UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

3318455889

COMBINED SCIENCE **0653/32**

Paper 3 (Extended) **October/November 2012**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a soft pencil for any diagrams, graphs, tables or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
A copy of the Periodic Table is printed on page 24.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total	

This document consists of **22** printed pages and **2** blank pages.

UNIVERSITY of CAMBRIDGE International Examinations

For Examiner's Use

1 Fig. 1.1 shows a red blood cell and a root hair cell.

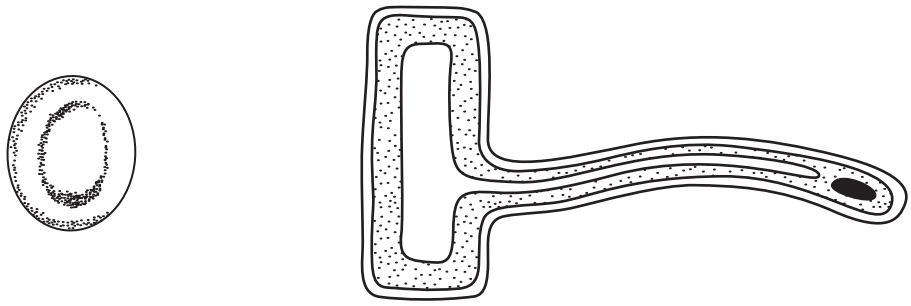

Fig. 1.1

(a) Name the red protein found in the cytoplasm of the red blood cell.

..... [1]

(b) **(i)** State the function of a root hair cell.

..... [1]

(ii) Explain how the root hair cell is adapted to carry out this function.

.....

.....

.....

..... [2]

(c) Fig. 1.2 shows a plant with its roots in a beaker of water containing a blue dye.

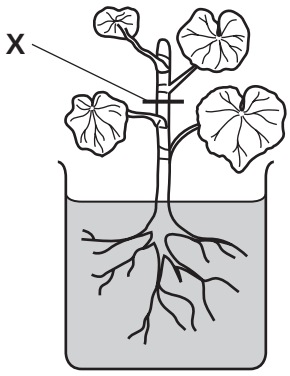

Fig. 1.2

After 10 minutes, the stem of the plant was cut across at **X**. Fig. 1.3 shows the appearance of the cut stem seen through a microscope.

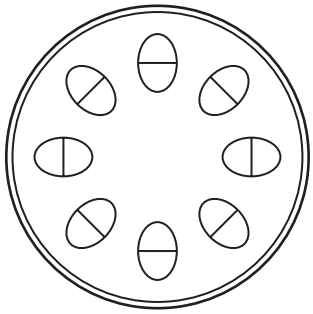

Fig. 1.3

(i) On Fig. 1.3, use a pencil to shade all of the parts that would look blue. [1]

(ii) The blue dye eventually reached the leaves of the plant. The following parts of the plant all became blue.

A leaf mesophyll cells

B xylem cells

C root hair cells

List the letters in order, to show the sequence in which the cells would become blue.

first to become blue .....

.....

last to become blue ..... [1]

(iii) Describe how water is lost from the leaves of plants.

.....

.....

.....

..... [3]

2 **(a)** In 2002 some research scientists claimed that they had produced a tiny amount of a new element that had a proton number of 118.

The scientists predicted that this element should be placed in Period 7 and Group 0 of the Periodic Table.

State the total number of electrons and the number of electron shells (energy levels) in one atom of this element.

total number of electrons .....

number of electron shells ..... [2]

(b) The halogens are reactive elements found in Group 7 of the Periodic Table.

Halogens combine vigorously with the alkali metals from Group 1 to form colourless ionic compounds. The halogens and alkali metals from Periods 2 to 5 are shown in Fig. 2.1.

Li	F
Na	Cl
K	Br
Rb	I

Fig. 2.1

(i) A student has a colourless solution which he knows is either potassium bromide or potassium iodide.

The student adds chlorine solution as shown in Fig. 2.2.

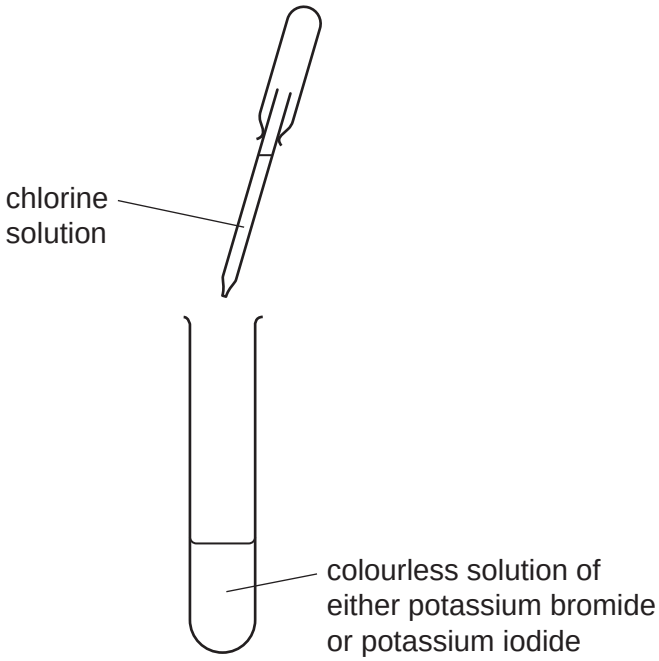

Fig. 2.2

Predict the colour the student would see if the test-tube contained

- potassium bromide, ...
- potassium iodide. .....

Explain your predictions.

.....

.....

.....

..... [3]

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(ii) The student is asked to predict which pair of elements, chosen from those shown in Fig. 2.1, would react together most vigorously.

He predicts that the reaction between lithium and fluorine would be the most vigorous.

Explain whether or not the student has made a correct prediction.

.....

.....

..... [2]

(c) Potassium bromide contains potassium ions, K^+ and bromide ions, Br^-.

Construct a balanced symbolic equation for the reaction between potassium and bromine to form potassium bromide.

..... [3]

3 Fig. 3.1 shows four swimmers at the start of a race.

For Examiner's Use

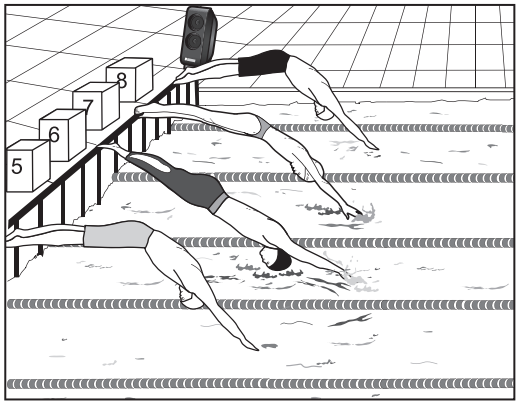


Fig. 3.1

(a) The swimmers start their race when they hear a loud, high-pitched sound from a loudspeaker.

(i) Explain why sound travels at a different speed through water than through air.

.....

.....

..... [2]

(ii) Fig. 3.2 shows the trace of a sound wave as it appears on an oscilloscope screen.

On Fig. 3.2 draw another trace of a sound wave from a sound that is louder than the one shown, but has the same pitch.

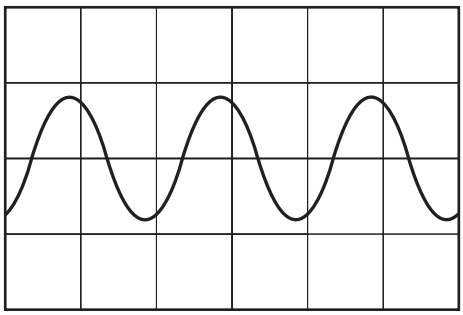


Fig. 3.2

[2]

(iii) The swimmers can hear the sound from the loudspeaker only if the frequency of the sound lies within a range of frequencies which the human ear can detect.

State this range of frequencies.

..... Hz to ..... Hz [1]

(iv) Waves are either longitudinal or transverse.

State whether each of the following is an example of a transverse or longitudinal wave.

the sound waves produced by the loudspeaker .....

the water waves produced by the swimmers in the pool ..... [1]

(b) Sound travels at 330 m / s in air. One swimmer is 0.4 m from the loudspeaker when he hears the sound.

(i) Calculate the time taken for the sound to travel from the loudspeaker to the swimmer.

State the formula that you use and show your working.

formula used

working

..... [2]

(ii) The loudspeaker produces a sound with a frequency of 2200 Hz.

Calculate the wavelength of this sound.

State the formula that you use and show your working.

formula used

working

..... [2]

For Examiner's Use

4 **(a)** Fig. 4.1 shows part of a food web in a forest ecosystem.

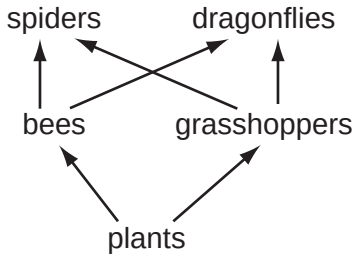


Fig. 4.1

(i) Define the term *ecosystem*.

.....

.....

..... [2]

(ii) What do the arrows in the food web represent?

..... [1]

(iii) State the trophic level at which spiders feed.

..... [1]

(iv) The food web contains several food chains.

Explain why food chains usually have fewer than five trophic levels.

.....

.....

..... [2]

(b) The food web shows that bees depend on plants. Some flowering plants also depend on bees to help them to reproduce.

Explain how bees help flowering plants to reproduce.

.....

.....

.....

.....

.....

..... [3]

For Examiner's Use

5 **(a)** A student investigated the reaction between antacid tablets and dilute hydrochloric acid.

The antacid tablets contain a mixture of sodium hydrogencarbonate, calcium carbonate and magnesium carbonate.

Fig. 5.1 shows one of the experiments the student carried out.

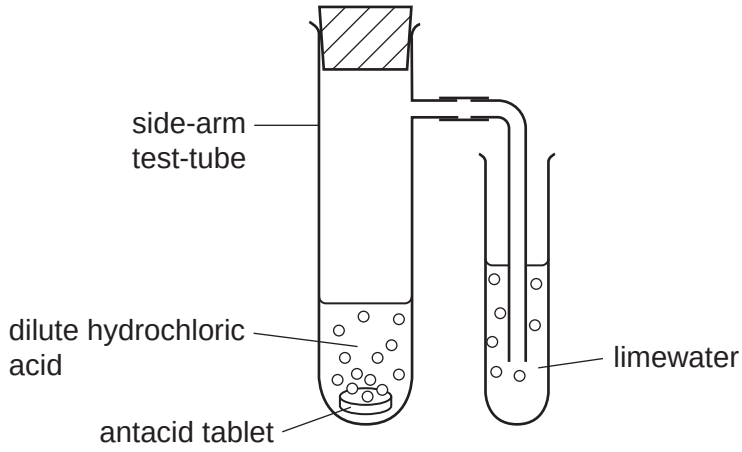


Fig. 5.1

Carbon dioxide gas was given off when the antacid tablet reacted with the dilute hydrochloric acid.

Describe and explain the change in appearance of the limewater during the experiment.

.....

.....

..... [2]

(b) Fig. 5.2 shows apparatus the student used to measure the rate of reaction between antacid tablets and hydrochloric acid.

- He added both hydrochloric acid and water to the side-arm test-tube to produce diluted hydrochloric acid.
- He dropped an antacid tablet into the diluted hydrochloric acid and immediately inserted the bung.
- He started the stop clock and timed how long it took for 25 cm^3 of gas to bubble up into the measuring cylinder.

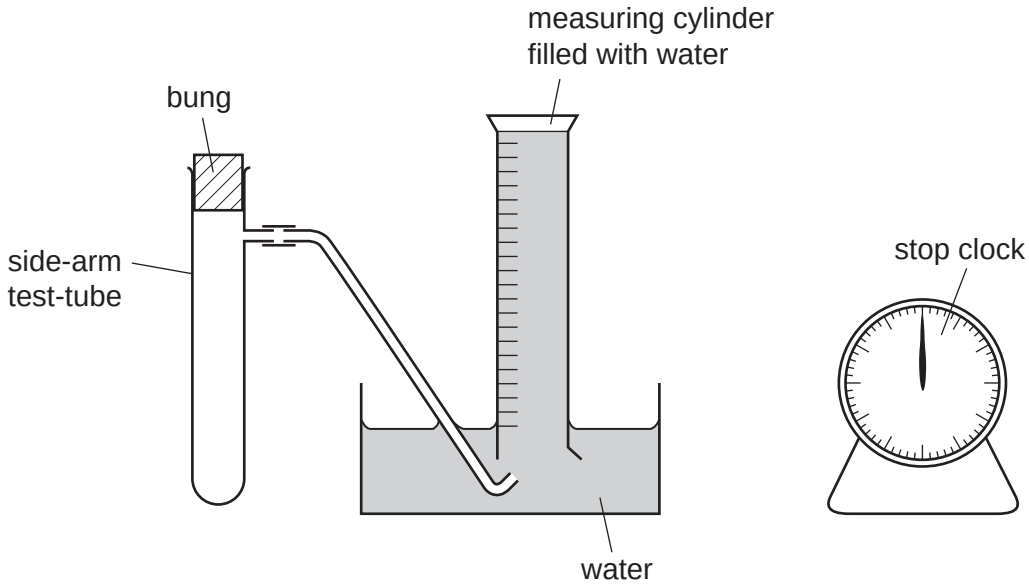


Fig. 5.2

The student carried out four experiments **A**, **B**, **C** and **D** in which he investigated the effect of changing reaction conditions on the rate.

Table 5.1 shows the data the student obtained.

Table 5.1

	volume of hydrochloric acid used / cm^3	volume of water used / cm^3	temperature of diluted hydrochloric acid / °C	time taken to collect 25 cm^3 gas / seconds
A	20	0	35	18
B	20	0	25	36
C	15	5	25	48
D	10	10	25	72

(i) State in which experiment, **A**, **B**, **C** or **D**, the reaction rate was the lowest.

..... [1]

(ii) State briefly the conclusions the student can draw from the results of experiments **A** and **B** and from the results of experiments **B**, **C** and **D**.

conclusion from experiments **A** and **B**

.....

.....

conclusion from experiments **B**, **C** and **D**

.....

..... [2]

(iii) Explain the conclusion from experiments **A** and **B**, in terms of collisions between particles.

.....

.....

.....

..... [2]

[Turn over

For Examiner's Use

6 **(a)** Fig. 6.1 shows a circuit for measuring the current through a filament lamp as the potential difference is changed.

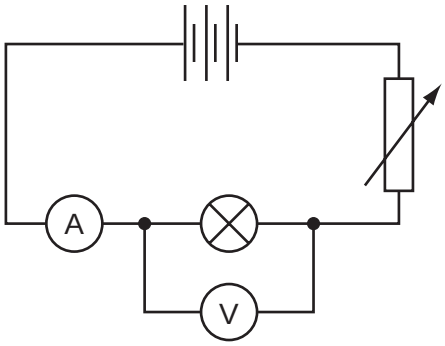


Fig. 6.1

Fig. 6.2 shows a graph of the results from an experiment using this circuit.

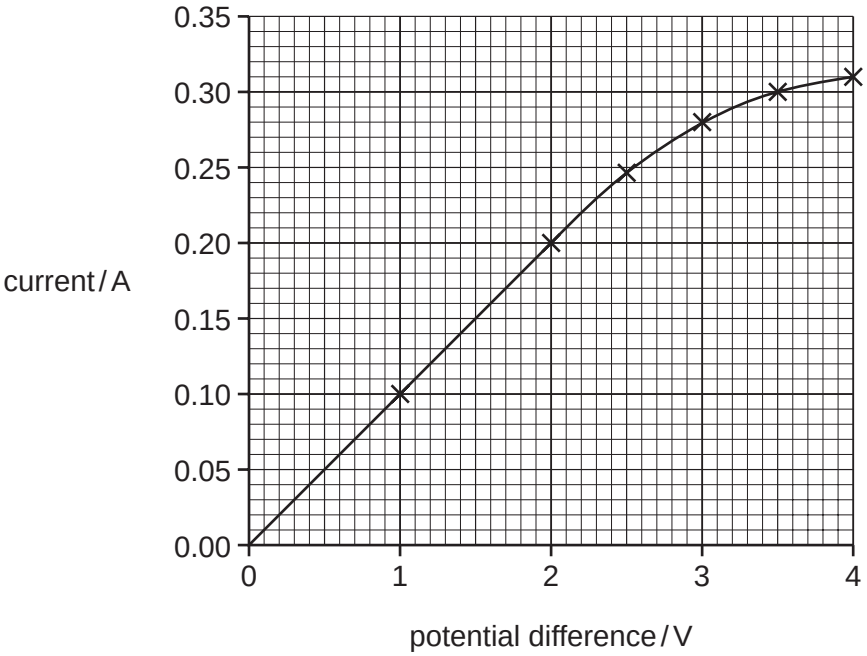


Fig. 6.2

(i) Use the graph to calculate the resistance of the lamp when the potential difference was 2.0 V and when the potential difference was 4.0 V.

State the formula that you use and show your working.

formula used

working

resistance at 2.0 V .....

resistance at 4.0 V ..... [2]

(ii) Describe how the current through the filament lamp changes as the voltage increases above 2.0 V.

.....

..... [1]

(b) A single ray of light from a torch (flashlight) is shone onto a mirror as shown in Fig. 6.3.

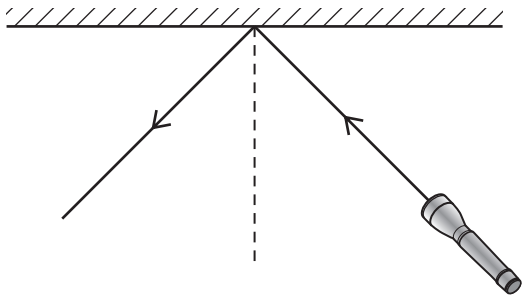


Fig. 6.3

(i) Label the angle of incidence and angle of reflection. [1]

(ii) The angle of incidence = 45°.

Write down the value of the angle of reflection.

..... [1]

For Examiner's Use

7 **(a)** Fig. 7.1 shows the human alimentary canal.

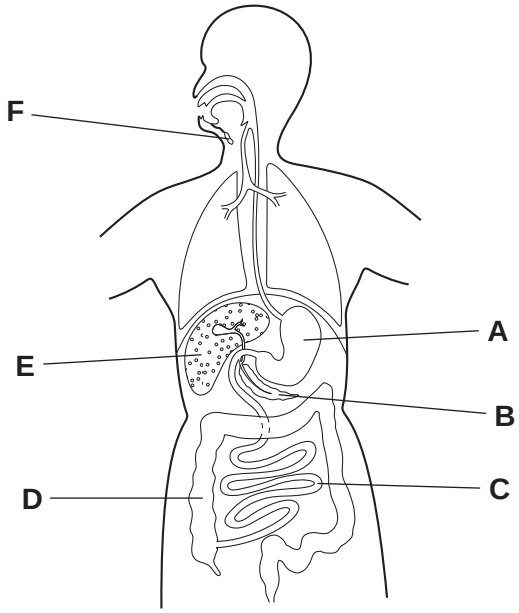


Fig. 7.1

State the **letter** that indicates

the liver, ...

the area where digested food is absorbed. ..... [2]

(b) Lipase is an enzyme that catalyses the breakdown of fats to fatty acids and glycerol.

fat ⟶ fatty acids + glycerol

A student carried out an experiment to investigate the effect of temperature on the rate of the breakdown of fats by lipase. Fig. 7.2 shows how she set up the two test-tubes.

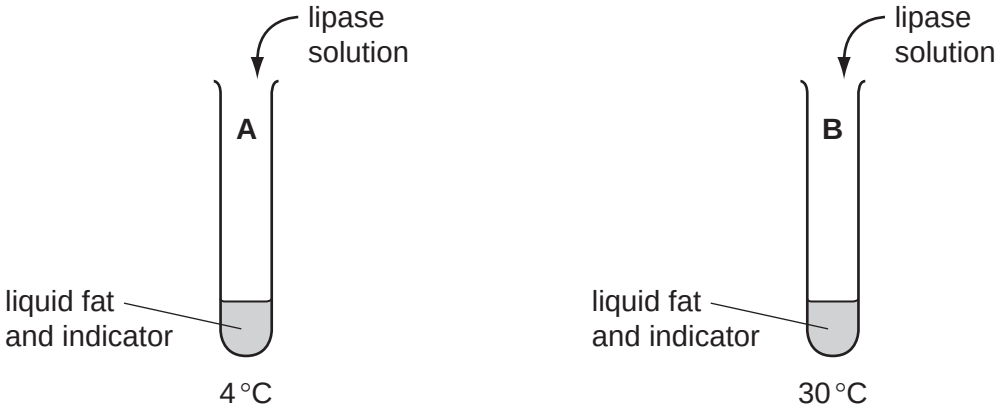


Fig. 7.2

The indicator that the student used changes colour from blue to yellow when the pH falls below 5.

Table 7.1 shows her results.

Table 7.1

time / minutes	tube A (4 °C)	tube B (30 °C)
0	blue	blue
5	blue	yellow
10	blue	yellow
15	yellow	yellow

(i) Using the information in the word equation, explain why the indicator eventually changed to yellow in both tubes.

.....

.....

..... [2]

(ii) Explain the reason for the difference between the results for tube **A** and tube **B**.

.....

.....

.....

.....

..... [3]

(c) Fat is an important component of a balanced diet.

Explain why a balanced diet should **not** contain too much fat.

.....

.....

.....

..... [2]

For Examiner's Use

8 Large amounts of chemical energy are stored in the world's reserves of fossil fuels such as natural gas and petroleum (crude oil).

(a) (i) Name the main compound in natural gas.

.....

Write the **word** chemical equation for the complete combustion of this compound.

..... [3]

(ii) Before it is refined, petroleum contains sulfur compounds.

Describe and explain how water in rivers and lakes could become polluted if sulfur compounds are **not** removed from fossil fuels before they are used.

.....

.....

.....

.....

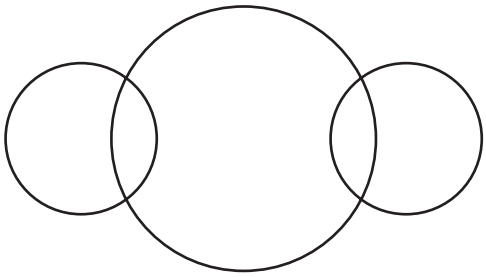
.....

..... [4]

(b) Sulfur is removed from petroleum by combining it with hydrogen to form the gaseous compound hydrogen sulfide, H_2S. Sulfur is in Group 6 of the Periodic Table.

Complete the bonding diagram of one molecule of hydrogen sulfide below to show

- the chemical symbols of the elements
- how the outer electrons in each element are arranged.



[2]

9 Fig. 9.1 shows a toy car travelling over a plastic surface.

For Examiner's Use

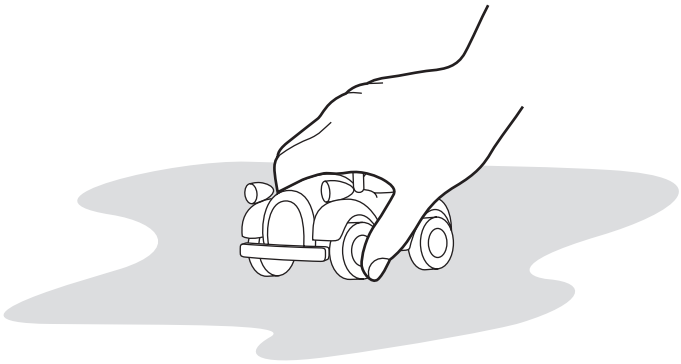


Fig. 9.1

(a) The car, of mass 0.5 kg is moving at a steady speed of 0.5 m/s.

Calculate the kinetic energy of the car.

State the formula that you use and show your working.

formula used

working

..... [2]

(b) While the car is moving, the wheels are rubbing against the plastic surface. The car becomes electrostatically charged with a positive charge.

Explain how this happens.

.....

.....

.....

.....

..... [3]

For Examiner's Use

(c) A speed – time graph for the car is shown in Fig. 9.2. It shows the motion of the car over a 25 second period.

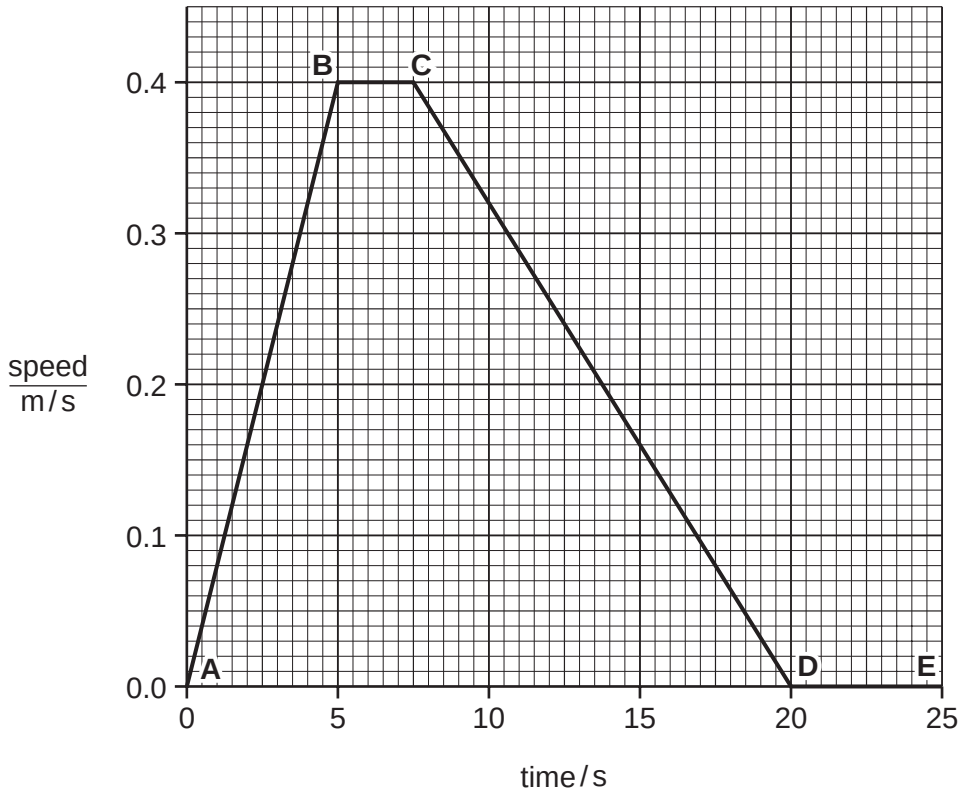


Fig. 9.2

(i) State the part of the graph when the car is not moving.

..... [1]

(ii) State **one** part of the graph when the car was travelling at constant speed and write down the value of this speed.

part of graph .....

speed ..... [1]

(iii) State **one** part of the graph when the car was accelerating and calculate this acceleration.

For Examiner's Use

Show your working.

part of graph .....

acceleration ..... [2]

(iv) Calculate the distance travelled by the car between **A** and **D**.

Show your working.

..... [3]

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DATA SHEET
The Periodic Table of the Elements

Group																	
I	II											III	IV	V	VI	VII	0
							1 **H** Hydrogen 1										4 **He** Helium 2
7 **Li** Lithium 3	9 **Be** Beryllium 4											11 **B** Boron 5	12 **C** Carbon 6	14 **N** Nitrogen 7	16 **O** Oxygen 8	19 **F** Fluorine 9	20 **Ne** Neon 10
23 **Na** Sodium 11	24 **Mg** Magnesium 12											27 **Al** Aluminium 13	28 **Si** Silicon 14	31 **P** Phosphorus 15	32 **S** Sulfur 16	35.5 **Cl** Chlorine 17	40 **Ar** Argon 18
39 **K** Potassium 19	40 **Ca** Calcium 20	45 **Sc** Scandium 21	48 **Ti** Titanium 22	51 **V** Vanadium 23	52 **Cr** Chromium 24	55 **Mn** Manganese 25	56 **Fe** Iron 26	59 **Co** Cobalt 27	59 **Ni** Nickel 28	64 **Cu** Copper 29	65 **Zn** Zinc 30	70 **Ga** Gallium 31	73 **Ge** Germanium 32	75 **As** Arsenic 33	79 **Se** Selenium 34	80 **Br** Bromine 35	84 **Kr** Krypton 36
85 **Rb** Rubidium 37	88 **Sr** Strontium 38	89 **Y** Yttrium 39	91 **Zr** Zirconium 40	93 **Nb** Niobium 41	96 **Mo** Molybdenum 42	**Tc** Technetium 43	101 **Ru** Ruthenium 44	103 **Rh** Rhodium 45	106 **Pd** Palladium 46	108 **Ag** Silver 47	112 **Cd** Cadmium 48	115 **In** Indium 49	119 **Sn** Tin 50	122 **Sb** Antimony 51	128 **Te** Tellurium 52	127 **I** Iodine 53	131 **Xe** Xenon 54
133 **Cs** Caesium 55	137 **Ba** Barium 56	139 **La** Lanthanum 57 *	178 **Hf** Hafnium 72	181 **Ta** Tantalum 73	184 **W** Tungsten 74	186 **Re** Rhenium 75	190 **Os** Osmium 76	192 **Ir** Iridium 77	195 **Pt** Platinum 78	197 **Au** Gold 79	201 **Hg** Mercury 80	204 **Tl** Thallium 81	207 **Pb** Lead 82	209 **Bi** Bismuth 83	**Po** Polonium 84	**At** Astatine 85	**Rn** Radon 86
Fr Francium 87	226 **Ra** Radium 88	227 **Ac** Actinium 89 †															

140 **Ce** Cerium 58	141 **Pr** Praseodymium 59	144 **Nd** Neodymium 60	**Pm** Promethium 61	150 **Sm** Samarium 62	152 **Eu** Europium 63	157 **Gd** Gadolinium 64	159 **Tb** Terbium 65	162 **Dy** Dysprosium 66	165 **Ho** Holmium 67	167 **Er** Erbium 68	169 **Tm** Thulium 69	173 **Yb** Ytterbium 70	175 **Lu** Lutetium 71
232 **Th** Thorium 90	**Pa** Protactinium 91	238 **U** Uranium 92	**Np** Neptunium 93	**Pu** Plutonium 94	**Am** Americium 95	**Cm** Curium 96	**Bk** Berkelium 97	**Cf** Californium 98	**Es** Einsteinium 99	**Fm** Fermium 100	**Md** Mendelevium 101	**No** Nobelium 102	**Lr** Lawrencium 103

*58-71 Lanthanoid series
†90-103 Actinoid series

Key: a over **X** over b

a = relative atomic mass
X = atomic symbol
b = proton (atomic) number

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).