GradeMax

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Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

4870886052

COMBINED SCIENCE **0653/43**

Paper 4 Theory (Extended) **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. Any blank pages are indicated.

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

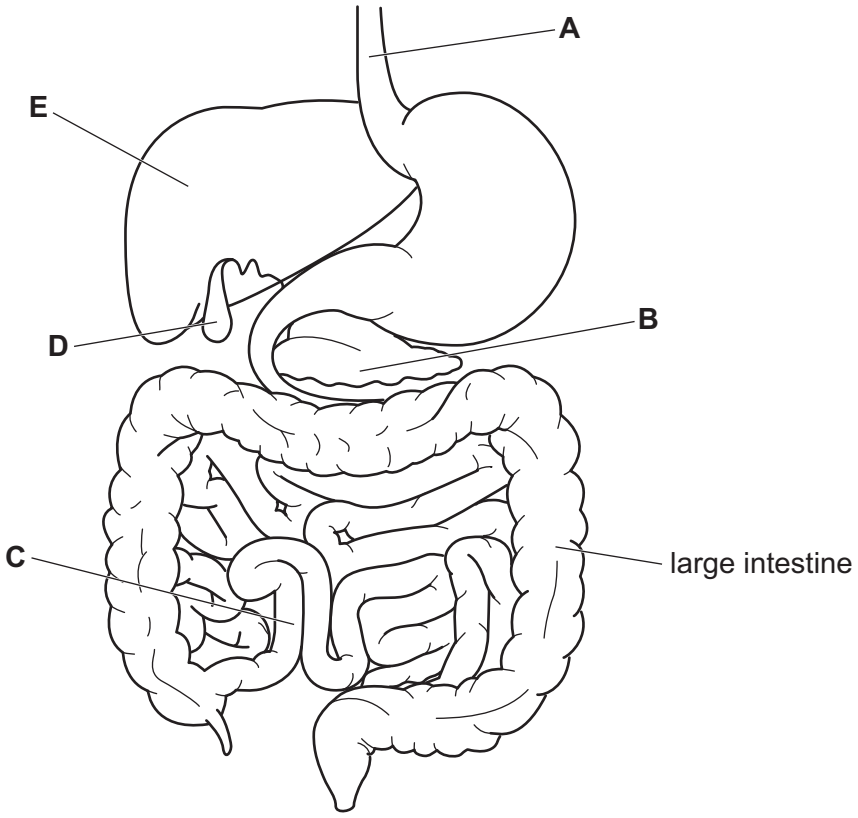


Fig. 1.1

(i) Use the letters on Fig. 1.1 to identify the:

gall bladder .....

part where absorption takes place .....

part that secretes amylase. .....

[3]

(ii) The large intestine has three different parts.

One part is called the anus.

Name the other **two** parts of the large intestine.

1 .....

2 .....

[2]

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(b) The graph in Fig. 1.2 shows the effect of pH on four different enzymes, **P**, **Q**, **R** and **S**.

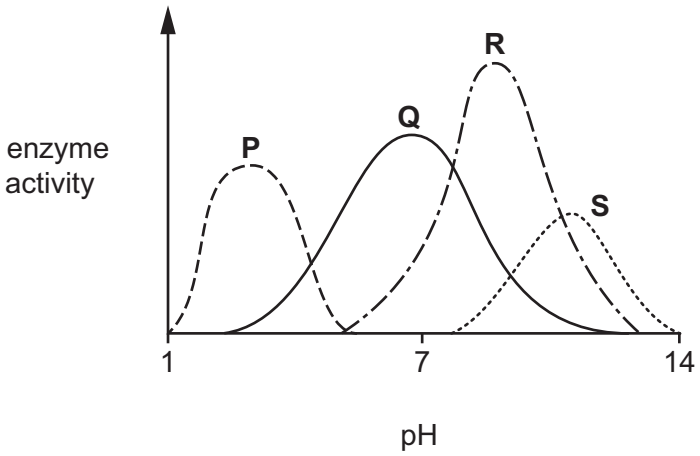


Fig. 1.2

(i) Identify the enzyme in Fig. 1.2 with optimum activity in the stomach.

..... [1]

(ii) Explain the effect of pH 7 on the activity of enzyme **S**.

.....

.....

.....

.....

.....

..... [3]

(c) Lipase is an enzyme in the digestive system.

Complete the sentence about the function of lipase.

Lipase breaks down ..... and ..... into two types of smaller molecules called ..... and ..... .

[2]

[Total: 11]

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2 **(a)** Fig. 2.1 shows a food web.

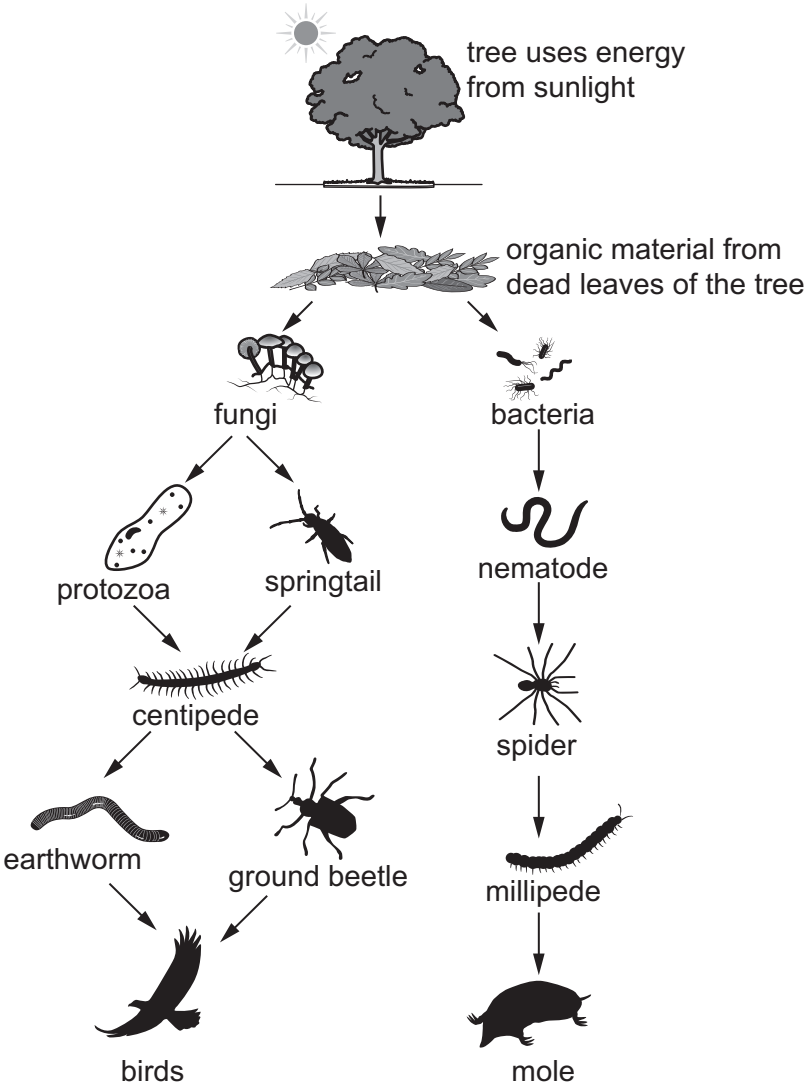


Fig. 2.1

(i) Circle the word that describes the tree in Fig. 2.1.

carnivore **decomposer** **herbivore** **producer**

[1]

(ii) Circle the word that describes the fungi in Fig. 2.1.

carnivore **decomposer** **herbivore** **producer**

[1]

(iii) Identify the animal in Fig. 2.1 that gets its energy from the spider.

..... [1]

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(b) Transpiration takes place in plants.

(i) Describe transpiration in plants.

.....

..... [1]

(ii) Describe the effect of variation of wind speed on transpiration rate.

.....

..... [1]

(c) Fig. 2.2 shows plant cells before and after being immersed in a concentrated sugar solution.

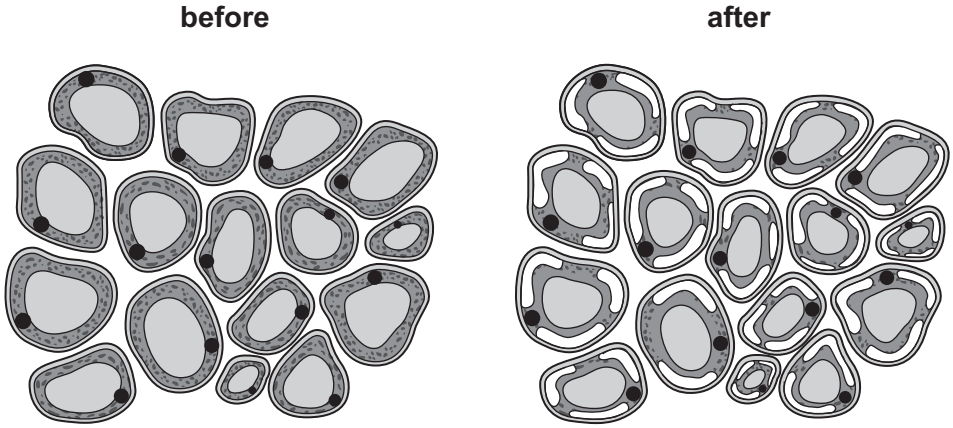


Fig. 2.2

Explain the effect of the concentrated sugar solution on the cells shown in Fig. 2.2.

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..... [4]

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3 **(a)** Fig. 3.1 shows the structure of a virus and a bacterial cell.

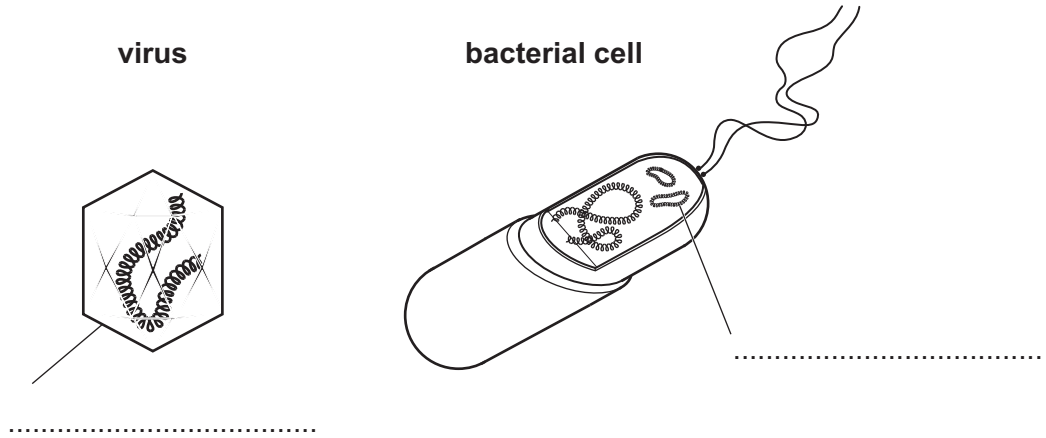


Fig. 3.1

Complete the labels on Fig. 3.1. Choose words from the list.

cell membrane **cell wall** **cytoplasm**

nucleus **plasmid** **protein coat**

[2]

(b) Some viruses and bacteria are pathogens.

Platelets in blood help to defend against pathogens by clotting the blood.

State **two** other body defences against pathogens.

1 .....

2 .....

[2]

(c) Antibiotics are drugs used to treat bacterial infections.

Describe what is meant by the term drug.

.....

..... [1]

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(d) Vaccines are drugs used to help protect the body from bacterial infections.

Describe how vaccinations protect the body from bacterial infection.

.....

.....

.....

..... [2]

[Total: 7]

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4 A student investigates the rate of reaction between large pieces of magnesium carbonate, $MgCO_3$, and dilute hydrochloric acid, HCl, using the apparatus shown in Fig. 4.1.

The student records the time taken to produce 10 cm^3 of gas.

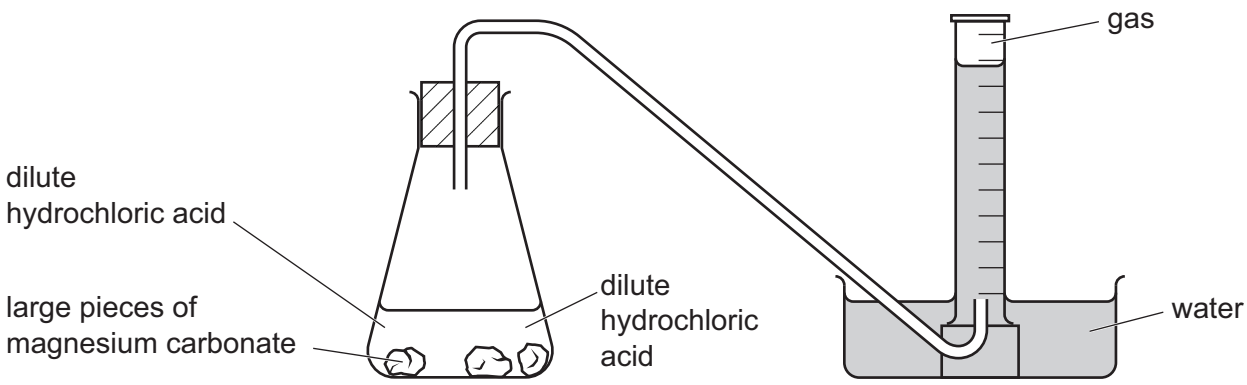


Fig. 4.1

(a) Three products are formed in the reaction: magnesium chloride $MgCl_2$, a gas and one other product.

Give the balanced symbol equation for this reaction.

..... [2]

(b) The student repeats the experiment using:

- small pieces of magnesium carbonate
- magnesium carbonate powder.

All other conditions are kept constant.

Table 4.1 shows the time taken to produce 10 cm^3 of gas and the rate of reaction.

Table 4.1

magnesium carbonate	**time taken to produce 10 cm^3 of gas in s**	**rate of reaction in cm^3 per s**
large pieces	15.2	0.66
small pieces	8.3	1.2
powder	5.1	

(i) Calculate the rate of reaction in cm^3 per s for magnesium carbonate powder.

Write your answer in Table 4.1. [1]

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(ii) State and explain how the size of the magnesium carbonate pieces affects the rate of this reaction.

.....

.....

.....

.....

.....

..... [3]

(c) Fig. 4.2 shows an atom of magnesium and an atom of chlorine.



magnesium atom **chlorine atom**

Fig. 4.2

Complete the dot-and-cross diagram in Fig. 4.3 to show the ionic bonding in magnesium chloride, $MgCl_2$.

Show **only** the outer-shell electrons and include the charges on the ions.

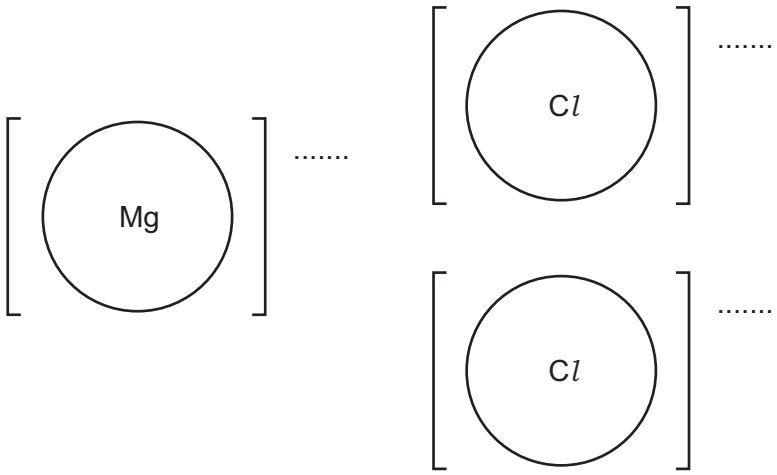


Fig. 4.3

[3]

[Total: 9]

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5 Group VII elements are known as the halogens.

(a) (i) Halogens can be represented by the formula X_2.

State the term used to describe molecules with the formula X_2.

..... [1]

(ii) Complete Table 5.1:

- state the appearance of bromine at room temperature and pressure (r.t.p.)
- predict the appearance of astatine at r.t.p.

Table 5.1

halogen	appearance at r.t.p.
chlorine	pale yellow-green gas
bromine	
iodine	grey-black solid
astatine	

[2]

(b) Aqueous potassium iodide is colourless.

Aqueous chlorine is added to aqueous potassium iodide in a test-tube.

State the colour change observed.

Explain why this colour change occurs.

colour change .....

explanation .....

.....

.....

[3]

(c) (i) State why chlorine is used in the treatment of the domestic water supply.

..... [1]

(ii) State **one** other stage in the treatment of the domestic water supply.

..... [1]

[Total: 8]

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6 Pentene is an alkene that contains one double carbon–carbon bond.

(a) Fig. 6.1 shows the structure of one form of pentene.

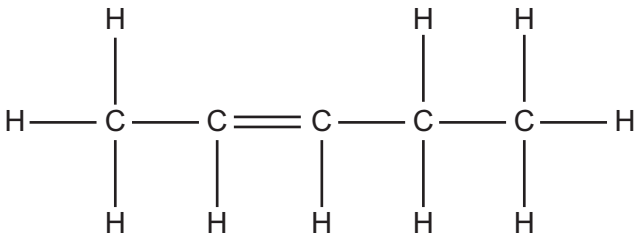


Fig. 6.1

(i) Use Fig. 6.1 to deduce the molecular formula of pentene.

..... [1]

(ii) The double carbon–carbon bond in pentene can be in different positions.

Complete Fig. 6.2 to show the structure of **one** other form of pentene.



Fig. 6.2

[1]

(iii) Pentene is a member of a homologous series.

State what is meant by a homologous series.

.....

.....

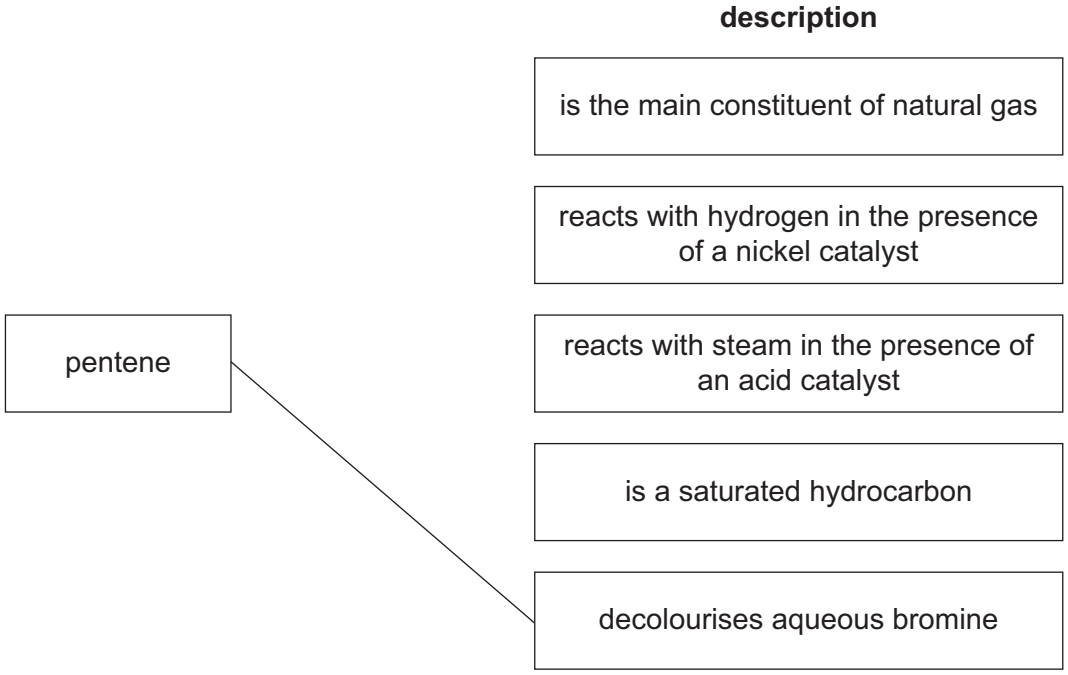
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..... [2]

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(iv) Draw lines to show which descriptions are true for pentene.

One has been drawn for you.



[2]

(b) Pentene combusts in a limited supply of oxygen to form two air pollutants: carbon monoxide and carbon particulates.

(i) Complete the balanced symbol equation by adding the missing state symbols.

$$C_5H_{10}(g) + 4O_2(g) \rightarrow 3CO(.....) + 2C(.....) + 5H_2O(l)$$

[1]

(ii) Name this type of combustion reaction.

..... [1]

(iii) State **one** adverse effect of carbon particulates on human health.

..... [1]

[Total: 9]

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7 A student assembles the circuit in Fig. 7.1.

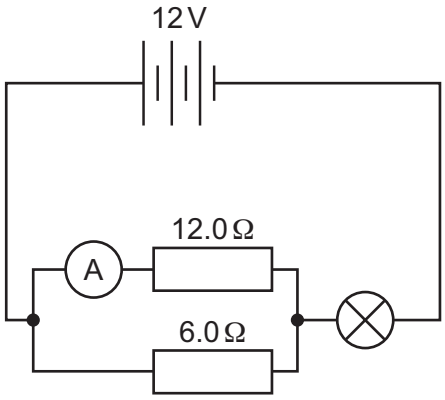


Fig. 7.1

The reading on the ammeter is 0.80 A.

The potential difference (p.d.) across the 12.0 Ω resistor is 9.6 V.

(a) Determine the p.d. across the lamp.

p.d. = ... V [1]

(b) Determine the current in the 6.0 Ω resistor.

current = ... A [2]

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(c) Calculate the charge flowing through the **lamp** in 2.0 minutes.

State the unit of charge.

charge = ... unit ..... [5]

[Total: 8]

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8 Fig. 8.1 shows a motor and an object at rest on the ground.

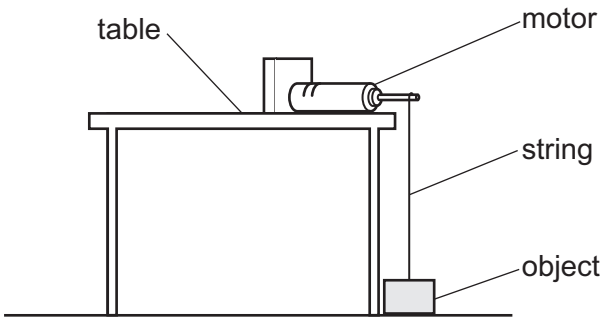


Fig. 8.1

The object has a mass of 2.9 kg.

Ignore any friction or air resistance.

(a) Calculate the weight of the object.

weight = ... N [2]

(b) The motor lifts the object with force *L*.

The object accelerates upwards from rest with a constant acceleration of 2.5 m / s^2.

Calculate *L*.

L = ... N [3]

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(c) The motor now lifts the object upwards at constant speed through vertical distance *h*.

(i) The total energy input to the motor is 150 J.

The motor has an efficiency of 66%.

Calculate the useful energy output of the motor.

useful energy output = ... J [2]

(ii) Use your answer in **(c)(i)** to calculate *h*.

h = ... m [2]

[Total: 9]

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9 **(a)** Fig. 9.1 shows a convection heater in a closed room.

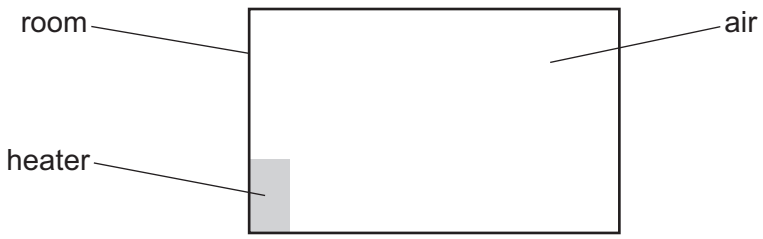


Fig. 9.1

The heater is on the floor on the left hand side of the room.

The heater warms the room by convection.

(i) State **one** other method of thermal energy transfer.

..... [1]

(ii) Explain how the heater warms the room by convection.

Use ideas about density in your answer.

You may draw on Fig. 9.1 if you wish.

.....

.....

.....

..... [2]

(iii) Explain why the air in the room exerts a greater pressure on the walls when the temperature of the air increases.

Use ideas about particles in your answer.

.....

.....

.....

.....

.....

..... [3]

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(b) Complete Table 9.1 to describe the difference between a transverse wave and a longitudinal wave.

Use **one** word in each gap.

Table 9.1

wave	**direction of ..... compared to direction of propagation**
transverse	at right angles
longitudinal	.....

[2]

(c) The Big Bang Theory includes statements about the beginning of the Universe that are supported by astronomical observations.

Give **two** statements about the beginning of the Universe included in the Big Bang Theory.

1 .....

.....

2 .....

.....

[2]

[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.).

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