



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

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* 4 7 8 4 2 0 1 0 5 2 *

COMBINED SCIENCE

0653/21

Paper 2 (Core)

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 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.

For Examiner's Use

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5	
6	
7	
8	
9	
Total	

This document consists of **18** printed pages and **2** blank pages.



- 1 (a) Complete Table 1.1 by choosing one of the words from the list to match statement.

ammeter ampere electron insulator
ohm volt voltmeter watt

Table 1.1

statement	word
a particle with a negative electrical charge	
an instrument that measures electrical current	
the unit of potential difference	
a material that does not conduct electricity	

[4]

- (b) Fig. 1.1 shows two circuits, **A** and **B**. All the lamps and both cells are the same.

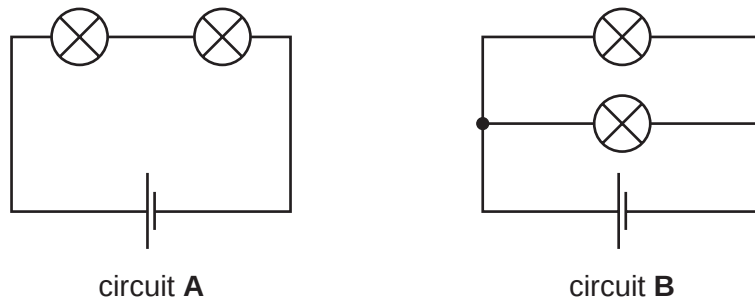


Fig. 1.1

- (i) One lamp is unscrewed from circuit **A**.

State what happens to the other lamp.

Explain your answer.

.....
.....
.....

[2]

- (ii) Explain why lights in a house are connected as in circuit **B** and **not** as in circuit **A**.

.....

 [2]

- (iii) The resistance of each lamp is $1.2\ \Omega$.

Calculate the combined resistance of the two lamps in circuit **A**.

State the formula that you use and show your working.

formula used

working

..... Ω [2]

- 2 (a) Fig. 2.1 shows part of the carbon cycle.

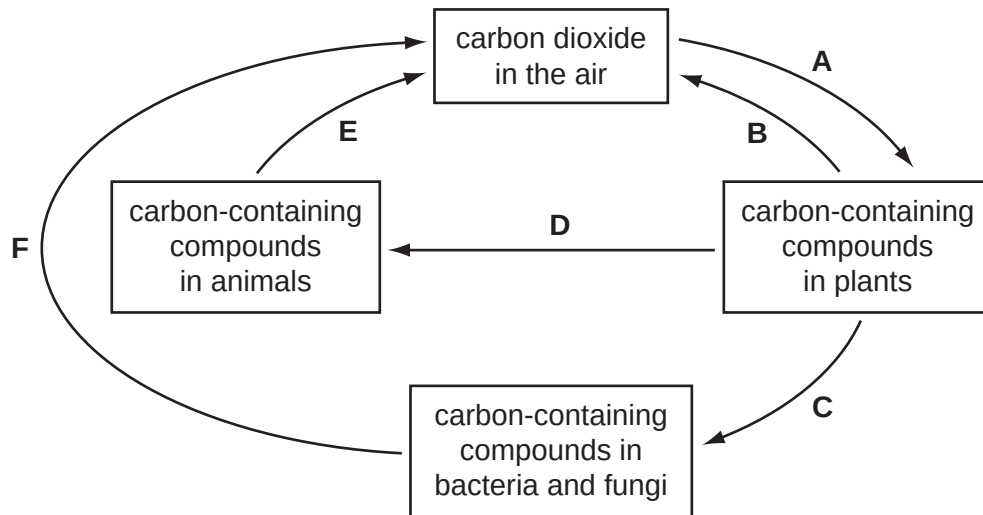


Fig. 2.1

- (i) State the letter that represents photosynthesis in Fig. 2.1. [1]
- (ii) State the **three** letters that represent respiration in Fig. 2.1.
 [1]
- (iii) Name **one** carbon-containing compound in plants.
 [1]
- (iv) State the approximate percentage of carbon dioxide in the air.
 [1]
- (b) (i) Earthworms play an important part in the carbon cycle. They eat leaves, and egest material containing plant nutrients into the soil.
 Explain the meaning of the term *egest*.

 [2]
- (ii) Underline the **two** words that describe the position of an earthworm in a food chain.

carnivore consumer herbivore producer

[1]

- (iii) Fishermen catch large numbers of earthworms to use as bait.

There are concerns that too many earthworms are being collected.

Suggest why it is important to conserve earthworms.

.....

.....

..... [2]

- 3 (a) Fig. 3.1 shows how a digital pH meter is used to measure the pH of some liquids.

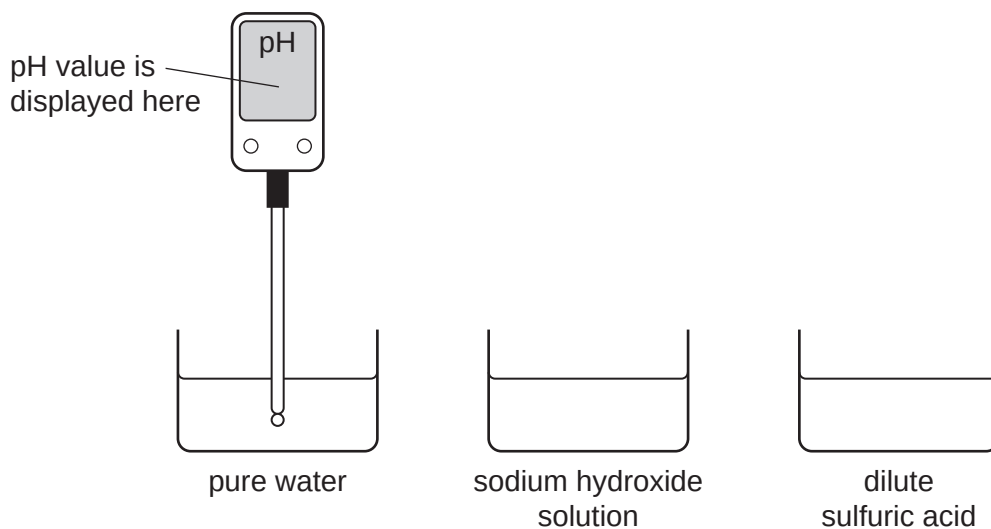


Fig. 3.1

- (i) Complete Table 3.1 by suggesting suitable pH values for the different liquids.

Table 3.1

liquid	pH
pure water	
sodium hydroxide solution	
dilute sulfuric acid	

[3]

- (ii) Suggest **one** advantage of using a digital pH meter rather than a piece of litmus paper to compare the acidity of two different acid solutions.

.....

 [1]

- (b) Describe how a student could use a solution of acidified silver nitrate to find out whether or not an unlabelled solution contains sodium chloride.

.....

 [2]

- (c) When a reactive metal is added to a dilute acid, the metal reacts and dissolves and gas is given off.

- (i) Name **one** reactive metal that must **not** be added to a dilute acid.

Explain why this metal should not be added to acid.

metal

explanation

[2]

- (ii) Fig. 3.2 shows how a student tested the gas given off when magnesium was added to dilute hydrochloric acid.

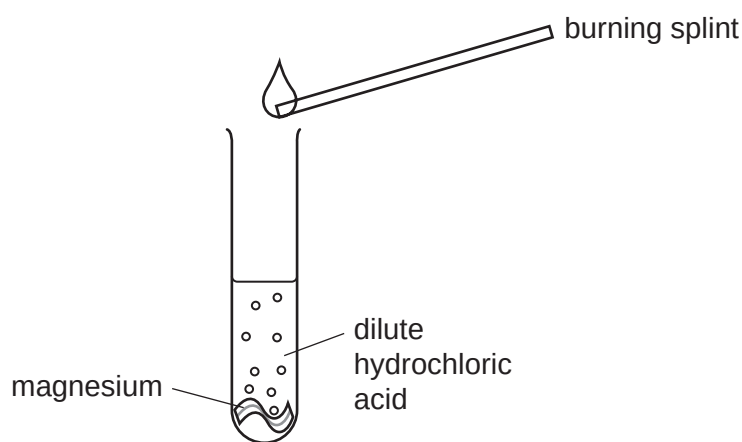


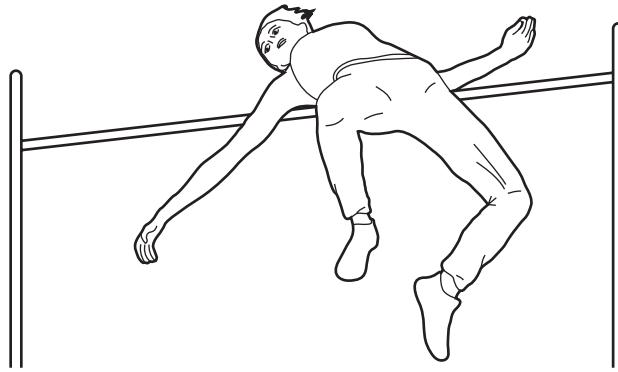
Fig. 3.2

State and explain what the student observed when he carried out this test.

observation

explanation [2]

- 4 An athlete competes in the high jump.



- (a) Describe the energy changes that take place between the athlete taking off and landing after the high jump.

.....

.....

.....

..... [3]

- (b) After jumping, the athlete is sweating.

- (i) Describe, in terms of particles, how evaporation occurs from the surface of a liquid.

.....

.....

..... [2]

- (ii) Explain how this process will cool down the athlete.

.....

.....

..... [1]

Please turn over for Question 5.

- 5 Table 5.1 shows some of the nutrients contained in 100 g of five foods.

Table 5.1

food	nutrients			
	sugar / g	starch / g	protein / g	fat / g
A	0	0	13	10
B	14	6	7	0
C	0	0	14	6
D	6	8	12	14
E	9	14	3	0

- (a) (i) Which **two** nutrients listed in Table 5.1 are carbohydrates?

..... and [2]

- (ii) Which nutrient listed in Table 5.1 contains nitrogen atoms in its molecules?

..... [1]

- (iii) State the letters of **two** foods in Table 5.1 that could have come from animals.

..... and [1]

- (iv) State the letter of **one** food that would appear orange-brown when tested with iodine solution, and give a purple colour when tested with biuret reagent.

..... [1]

- (v) State the letter of the food that provides the most energy per 100 g.

..... [1]

- (b) Table 5.1 does **not** contain information about vitamins or minerals.

Outline the symptoms that a person may develop if their diet is deficient in

- (i) vitamin D, ...

..... [1]

- (ii) iron.

..... [1]

- (c) Explain why eating a lot of foods containing sugar can increase the risk of tooth decay.

.....

.....

.....

.....

..... [3]

- 6 Some types of firework are made by filling a cardboard tube with firework mixture. The mixture is made from several solid substances which have been powdered and mixed together.

Fig. 6.1 shows a typical firework.

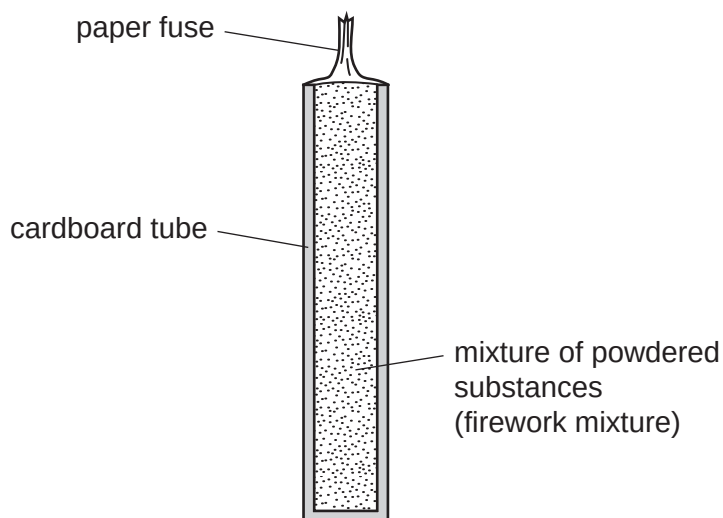


Fig. 6.1

When the paper fuse is lit, exothermic chemical reactions occur inside the firework.

- (a) (i) State **two** forms of energy that are released when the firework mixture reacts.

1

2

[2]

- (ii) State the effect on the rate of reaction of using firework mixture in the form of a powder.

.....

[1]

- (b) Some firework mixtures contain aluminium which is oxidised when the firework is lit.

Table 6.1 shows the numbers of protons and electrons in four particles, **A**, **B**, **C** and **D**, which are involved in the oxidation of aluminium.

Table 6.1

particle	number of protons	number of electrons
A	8	10
B	13	13
C	8	8
D	13	10

- (i) Atoms of the element aluminium have the proton number 13.

State and explain which particle, **B** or **D**, in Table 6.1 is an **atom** of aluminium.

particle

explanation

[1]

- (ii) State and explain which **two** particles in Table 6.1 could be found bonded together in aluminium oxide.

particles and

explanation

[3]

- (c) Firework mixtures contain the compound potassium perchlorate, KClO_4 .

When potassium perchlorate is heated, a colourless gas is given off which re-lights a glowing splint.

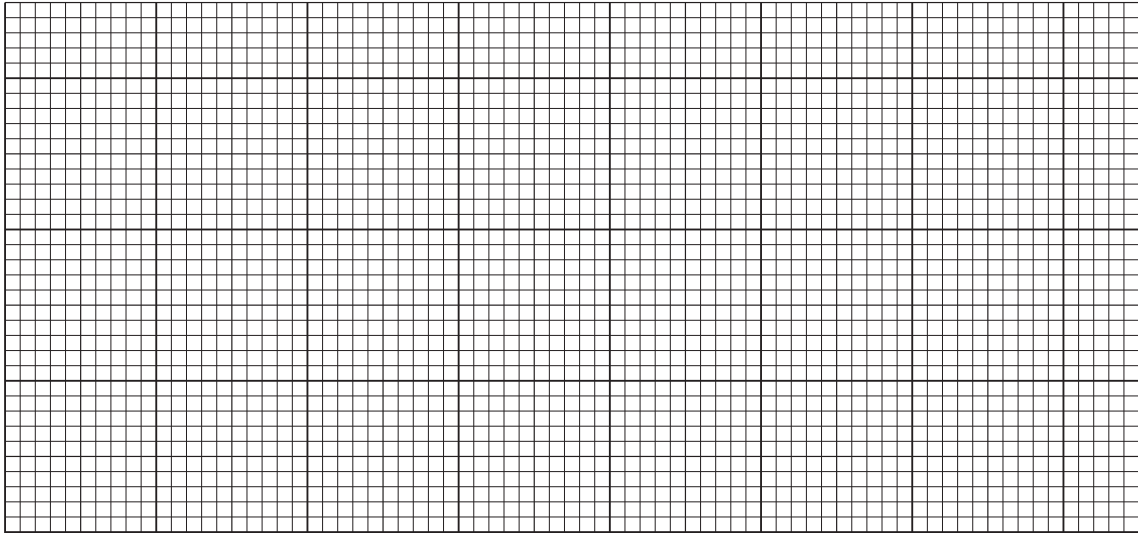
- (i) State the name of this gas. [1]

- (ii) Suggest how potassium perchlorate in the firework mixture helps the mixture to burn.

[2]

- 7 (a) On the grid below, draw a wave with an amplitude of 2 cm and a wavelength of 4 cm.

On your diagram, clearly label the amplitude and the wavelength.



[3]

- (b) (i) Two sound waves, **A** and **B**, have the same frequency. **A** has a greater amplitude than **B**.

What difference would you hear?

..... [1]

- (ii) Two sound waves, **X** and **Y**, have the same amplitude. **X** has a greater frequency than **Y**.

What difference would you hear?

..... [1]

- (c) Energy travels to the Earth from the Sun.

State whether this transfer of energy is by conduction, convection or radiation.

Explain your answer.

.....

.....

..... [2]

- 8 Fig. 8.1 shows the male reproductive system.

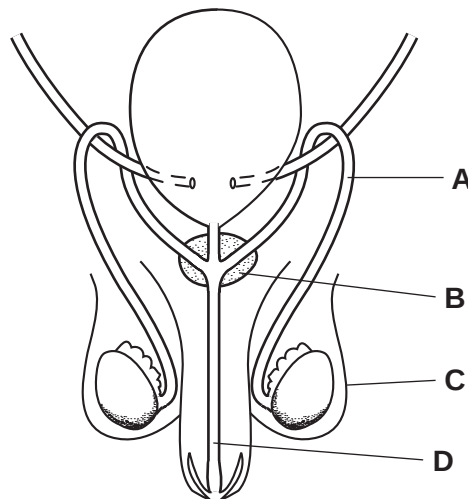


Fig. 8.1

- (a) (i) Name parts **C** and **D**.

C

D [2]

- (ii) State the functions of parts **A** and **B**.

A

B [2]

- (iii) On Fig. 8.1, use a label line and the letter **S** to indicate where male gametes are made. [1]

- (b) The human immunodeficiency virus (HIV) can be transmitted during sexual intercourse.

Outline **two** other ways in which HIV can be transmitted.

1

.....

2

..... [2]

- 9 Chlorine is released when hydrochloric acid reacts with the compound, manganese dioxide.

(a) (i) Explain why chlorine is an example of an *element* and **not** a *compound*.

.....

.....

.....

..... [2]

(ii) Describe a safe test for chlorine gas.

.....

..... [2]

(b) Chlorine is produced in the chemical industry by electrolysis.

A simplified diagram of the apparatus used to produce chlorine is shown in Fig. 9.1.

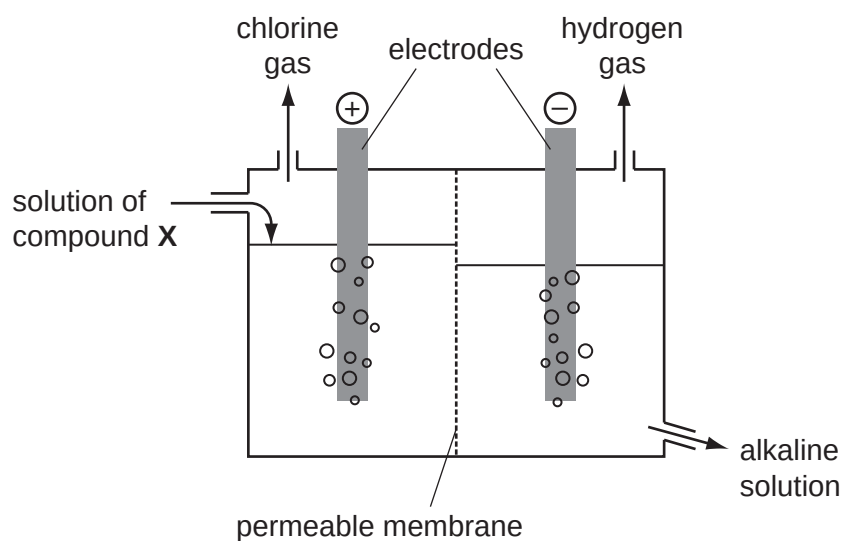


Fig. 9.1

(i) State the meaning of the term *anode*.

.....

..... [1]

- (ii) A student knows that compound **X** in Fig. 9.1 is either sodium hydroxide, NaOH, or sodium chloride, NaCl.

Using information from Fig. 9.1, deduce whether compound **X** is sodium hydroxide or sodium chloride.

Explain your answer.

X is

explanation

..... [1]

- (c) Chlorine is found in Group 7 of the Periodic Table. Two of the other elements in Group 7 are bromine and iodine.

- (i) Chlorine is a gas at room temperature.

What are the physical states of bromine and iodine at room temperature?

bromine

iodine [2]

- (ii) Explain briefly why a solution of sodium bromide turns orange when chlorine is bubbled through it.

.....

..... [2]

DATA SHEET
The Periodic Table of the Elements

Group																	
I	II								III	IV	V	VI	VII	0			
												1 H Hydrogen 1					
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	101 Ru Ruthenium 44	101 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	127 Te Tellurium 52	131 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	209 Po Polonium 84	209 At Astatine 85	209 Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89															
58-71 Lanthanoid series																	
90-103 Actinoid series																	
175 Lu Lutetium 71																	
173 Yb Ytterbium 70																	
169 Tm Thulium 69																	
167 Er Erbium 68																	
165 Ho Holmium 67																	
162 Dy Dysprosium 66																	
159 Tb Terbium 65																	
157 Gd Gadolinium 64																	
152 Eu Europium 63																	
150 Sm Samarium 62																	
144 Nd Neodymium 60																	
141 Pr Praseodymium 59																	
140 Ce Cerium 58																	
238 U Uranium 92																	
232 Th Thorium 90																	
231 Pa Protactinium 91																	
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231 Pa Protactinium 91																	
238 U																	

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

Key

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

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).



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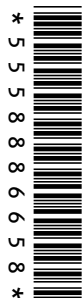
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COMBINED SCIENCE

0653/22

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



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

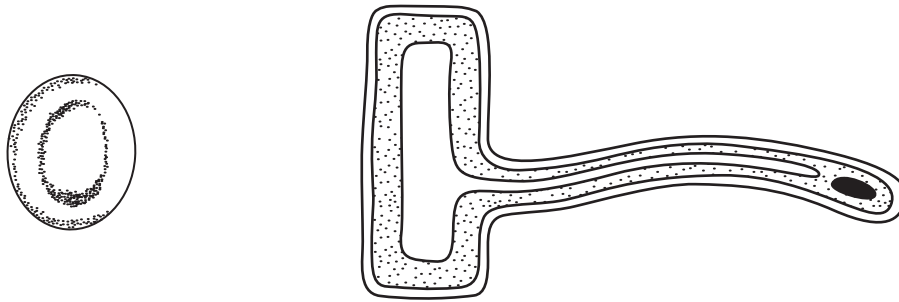


Fig 1.1

- (a) Tick (✓) the boxes to show which structures are present in

- a red blood cell,
- a root hair cell.

structure	red blood cell	root hair cell
cell membrane	☐	☐
nucleus	☐	☐
chloroplast	☐	☐

[2]

- (b) (i) Name the red protein found in the cytoplasm of the red blood cell.

..... [1]

- (ii) State the function of a red blood cell.

..... [1]

- (c) Name the colourless carbohydrate in the cell wall of the root hair cell.

..... [1]

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

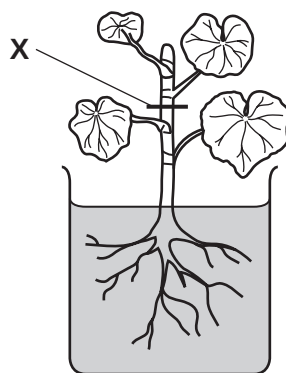


Fig. 1.2

After 10 minutes, the veins in the leaves of the plant became blue.

- (i) Explain why the veins in the leaves became blue.

.....

.....

..... [2]

- (ii) A student cut the stem of the plant at **X**. Fig. 1.3 shows the appearance of the cut stem seen through a microscope.

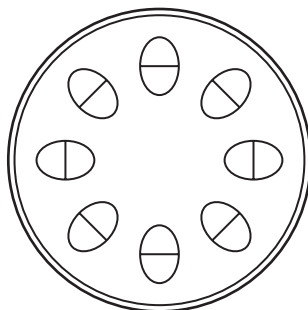


Fig. 1.3

On Fig. 1.3, use a pencil to shade the part that would look blue.

[1]

- 2 (a) The proton (atomic) number of the element fluorine is 9. Fluorine is found in Period 2 and Group 7 of the Periodic Table.

- (i) Predict the number of electrons in one atom of fluorine.

Explain your answer.

total number of electrons

explanation

..... [2]

- (ii) Predict and explain, in terms of its position in the Periodic Table, whether this element would be an electrical conductor or an insulator.

.....

..... [1]

- (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 4 are shown in Fig. 2.1.

Li	F
Na	Cl
K	Br

Fig. 2.1

- (i) The alkali metals react with water to produce an alkaline solution and a gas. Name the gas and the element.

State and explain briefly which **one** of the alkali metals shown in Fig. 2.1 reacts most vigorously with water.

alkali metal

explanation

..... [2]

- (ii) Name the gas which is given off during the reaction in (i) and describe a test for this gas.

name

test

..... [3]

- (iii) Describe how potassium and bromine atoms become strongly bonded together when they react to form potassium bromide.

You may draw a diagram if it helps your answer.

.....

.....

.....

.....

..... [3]

- (c) A student adds a solution containing chlorine to a colourless solution of potassium bromide as shown in Fig. 2.2.

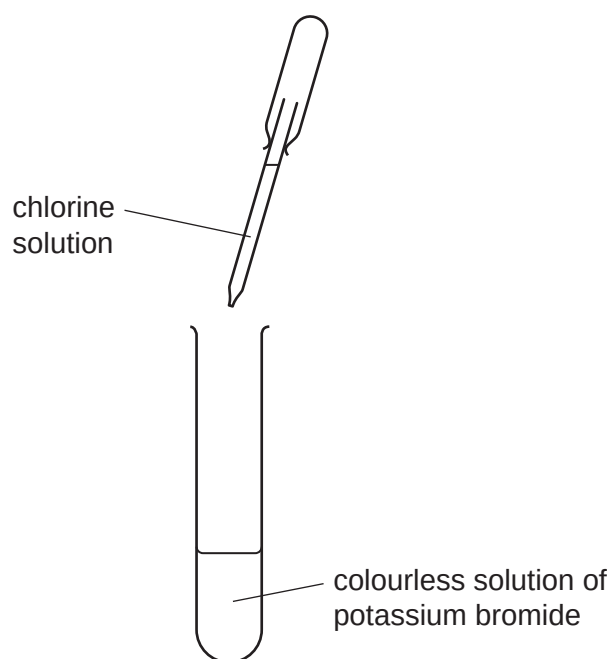


Fig. 2.2

Describe and explain briefly what is observed when chlorine and potassium bromide react.

observation

.....

explanation

..... [2]

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

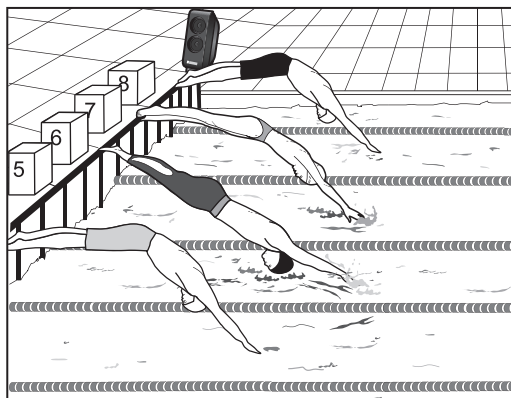


Fig. 3.1

- (a) State the form of energy which the swimmers lose as they fall from their starting positions into the water.

..... [1]

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

- (i) 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.

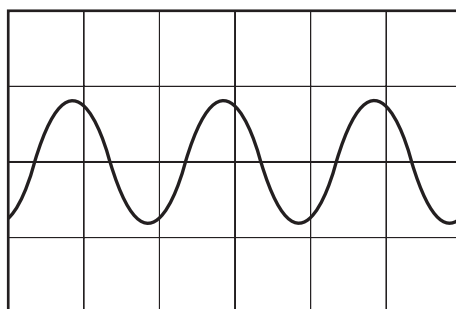


Fig. 3.2

[2]

- (ii) Fig. 3.3 shows the trace of a sound wave as it appears on an oscilloscope screen. For

On Fig. 3.3 draw another trace of a sound wave from a sound that has a higher pitch than the one shown, but has the same loudness.

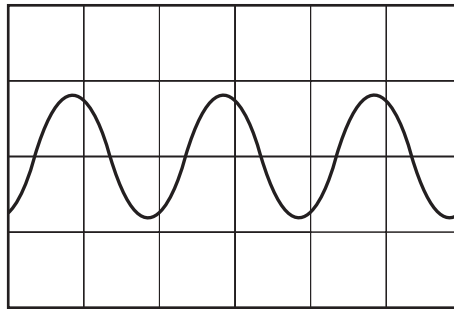


Fig. 3.3

[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]

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

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

..... s [2]

- (d) When the swimmers have finished their race, they leave the pool. The water on their bodies evaporates.

Explain in terms of particles how this evaporation takes place.

.....

.....

.....

..... [3]

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

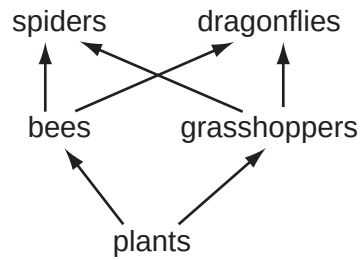


Fig. 4.1

- (i) Plants are the producers in this food web.

Define the term *producer*.

.....

 [2]

- (ii) Name **one** organism in the food web that is a carnivore.

..... [1]

- (iii) What do the arrows in the food web represent?

..... [1]

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

- (i) Complete the sentences, using words from the list.

anthers	asexual	diploid	haploid
ovary	petals	sexual	stigma

Flowers are organs in which reproduction takes place.

Pollen grains are made in the

During pollination, insects carry pollen grains from one flower to another. The

pollen grains are transferred to the [3]

- (ii) After they have been pollinated, flowers produce seeds.

List **two** environmental conditions that all seeds need for germination.

1

2

[2]

- 5 Acid indigestion is caused by unusually high levels of stomach acid. This condition is treated by taking an antacid tablet.

One type of antacid tablet contains a mixture of sodium hydrogencarbonate, calcium carbonate and magnesium carbonate.

A student investigated the reaction between these antacid tablets and dilute hydrochloric acid.

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

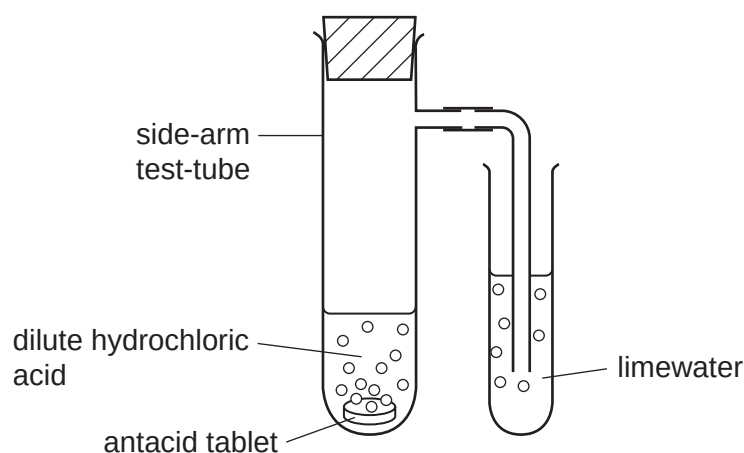


Fig. 5.1

A gas was given off when the antacid tablet reacted with the dilute hydrochloric acid. This gas reacted with the limewater.

- (a) Describe and explain the change in appearance of the limewater during the experiment.

.....

 [2]

- (b) The student used excess acid in the reaction shown in Fig. 5.1, which caused the antacid tablet to react and dissolve completely.

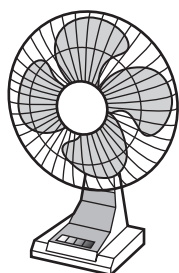
State the names of **two** salts that remain in the solution when the reaction is finished.

1
 2 [2]

- 6 (a) The appliances shown convert electrical energy into other forms of energy.

Complete the sentences next to each diagram to show the useful form of energy released.

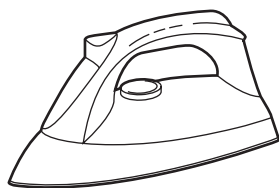
(i)



A fan converts electrical energy into

..... energy. [1]

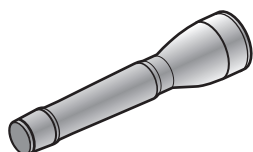
(ii)



An iron converts electrical energy into

..... energy. [1]

(iii)



A torch (flashlight) converts electrical energy into

..... energy. [1]

- (b) There are several precautions that are necessary to avoid getting an electric shock or starting a fire when using electrical appliances.

(i) State **one** precaution that must be taken when using an electrical appliance.

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

(ii) For the precaution described in (i), explain why it is important.

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

- (c) Some torches (flashlights) use a filament lamp. Fig. 6.1 shows a circuit for measuring the current through a filament lamp as the potential difference is changed.

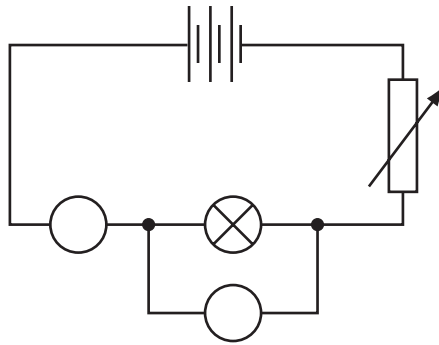


Fig. 6.1

Write the letters **A** and **V** in the two circles on the diagram. They should show the correct positions of the ammeter **A** and voltmeter **V**. [1]

- (d) Fig. 6.2 shows a graph of the results.

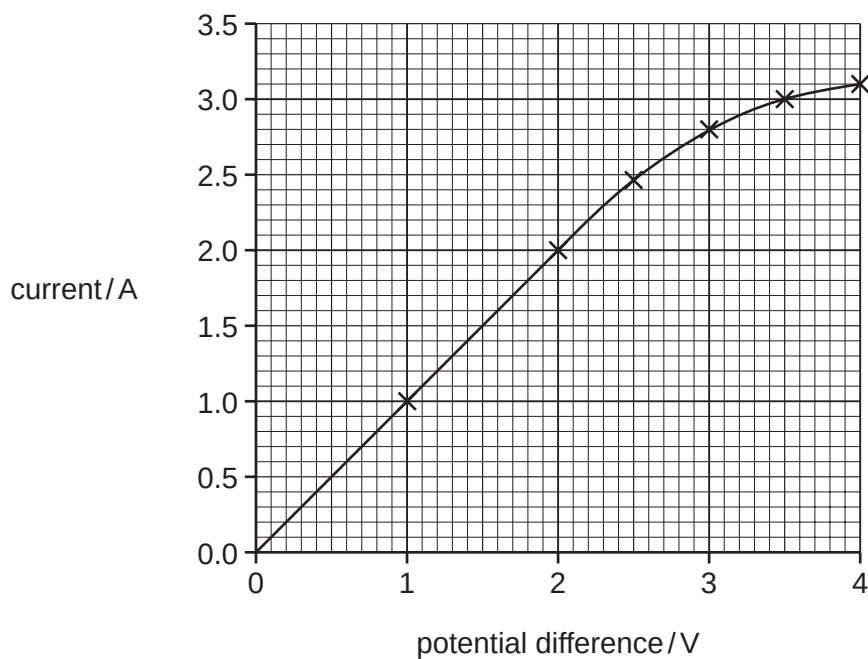


Fig. 6.2

- (i) Use the graph to find the current when the potential difference is 1.5 V.

Show your working on the graph.

..... A [1]

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

.....
 [1]

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

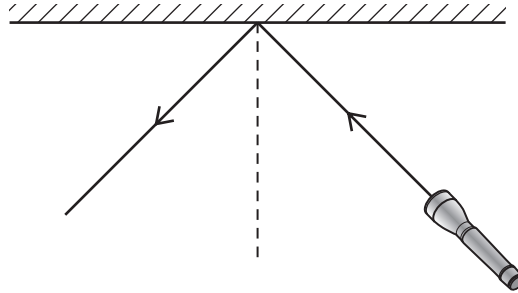


Fig. 6.3

- (i) On Fig. 6.3, 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]

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

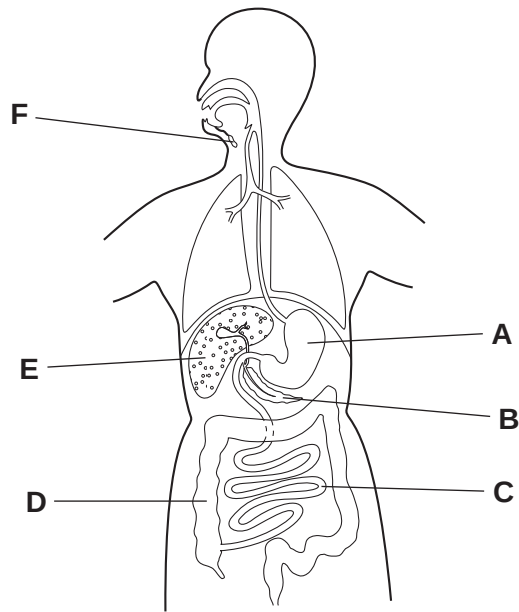


Fig. 7.1

- (i) Name

part A, ...

part D.

[2]

- (ii) State the **letter** that indicates

the liver, ...

the area where digested food is absorbed.

[2]

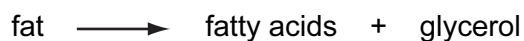
- (b) Describe how the molar teeth help in the digestion of food.

.....

.....

..... [2]

- (c) Lipase is an enzyme that catalyses the breakdown of fats to fatty acids and 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 two test-tubes.

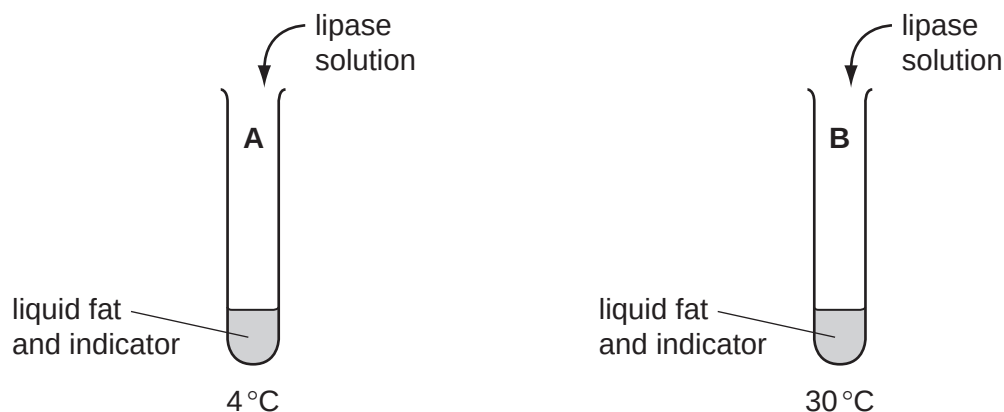


Fig. 7.2

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) Explain why the indicator eventually changed to yellow in both tubes.

..... [1]

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

.....

.....

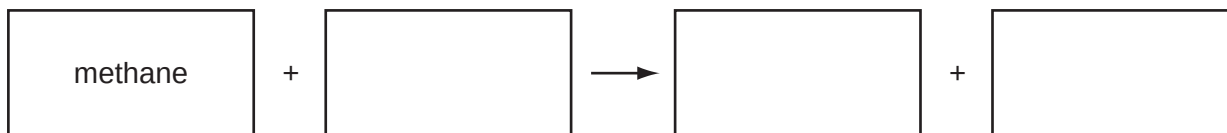
.....

..... [2]

- 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) Methane is found in natural gas.

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



[3]

(ii) State the term used to describe chemical reactions that release heat.

..... [1]

(b) Petroleum is a mixture of a very large number of compounds.

Fig. 8.1 shows a diagram of the industrial process used to separate petroleum into mixtures that are more useful.

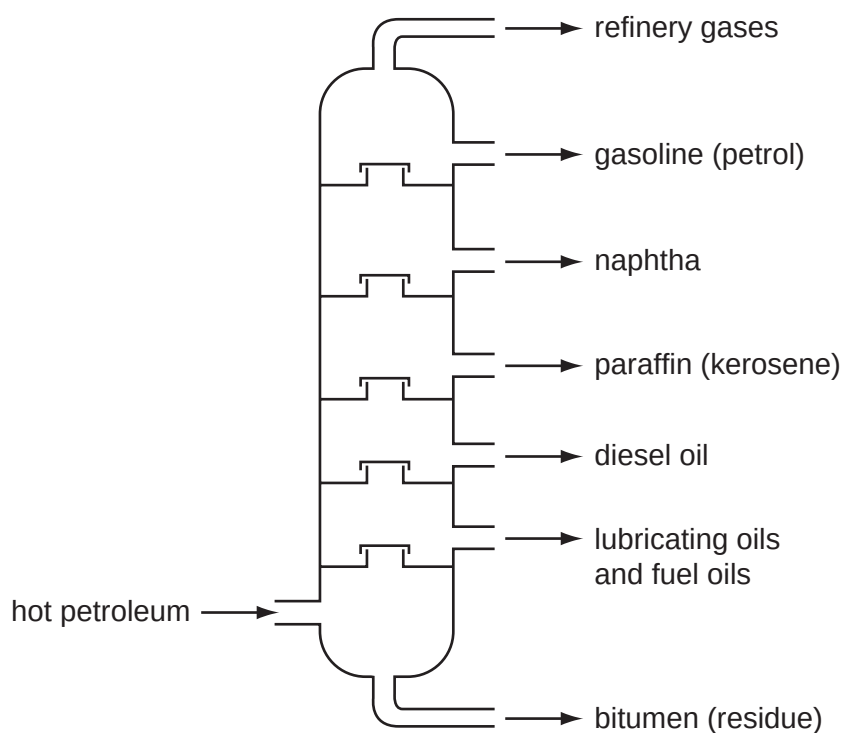
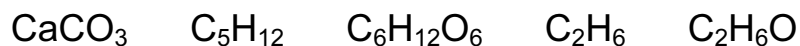


Fig. 8.1

(i) State the full name of the process shown in Fig. 8.1.

..... [1]

- (ii) The list below shows the chemical formulae of five compounds.



State and explain which of these formulae represent compounds that are found in petroleum.

formulae

explanation [2]

- (iii) State **one** use of refinery gas.

..... [1]

- (iv) Refinery gas contains the compound ethane.

Complete the diagram of the structure of one molecule of ethane which has been started below.



[2]

- 9 Fig. 9.1 shows a toy car of mass 0.5 kg travelling over a plastic surface.

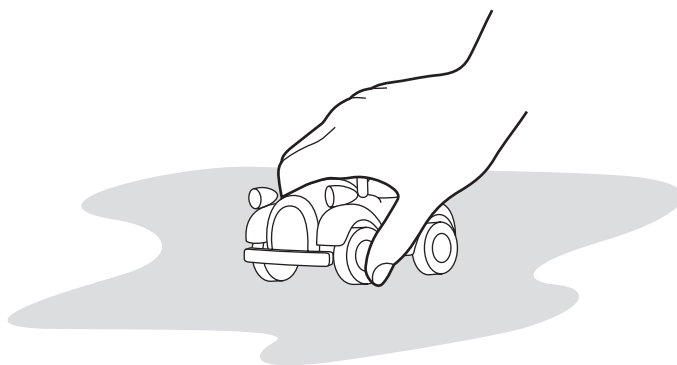


Fig. 9.1

- (a) 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]

- (b) 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.

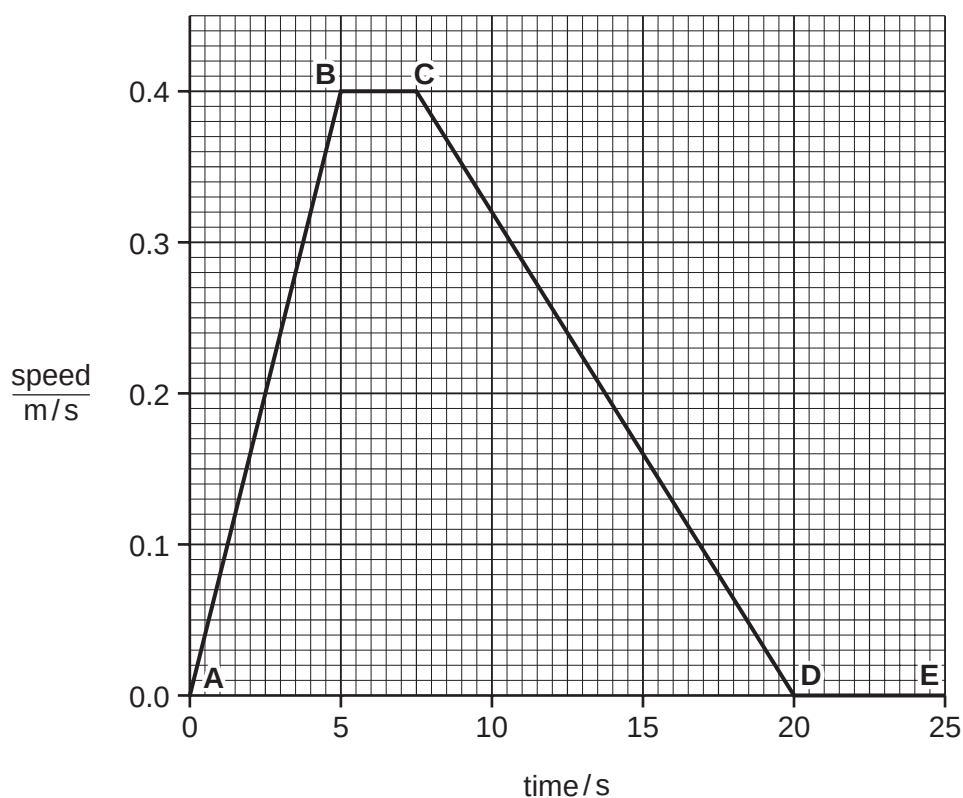


Fig. 9.2

- (i) Use the graph to find one time when the car is not moving. Write down this time.

..... [1]

- (ii) Determine **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 [2]

DATA SHEET
The Periodic Table of the Elements

Group																							
I	II											III	IV	V	VI	VII	0						
												1 H Hydrogen 1											
7 Li Lithium 3	9 Be Beryllium 4																						
23 Na Sodium 11	24 Mg Magnesium 12																						
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	101 Ru Ruthenium 44	101 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	127 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																					
58-71 Lanthanoid series																							
90-103 Actinoid series																							
a = relative atomic mass X = atomic symbol X ^a _b = proton (atomic) number																							
Key	X																						

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

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

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

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* 2 9 2 2 5 4 7 3 0 9 *

COMBINED SCIENCE

0653/23

Paper 2 (Core)

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 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.

For Examiner's Use

1	
2	
3	
4	
5	
6	
7	
8	
9	
Total	

This document consists of **20** printed pages.



1 Flowers are organs in which sexual reproduction takes place.

(a) (i) Complete the definition of sexual reproduction. Use words from the list.

dissimilar **female** **haploid** **identical**
ovary **sperm** **zygote**

Sexual reproduction is the process involving the fusion of

..... nuclei to form a diploid

and the production of genetically offspring. [3]

(ii) State the scientific term for the fusion of two nuclei.

..... [1]

(b) Fig. 1.1 shows a section through a flower.

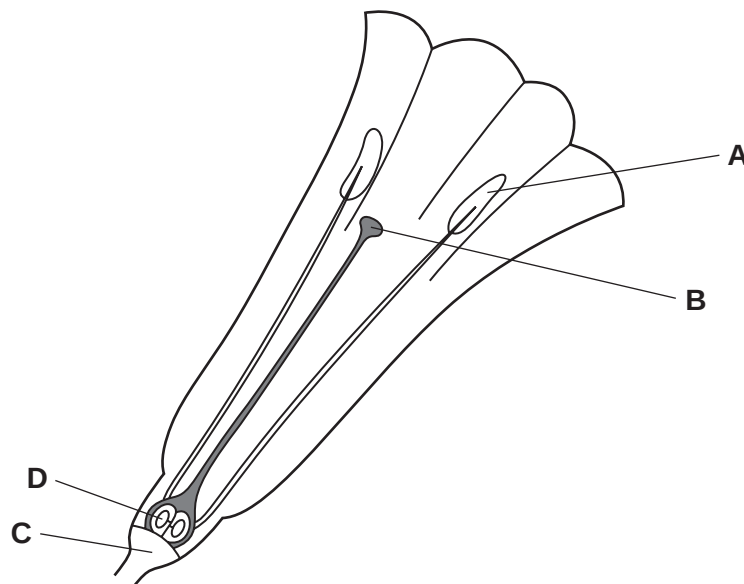


Fig. 1.1

(i) Name the parts labelled **A** and **B**.

A

B [2]

(ii) State the **letter** of the part in which

the male gametes are produced, ...

a zygote is produced. [2]

- (c) After pollination, seeds are produced. A student set up an experiment to investigate the conditions needed for the germination of lettuce seeds.

He placed five lettuce seeds on cotton wool in each of five test-tubes. Fig. 1.2 shows the conditions present in each tube.

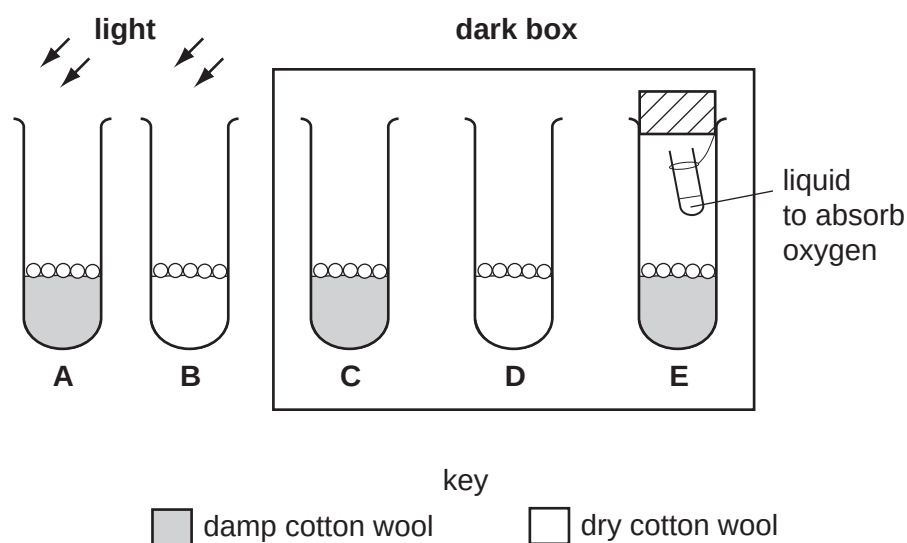


Fig. 1.2

Table 1.1 shows his results.

Table 1.1

tube	conditions			number of seeds that germinated
A	water	oxygen	light	5
B	no water	oxygen	light	0
C				5
D				0
E				0

- (i) Complete Table 1.1 to show the conditions present in each tube. Tubes **A** and **B** have been done for you. [2]

- (ii) What conclusions can the student make from these results?

.....

.....

.....

..... [3]

- 2 (a) (i) State the percentages of nitrogen and oxygen in the air.

nitrogen

oxygen

[2]

- (ii) During a thunderstorm, energy from lightning causes nitrogen and oxygen to combine to form nitric oxide.

Explain why nitrogen is an example of an *element* and nitric oxide is an example of a *compound*.

.....

 [2]

- (iii) Nitric oxide has the chemical formula, NO.

Explain what is meant by this formula.

.....

 [2]

- (iv) What name is given to the type of chemical reaction that occurs when oxygen bonds to another element?

..... [1]

- (b) When magnesium burns in air, a white solid is formed. This white solid contains magnesium oxide, MgO.

- (i) Name the type of chemical bonding in magnesium oxide.

Explain your answer.

type of chemical bonding

explanation

..... [2]

- (ii) A student burned some magnesium in air and then added the white solid formed to water.

She tested the solution with Universal (full range) Indicator and found that the pH was 9.

State a conclusion that the student can draw from this observation.

.....

..... [1]

- 3 (a) Draw lines to connect each quantity measured to its correct unit and symbol.

One has been done for you.

quantity measured	unit	symbol
mass	kilogram	W
force	joule	N
power	newton	J
work	watt	kg

[2]

- (b) Fig. 3.1 shows two speed/time graphs for a car.

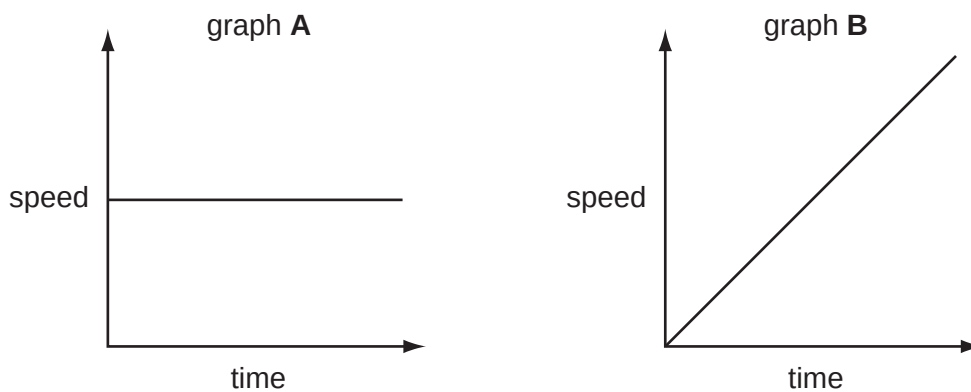


Fig. 3.1

Describe the motion of the car in

graph A, ...

graph B. [2]

- (c) The car travels at 20 m/s for 90 seconds.

Calculate the distance covered.

State the formula that you use and show your working.

formula used

working

..... m [2]

- (d) One of the car's headlamps has a current of 2 A, when the voltage across it is 12 V.

- (i) Show that the resistance of the headlamp is $6\ \Omega$.

State the formula that you use and show your working.

formula used

working

[2]

- (ii) The car has two of these identical headlamps connected in series.

Calculate the total resistance of these two headlamps.

State the formula that you use and show your working.

formula used

working

..... Ω [2]

4 Many bats are predators that fly at night. They eat moths and other insects.

(a) Underline the **two** words that describe the position of a bat in a food chain.

carnivore

consumer

herbivore

producer

[1]

(b) Bats emit ultrasound.

(i) Ultrasound is sound that has a frequency too high for a human to hear.

Suggest a frequency for the ultrasound emitted by bats. Hz [1]

(ii) Underline the **one** word that correctly describes an ultrasound wave.

electromagnetic

longitudinal

transverse

[1]

(c) Bats use echo location to detect objects around them.

The reflected ultrasound waves are detected by special cells in the bat's head.

Fig. 4.1 shows how ultrasound waves are reflected from a rough surface and from a smooth surface. The arrows show the direction in which the sound waves travel.

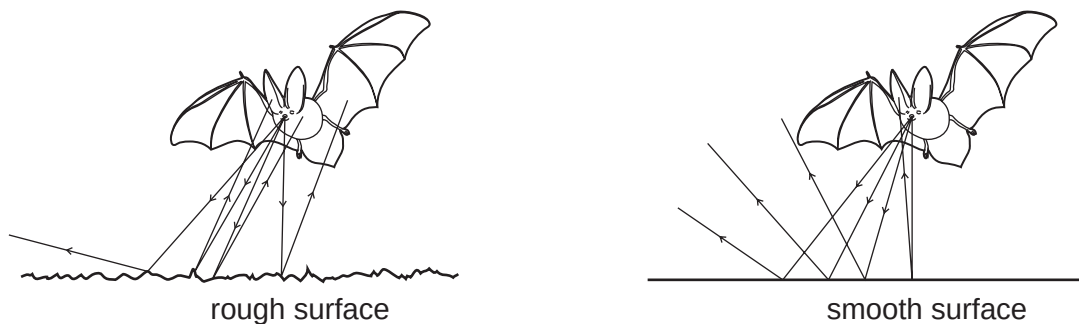


Fig. 4.1

(i) Use the information in Fig. 4.1 to describe what happens to the ultrasound waves when they hit

a rough surface, ...

.....

a smooth surface.

..... [1]

- (ii) Suggest how the bat can tell if it is flying over a rough surface or a smooth surface even when it is completely dark.

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

- (d) Many kinds of bat live in trees in forests.

List **three** ways in which deforestation can damage the environment.

- 1
2
3 [3]

- 5 (a) In many countries, river water is collected and treated to make it safe for human drink.

State and explain which **two** of the processes shown below are used to treat river water so that it becomes safe to drink.

chlorination
crystallisation
filtration
evaporation

first process

reason why this process is carried out

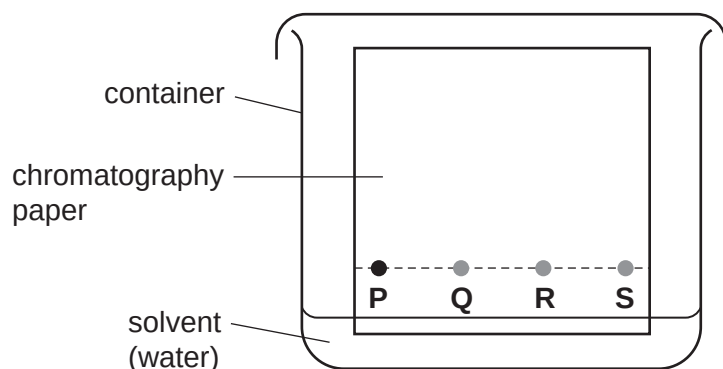
.....

second process

reason why this process is carried out

..... [4]

- (b) Fig. 5.1 shows chromatography being used by a student to investigate mixtures of dyes (coloured compounds) used to colour sweets.



key

Q, R, S dyes extracted from three sweets

P mixture of common food dyes

Fig. 5.1

Fig. 5.2 shows the appearance of the chromatography paper after several minutes.

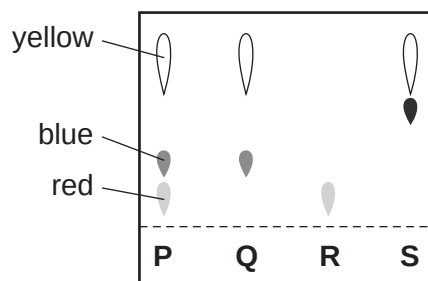


Fig. 5.2

- (i) Deduce and explain the colour of the sweet which contains only one dye.

colour

explanation

[2]

- (ii) State which sweet contained a dye which was **not** one of the common food dyes in the mixture **P**.

..... [1]

- 6 (a) Fig. 6.1 shows a washing machine.



Fig. 6.1

Complete the sentence below using **two** of the words in the list.

heat

kinetic

light

potential

sound

A washing machine is designed to transform electrical energy into

..... energy and energy. [2]

- (b) (i) Some of the water inside the washing machine evaporates.

Explain the process of evaporation in terms of particles.

.....

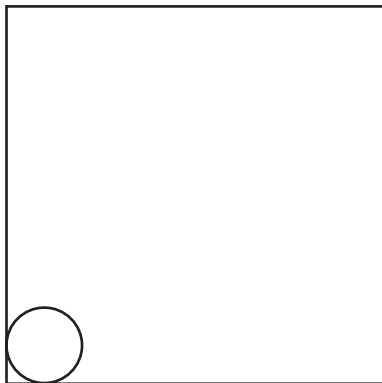
 [2]

- (ii) Explain why evaporation has a cooling effect.

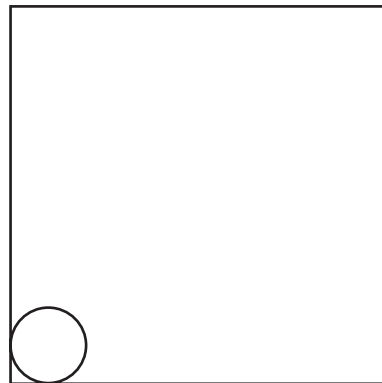
.....
 [1]

- (c) The casing of the washing machine is a solid. The water used in it is a liquid.

Complete the diagrams below to show the arrangement of particles in a solid and in liquid.



solid



liquid

[2]

- (d) Before buying a washing machine, a person may research several types to find out which washing machine has the greatest energy efficiency.

Explain the meaning of the term *efficiency*.

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

- 7 (a) Fig. 7.1 shows two human teeth.

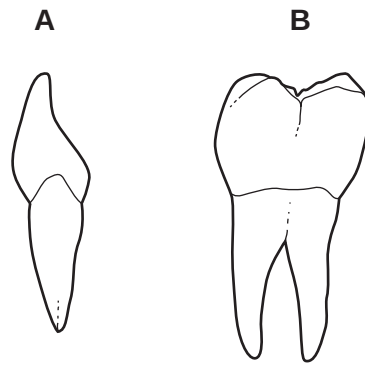


Fig. 7.1

- (i) Name the **two** types of teeth shown in Fig. 7.1.

tooth **A**

tooth **B**

[2]

- (ii) Explain how tooth **B** helps to digest a food such as bread.

.....

 [2]

- (b) For each part of the digestive system in the list below, tick (✓) the correct function or functions.

part	ingestion	digestion	absorption
mouth	☐	☐	☐
stomach	☐	☐	☐
small intestine	☐	☐	☐

[3]

Please turn over for Question 8.

- 8 Metallic copper is a very important material that has been extracted from compounds for thousands of years.

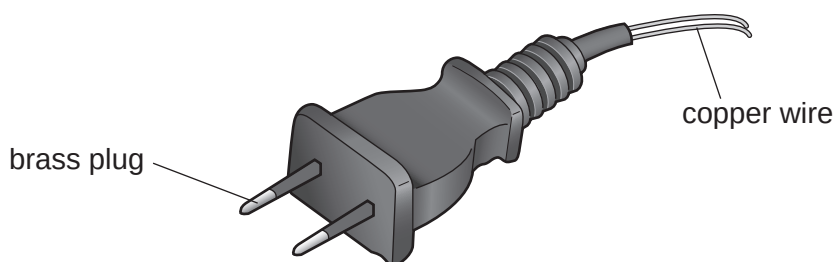
(a) (i) The wires used in many electrical devices are made from copper.

State the **two** properties of metals such as copper, that make them suitable for making electrical wires.

1

2 [2]

(ii) Copper wires are connected to the mains electrical supply using brass plugs. Brass is an alloy.



Explain the meaning of the term *alloy* and state **one** difference in the physical properties of brass compared to copper.

meaning of *alloy*

.....

difference in physical property

..... [2]

(iii) One of the processes used in the extraction of copper involves heating copper(I) sulfide in air.

One of the reactions that occurs is between copper(I) sulfide and oxygen. This reaction also produces sulfur dioxide.

Construct the **word** chemical equation for this reaction.

..... [1]

- (b) Copper may also be formed by the electrolysis of an aqueous solution of chloride using electrodes made of graphite (carbon).

Fig. 8.1 shows a laboratory apparatus a student used to carry out this electrolysis reaction.

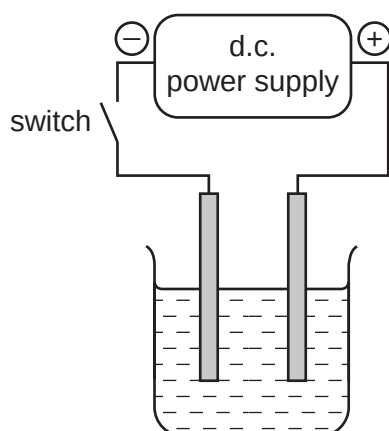


Fig. 8.1

- (i) What is the electrolyte in this electrolysis reaction?

..... [1]

- (ii) Name the product formed and describe what is observed at the surface of each electrode when an electric current is passing through the circuit.

positive electrode

product

observation

negative electrode

product

observation [4]

- 9 (a) Complete Table 9.1 to show the circuit symbol for each of the named components.

Table 9.1

component	symbol
ammeter	
fuse	
variable resistor	

[3]

- (b) Fig. 9.1 shows an electrical circuit for a torch (flashlight).

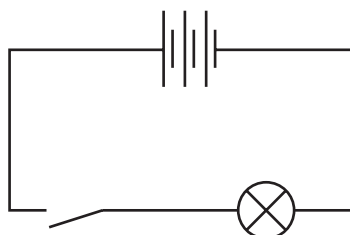


Fig. 9.1

- (i) How many cells are fitted in the torch? [1]

- (ii) A voltmeter is used to check the voltage across the light bulb.

Draw the symbol for the voltmeter in the correct position on the circuit. [1]

- (c) A single ray of light from a torch is shone onto a mirror as shown in Fig. 9.2.

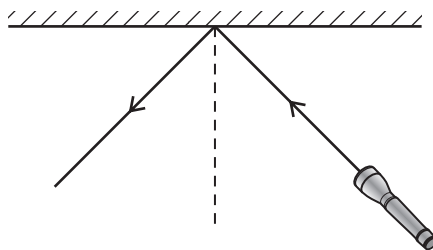


Fig. 9.2

- (i) On Fig. 9.2, 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]

Group

[illegible]

Key

a	X
---	----------

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