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CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

3230330382

COMBINED SCIENCE **0653/33**

Paper 3 Theory (Core) **May/June 2026**

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. Do **not** use correction fluid or tape.
- 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.

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[Turn over

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1 **(a)** Figure 1.1 shows the structure of the male reproductive system in humans.

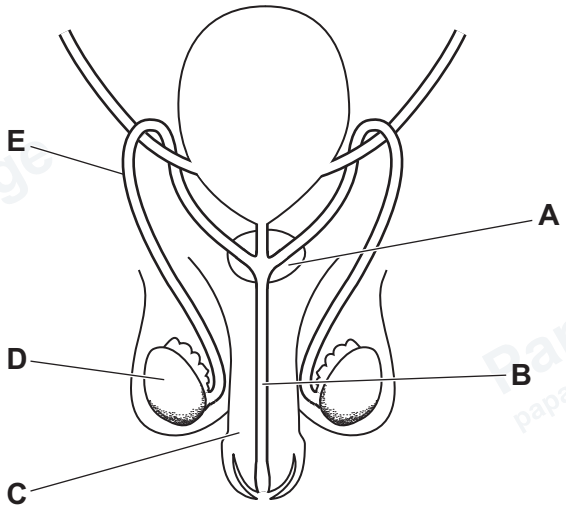


Figure 1.1

State the letter in Figure 1.1 that identifies the:

penis .....

part that produces a fluid for sperm to swim in. .....

[2]

(b) Complete the sentences about reproduction in humans.

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

cells **cytoplasm** **ovary** **oviduct**

nuclei **uterus** **vagina**

The male releases sperm into the ..... of the female.

A sperm fertilises an egg cell in the ..... .

Fertilisation is the fusion of the ..... from a male gamete and a female gamete.

[3]

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(c) Reproduction is one of the characteristics of living organisms.

State **two** other characteristics of living organisms.

1 .....

2 .....

[2]

(d) Sexually transmitted infections are caused by pathogens.
The pathogens are transmitted in bodily fluids during reproduction.

Figure 1.2 is a graph that shows the percentage of a population with one type of sexually transmitted infection.

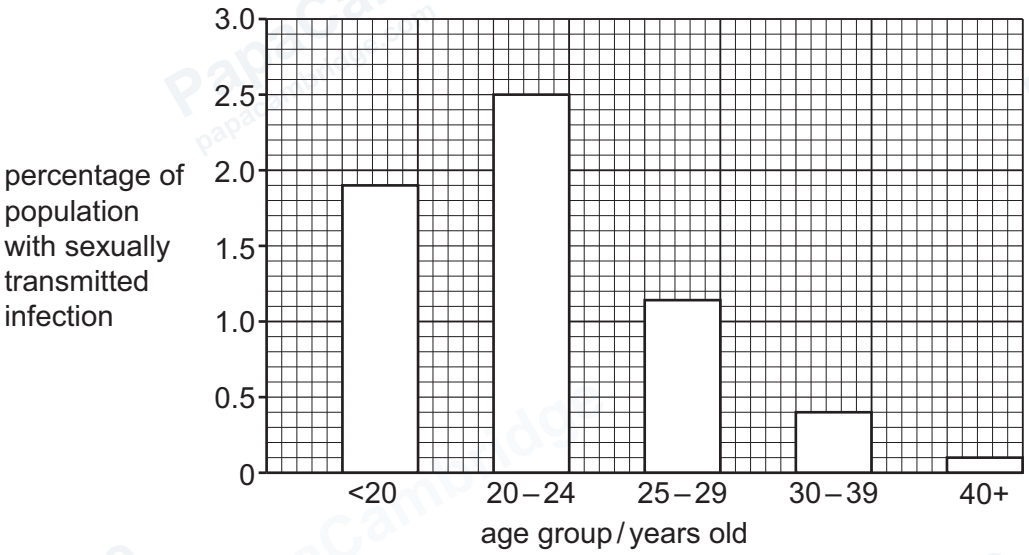


Figure 1.2

Describe the data in Figure 1.2.

.....

.....

.....

..... [2]

[Total: 9]

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2 **(a)** Figure 2.1 is an image of a red blood cell.

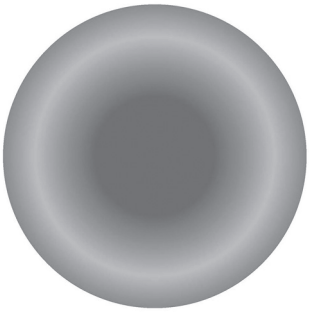


Figure 2.1

(i) The diameter of the red blood cell image in Figure 2.1 is 40 mm.

The actual diameter of the red blood cell in Figure 2.1 is 0.008 mm.

Calculate the magnification of the image in Figure 2.1.

magnification = ... × [2]

(ii) Oxygen moves into a red blood cell by diffusion.

Complete the definition of diffusion.

Diffusion is the ..... movement of particles from a region of their ..... concentration to a region of their ..... concentration, as a result of their random movement.

[2]

(b) Red blood cells are one component of blood.

State **two** other components of blood.

1 .....

2 .....

[2]

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(c) Figure 2.2 is a drawing of the human heart.

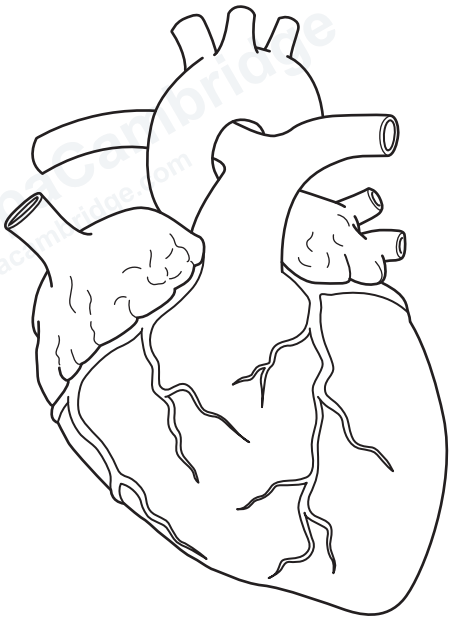


Figure 2.2

(i) Draw a label line and the letter **C** to identify a coronary artery on Figure 2.2. [1]

(ii) Blood flows through the hollow centre of an artery.

Circle the name of this hollow centre.

lumen **septum** **vacuole** **valve**

[1]

(d) Blood transports amino acids and glucose around the body.

(i) State the name of the large molecules made from amino acids.

..... [1]

(ii) List **all** the chemical elements in a molecule of glucose.

..... [1]

[Total: 10]

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3 **(a)** Figure 3.1 is a diagram of a root section.

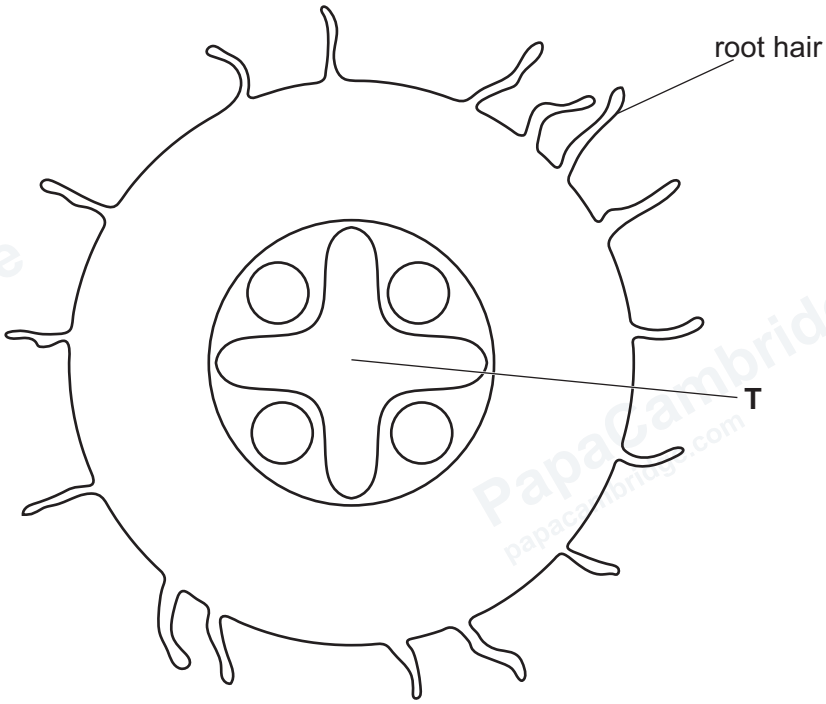


Figure 3.1

(i) The part labelled **T** transports water from the root to the stem.

State **two** other functions of the part labelled **T** on Figure 3.1.

1 .....

2 .....

[2]

(ii) Complete the flow chart to outline the pathway of water from the root hair cells to the leaf.

root hair cells	→	root ..... cells	→	part **T**	→	..... cells in leaf

[2]

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(b) Plants synthesise carbohydrates from raw materials during photosynthesis.

Figure 3.2 shows apparatus used to measure the rate of photosynthesis.

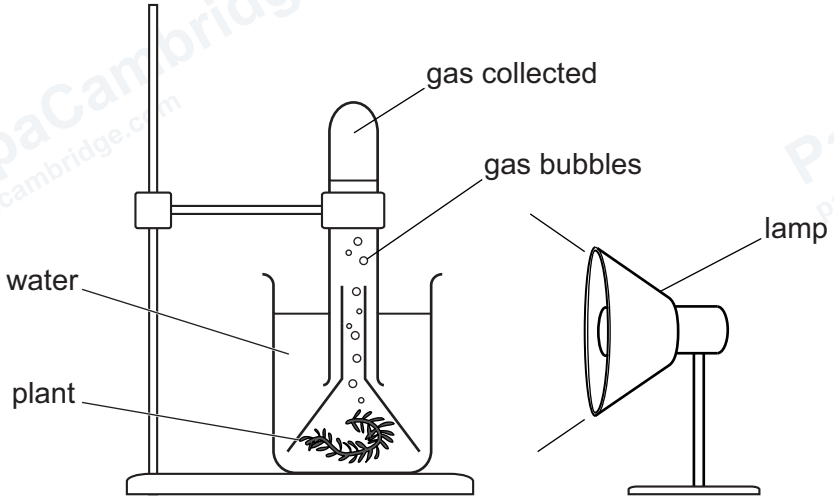


Figure 3.2

(i) Name the gas collected in the test-tube in Figure 3.2 that is produced during photosynthesis.

..... [1]

(ii) The rate of photosynthesis is measured by counting the number of gas bubbles produced in one minute.
A student records the number of gas bubbles produced in one minute with the lamp switched on.
The student repeats the method with the lamp switched off.

Table 3.1 shows the results.

Table 3.1

lamp	number of gas bubbles produced in one minute
on	12
off	2

Complete the sentences about the results.

The rate of photosynthesis ..... when the lamp is turned off.

This is because ..... energy is needed for photosynthesis.

[2]

(c) Name the green pigment used in photosynthesis.

..... [1]

[Total: 8]

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4 **(a)** Table 4.1 shows information about atoms of some Group I elements.

Table 4.1

symbol	number of protons	number of neutrons	number of electrons
Li	3	4	
	11	12	11
	19		

Use the Periodic Table to complete Table 4.1. [4]

(b) Complete the sentences about Group I elements.
Choose words from the list.
Each word may be used once, more than once or not at all.

acidic **basic** **decreases** **diatomic**

increases **metallic** **non-metallic** **stays the same**

Group I elements are ..... .

The oxides of Group I elements are ..... .

Down Group I, the melting point ..... .

Down Group I, the reactivity ..... .

[3]

(c) Lithium is added to aluminium to make an aluminium alloy.

(i) Describe what is meant by an alloy.

.....

..... [1]

(ii) Suggest **one** advantage of using an aluminium alloy rather than pure aluminium.

.....

..... [1]

[Total: 9]

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5 Methane, CH_4, is a simple covalent molecule.

(a) Complete the dot-and-cross diagram in Figure 5.1 to show the electronic configuration of a molecule of methane.

Show **only** the outer-shell electrons.

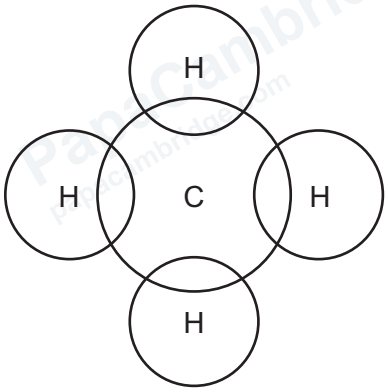


Figure 5.1

[1]

(b) Methane is a gas at 20 °C.

Circle the boiling point of methane.

–162 °C **25 °C** **100 °C** **162 °C**

[1]

(c) Methane is used as a fuel.

Complete the word equation and symbol equation for the combustion of methane.

methane + ... → carbon dioxide + ...

CH_4 + $2O_2$ → ..... + 2 .....

[3]

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(d) Explain how more methane in the atmosphere affects the environment.

.....

.....

..... [2]

(e) Methane is an alkane.

Explain why methane does **not** react with aqueous bromine.

.....

..... [1]

[Total: 8]

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6 **(a)** The treatment of the domestic water supply involves several processes.

Each process has a different purpose.

Complete Table 6.1 to identify the processes.

Choose words from the list.

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

chlorination **chromatography** **filtration**

neutralisation **sedimentation** **adding carbon**

Table 6.1

purpose	process
remove solids	..... and .....
remove taste and odour	.....
kill microbes	.....

[3]

(b) Explain why distilled water rather than tap water is used in practical chemistry.

.....

..... [1]

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(c) A student tests two colourless liquids, **H** and **J**, with anhydrous cobalt(II) chloride paper.

The results are shown in Table 6.2.

Table 6.2

liquid	appearance of cobalt(II) chloride paper
H	blue
J	pink

(i) Suggest what these results show about liquid **H** and liquid **J**.

.....

..... [1]

(ii) Cobalt(II) chloride contains chloride ions.

Tick (✓) **one** box to show the acidified aqueous substance used to test for chloride ions.

ammonia ☐

limewater ☐

silver nitrate ☐

sodium hydroxide ☐

[1]

(d) Cobalt(II) chloride contains cobalt.

Cobalt is used in a reaction to remove sulfur compounds from petrol before combustion.

(i) Suggest why removing sulfur compounds from petrol before combustion is important for the environment.

.....

.....

..... [2]

(ii) Cobalt increases the rate of the reaction and is unchanged at the end of the reaction.

State the role of cobalt in this reaction.

..... [1]

[Total: 9]

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7 A student walks along a straight level road from house **X** to house **Y**.

(a) Figure 7.1 shows the distance–time graph for the student's journey.

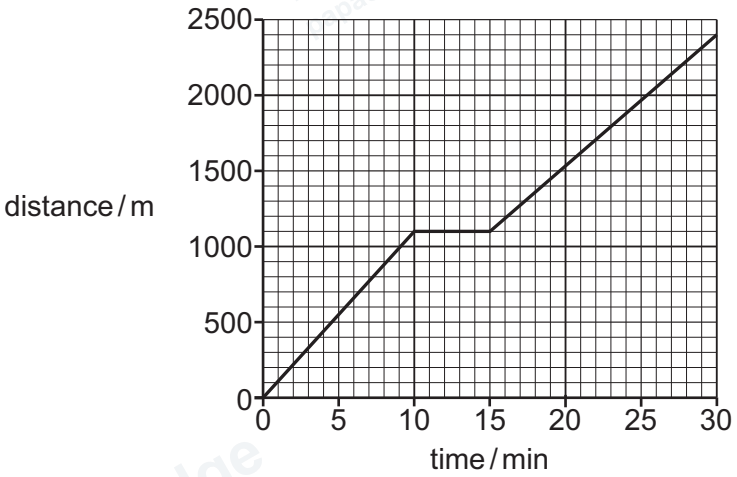


Figure 7.1

(i) Complete the sentence to describe the motion of the student.

Between 10 min and 15 min, the student is ..... . [1]

(ii) Determine the speed of the student between 15 min and 30 min.

Give your answer in m / s.

speed = ... m / s [4]

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(b) Figure 7.2 shows the student pushing a bicycle along a road.



Figure 7.2

(i) A force acting between the road and the bicycle resists the forward motion of the bicycle.

State the name of this force.

..... [1]

(ii) There is no resultant force on the bicycle.

Circle **two** words or phrases to describe the motion of the bicycle.

accelerating **changing direction** **decelerating**

moving at constant speed **moving in a straight line**

[2]

[Total: 8]

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8 **(a)** A teacher heats a solid substance. The substance turns into a liquid.

(i) State the term for the change in state from a solid to a liquid.

..... [1]

(ii) Describe the arrangement and separation of the particles in the substance when it is a solid.

arrangement .....

.....

separation .....

.....

[2]

(iii) Describe how the motion of the particles in a solid is different from the motion of the particles in a gas.

.....

.....

..... [2]

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(b) The Sun is a star in the Milky Way galaxy. It consists of hot gases.

(i) The Sun consists mostly of two gases.

Name these **two** gases.

1 .....

2 .....

[2]

(ii) The Sun radiates most of its energy in three regions of the electromagnetic spectrum.

Circle these **three** regions.

radio **microwave** **infrared** **visible**

ultraviolet **X-ray** **gamma**

[2]

(iii) A different star is situated near the centre of the Milky Way galaxy.

Show that it takes light from this star approximately 50 000 years to reach the outer edge of the Milky Way.

[1]

[Total: 10]

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9 A student investigates thin converging lenses.

(a) The student uses a lamp to produce the beam of light.

(i) Figure 9.1 shows the action of a thin converging lens on a parallel beam of light from the lamp.

Complete the labels on Figure 9.1.

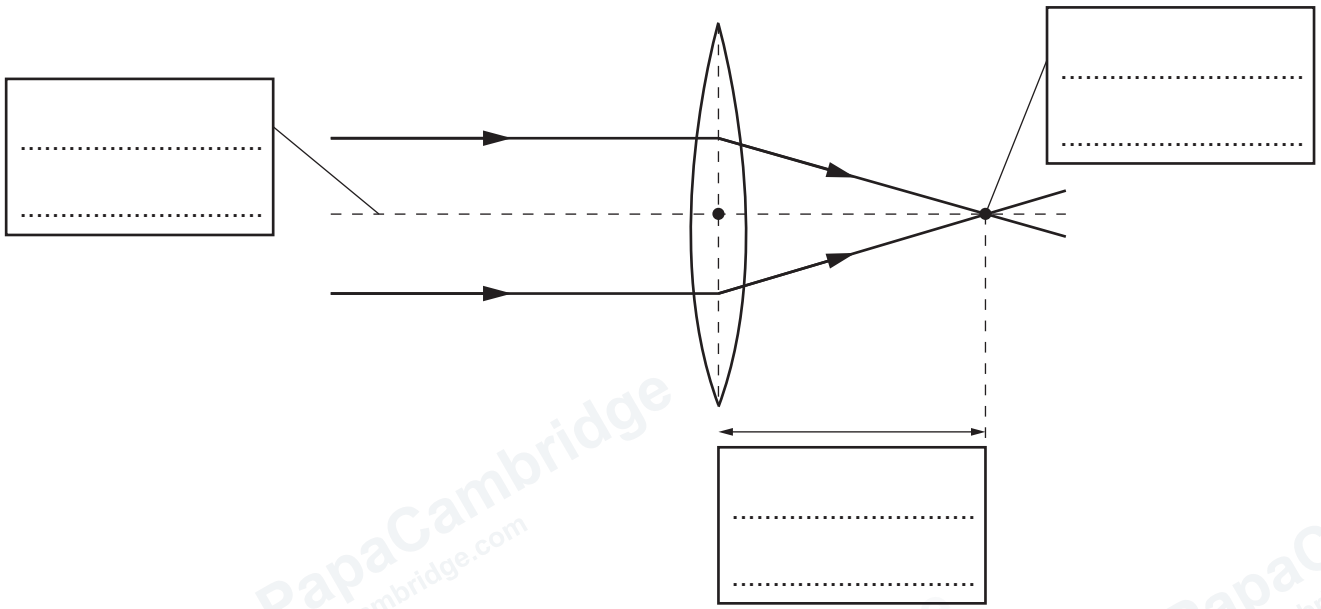


Figure 9.1

[3]

(ii) The cost of the electricity used in this investigation is $0.04.

The cost of 1 kW h of electricity is $0.25.

Calculate the energy used in this investigation in kW h.

energy = ... kW h [2]

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(iii) The current in the lamp is 2.4 A. The voltage across the lamp is 15 V.

Calculate the power of the lamp.

power = ... W [2]

(b) Figure 9.2 shows the image of an object formed by a thin converging lens.

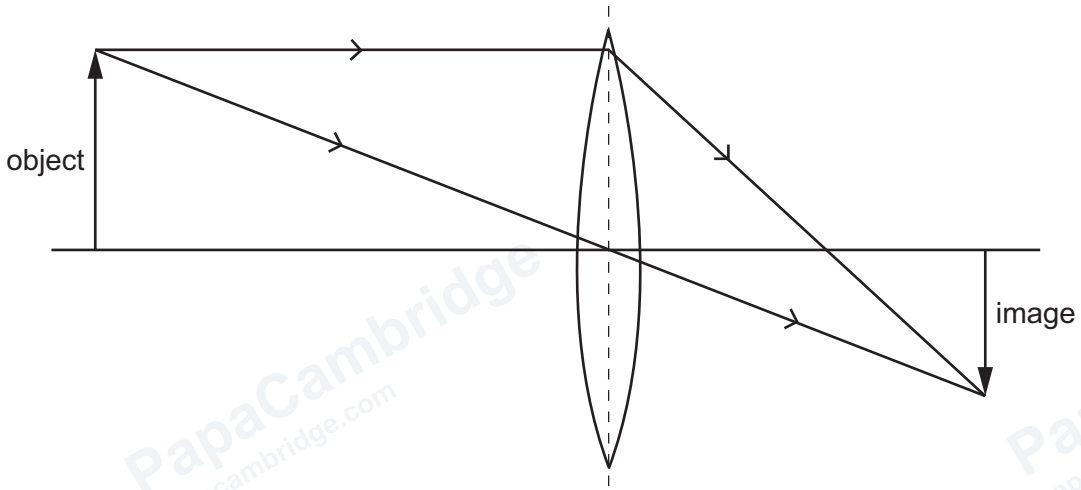


Figure 9.2

Tick (✓) **two** boxes which describe the characteristics of the image formed.

diminished	☐
enlarged	☐
inverted	☐
same size	☐
upright	☐

[2]

[Total: 9]

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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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