right describe some functions of cell structures.

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

structure	function
	controls cell activities
nucleus	
	site of photosynthesis
vacuole	
	supports the cell

[2]

(b) Sperm cells are specialised animal cells.

(i) State the part of the human male reproductive system that produces sperm.

..... [1]

(ii) Fig. 1.1 shows an image of human sperm cells as seen with a light microscope.

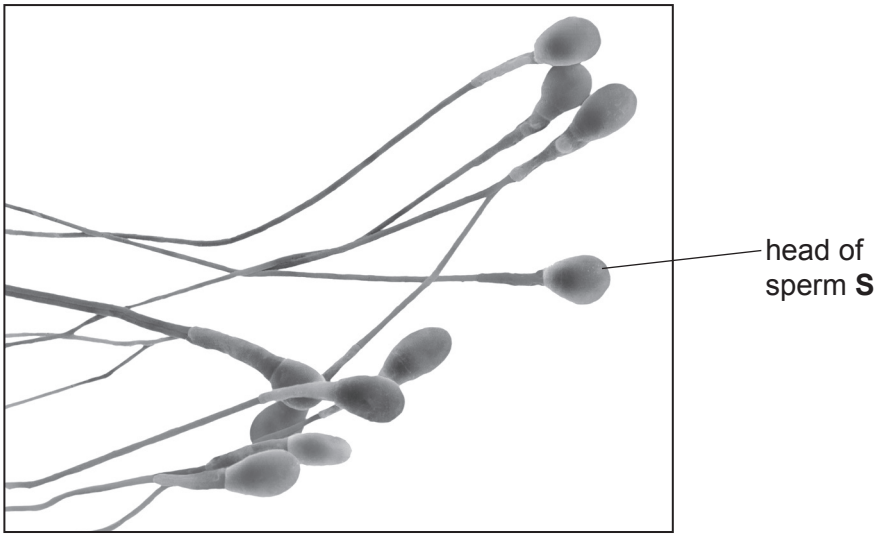


Fig. 1.1

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The head of sperm **S** in the image shown in Fig. 1.1 is 9 mm in length.

The magnification is ×2000.

Calculate the actual length of the head of sperm **S**.

actual length = ... mm [2]

(c) Sperm fertilise the ovum inside the human female reproductive system.

(i) State the site of fertilisation in the human female reproductive system.

..... [1]

(ii) Complete the sentences to describe the development of the fertilised ovum.

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

cervix **embryo** **gamete**

ovule **uterus** **vagina** **zygote**

The fertilised ovum is called the ..... .

This fertilised ovum divides into a ball of cells called the ..... .

The ball of cells then implants into the wall of the ..... .
[3]

[Total: 9]

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2 Lithium is an element in Group I of the Periodic Table.

(a) An atom of lithium is represented as shown.

$$^{7}_{3}\mathrm{Li}$$

Complete Table 2.1 to show the number of protons, electrons and neutrons in one atom of $^{7}_{3}\mathrm{Li}$.

Table 2.1

number of protons	number of electrons	number of neutrons

[2]

(b) Describe what happens when an atom of lithium becomes an ion of lithium.

.....

..... [1]

(c) Lithium reacts slowly with oxygen at room temperature to form lithium oxide.

This reaction is exothermic.

(i) Balance the symbol equation for this reaction.

$$\ldots\ldots\ \mathrm{Li} \quad + \quad \ldots\ldots\ \mathrm{O_2} \quad \rightarrow \quad \ldots\ldots\ \mathrm{Li_2O}$$

[1]

(ii) Circle the word that describes the reaction between lithium and oxygen.

decomposition **distillation** **neutralisation** **oxidation** [1]

(iii) Describe **one** observation that shows the reaction is exothermic.

.....

..... [1]

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(d) There is an alloy that contains lithium and aluminium only.

Tick (✓) **one** box to show which statement describes this alloy.

It contains one type of atom only. ☐

It is a mixture. ☐

It has the chemical properties of aluminium only. ☐

It has the physical properties of lithium only. ☐

[1]

(e) Aluminium is used to make cooking pans.

Suggest why lithium is **not** used to make cooking pans.

.....

..... [1]

(f) Recycling aluminium is cheaper than producing it from its ore.

Suggest **one other** reason why aluminium is recycled.

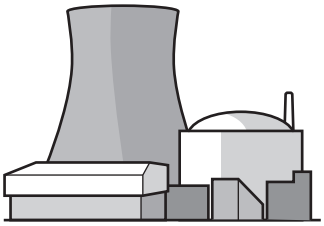
.....

..... [1]

[Total: 9]

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3 **(a)** Fig. 3.1 shows a nuclear power station.



nuclear power station

Fig. 3.1

State the process in the nuclear power station that releases energy from nuclear fuel.

..... [1]

(b) Fig. 3.2 shows four fuses connected to wires in a house.

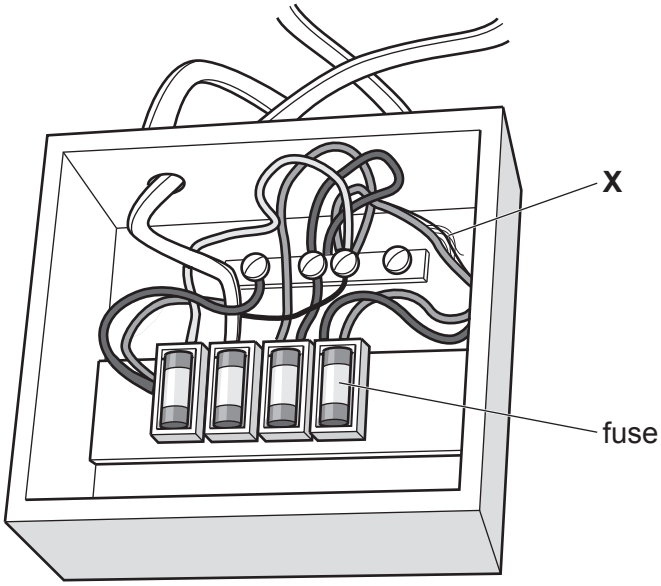


Fig. 3.2

(i) Draw the circuit symbol for a fuse.

[1]

(ii) State the purpose of a fuse in an electrical circuit.

.....

..... [1]

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(iii) Identify the electrical hazard labelled **X** in Fig. 3.2.

.....

..... [1]

(c) An electric kettle is used to boil water in a house.

The supply voltage to the house is 240 V.

The current in the kettle when switched on is 13 A.

(i) Calculate the resistance of the kettle.

Give the unit for your answer.

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

(ii) Fig. 3.3 shows a circuit diagram for the kettle and a lamp in the same room.

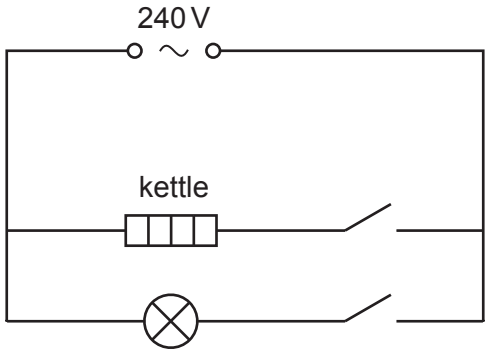


Fig. 3.3

When connected in parallel, the lamp and the kettle can be switched on and off independently. If one component breaks, the other component will still work.

When they are working correctly, the current in the lamp is 1 A and the current in the kettle is 13 A.

Explain why the kettle and the lamp must be connected in parallel and **not** in series for both to work correctly.

.....

.....

.....

..... [2]

[Total: 9]

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4 **(a)** Blood and blood vessels are part of the circulatory system in humans.

(i) State the component of blood involved in phagocytosis.

..... [1]

(ii) State the name of the blood vessel that transports blood from the heart to the lungs.

..... [1]

(iii) Blood transports hormones around the body.

Complete the sentences to describe hormones.

A hormone is a chemical substance produced by a ..... .

Hormones alter the activity of a specific ..... organ. [2]

(b) The circulatory system transports oxygen from the lungs to the rest of the body.

Fig. 4.1 shows the gas exchange system in humans.

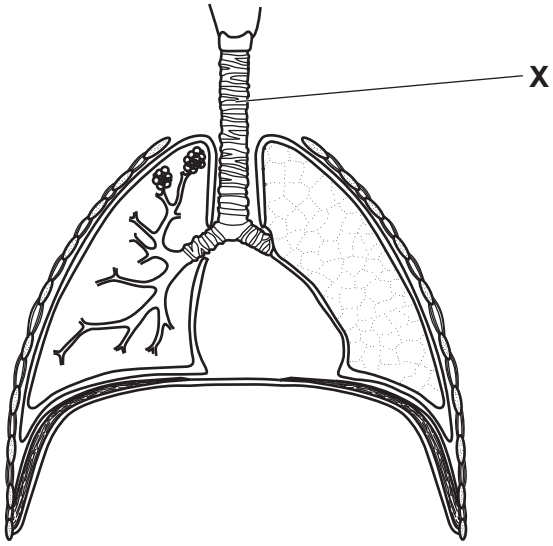


Fig. 4.1

(i) Identify the part labelled **X** shown on Fig. 4.1.

..... [1]

(ii) Draw a label line and the letter **D** to identify the diaphragm on Fig. 4.1. [1]

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(c) Water is transported through xylem vessels in plants from the roots to the leaves.

(i) Describe how the water **vapour** is lost from the leaves of plants.

.....

.....

..... [2]

(ii) State the effect of an increase in humidity on the rate of water loss from leaves.

..... [1]

[Total: 9]

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5 **(a)** Fig. 5.1 is a pie chart showing the composition of clean air.

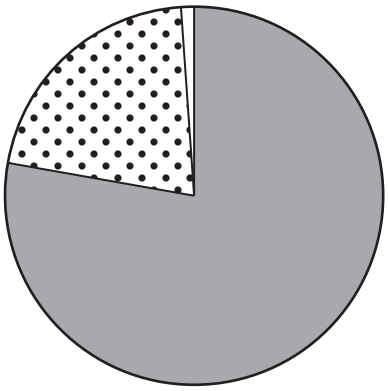


Fig. 5.1

Identify the gases in clean air by completing the key for the pie chart shown in Fig. 5.1.

Key



.....

.....

..... and

..... and

.....

[3]

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(b) Carbon monoxide and the oxides of nitrogen are common pollutants in air.

State **one** adverse effect that each of these air pollutants causes.

carbon monoxide .....

.....

oxides of nitrogen .....

.....

[2]

(c) Carbon dioxide is a gas.

(i) Carbon dioxide forms during the thermal decomposition of calcium carbonate. Calcium oxide is the other product.

Write the word equation for this reaction in the boxes.



[1]

(ii) Calcium carbonate reacts with dilute hydrochloric acid to form carbon dioxide.

Suggest a value for the pH of dilute hydrochloric acid.

pH = ... [1]

(d) Hydrogen chloride, H*Cl*, is a covalent molecule.

Complete Fig. 5.2 to show the dot-and-cross diagram for a molecule of hydrogen chloride. Show only the electrons in the outer shells.

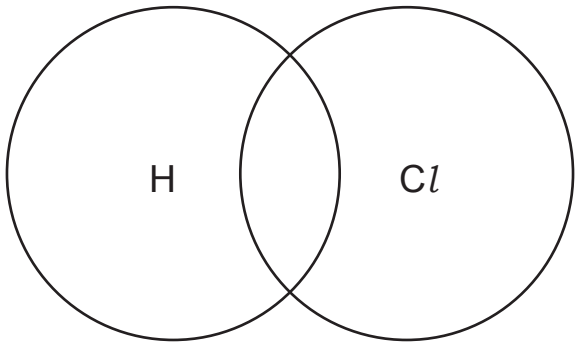


Fig. 5.2

[2]

[Total: 9]

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6 Fig. 6.1 shows the forces **P**, **Q**, **R** and **S** acting on a fishing boat at sea.

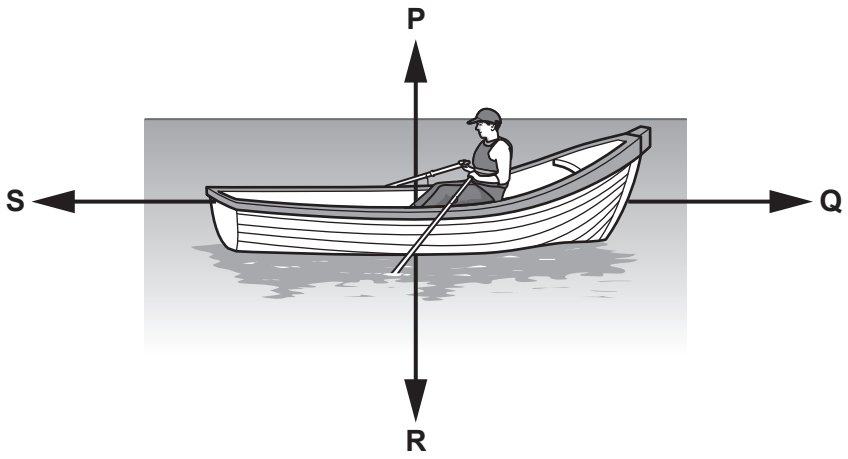


Fig. 6.1

(a) The boat in Fig. 6.1 is moving forward to the right at a constant speed.

(i) State which of the forces **P**, **Q**, **R** or **S** is moving the boat forward to the right.

..... [1]

(ii) State the name of the force labelled **R**.

..... [1]

(iii) Explain why force **Q** and force **S** must be equal and opposite.

.....

..... [1]

(b) Fig. 6.2 shows a person catching a fish.

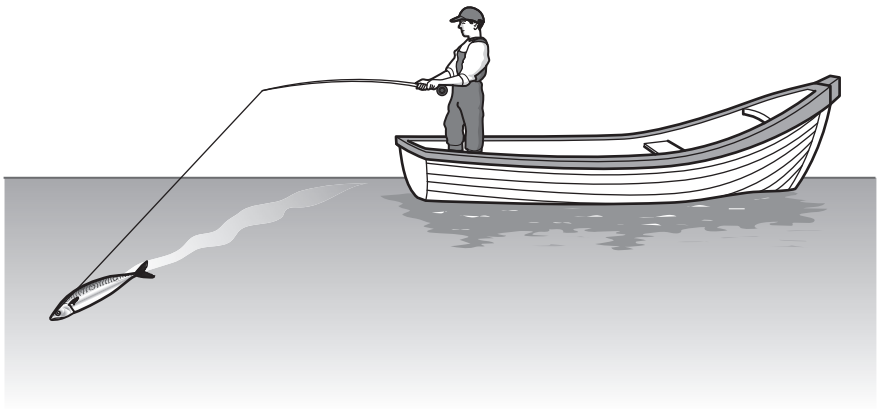


Fig. 6.2

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The fish exerts a force of 200 N on the fishing line as it tries to swim away. The person exerts a force of 250 N on the fishing line to pull the fish into the boat.

Determine the resultant force on the fish and the direction of the force.

force = ... N

direction of the force .....
[1]

(c) Fig. 6.3 shows a speed–time graph of the motion of the fish when the constant resultant force is applied.

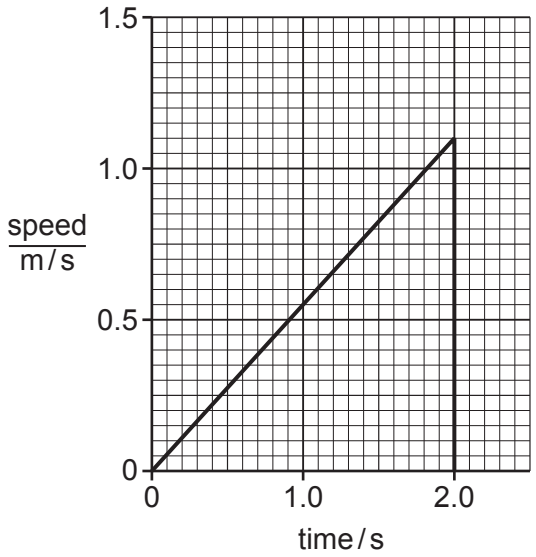


Fig. 6.3

(i) Describe the motion of the fish between t = 0 and t = 2.0 s.

.....

..... [1]

(ii) Describe what happens to the motion of the fish at 2.0 s.

.....

..... [1]

(d) The body temperature of the fish is 5 °C.

The fish is put into a bucket of ice at 0 °C.

(i) Describe the effect on the ice and the effect on the temperature of the fish.

effect on the ice .....

effect on the temperature of the fish .....
[2]

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[Turn over

(ii) The mass of the bucket is 2300 g.

The volume of ice added to the bucket is 5000 cm^3.

The total mass of the bucket and the ice is 6900 g.

Calculate the density of the ice.

density = ... g/cm^3 [3]

[Total: 11]

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7 **(a)** Fig. 7.1 shows part of the carbon cycle.

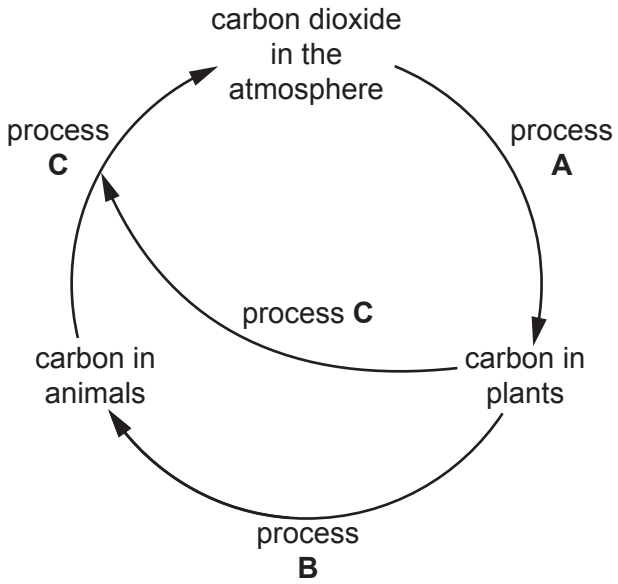


Fig. 7.1

(i) Identify process **B** shown in Fig. 7.1.

..... [1]

(ii) Complete the word equation for process **A** shown in Fig. 7.1.

carbon dioxide + ... → ..... + ...

[2]

(iii) The combustion of fossil fuels has an effect on the carbon cycle.

Tick (✓) **one** box that describes an **undesirable** effect of combustion.

less carbon is available for animals	
the rate of food production in plants decreases	
the carbon dioxide concentration in the atmosphere increases	
more carbon is available for plants	

[1]

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(b) Fig. 7.2 shows some feeding relationships between plants and animals on the African Savanna.

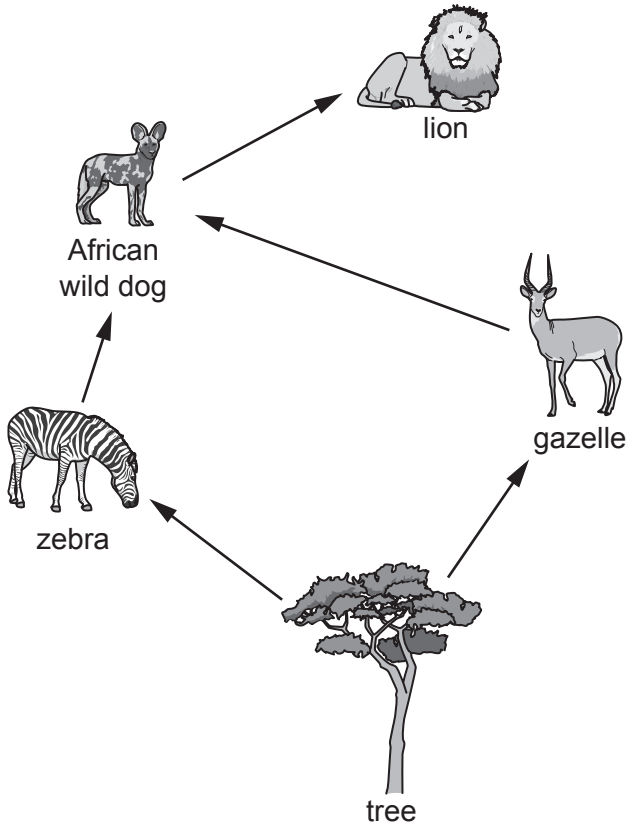


Fig. 7.2

(i) State the name of the type of diagram shown in Fig. 7.2.

..... [1]

(ii) Use Fig. 7.2 to identify **one** carnivore and **one** tertiary consumer.

carnivore .....

tertiary consumer .....
[2]

(iii) Lions eat gazelles.

Draw **one** arrow on Fig. 7.2 to show this relationship. [1]

(c) Trees grow from seeds.

One environmental condition needed for the successful germination of seeds is a suitable temperature.

State **one other** environmental condition needed for germination.

..... [1]

[Total: 9]

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[Turn over

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8 Ethene is an example of an alkene.

All alkenes are unsaturated hydrocarbons.

(a) Describe what is meant by unsaturated and hydrocarbon.

unsaturated .....

.....

hydrocarbon.....

.....

[2]

(b) Ethene is a gas at room temperature and pressure.

Describe the arrangement and motion of particles in gases.

arrangement .....

.....

motion .....

.....

[2]

(c) Table 8.1 shows the melting point and boiling point of ethene.

Table 8.1

melting point / °C	boiling point / °C
–169	–104

Predict the state of ethene at –190 °C.
Give a reason for your answer.

state .....

reason .....

.....

[1]

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(d) The reaction between ethene and oxygen is exothermic.

The word equation for this reaction is shown.

ethene + oxygen → carbon dioxide + water

State the type of chemical reaction shown in this equation.

..... [1]

(e) Poly(ethene) is formed from ethene.

Complete the sentence about this process.

Poly(ethene) is formed by the ..... polymerisation of

monomer ..... .

[2]

[Total: 8]

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9 Fig. 9.1 shows a spacecraft approaching the planet Venus.

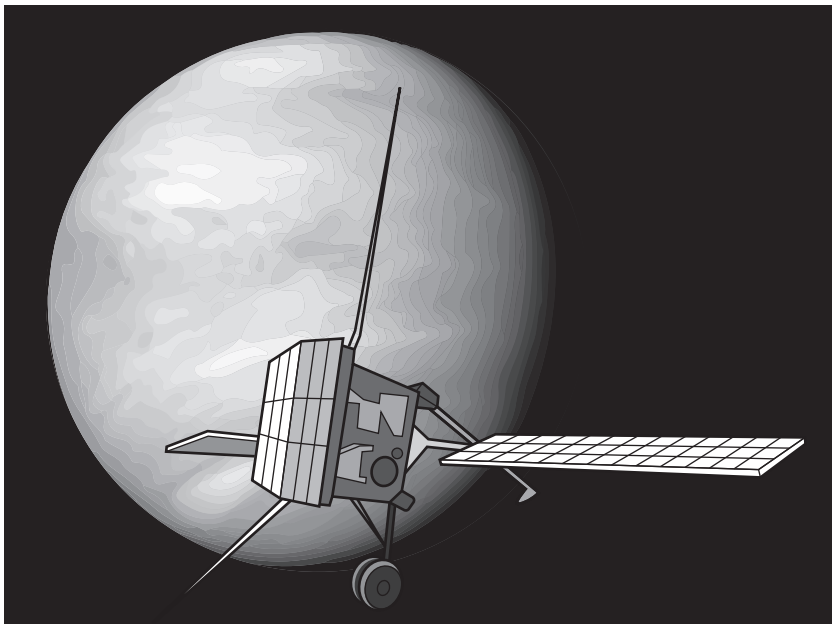


Fig. 9.1

(a) The spacecraft detects visible light and infrared radiation coming from Venus.

(i) Complete the sentences using words from this list.
Each word may be used once, more than once or not at all.

electromagnetic **higher** **longer** **lower**

radio **shorter** **ultraviolet** **X–ray**

Visible light and infrared radiation are regions of the .....

spectrum.

The frequency of visible light is ..... than the

frequency of infrared radiation. [2]

(ii) Suggest why energy is **not** transferred by conduction or convection through space.

.....

..... [1]

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(b) The spacecraft takes 120 days to travel from the Earth to Venus.

The distance travelled from the Earth to Venus is 6.9×10^{10} km.

(i) Calculate the average speed of the spacecraft in kilometres per hour (km / h).

speed = ... km / h [3]

(ii) State the energy that the spacecraft has due to its motion.

..... [1]

[Total: 7]

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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.).

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