UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTER NUMBER

CANDIDATE NUMBER

2505002583

CO-ORDINATED SCIENCES (DOUBLE)(US) **0442/23**

Paper 2 (Core) **October/November 2013**

2 hours

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Center 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 28.

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 **28** printed pages.

UNIVERSITY of CAMBRIDGE International Examinations

1 Fig. 1.1 shows a root hair cell.

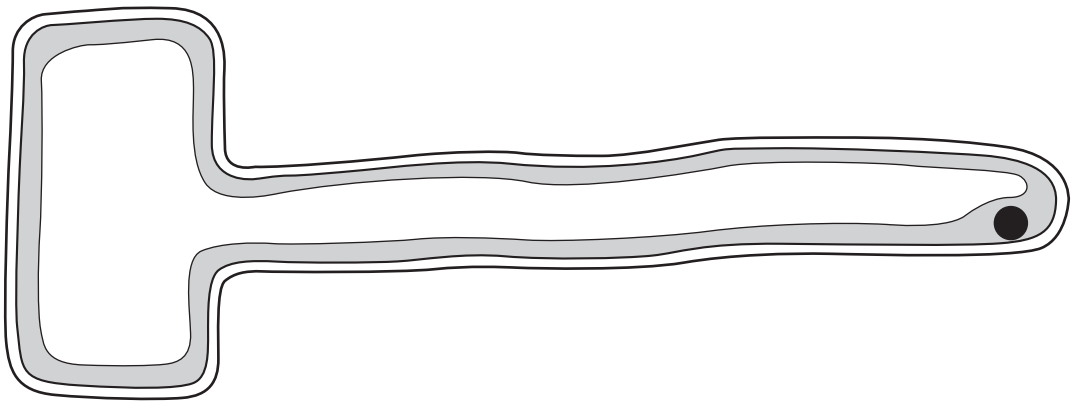


Fig. 1.1

(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 p… has been removed.

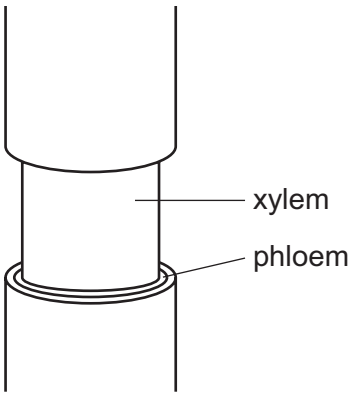


Fig. 1.2

(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.

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.

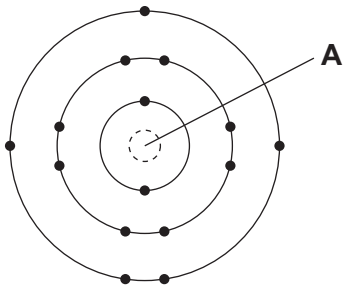


Fig. 2.1

(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]

(c) A student added **excess** acidified barium chloride solution to a solution of a magnesium compound to produce mixture **W**.

Fig. 2.2 shows the procedure followed.

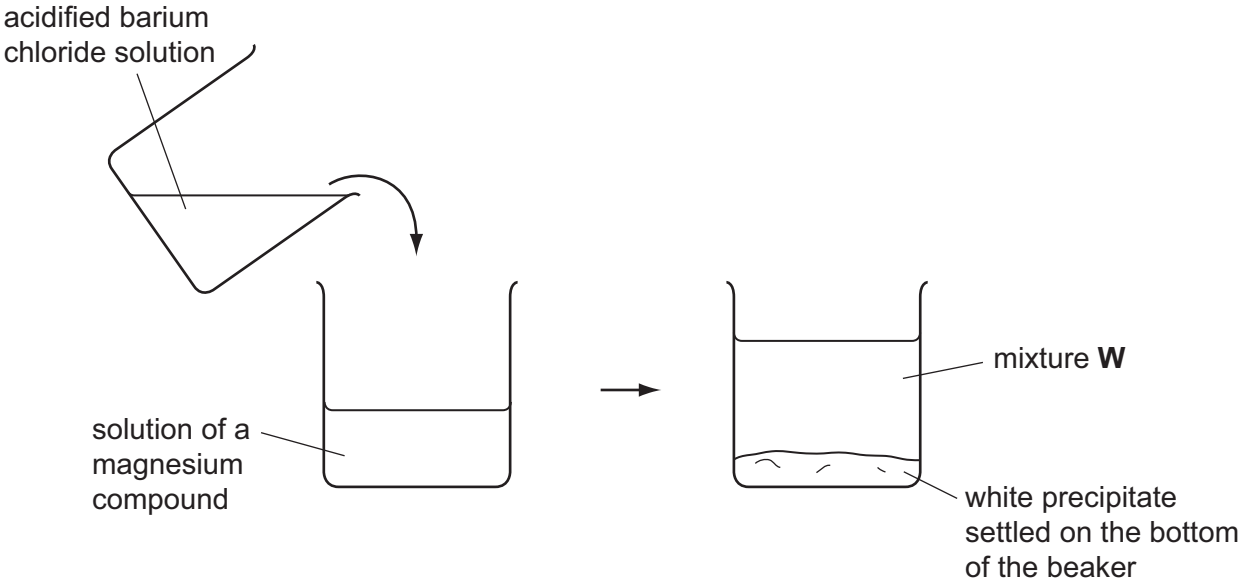


Fig. 2.2

(i) Suggest the full name of the magnesium compound in the original solution.

..... [1]

(ii) Describe briefly what the student should do to find the mass of the white precipitate in mixture **W**.

.....

.....

.....

..... [3]

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

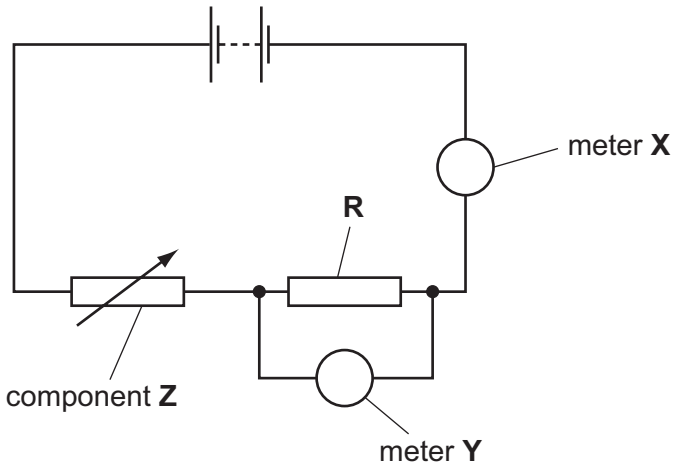


Fig. 3.1

(i) Describe the purpose of component **Z** in the circuit.

.....

..... [1]

(ii) 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]

(iii) Calculate the resistance of resistor **R**.

State the formula that you use and show your working.

formula

working

..... Ω [2]

(b) Complete the sentences below using a word or phrase from the list. Each w... phrase can be used once, more than once or not at all.

decreases **increases** **is zero** **stays the same**

When the voltage across the resistor is reduced, the current through the resistor

..... .

When the voltage of the supply is reduced, the voltage across the resistor

..... .

When the voltage across the resistor is reduced, the resistance of the wire

..... .

[2]

(c) The resistance of a piece of wire depends on a number of variables such as the temperature of the wire and the material from which it is made.

State **two other** factors which affect the resistance of a piece of wire.

1 .....

2 ..... [2]

4 Soya beans are an important crop in Brazil. Soya beans contain a lot of protein and smaller quantities of starch and fat.

(a) Describe how you could test a sample of soya beans to find out if they contain fat.

.....

.....

.....

..... [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) Raw soya beans contain substances that stop protease enzymes from working. Cooking destroys these substances.

Suggest how eating uncooked soya beans could prevent the absorption of some of the nutrients from them.

.....

.....

..... [2]

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

Explain how cutting down the rainforest can harm the environment.

.....

.....

.....

.....

.....

.....

..... [4]

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

Fig. 5.1 shows what the student observed.

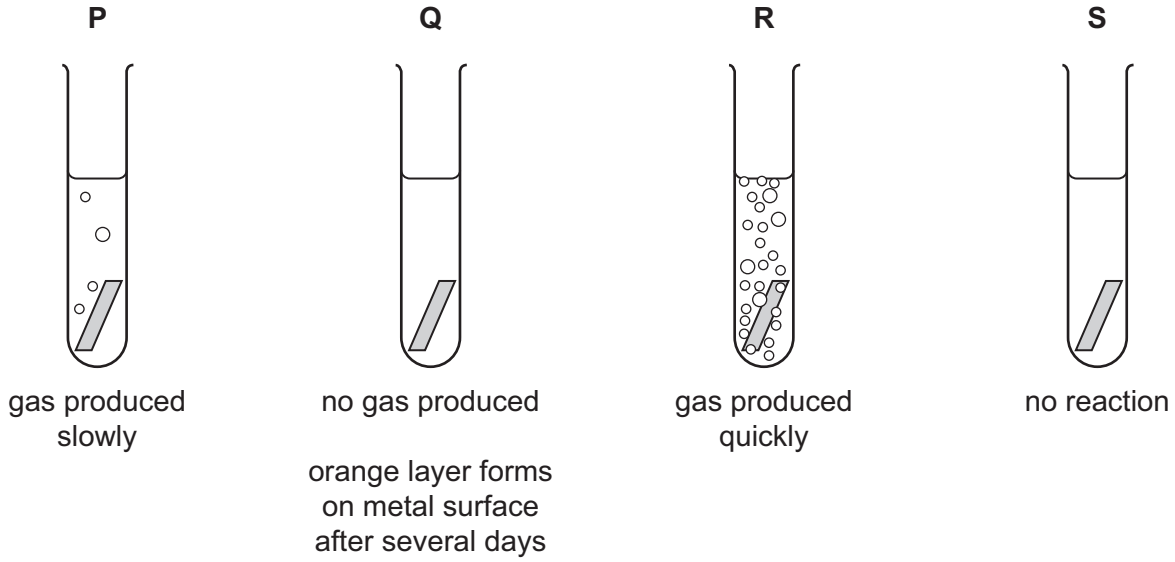


Fig. 5.1

(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 colorless 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 the name of the metal that was added to test-tube **P**.

..... [1]

(b) In the process of copper plating, a thin layer of copper is formed on the surface of a metal object.

Fig. 5.2 shows the apparatus and materials that are needed to copper plate a metal key.

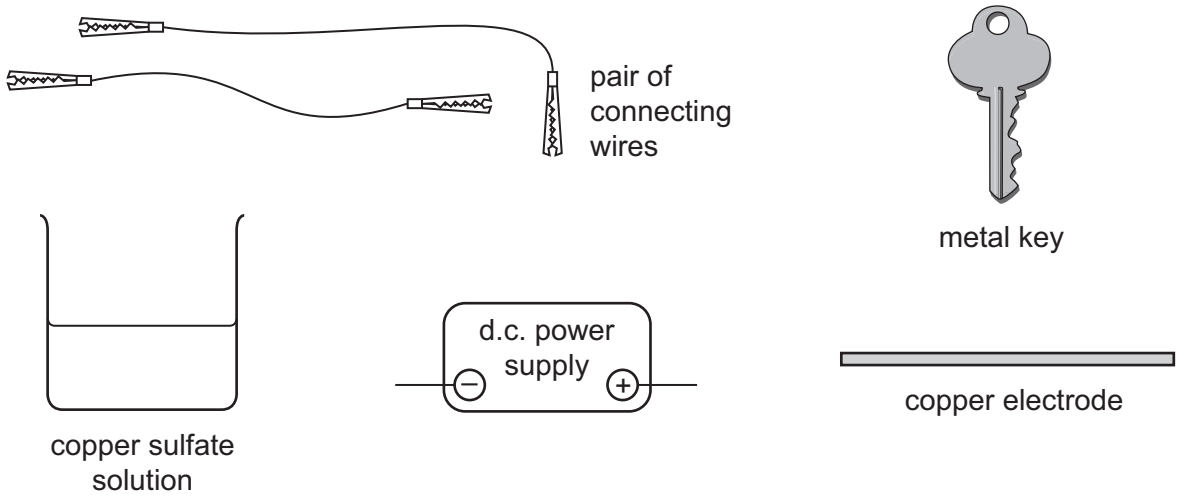


Fig. 5.2

Draw a diagram which shows how the apparatus and materials in Fig. 5.2 should be assembled so that the metal key will be copper plated.

[3]

6 **(a)** Fig. 6.1 gives information about the uses of different types of electromagnetic 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.

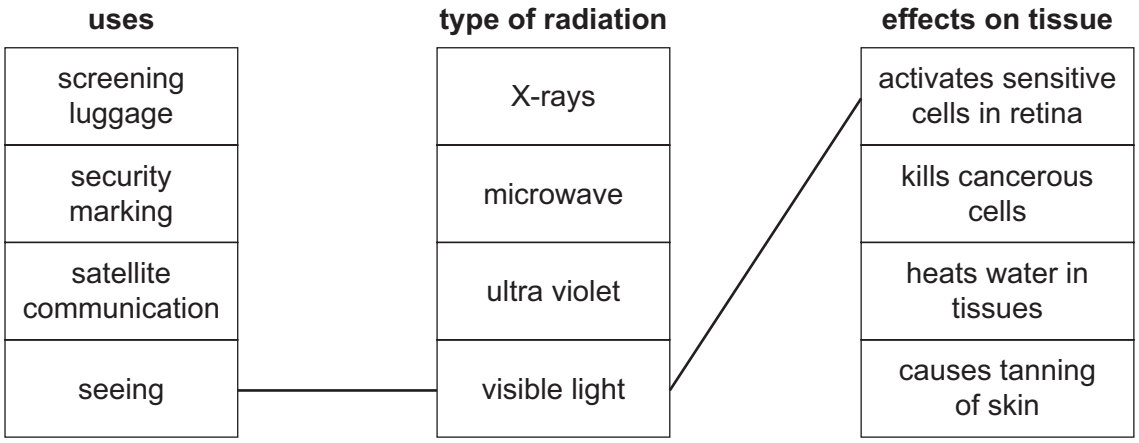


Fig. 6.1

[4]

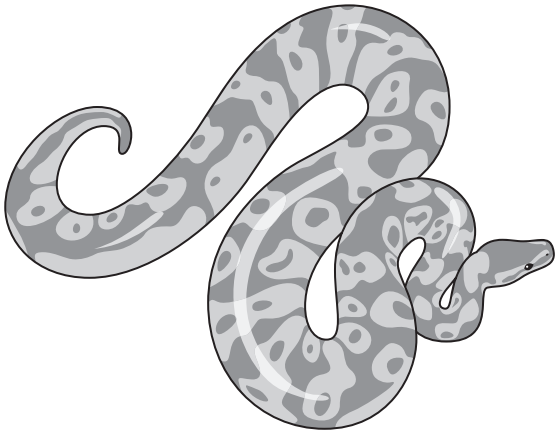
(b) Electromagnetic waves are transverse waves. Water waves are also transverse.

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

[3]

Please turn over for Question 7.

7 Ball pythons (royal pythons) are snakes that are kept as pets in many parts of the wo



The color of a ball python is determined by its genes.

Some ball pythons are albino (white). This is caused by a recessive allele, **a**. The dominant allele, **A**, gives normal coloring.

(a) Complete Table 7.1 to show the possible genotypes and colors arising from this gene.

Table 7.1

genotype	color
AA	
Aa	normal
	albino

[2]

(b) State the correct biological term for the visible appearance produced by the genotype, in this case the color of the snake.

..... [1]

(c) **(i)** Complete the genetic diagram to explain the results of crossing two snake... are heterozygous for these alleles.

genotype of parents ..... Aa ..... and .....

gametes ○ and ○ ○ and ○

gametes from one parent

gametes from the other parent	○	○
○		
○		

[3]

(ii) State the ratio of offspring that you would expect from this cross.

ratio of normal : albino offspring = ... : ..... [1]

(d) A breeder has several snakes with normal coloring.

Suggest how she can find out whether a particular snake is homozygous or heterozygous.

.....

.....

..... [2]

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

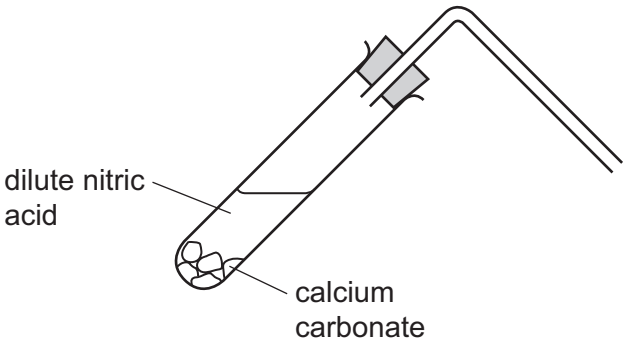


Fig. 8.1

(i) Name the gas that is given off in this reaction.

..... [1]

(ii) Describe how the student could test for the gas you named in **(i)**. You may wish to complete the diagram in Fig. 8.1 to help you to answer this question.

.....

.....

..... [2]

(iii) 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]

(iv) The chemical formula of calcium nitrate is $Ca(NO_3)_2$.

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 reac
(a) changed when he varied the concentration of the nitric acid.

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

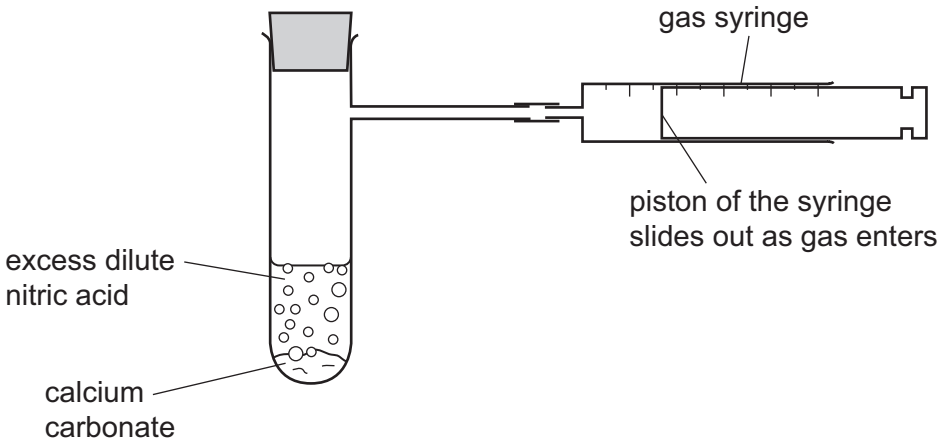


Fig. 8.2

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.

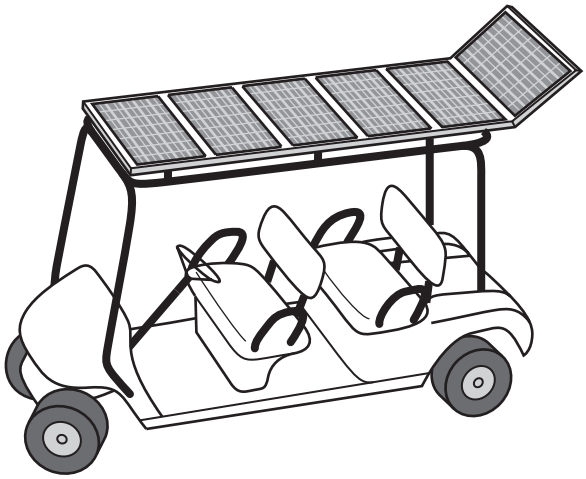


Fig. 9.1

(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.

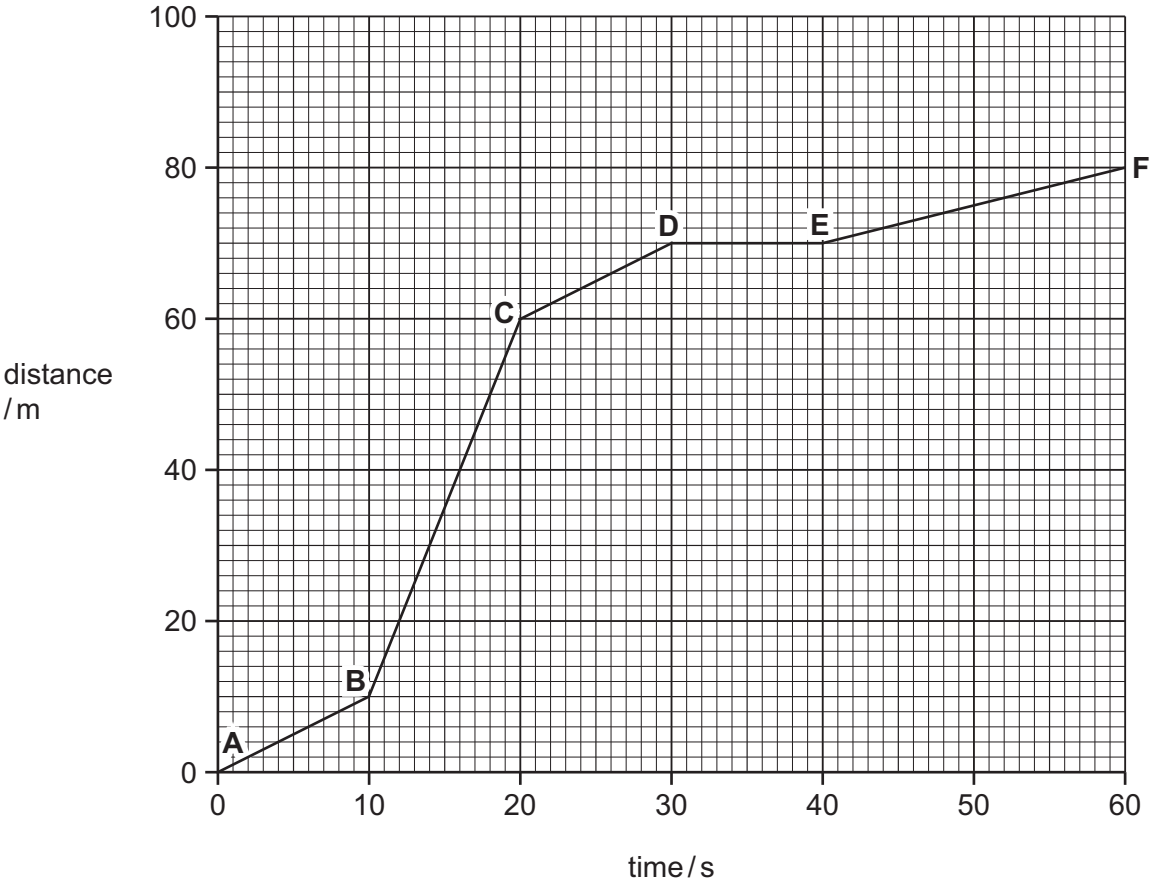


Fig. 9.2

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

(ii) Calculate the speed of the cart between **B** and **C**.

Show your working.

..... m/s [1]

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

.....

..... [1]

(iv) 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 45 g. The volume of a golf ball is 36 cm^3.

Calculate the density of the golf ball.

State the formula that you use and show your working.

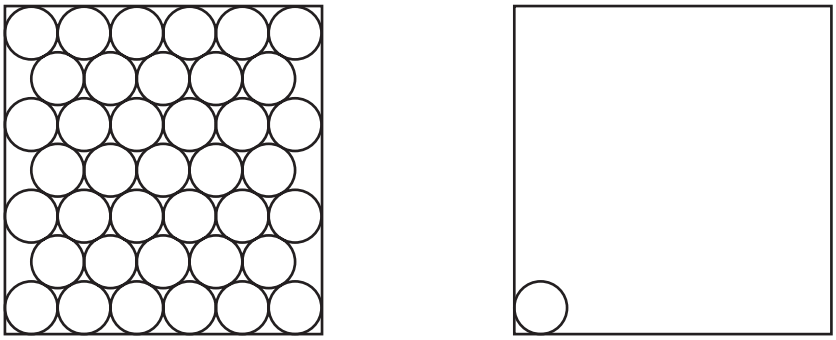
formula

working

..... g / cm^3 [2]

(e) **(i)** The head of the golf club is made of solid metal. The air that the golf ball is traveling through is a gas.

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]

(ii) During the cart's journey, the temperature of the air in the tires increases by 15 °C.

The volume of the air in the tire remains the same.

Explain in terms of particles why the **pressure** of the air in the tire increases when this happens.

.....

.....

..... [1]

(iii) Sometimes the golfer's hands begin to sweat.

Explain in terms of particles how sweating cools his hands.

.....

.....

.....

..... [3]

10 Fig. 10.1 shows the contents of the human thorax (chest).

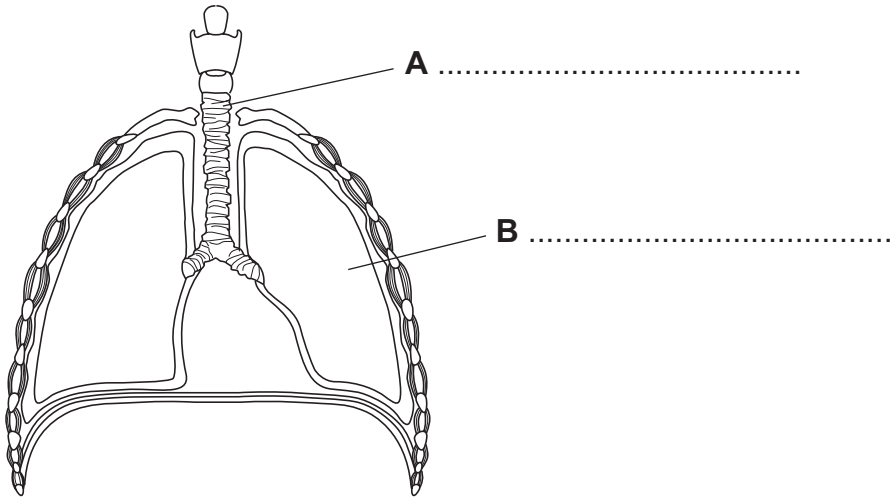


Fig. 10.1

(a) On Fig. 10.1, 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 b
the alveoli.

Explain your answer.

effect on rate of diffusion .....

explanation .....

..... [2]

11 Petroleum (crude oil) is a liquid fossil fuel.

(a) Name **one** solid fossil fuel. ..... [1]

(b) Gasoline and diesel are mixtures of liquid hydrocarbons obtained from petroleum.

(i) Name the process used to separate gasoline and diesel from petroleum.

..... [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 is a gaseous fossil fuel, which contains mainly methane mixed with other compounds such as ethane.

(i) Complete the diagram of the structure of one molecule of ethane.

—C

[2]

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

ethane	+		→		+	

[2]

(d) Ethene, C_2H_4, is an unsaturated hydrocarbon.

Ethene is manufactured by heating large hydrocarbon molecules in the presence of a catalyst. During this process no air must be allowed into the reaction vessel.

(i) Name the process used to manufacture ethene. ..... [1]

(ii) Suggest **one** reason why air must be kept out of the reaction vessel.

.....

.....

..... [2]

12 **(a)** Fig. 12.1 shows a light ray entering an optical fiber.

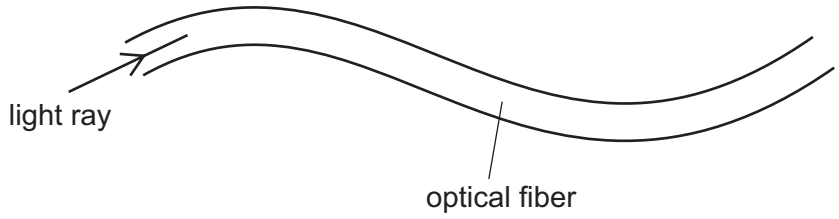


Fig. 12.1

The light ray travels all the way through the optical fiber.

Explain why the light ray is able to stay inside the optical fiber.

You may draw on the diagram if it helps your answer.

.....

.....

.....

..... [2]

(b) White light is passed through a prism as shown in Fig. 12.2.

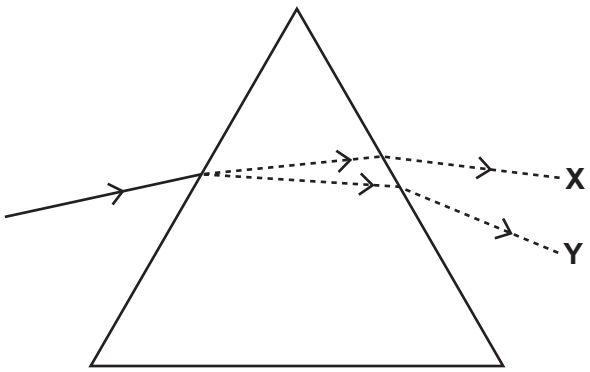


Fig. 12.2

(i) State the colors seen at positions **X** and **Y**.

X .....

Y ..... [2]

(ii) A rainbow is formed in a similar way. Suggest what is acting as a prism when forming a rainbow.

..... [1]

(c) Fig. 12.3 shows a person looking into a mirror and seeing an image.

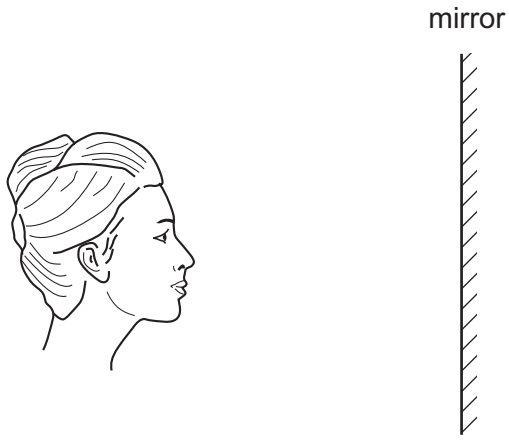


Fig. 12.3

(i) Write the letter **X** on Fig. 12.3 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]

DATA SHEET
The Periodic Table of the Elements

Group																	
I	II										III	IV	V	VI	VII	0
																4 He Helium 2
						1 H Hydrogen 1					11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
7 Li Lithium 3	9 Be Beryllium 4										27 Al Aluminum 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
23 Na Sodium 11	24 Mg Magnesium 12										70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
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	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
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	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
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						
	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	a = relative atomic mass
X	X = atomic symbol
b	b = proton (atomic) number

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