



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE
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COMBINED SCIENCE

0653/23

Paper 2 (Core)

October/November 2013

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 pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

DO NOT WRITE IN ANY BARCODES.

Answer **all** questions.

Electronic calculators may be used.

You may lose marks if you do not show your working or if you do not use appropriate units.

A copy of the Periodic Table is printed on page 20.

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.

This document consists of **19** printed pages and **1** blank page.



1 Fig. 1.1 shows a root hair cell.

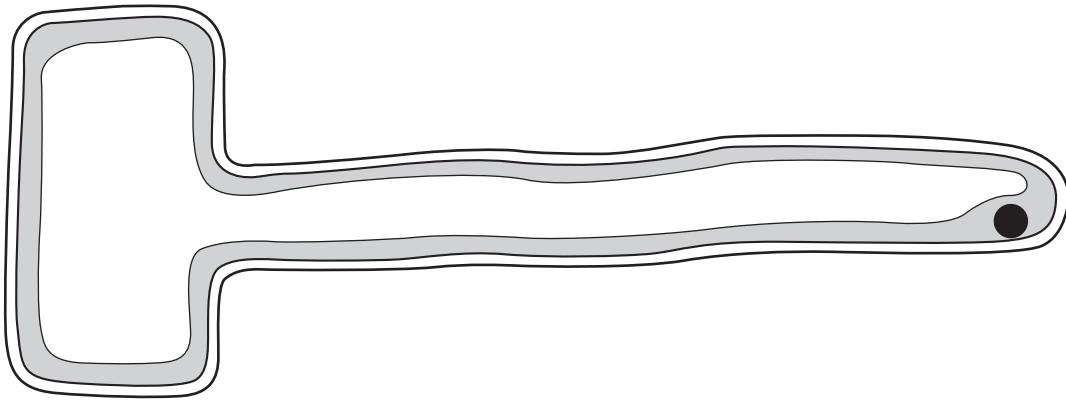


Fig. 1.1

(a) Use the letters **A**, **B** and **C** to label these parts of the root hair cell in Fig. 1.1.

A the cell membrane

B the part that contains chromosomes

C a structure that is **not** present in animal cells

[3]

(b) Name **two** substances that are absorbed by root hair cells.

1

2

[2]

(c) Fig. 1.2 shows part of a plant stem from which the outer layer, including the phloem, has been removed.

For
Examiner's
Use

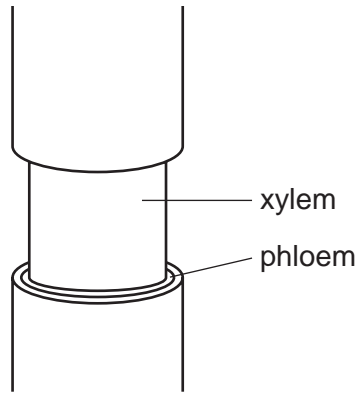


Fig. 1.2

(i) State the function of phloem.

.....
.....
..... [2]

(ii) Suggest why this treatment would cause the roots of the plant to die.

.....
.....
..... [2]

- 2 (a) Table 2.1 shows information about some chemical elements and their positions in the Periodic Table.

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Table 2.1

element	group number in the Periodic Table
oxygen	6
calcium	2
lithium	1
sulfur	6
fluorine	7

- (i) State the noble (inert) gas that is in the same period of the Periodic Table as sulfur.

..... [1]

- (ii) Select **two** elements from Table 2.1 whose atoms form ionic chemical bonds with each other and explain your answer.

..... and

explanation

..... [2]

- (b) Fig. 2.1 shows a diagram of an atom.

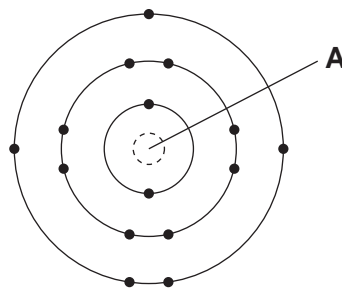


Fig. 2.1

- (i) Name structure **A** in Fig 2.1. [1]

(ii) State the proton number of the atom in Fig. 2.1.

Explain your answer briefly.

proton number

explanation

..... [2]

*For
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- 3 Fig. 3.1 shows a circuit used to measure the current passing through a resistor when the voltage across it is changed.

For
Examiner's
Use

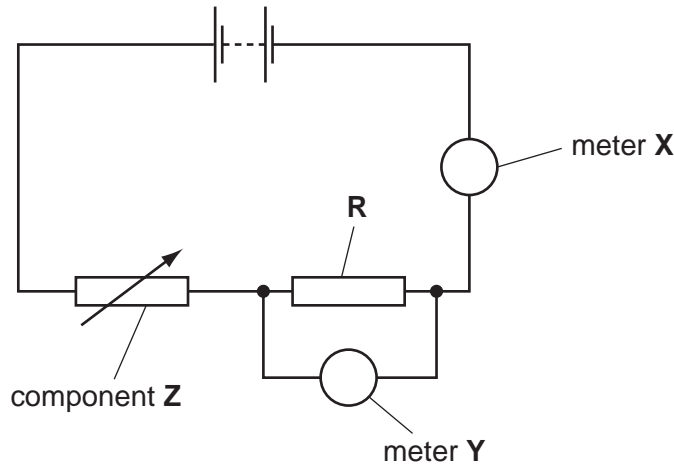


Fig. 3.1

- (a) Describe the purpose of component Z in the circuit.

..... [1]

- (b) The meters shown in the circuit give readings of 0.6 A and 8.0 V.

State which meter, X or Y, gives the reading of 0.6 A.

Explain your answer.

meter

explanation

..... [1]

- (c) Use the formula

$$\text{resistance} = \text{potential difference} / \text{current}$$

to calculate the resistance of the resistor.

State the units for your answer.

working

..... unit [2]

4 Soya beans are an important crop in Brazil.

(a) Table 4.1 contains information about the tests used and results obtained when testing soya beans for protein, fat and starch.

Table 4.1

nutrient tested for	reagent	result	conclusion
protein		purple	
starch			contains starch
fat		milky white	

Complete the table. [3]

(b) Explain why protein is an important part of a balanced diet.

.....

 [2]

(c) When a person eats soya beans, the beans are chewed in the mouth.

Explain why this makes it easier for enzymes in the digestive system to digest the beans.

.....

 [2]

(d) Large areas of rainforest have been cleared in Brazil, to provide more land for growing soya beans.

State **two** ways in which cutting down the rainforest can harm the environment.

1

 2
 [2]

- 5 (a) A student placed four equally-sized pieces of different metals into colourless liquids contained in four test-tubes **P**, **Q**, **R** and **S**.

For
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Fig. 5.1 shows what the student observed.

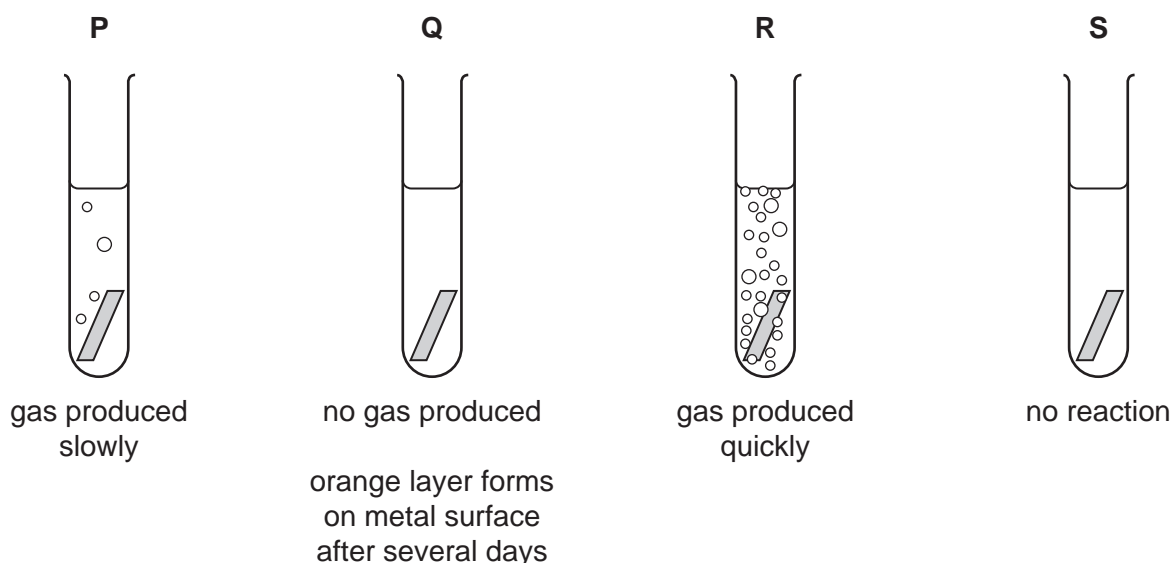


Fig. 5.1

- (i) Suggest which of the test-tubes in Fig. 5.1 contained water to which a piece of iron was added.

Explain your answer.

test-tube

explanation

.....

.....

..... [3]

- (ii) The colourless liquid in test-tube **R** was dilute hydrochloric acid.

Suggest the name of the metal that was added to test-tube **R** and name the gas that was produced.

metal

gas [2]

- (iii) Test-tube **P** contained the same concentration of dilute hydrochloric acid at the same temperature as test-tube **R**.

Suggest a reason why gas was produced more slowly in test-tube **P** than in test-tube **R**.

.....
 [1]

- (b) Gasoline and diesel are mixtures of liquid hydrocarbons obtained from petroleum by the process of fractional distillation.

- (i) State **one** difference in the properties of the hydrocarbons in gasoline that allows them to be separated by fractional distillation.

.....
 [1]

- (ii) State the main use of gasoline and explain, in terms of its chemical properties, why it is suitable for this use.

use

explanation

..... [2]

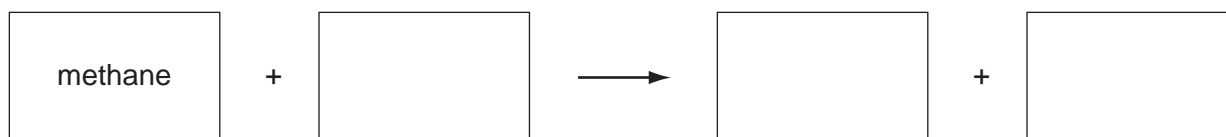
- (c) Natural gas contains mainly methane.

- (i) Complete the diagram of the structure of one molecule of methane.



[1]

- (ii) Complete the **word** chemical equation for the complete combustion of methane.



[2]

- 6 (a) Fig. 6.1 gives information about the uses of different types of electromagnetic waves and their effects on living tissue.

Draw lines to link each electromagnetic wave with its effect on living tissue and its use. One has been completed as an example.

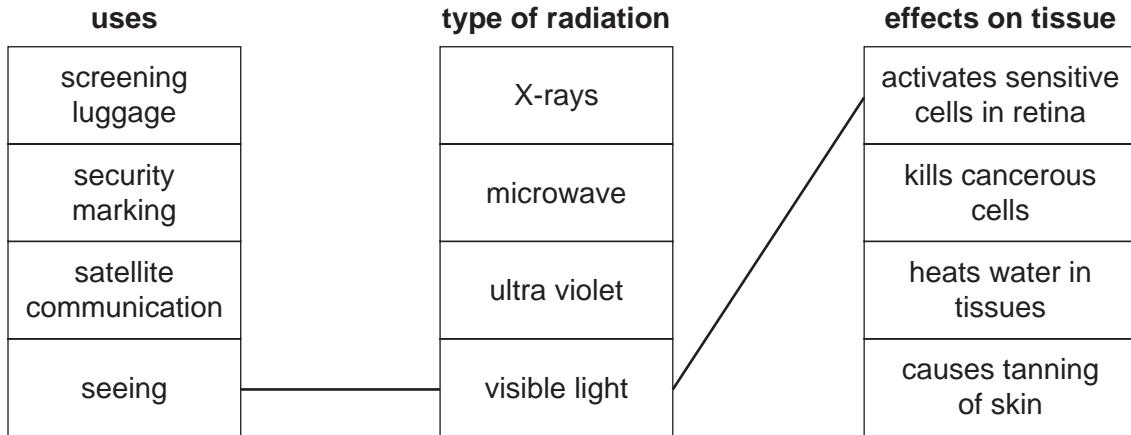
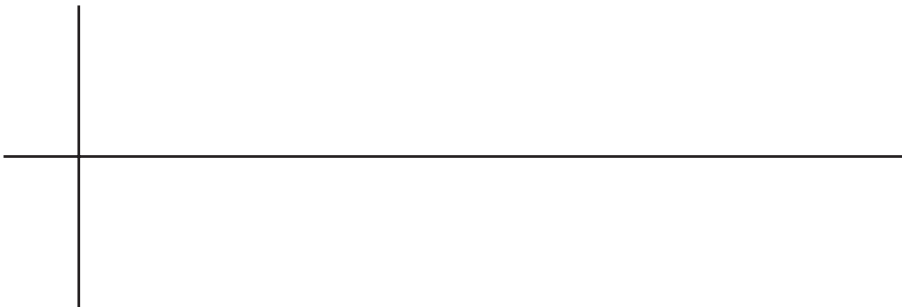


Fig. 6.1

[4]

- (b) Electromagnetic waves are transverse waves. Water waves are also transverse.

Draw a diagram of a transverse wave on the axes below. Label the amplitude and **one** wavelength on your diagram.



[3]

(c) Fig. 6.2 shows a person looking into a mirror and seeing an image.

For
Examiner's
Use

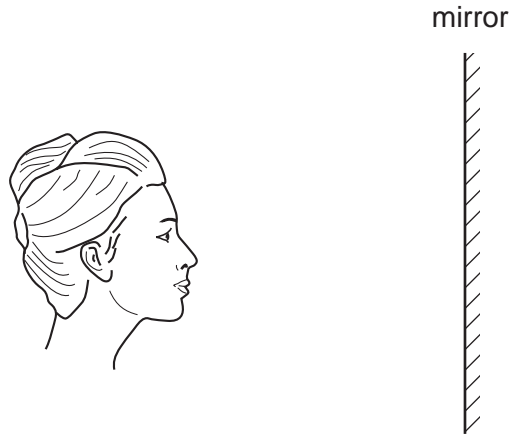


Fig. 6.2

- (i) Write the letter **X** on Fig. 6.2 to show the position of the image of the person's nose. [2]
- (ii) Select **three** words or phrases from the list that describe the image correctly.

- larger than object
- real
- same size as object
- smaller than object
- upright
- upside down
- virtual

.....

..... [3]

7 Fig. 7.1 shows the contents of the human thorax (chest).

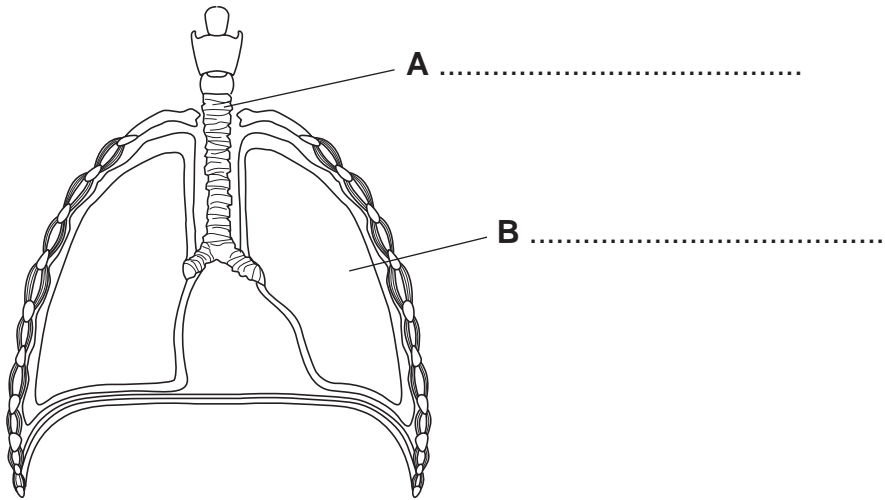


Fig. 7.1

(a) On Fig. 7.1, name structures **A** and **B**. [2]

(b) Oxygen diffuses into the blood from the alveoli inside the lungs. Carbon dioxide diffuses into the alveoli from the blood.

(i) Define the term *diffusion*.

.....
.....
..... [2]

(ii) Name the component of blood that transports dissolved carbon dioxide.
..... [1]

(iii) When a person is doing vigorous exercise, the concentration of carbon dioxide in the blood increases.

Explain why this happens.

.....
.....
..... [2]

- (iv) Suggest how this will affect the rate of diffusion of carbon dioxide from the blood to the alveoli.

Explain your answer.

effect on rate of diffusion

explanation

..... [2]

*For
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- 8 (a) Fig. 8.1 shows apparatus a student used to investigate the reaction between dilute nitric acid and excess calcium carbonate.

For
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Use

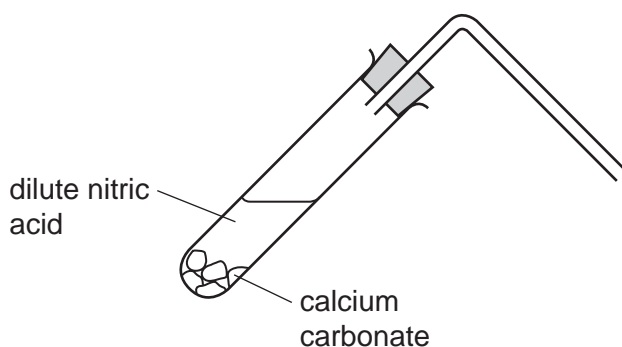


Fig. 8.1

- (i) Describe how the student could show that the reaction in Fig. 8.1 produced carbon dioxide. You may complete the diagram to help you answer this question.

.....

 [2]

- (ii) At the end of the reaction the test-tube in Fig. 8.1 contains a solution of the compound calcium nitrate.

State the general name for compounds like calcium nitrate which are produced when an acid reacts with a metal carbonate.

..... [1]

- (iii) The chemical formula of calcium nitrate is $\text{Ca}(\text{NO}_3)_2$.

State the total number of atoms and the number of different elements that are shown combined together in this formula.

total number of atoms

number of different elements [2]

- (b) The student then carried out an investigation into the way that the rate of the reaction in (a) changed when he varied the concentration of the nitric acid.

For
Examiner's
Use

Fig. 8.2 shows the apparatus the student used to measure the rate of reaction.

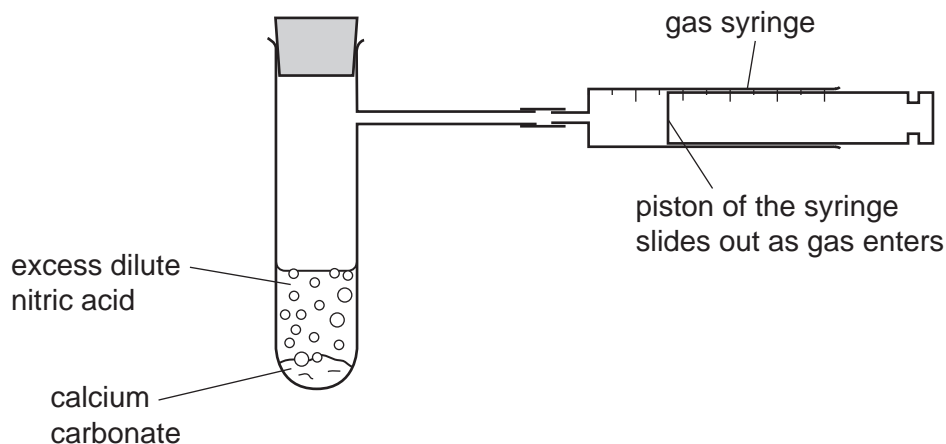


Fig. 8.2

The student measured the rate of reaction by finding how long it took for the gas syringe to fill with gas.

- (i) After he had completed several measurements, the student wrote the following correct conclusion in his notebook.

	Conclusion
	The higher the pH of the dilute nitric acid the longer it took for the gas syringe to fill with gas.

Explain this conclusion briefly.

.....

 [2]

- (ii) State **two** other variables that can affect the rate of reaction between dilute nitric acid and calcium carbonate.

1
 2 [2]

9 Fig. 9.1 shows a solar- powered golf cart used to carry golfers around a golf course.

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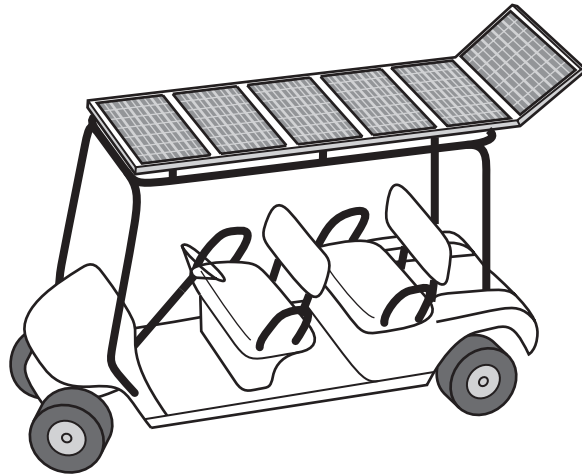


Fig. 9.1

(a) As the cart moves around the course, the motion of the cart is measured.

Fig. 9.2 shows a distance /time graph for a small part of the journey lasting 60 seconds.

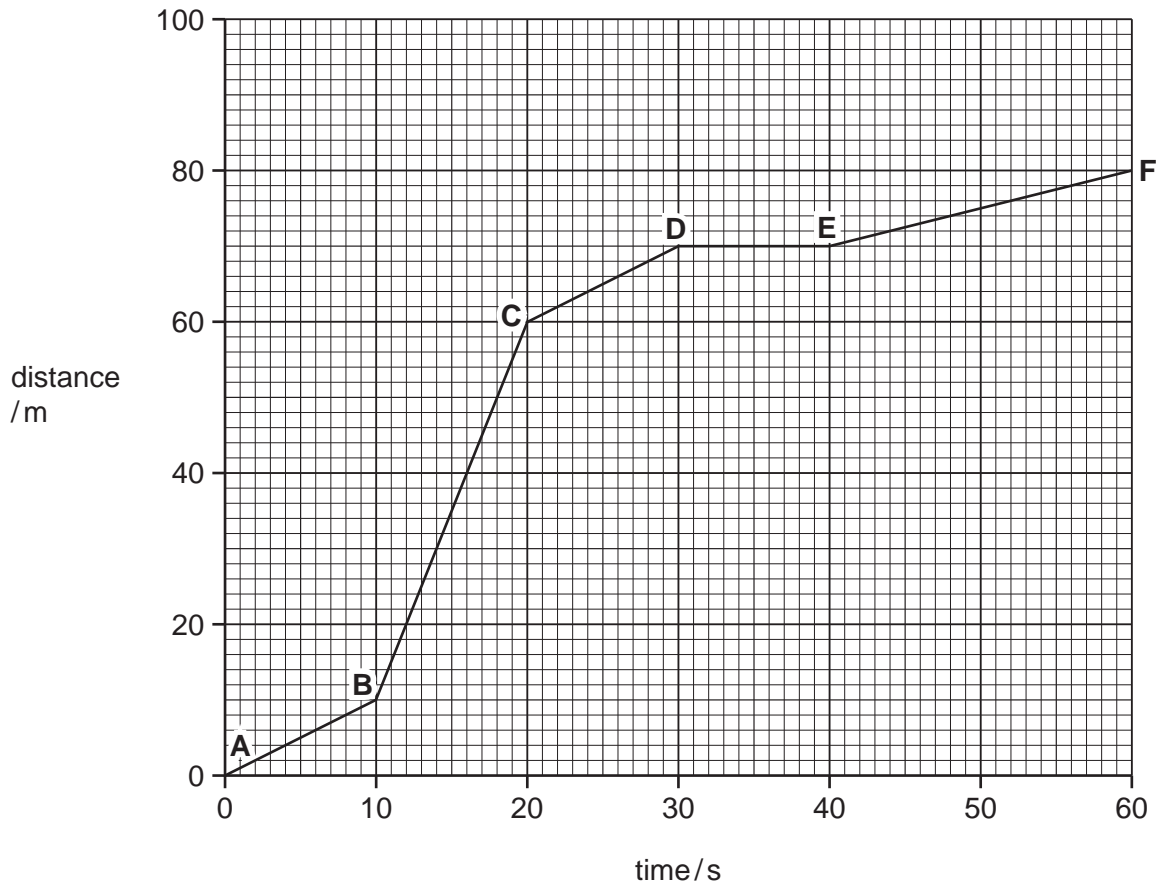


Fig. 9.2

(i) Write down the total distance covered in 60 s. m [1]

(ii) Describe the motion of the cart between **D** and **E**.

.....
..... [1]

(iii) During another part of the journey, the cart is accelerating.

State whether the forces acting on the cart are balanced or unbalanced.

Explain your answer.

.....
..... [1]

(b) The cart is powered by solar cells on its roof. The solar cells produce electrical energy used to charge the rechargeable batteries in the cart.

Name **one** other renewable energy resource that could produce electrical energy.

..... [1]

(c) The golfer hits a golf ball with his club. The ball flies through the air.

(i) State the form of energy given to the golf ball when the ball is hit.

..... [1]

(ii) State the form of energy gained by the golf ball as it rises into the air after being hit.

..... [1]

(d) The mass of a golf ball is 45g. The volume of a golf ball is 36 cm³.

Calculate the density of the golf ball.

State the formula that you use and show your working.

formula

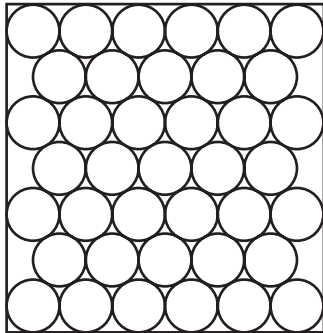
working

..... g/cm³ [2]

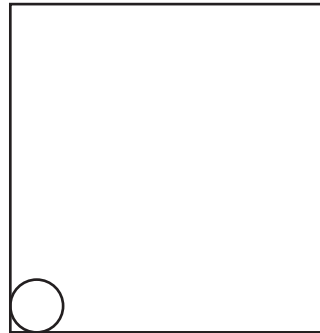
- (e) The head of the golf club is made of solid metal. The air the golf ball is travelling through is a gas.

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Complete Fig. 9.3 below to show the arrangement of particles in a gas. The diagram for a solid has been done for you.



solid



gas

Fig. 9.3

[2]

DATA SHEET
The Periodic Table of the Elements

		Group																			
		I	II	III	IV	V	VI	VII	VIII	IX	X										
		1 H Hydrogen 1																			
7	9	Li Lithium 3	Be Beryllium 4									He Helium 2									
23	24	Na Sodium 11	Mg Magnesium 12									Ne Neon 10									
39	40	K Potassium 19	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	88	Rb Rubidium 37	Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	101 Ru Ruthenium 44	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	137	Cs Caesium 55	Ba Barium 56	139 La Lanthanum 57	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	190 Os Osmium 76	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	210 Po Polonium 84	210 At Astatine 85	210 Rn Radon 86				
87	88	Fr Francium	Ra Radium	226 Ac Actinium									227 Ac Actinium								
												*58-71 Lanthanoid series		†90-103 Actinoid series							
		a		X		b		a = relative atomic mass		X = atomic symbol		b = proton (atomic) number									
		Key		X		b		a = relative atomic mass		X = atomic symbol		b = proton (atomic) number									
140	141	Ce Cerium 58	Pr Praseodymium 59	144 Nd Neodymium 60	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71								
90	91	Th Thorium	Pa Protactinium	232 U Uranium	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 dm³ at room temperature and pressure (r.t.p.).

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