Cambridge Assessment International Education

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COMBINED SCIENCE **0653/31**

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

DC (DE/CB) 352018/3

[Turn over

1 **(a)** Fig. 1.1 is a diagram of the human digestive system.

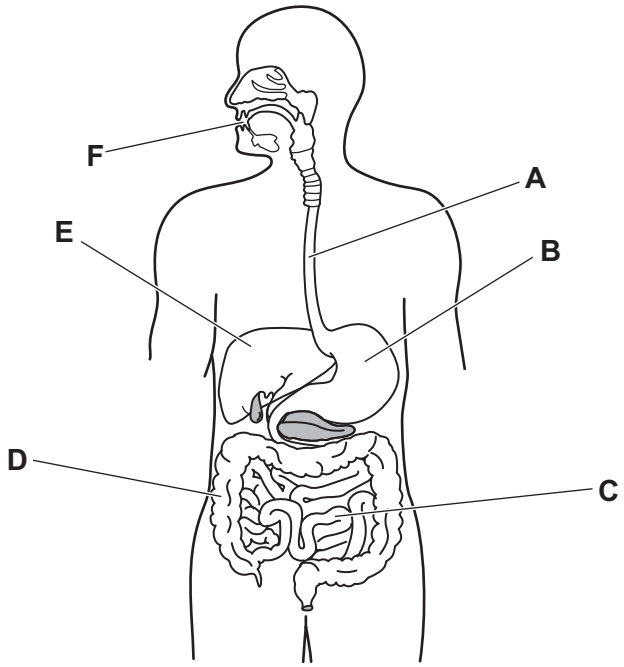


Fig. 1.1

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

..... [1]

(ii) The boxes on the left show the letters of some parts labelled in Fig. 1.1.

The boxes on the right show the functions of the parts.

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

part	function
A	absorption of water before egestion
D	ingestion of food
F	movement of food to the stomach

[2]

(iii) Physical digestion takes place in the alimentary canal.

Place a tick (✓) in the box next to the description of physical digestion.

Pieces of food are broken down using enzymes. ☐

Insoluble molecules are broken down into soluble molecules. ☐

Large food pieces are broken down into smaller food pieces. ☐

Large molecules are broken down into smaller molecules. ☐

[1]

(b) Some substances in the digestive system move into the blood by diffusion.

(i) Complete the sentence to describe diffusion.

Diffusion is the ..... movement of particles from a region of their higher concentration to a region of their lower concentration (i.e. down a concentration .....).

[2]

(ii) Water moves through partially permeable membranes by a type of diffusion.

Name this type of diffusion.

..... [1]

(c) A student adds food to a test solution. The test solution changes colour from blue to purple (violet).

Identify the biological molecule present in the food and name the test solution used.

biological molecule .....

test solution .....

[2]

[Total: 9]

2 **(a)** Fig. 2.1 is a diagram of the male reproductive system in humans.

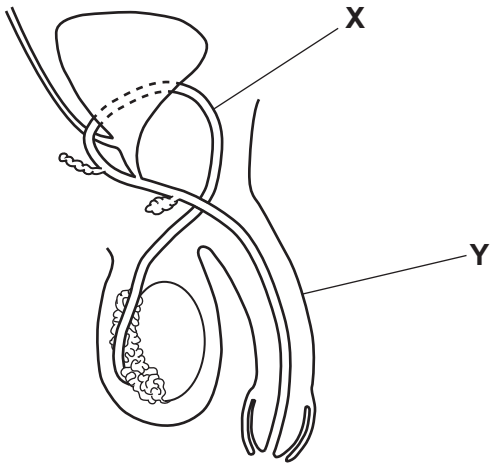


Fig. 2.1

(i) Name the parts labelled **X** and **Y** in Fig. 2.1.

X .....

Y .....

[2]

(ii) Draw a line labelled with the letter **T** on Fig. 2.1 to identify the testis. [1]

(b) Sperm are the male gametes in humans that fertilise female gametes.

(i) Name the female gametes in humans.

..... [1]

(ii) Circle the part of the female reproductive system where fertilisation takes place.

ovary **oviduct** **uterus** **vagina**

[1]

(c) Hepatitis B is an infectious disease transmitted through body fluids.

(i) Hepatitis B is caused by a virus infection.

Explain why hepatitis B should **not** be treated with antibiotics.

.....

..... [1]

(ii) Scientists investigate the number of people infected with hepatitis B in a population.

The scientists test 100 females and 100 males in each of four different age groups.

Fig. 2.2 is a chart of the results.

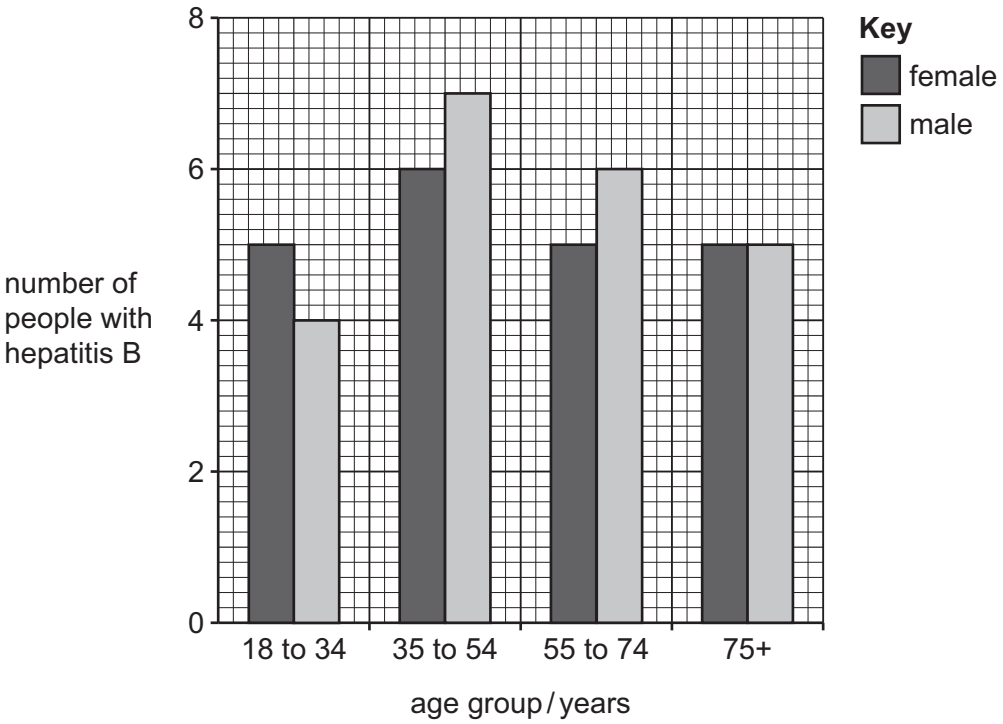


Fig. 2.2

Calculate the percentage increase in males with hepatitis B between age group 18 to 34 years and age group 35 to 54 years.

number of males with hepatitis B in age group 18 to 34 years = ...

number of males with hepatitis B in age group 35 to 54 years = ...

increase in number of males = ...

percentage increase in number of males = ...%
[3]

[Total: 9]

3 **(a)** Fig. 3.1 shows a food web.

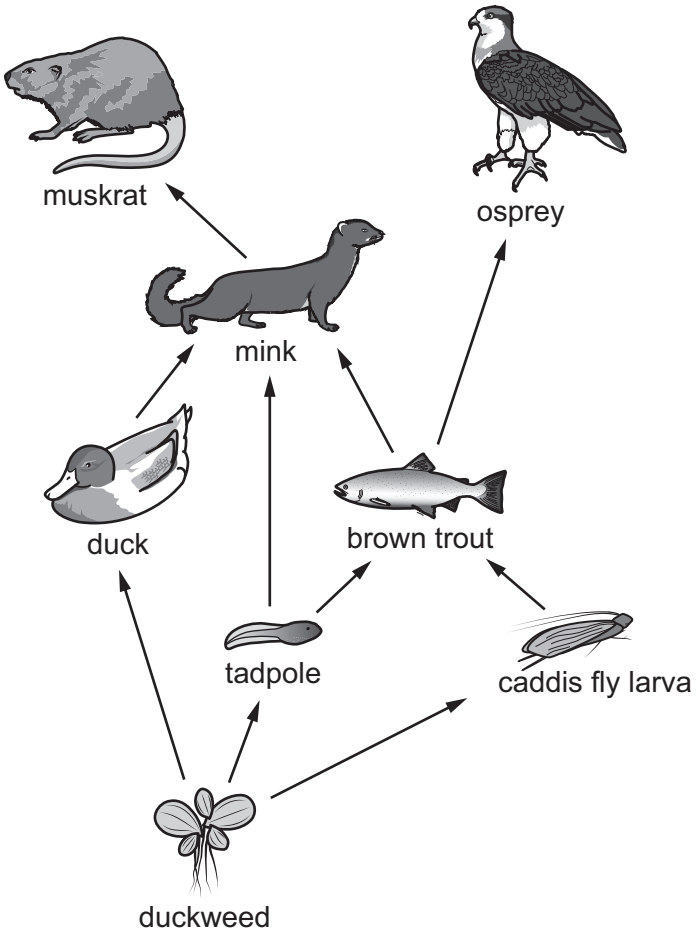


Fig. 3.1

(i) Identify in Fig. 3.1:

one secondary consumer .....

the **total** number of carnivores. .....

[2]

(ii) Identify the organism in Fig. 3.1 that gains energy from the mink.

..... [1]

(b) Duckweed uses energy from light for photosynthesis.

Choose words from the list to complete the sentences.

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

brown **chloroplasts** **decompose** **digest** **green**

mitochondria **nuclei** **purple** **synthesise**

Photosynthesis is the process by which plants ..... carbohydrates.

Photosynthesis in plants requires a ..... pigment.

The pigment is found inside ..... .

[3]

(c) Carbohydrates are part of a balanced diet for humans.

(i) List all the chemical elements that make up carbohydrates.

..... [1]

(ii) State why carbohydrates are important in the body.

..... [1]

(iii) State the component of blood that transports carbohydrates and other nutrients around the body.

..... [1]

[Total: 9]

4 Aqueous hydrogen peroxide, H_2O_2, breaks down to form oxygen and water.

(a) Complete the balanced symbol equation for this reaction.

.....H_2O_2 → .....O_2 + ...H_2O

[1]

(b) A student investigates the rate of this reaction by measuring the volume of oxygen gas produced in 60 seconds.

Fig. 4.1 is a diagram of the apparatus used in the investigation.

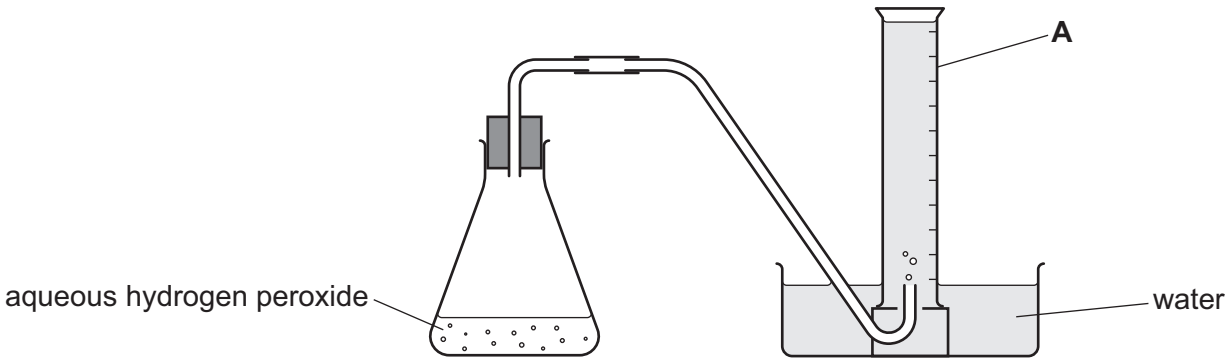


Fig. 4.1

(i) Name the piece of apparatus labelled **A** in Fig. 4.1.

..... [1]

(ii) The volume of gas produced in 60 seconds is 22.6 cm^3.

Calculate the rate of reaction in cm^3 per second.

Give your answer to **two** decimal places.

rate of reaction = ... cm^3 per second [2]

(iii) Manganese(IV) oxide is a catalyst for this reaction.

Describe what is meant by a catalyst.

.....

.....

..... [2]

(iv) Name the group of elements in the Periodic Table that often act as catalysts.

..... [1]

(c) Fig. 4.2 shows the dot-and-cross diagram for a hydrogen peroxide molecule.

Only the outer-shell electrons are shown.

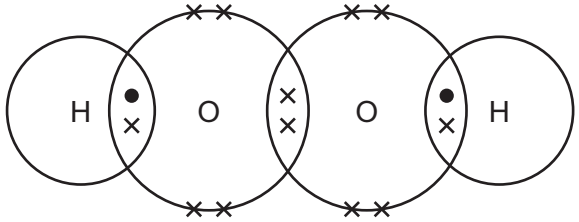


Fig. 4.2

Name the type of bonding in a hydrogen peroxide molecule.

Give a reason for your answer.

type of bonding .....

reason .....

.....

[2]

[Total: 9]

5 **(a)** Fig. 5.1 shows three substances and models used to represent them.

Draw **one** line from each substance to the correct model.

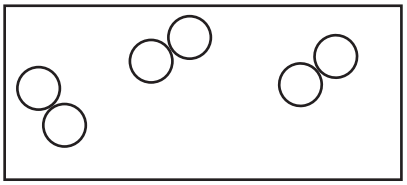
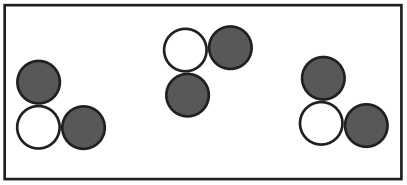
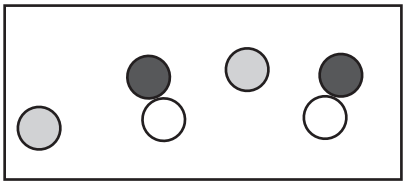
substance	**model**
compound	
element	
mixture	

Fig. 5.1

[2]

(b) Fig. 5.2 shows part of the Periodic Table.

3	4	5	6	7	8	9	10
Li	Be	B	C	N	O	F	Ne
lithium	beryllium	boron	carbon	nitrogen	oxygen	fluorine	neon
7	9	11	12	14	16	19	20

Fig. 5.2

(i) Circle the word that describes the part of the Periodic Table shown in Fig. 5.2.

group **period** **property** **transition**

[1]

(ii) Identify an element in Fig. 5.2 that matches each description.

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

- forms an ion with a charge of 1–

  .....

- has only two outer-shell electrons

  .....

- is used as an inert electrode in electrolysis

  .....

- reacts with oxygen to form a gas that leads to global warming

  .....

[4]

(iii) State how the metallic character of the elements shown in Fig. 5.2 changes from Li to Ne.

..... [1]

[Total: 8]

6 **(a)** Fig. 6.1 shows the combustion of magnesium ribbon in air.

A white powder of magnesium oxide is formed.

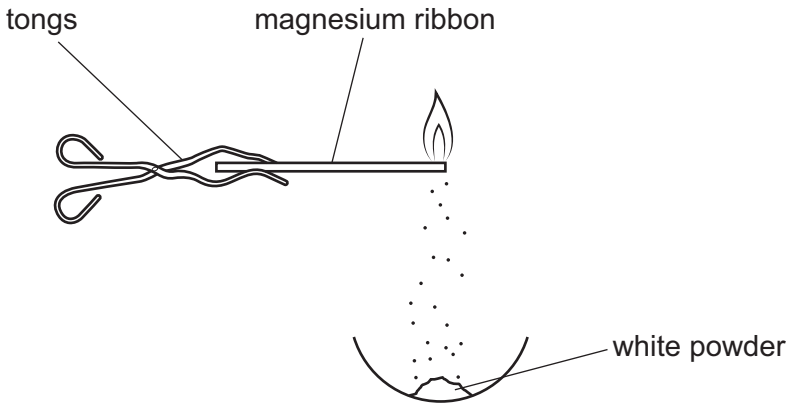


Fig. 6.1

(i) Name the gas that reacts with the magnesium.

..... [1]

(ii) Magnesium oxide is a metallic oxide.

Circle the term that describes this type of oxide.

acidic **aqueous** **basic** **carbonate** **solvent**

[1]

(iii) This reaction is exothermic.

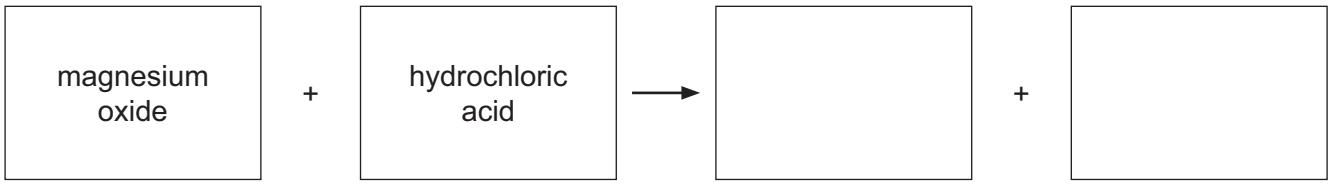
Describe what is meant by exothermic.

.....

..... [1]

(iv) Magnesium oxide reacts with dilute hydrochloric acid.

Complete the word equation for this reaction.



[2]

(b) Sulfur dioxide and oxides of nitrogen are air pollutants that cause the same adverse effect to the environment.

(i) Name this adverse effect.

..... [1]

(ii) State **one** source of sulfur dioxide.

..... [1]

(c) Iron is extracted from iron(III) oxide in the blast furnace.

(i) Name this type of reaction.

..... [1]

(ii) Name an ore that contains iron(III) oxide.

..... [1]

[Total: 9]

7 **(a)** A student rides a bicycle along a straight, level road.

Fig. 7.1 shows the distance–time graph for part of the student's journey.

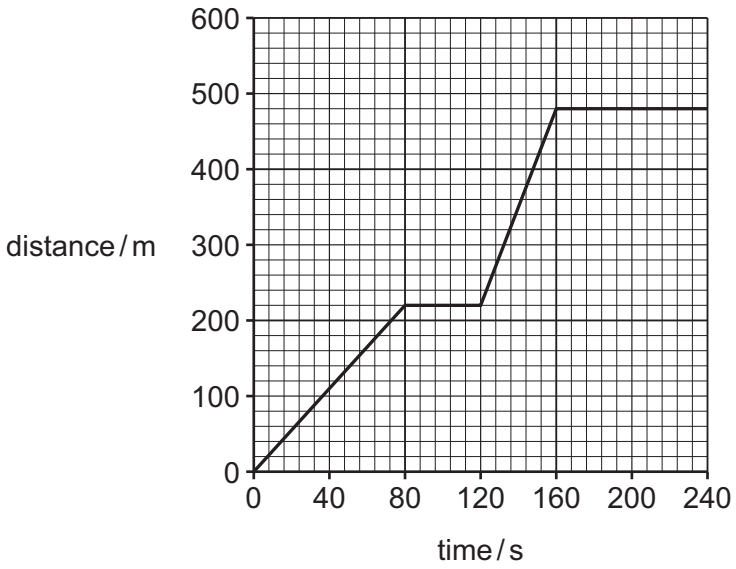


Fig. 7.1

(i) State the total distance travelled by the student in 240 s.

distance = ... m [1]

(ii) Draw **one** line from each time interval to the correct description of motion.

time interval	description of motion
0–80 s	at rest
80–120 s	
120–160 s	moving with constant speed
160–240 s	

[2]

(iii) Determine the maximum speed of the student.

speed = ... m / s [2]

(b) **(i)** The student in **(a)** now accelerates along the straight, level road.

Circle **one** word to describe how each energy store for the student is affected.

chemical **increases** / **decreases** / **stays the same**

kinetic **increases** / **decreases** / **stays the same**

gravitational potential **increases** / **decreases** / **stays the same**

[1]

(ii) The student in **(a)** now travels up a slope at constant speed.

Circle **one** word to describe how each energy store for the student is affected.

chemical **increases** / **decreases** / **stays the same**

kinetic **increases** / **decreases** / **stays the same**

gravitational potential **increases** / **decreases** / **stays the same**

[1]

(c) Fossil fuels are burned to obtain useful energy.

Describe how electrical power is generated from fossil fuels in a power station.

.....

.....

.....

..... [2]

[Total: 9]

8 **(a)** A student writes some statements about the arrangement, separation and motion of particles in the kinetic particle model of matter.

Tick (✓) **four** boxes to identify the statements that describe particles in a solid.

The particles are very closely packed together.	☐
The particles are widely spaced apart.	☐
The particles have a random arrangement.	☐
The particles have a regular arrangement.	☐
The particles are in fixed positions.	☐
The particles move around freely at high speeds.	☐
The particles vibrate only.	☐
The particles move in random directions.	☐

[3]

(b) The student sets up the experiment in Fig. 8.1 to show convection in air.

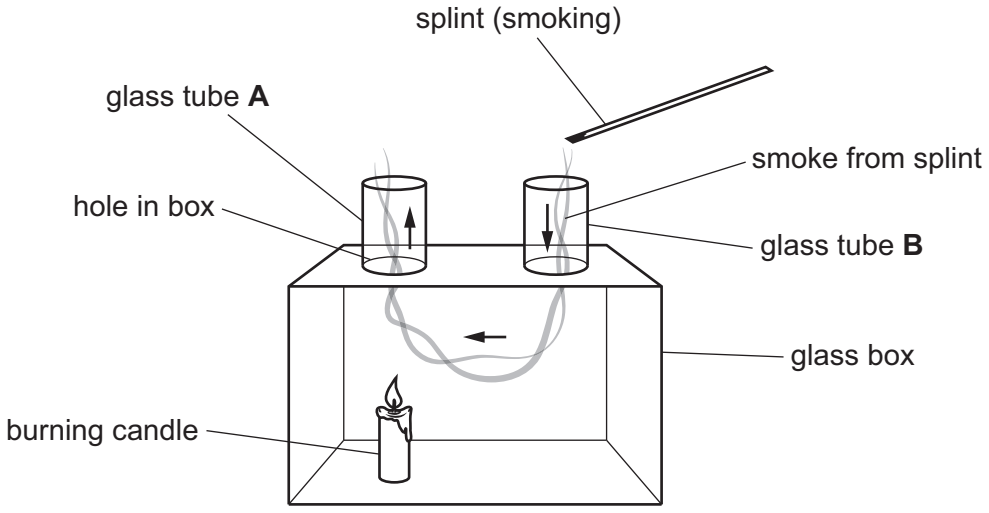


Fig. 8.1

The splint produces smoke but has no heating effect.

The arrows in Fig. 8.1 show the direction of movement of the smoke. The smoke is used to show the movement of air through the box.

Describe how convection causes the smoke to move in this way.

.....

.....

.....

..... [2]

(c) (i) Some solids are electrical insulators.

Describe what is meant by an electrical insulator.

.....

..... [1]

(ii) The student assembles the electrical circuit in Fig. 8.2 to determine the current in a resistor and the voltage across the resistor.

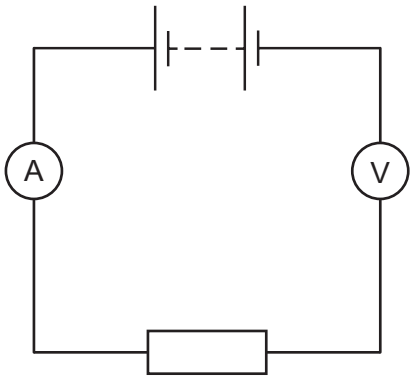


Fig. 8.2

The student makes **one** error when connecting the components.

Identify the error and state how the student corrects the error.

error .....

correction .....

.....

[2]

(iii) The student connects a lamp in parallel with the resistor in the circuit.

Draw on Fig. 8.2 to show the lamp connected in parallel with the resistor. [2]

[Total: 10]

9 **(a)** Fig. 9.1 represents a wave.

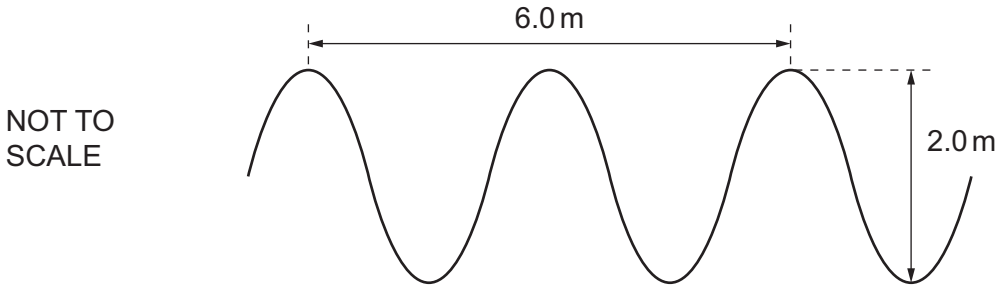


Fig. 9.1

Determine the wavelength of the wave.

wavelength = ... m [1]

(b) **(i)** The speed of a sound wave in air is 330 m / s.

The sound wave has a wavelength of 0.15 m.

Calculate the frequency of this sound wave.

State the unit of your answer.

frequency = ... unit ..... [3]

(ii) Explain why sound waves **cannot** travel through the vacuum of space.

.....

..... [1]

(c) The Sun is a small mass star.

Use words or phrases from the list to describe the next stages in the life cycle of the Sun.

black hole **neutron star** **planetary nebula** **red giant**

red supergiant **supernova** **white dwarf**

..... → ..... + ...

[3]

[Total: 8]

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.).