



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

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COMBINED SCIENCE

0653/21

Paper 2 (Core)

May/June 2010

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	
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9	
Total	

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



- 1 Fig. 1.1 shows some of the animals and plants that live in or close to a pond.

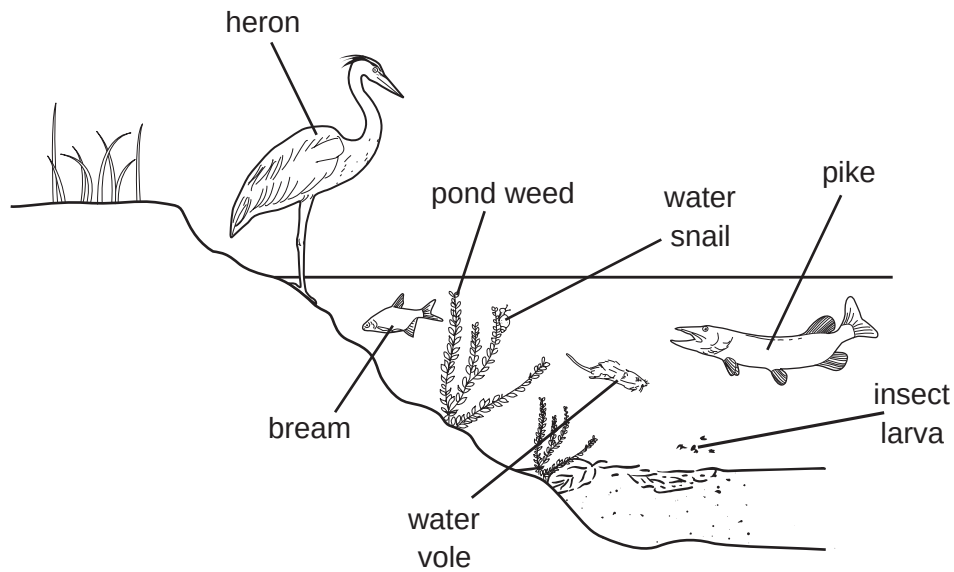


Fig. 1.1

- (a) Choose the correct term from the list below for each of the following descriptions.

community

decomposer

ecosystem

habitat

photosynthesis

population

all the animals and plants that live in and around the pond

all the water voles living in and around the pond

all the living things, and their environment, interacting with each other

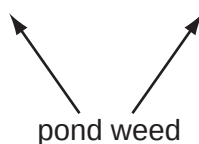
..... [3]

- (b) The pond weed is a producer.

Water snails and water voles are primary consumers.

The heron and pike are secondary consumers.

Complete the diagram of a food web that includes only these five organisms.



[3]

- (c) The pond is at the bottom of a sloping field which was ploughed.

During very heavy rain, a lot of soil from the field was washed into the pond.

It made the water cloudy and stopped the light from reaching the leaves of the water plants, so that the plants died.

After a while, the fish and other animals also died.

Give **two** reasons why the fish and other animals died.

- 1
-
- 2
-

[2]

(d) Fig. 1.2 shows a cell from the pond weed.

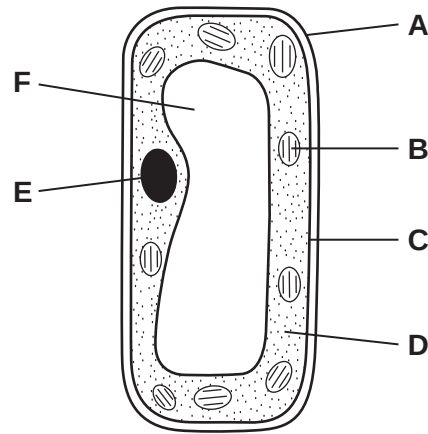


Fig. 1.2

- (i) Give the letter of the part of the cell that
 controls what enters and leaves the cell, ...
 is the place where photosynthesis happens, ...
 contains DNA. [3]
- (ii) Describe **two** ways in which a cell from the heron would look different from the cell in Fig. 1.2.
- 1

 2
 [2]

- 2 (a) Alpha, beta and gamma are three types of radiation emitted during radioactive decay. Name a suitable detector for these three types of radiation.

..... [1]

- (b) State **two** hazards to the human body from exposure to radiation.

1

2 [2]

- (c) (i) Complete the table to compare alpha, beta and gamma radiations.

Tick **one** box in each of the two rows in the table.

	alpha	beta	gamma
most penetrating			
most ionising			

[2]

- (ii) State which type of radiation

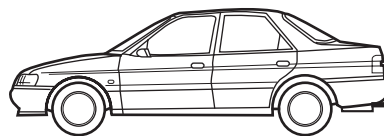
consists of particles with the greatest mass, ...

consists of electromagnetic waves. [2]

- 3 Aluminium, iron and sodium are metallic elements. Aluminium and iron are widely used in making many useful objects but no useful objects can be made out of metallic sodium.



aluminium alloys are
used in aircraft



iron is used to make
steel for cars

- (a) (i) State **one** property of a metallic element which is different from a non-metallic element.

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

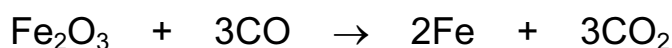
- (ii) Use your knowledge of the metals in Group I of the Periodic Table to state **one** reason, other than cost, why no useful objects can be made out of metallic sodium.

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

- (b) Aluminium and iron are mainly found as their oxides in rocks.

- (i) In order to obtain metallic iron, iron oxide is heated strongly in a furnace with carbon monoxide.

One reaction which occurs in the furnace has the symbolic chemical equation shown below.



Explain whether or not this equation is balanced.

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

- (ii) State the formula of the compound which has been reduced in the equation in (i).

Explain your answer.

formula

explanation

..... [2]

- (c) Aluminium is produced by electrolysis in which the electrolyte contains aluminium oxide.

Aluminium oxide is a compound of a metal with a non-metal.

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

..... [1]

- (ii) State the meaning of the term *electrolyte*.

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

- (iii) State the type of energy which must be supplied to decompose molten aluminium oxide.

..... [1]

- (iv) Name **one** other metal which is produced industrially by electrolysis.

..... [1]

- 4 Fig. 4.1 shows part of the human nervous system.

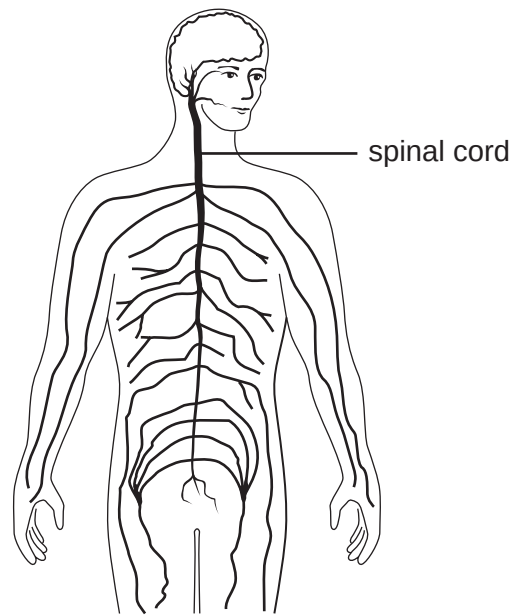


Fig. 4.1

- (a) The spinal cord is part of the central nervous system.

(i) On Fig. 4.1, label and name **one** other part of the central nervous system. [1]

(ii) Complete the sentences below.

When a receptor receives a stimulus, signals pass along to
the central nervous system. They then pass to which
respond to the stimulus. [2]

- (b) Messages can also be passed from one part of the body to another in the form of hormones.

Name the type of gland that produces hormones. [1]

- (c) A hormone secreted by the pancreas helps to keep blood sugar levels constant.

(i) On Fig. 4.1, write the letter **P** to show the position of the pancreas in the body. [1]

(ii) Name the hormone that reduces the blood sugar level if it gets too high.

..... [1]

(iii) Which body organ removes extra glucose from the blood when the blood sugar level gets too high?

..... [1]

- (iv) Suggest why it is harmful to the body if the blood sugar level falls very low.

.....

.....

..... [2]

- 5 Fig. 5.1 shows two dolphins communicating with each other using sound waves.

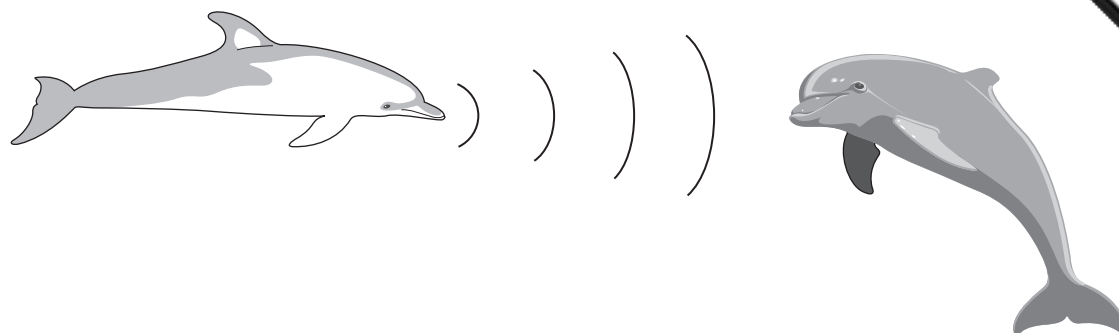


Fig. 5.1

- (a) How does a sound wave travel through water?

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

- (b) Sound travels at different speeds through different substances.

substance	speed of sound (m/s)
air	340
steel	5200
water	1500

- (i) Does sound travel fastest in a solid, a liquid or a gas?

..... [1]

- (ii) It takes 0.5 seconds for the sound wave to travel from one dolphin to the other.

Calculate the distance between the two dolphins.

State the formula that you use and show your working.

formula

working

.....m [2]

(c) A student is measuring the density of water.

(i) Name a piece of apparatus he could use to measure the volume of the water.

..... [1]

(ii) Name the piece of apparatus he could use to measure the mass of the water.

..... [1]

(iii) Complete the formula that he would use to calculate the density.

density = ... [1]

- 6 Fig. 6.1 shows samples of three of the elements in Group VII (Group 7) of the Periodic Table.

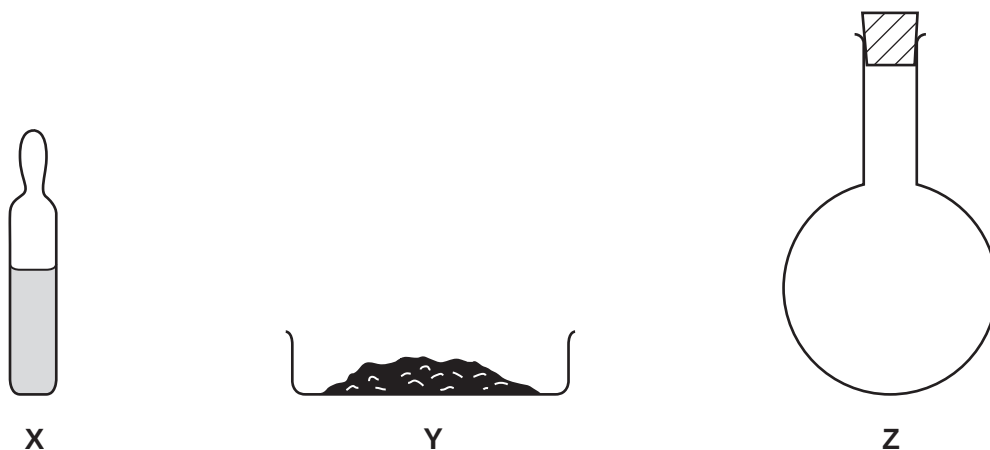


Fig. 6.1

- (a) The elements in Fig. 6.1 are at the same temperature. One element is a solid, one is a liquid and one is a gas.

- (i) State which element, **X**, **Y** or **Z**, has the highest melting point.

.....

[1]

- (ii) Suggest the names of the elements, **X**, **Y** and **Z**.

X

Y

Z

[2]

- (b) An atom of fluorine has a proton (atomic) number of 9 and a nucleon (mass) number of 19.

- (i) A diagram of this fluorine atom is shown in Fig. 6.2.

Complete the labelling of the diagram by writing the words **electrons**, **neutrons** and **protons** in the spaces.

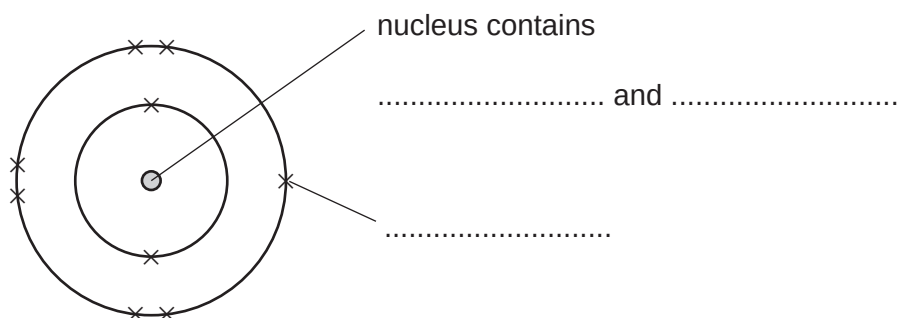


Fig. 6.2

[1]

- (ii) State the number of neutrons in the fluorine atom in Fig. 6.2.

..... [1]

- (iii) Explain why the nucleus of an atom has almost the same mass as the whole atom.

.....

..... [1]

- (c) Many people use solutions which contain chlorine to clean some parts of their homes.

Suggest **one** advantage of using a solution containing chlorine rather than water alone when cleaning homes.

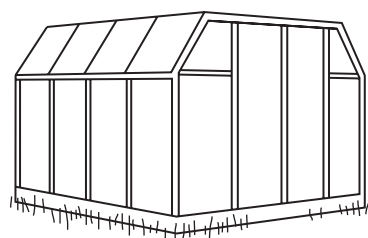
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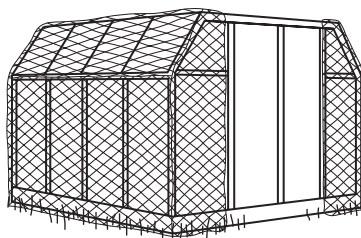
..... [2]

- 7 An investigation was carried out in Tamil Nadu, India, into the best conditions for growing tomatoes.

The tomato plants were grown in unheated glasshouses or outside. Netting was used to provide shade in one of the glasshouses.



glasshouse **A**
no shade



glasshouse **B**
all four side walls shaded



outside
no shade

Table 7.1 shows the mean temperature, and the mass of tomatoes produced, in the two glasshouses and outside.

Table 7.1

	mean temperature / °C	mass of tomatoes produced per plant / g
glasshouse A	38	1020
glasshouse B	36	2310
outside	34	1380

- (a) Which temperature gave the greatest mass of tomatoes?

..... °C [1]

- (b) Use your knowledge of convection to explain why the air inside the glasshouses stayed warmer than the air outside.

.....

 [2]

- (c) Tomatoes are a fruit, produced from the fertilised flowers of tomato plants.

Bees are most active in temperatures between 35 °C and 36 °C.

Suggest why the mass of tomatoes produced was greater in glasshouse **B** than in glasshouse **A**.

.....

.....

..... [2]

- (d) Suggest **two** factors, other than temperature, that could account for the lower mass of tomatoes produced outside than in glasshouse **B**.

1

2 [2]

- 8 (a) (i) The air is a mixture of gases.

Complete Table 8.1 to show the percentages of the two main gases in the air.

Table 8.1

name of gas	percentage in the air
oxygen	
nitrogen	

[2]

- (ii) Name **one** other gas which is found in unpolluted air.

[1]

- (b) Sulfur dioxide is a gas which causes air pollution.

Sulfur dioxide enters the air when volcanoes erupt.



- (i) Write the chemical formula of sulfur dioxide.

[1]

- (ii) Describe **one** environmental problem which can occur when large amounts of sulfur dioxide are released into the air.

[2]

- (c) When gasoline burns, the two main gases which are formed are carbon dioxide and water vapour. Both of these compounds are made of non-metallic elements bonded together.

(i) Name the type of chemical bonding in molecules of carbon dioxide and water.

..... [1]

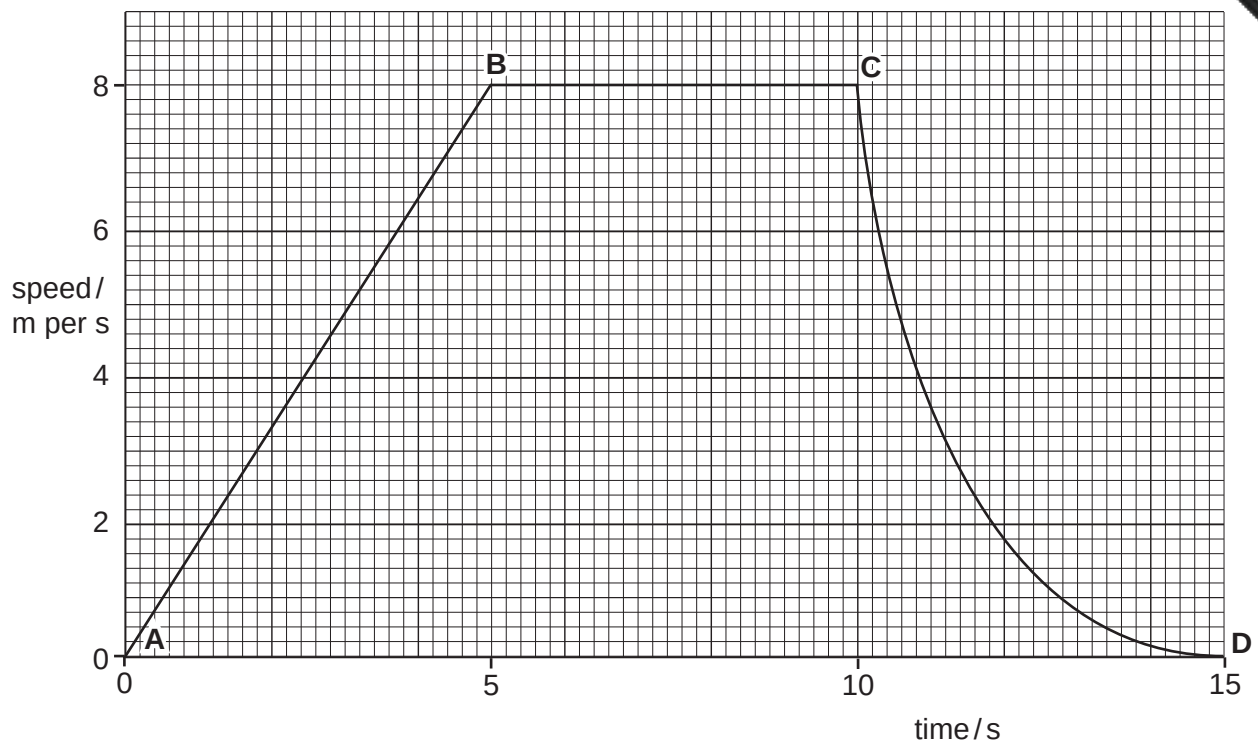
(ii) The displayed (graphical) formula of a water molecule is shown below.



Draw the displayed formula of a carbon dioxide molecule.

[2]

- 9 (a) A rider on his bicycle roll down a constant slope onto level ground. The rider uses the brakes to stop the bicycle. Fig. 9.1 shows the motion of the bicycle.



- (i) Over which section of the graph was the speed of the bicycle constant?

..... [1]

- (ii) How long did it take the bicycle to stop after the brakes were used?

..... s [1]

- (b) As the bicycle moves along a level road, the brakes are suddenly applied. The bicycle comes to a stop after 10 m.

When the brakes are applied, the average frictional force stopping the bicycle is 250 N.

Work is done and energy is transferred.

- (i) Calculate the work done as the bicycle slows down to a stop.

State the formula that you use and show your working.

formula

working

..... J [2]

- (ii) Identify the energy transfer which takes place.

from energy to energy [2]

(c) Fig. 9.2 shows a bicycle with two lamps at the front.



Fig. 9.2

Fig. 9.3 shows the circuit used to power the two lamps.

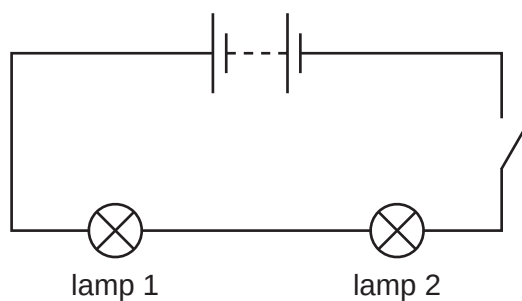


Fig. 9.3

(i) What name is given to this type of circuit?

..... [1]

(ii) The resistance of each lamp in the circuit is 4Ω .

State the combined resistance of the two lamps.

..... Ω [1]

(d) Fig. 9.4 shows a metal nut on the bicycle wheel which is difficult to unscrew.

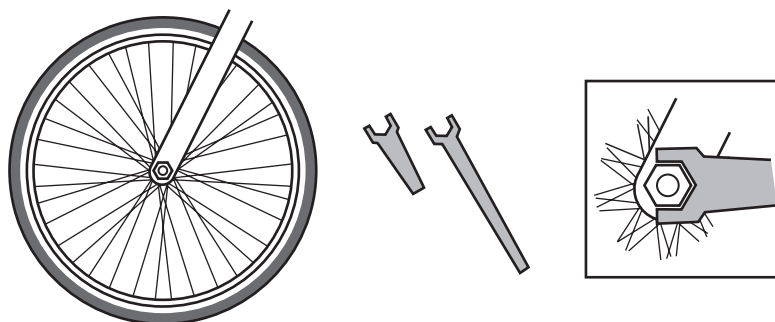


Fig. 9.4

Explain why a long spanner is better than a short spanner to unscrew the nut.

.....

.....

..... [2]

DATA SHEET
The Periodic Table of the Elements

Group																	
I	II											III	IV	V	VI	VII	0
7 Li Lithium 3	9 Be Beryllium 4	1 H Hydrogen 1										11 B Boron 5	12	14	16	19	20
													6 C Carbon 6	7 N Nitrogen 7	8 O Oxygen 8	9 F Fluorine 9	10 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12											13 Al Aluminium 13	14 Si Silicon 14	15 P Phosphorus 15	16 S Sulfur 16	17 Cl Chlorine 17	18 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	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	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 Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89															

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

a	X	b
Key a = relative atomic mass X = atomic symbol 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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0653/22

May/June 2010

1 hour 15 minutes

No Additional Materials are required.

* 4 2 2 9 8 1 3 0 2 3 *

DO **NOT** WRITE IN ANY BARCODES.

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

The number of marks is given in brackets [] at the end of each question or part question.

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UNIVERSITY of CAMBRIDGE
International Examinations

[Turn over

- 1 (a) Circle the characteristics in the list below that are shared by all living organisms.

excretion heartbeat photosynthesis sensitivity sight

[2]

- (b) A student peeled a layer of cells from the inside of an onion bulb. She placed them in a drop of water on a microscope slide and covered them with a coverslip.

Fig. 3.1 shows what she saw when viewing the cells through a microscope.

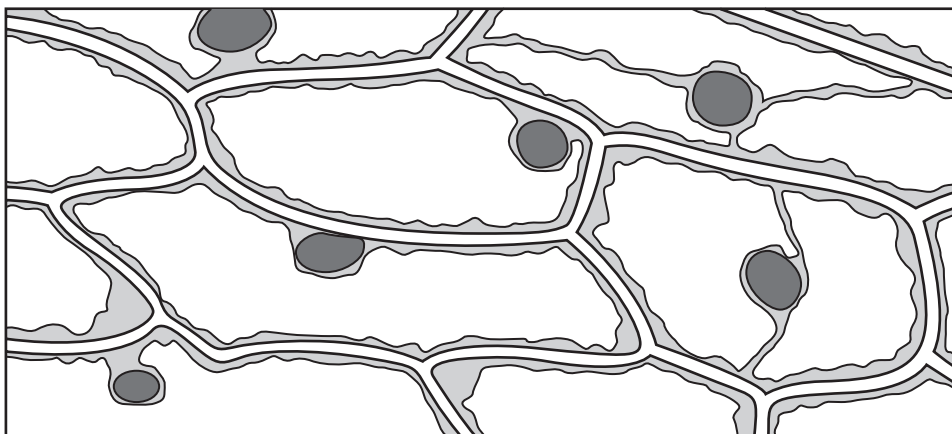


Fig. 3.1

- (i) The cells in Fig. 3.1 are all similar to each other.

Give the name for a group of similar cells. [1]

- (ii) State **two** ways in which the cells in Fig. 3.1 differ from animal cells.

1

2 [2]

- (c) Onion cells often contain stores of starch. When a person eats an onion, the starch is digested.

- (i) Explain why nutrients such as starch must be digested before they can be used by the human body.

.....

.....

..... [2]

(ii) Outline the roles of each of the following in the digestion of starch.

teeth

.....

enzymes

..... [2]

- 2 The Periodic Table on page 20 shows the chemical elements in rows (left to right) and columns (up and down).

(a) (i) A column of elements in the Periodic Table is called a group.

What is a row of elements called? [1]

(ii) State the chemical symbol of the element which has a proton (atomic) number of 32.

..... [1]

(b) Table 2.1 shows the uses of some elements.

Complete the table by writing the names of elements chosen from the list into the correct boxes.

aluminium

carbon

chlorine

helium

iron

nitrogen

sodium

xenon

Table 2.1

element	use
	used to make food containers because it does not react with food
	used to sterilise drinking water because it kills harmful bacteria
	used in airships because it is an unreactive gas which is much less dense than air

[3]

- (c) A teacher placed a small piece of potassium into a container filled with chlorine. She also mixed together some iron filings and sulfur powder.

Fig. 2.1 shows what the class observed.

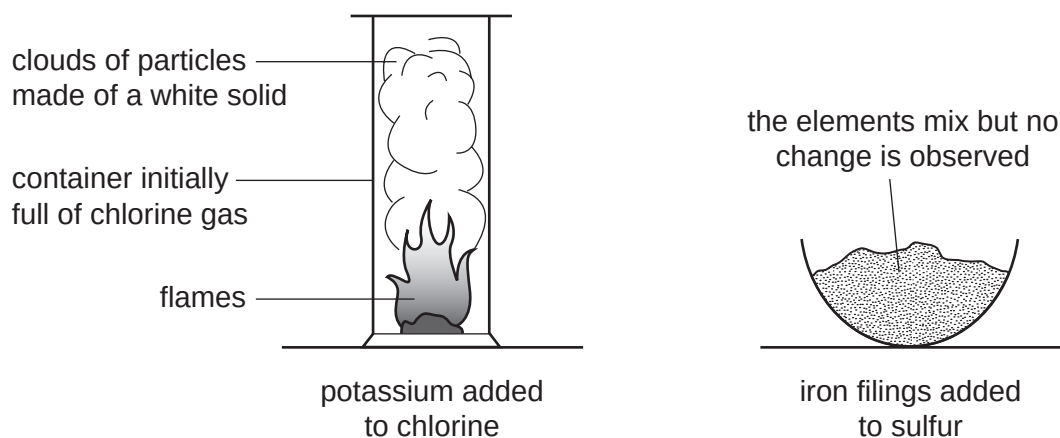


Fig. 2.1

- (i) State **two** observations which showed that the elements potassium and chlorine were combining to form a compound.

1

 2 [2]

- (ii) Suggest the **word** chemical equation for the reaction between potassium and chlorine.

..... [1]

- (iii) Iron sulfide is a compound made of the elements iron and sulfur.

Using this example, describe **two** ways in which a mixture of two elements differs from a compound of the elements.

1

 2 [2]

- 3 (a) Fig. 3.1 shows an astronaut on a space walk. His space suit is designed to protect him from dangerous electromagnetic radiation from the Sun reaching the astronaut's body.

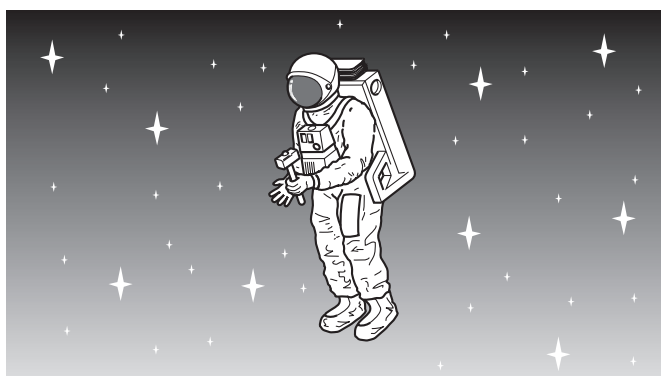


Fig. 3.1

- (i) Name **two** types of electromagnetic radiation that can harm the body.

1

2 [2]

- (ii) State **one** way in which electromagnetic radiation can harm the body.

..... [1]

- (b) Two astronauts are in a rocket being launched to the Moon. One of the astronauts has a mass of 96 kg. The gravitational field strength on the Moon is about one sixth of that on Earth.

State the difference, if any, between

- (i) the mass of the astronaut on the Earth and on the Moon,

..... [1]

- (ii) the weight of the astronaut on the Earth and on the Moon.

..... [1]

- (c) The astronauts land on the Moon, which has no atmosphere. They use radio signals to talk to each other.

Explain why sound waves need a medium, such as air, to travel through.

.....

..... [2]

- (d) A rock on the moon weighs 6 N. The astronaut lifts it up by 2 metres.

Calculate the work done on the rock.

State the formula that you use and show your working.

formula

working

..... J [2]

- 4 (a) A student investigated the conditions needed for the germination of mustard seeds.

Fig. 4.1 shows the apparatus at the start of his experiment.

Tubes **A** to **E** were placed in the laboratory at room temperature. Tube **E** was placed in a freezer at -4°C .

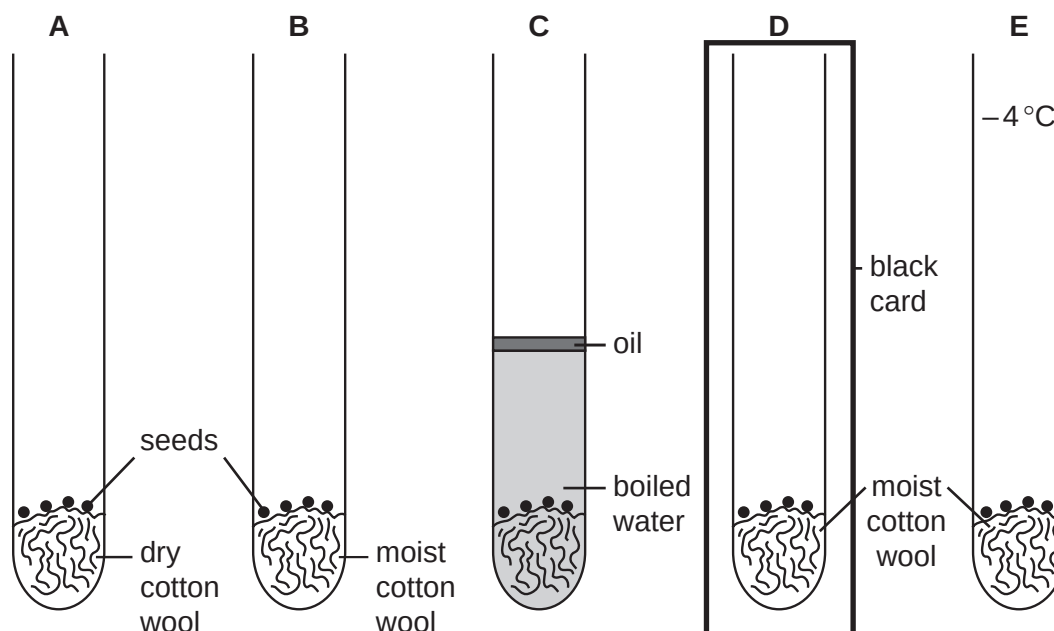


Fig. 4.1

- (i) Which **one** of these factors should the student have kept the same for all of the tubes? Circle the correct answer.

age of seeds

amount of water

temperature

[1]

- (ii) After three days, the seeds in tubes **B** and **D** had germinated.

The seeds in all the other tubes had not germinated.

Use these results to deduce the conditions needed for the germination of mustard seeds.

.....

.....

.....

..... [3]

- (b) In a tropical rainforest, the trees often grow very closely together, which reduces the amount of light reaching the forest floor.

The seeds of many species of rainforest trees will not germinate unless they get plenty of light.

- (i) Suggest why this is an advantage to the seedlings.

.....
 [1]

- (ii) In a separate experiment the student used seeds of rainforest trees.

State the tube in Fig. 4.1 in which the result would differ from those he obtained for mustard seeds.

..... [1]

- (c) (i) Tropical rainforests have a very large number of different plant species.

Suggest how this could lead to a high species diversity of animals in tropical rainforests.

.....

 [2]

- (ii) When rainforests are cut down, species diversity is reduced.

Explain how else cutting down rainforests may damage the environment.

.....

 [3]

5 Some fuels are listed below.

animal dung

coal

methane

wood

(a) (i) State **one** fuel from the list which is an example of a fossil fuel.

Explain your answer.

example of a fossil fuel

explanation

.....

..... [2]

(ii) The chemical formulae of some substances which can be used as fuels are shown below.

C_2H_6O

H_2

CO

C_2H_2

C

Explain which **one** of these formulae represents one molecule of a *hydrocarbon*.

.....

.....

..... [2]

(b) At an oil refinery, useful products are separated from petroleum (crude oil).

Complete the sentences by choosing terms from the list below.

boiling points

colours

catalytic cracking

filtration

filtered

fractional distillation

heated

stirred

The process used to separate petroleum into useful products is called

.....

In this process, petroleum is

Different products separate because they have different

.....

[3]

- (c) A student suggested that when the liquid fuel ethanol is burned, carbon dioxide should be produced.

Fig. 5.1 shows apparatus which he used to find out if this was true.

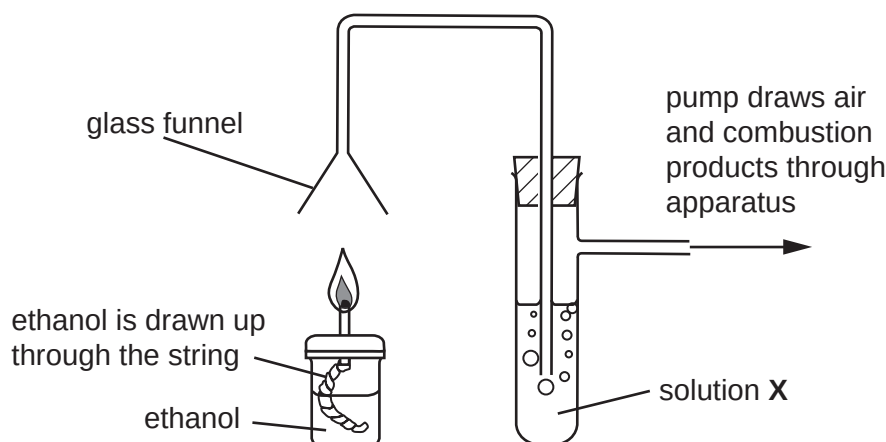


Fig. 5.1

- (i) Solution **X** is used to test for carbon dioxide.

Name solution **X**, and describe what would be observed if the combustion of ethanol does produce carbon dioxide.

solution **X**

observation

[2]

- (ii) Explain why the combustion of ethanol is an example of an oxidation reaction.

.....

..... [1]

6 Fig. 6.1 shows a cube.

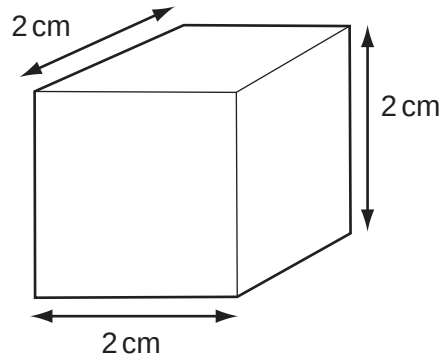


Fig. 6.1

(a) (i) Name a suitable piece of apparatus for measuring the length of the cube.

..... [1]

(ii) Calculate the volume of the cube. cm^3 [1]

(iii) The mass of the cube is 21.6 g.

Calculate the density of the cube.

State the formula that you use and show your working.

formula

working

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

- (b) The solid cube is made up of very small particles.

Fig. 6.2 shows their arrangement.

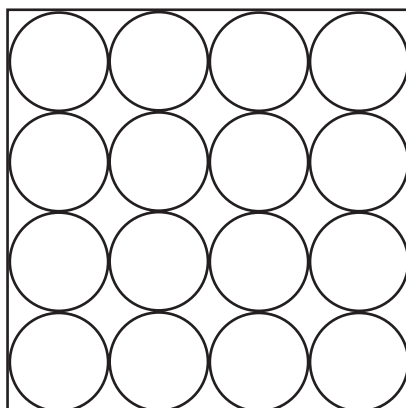
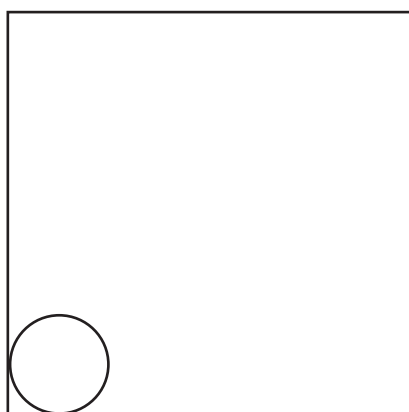
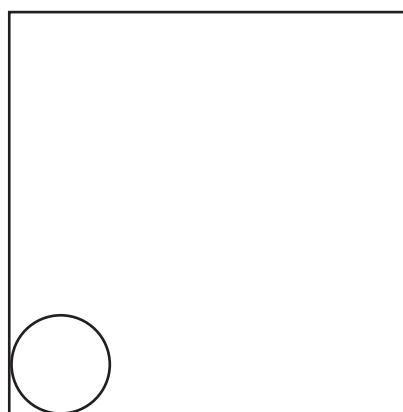


Fig. 6.2

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



liquid



gas

[2]

- (c) (i) Explain, in terms of particles, why a solid expands when heated.

.....
 [1]

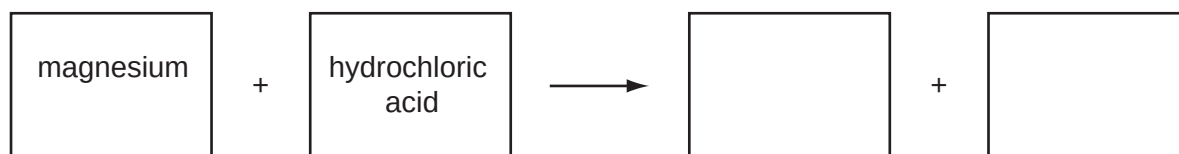
- (ii) Describe **one** problem caused by a solid metal expanding when it gets hot.

.....

 [2]

- 7 When magnesium metal reacts with dilute hydrochloric acid, a soluble salt and a gas are produced.

(a) Complete the **word** chemical equation for the reaction between magnesium and hydrochloric acid.



[2]

(b) A student used the apparatus in Fig. 7.1 to investigate the rate of this reaction.

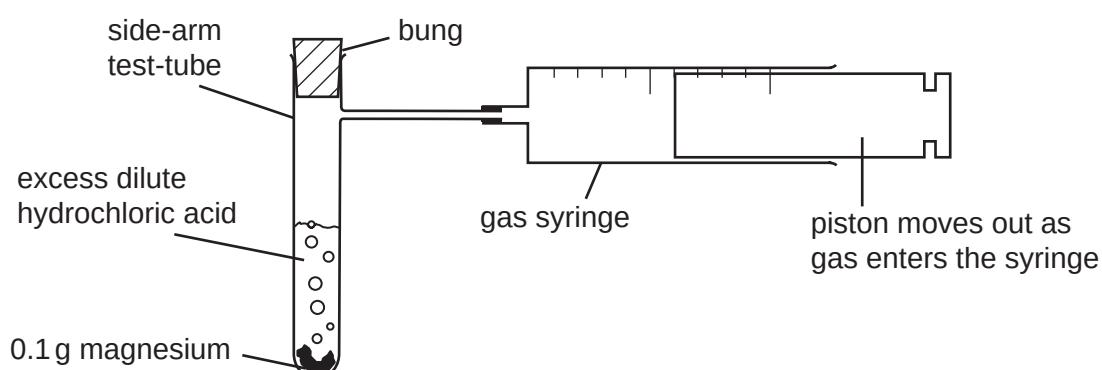


Fig. 7.1

The student dropped the magnesium into the acid contained in the side-arm test-tube and put in the bung.

A stopwatch was used to time how long it took for the gas syringe to fill with gas.

The student carried out two experiments and the results are shown in Table 7.1.

Table 7.1

experiment	time taken to collect 100 cm ³ of gas / seconds
1	45
2	31

- (i) Explain how the results show that the rate of reaction in experiment 2 was higher than that in experiment 1.

.....

..... [1]

- (ii) Suggest **two** ways in which the rate of reaction between magnesium and hydrochloric acid could be increased.

1

.....

2

..... [2]

- (iii) Sodium is an alkali metal in Group 1 of the Periodic Table.

Explain why the student must not attempt the experiment shown in Fig. 7.1 using sodium instead of magnesium.

.....

.....

..... [2]

- 8 (a) A torch (flash light) contains two cells providing a total voltage of 3.0 V across the lamp. When the torch is lit, the current flowing through the lamp is 0.3 A.

- (i) Calculate the resistance of the lamp.

State the formula that you use, show your working, and state the units of resistance.

formula

working

[3]

- (ii) To measure the current through the lamp and the voltage across the lamp, the student set up the circuit in Fig. 8.1.

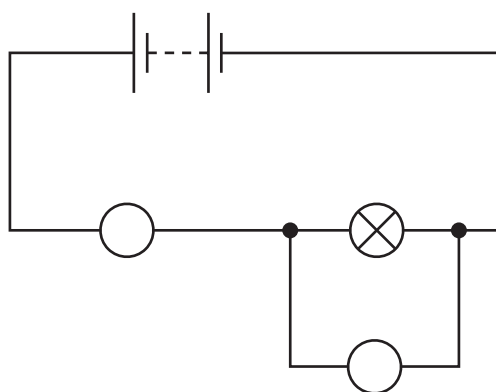


Fig. 8.1

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

- (b) Complete the sentences below to describe the energy changes which take place when the torch is used.

Choose from the words given.

chemical

electrical

heat

kinetic

light

nuclear

potential

sound

Energy is stored in the cells as energy. This is changed into energy which passes through the lamp. The useful energy output from the lamp is energy, but much energy is wasted as energy. [4]

- 9 Fig. 9.1 shows a section through a human heart seen from the front.

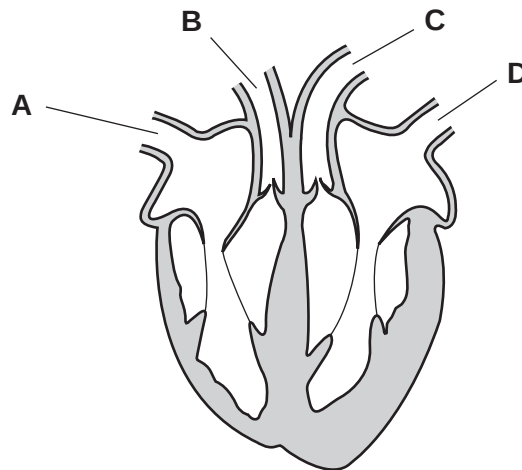


Fig. 9.1

- (a) (i) The walls of the heart are made of cardiac muscle.

Describe the function of the cardiac muscle in the heart.

.....

 [2]

- (ii) State the name of the blood vessels that supply the cardiac muscle with oxygen.

..... [1]

- (iii) Give the letters of the **two** labelled blood vessels in Fig. 9.1 that contain oxygenated blood.

..... and [1]

- (b) Plants also have transport systems in which liquids flow through vessels. However, they do not have a heart.

Instead, transpiration pulls water up through the plant.

- (i) Explain what is meant by the term *transpiration*.

.....

 [2]

- (ii) Name the vessels through which water travels up a plant.

..... [1]

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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	101 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	210 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86			
226 Ra Radium 88		227 Ac Actinium 89																		
58-71 Lanthanoid series																				
90-103 Actinoid series																				

Key

a	X	b
---	---	---

a = relative atomic mass
X = atomic symbol
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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COMBINED SCIENCE

0653/23

Paper 2 (Core)

May/June 2010

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 **19** printed pages and **1** blank page.



- 1 (a) Circle the characteristics in the list below that are shared by all living organisms.

excretion heartbeat photosynthesis sensitivity sight

[2]

- (b) A student peeled a layer of cells from the inside of an onion bulb. She placed them in a drop of water on a microscope slide and covered them with a coverslip.

Fig. 3.1 shows what she saw when viewing the cells through a microscope.

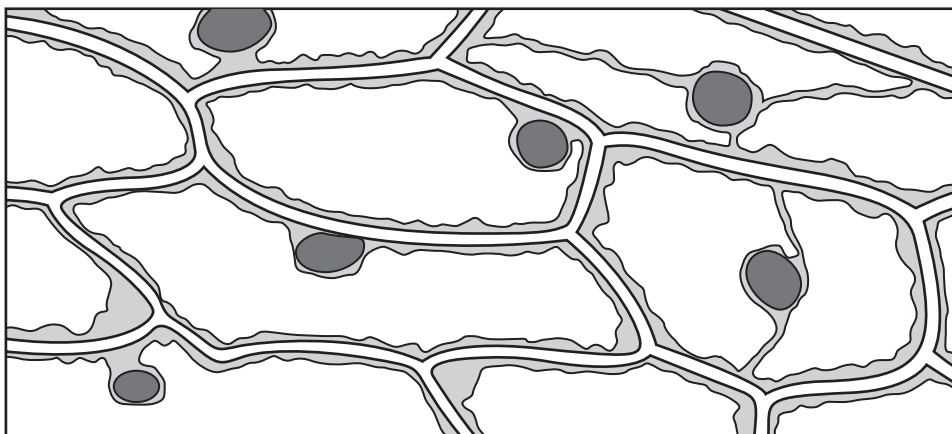


Fig. 3.1

- (i) The cells in Fig. 3.1 are all similar to each other.

Give the name for a group of similar cells. [1]

- (ii) State **two** ways in which the cells in Fig. 3.1 differ from animal cells.

1

2 [2]

- (c) Onion cells often contain stores of starch. When a person eats an onion, the starch is digested.

- (i) Explain why nutrients such as starch must be digested before they can be used by the human body.

.....

.....

..... [2]

(ii) Outline the roles of each of the following in the digestion of starch.

teeth

.....

enzymes

..... [2]

- 2 The Periodic Table on page 20 shows the chemical elements in rows (left to right) and columns (up and down).

(a) (i) A column of elements in the Periodic Table is called a group.

What is a row of elements called? [1]

(ii) State the chemical symbol of the element which has a proton (atomic) number of 32.

..... [1]

(b) Table 2.1 shows the uses of some elements.

Complete the table by writing the names of elements chosen from the list into the correct boxes.

aluminium

carbon

chlorine

helium

iron

nitrogen

sodium

xenon

Table 2.1

element	use
	used to make food containers because it does not react with food
	used to sterilise drinking water because it kills harmful bacteria
	used in airships because it is an unreactive gas which is much less dense than air

[3]

- (c) A teacher placed a small piece of potassium into a container filled with chlorine. She also mixed together some iron filings and sulfur powder.

Fig. 2.1 shows what the class observed.

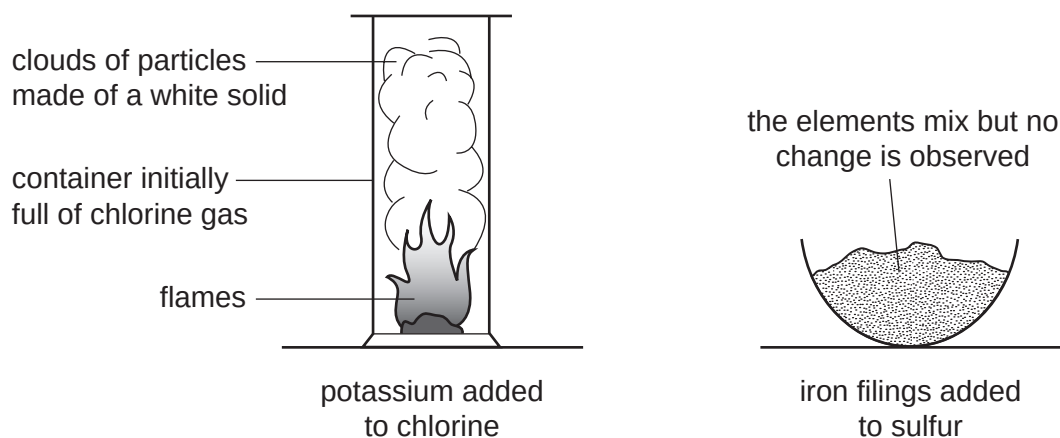


Fig. 2.1

- (i) State **two** observations which showed that the elements potassium and chlorine were combining to form a compound.

1

.....

2

..... [2]

- (ii) Suggest the **word** chemical equation for the reaction between potassium and chlorine.

..... [1]

- (iii) Iron sulfide is a compound made of the elements iron and sulfur.

Using this example, describe **two** ways in which a mixture of two elements differs from a compound of the elements.

1

.....

2

..... [2]

- 3 (a) Fig. 3.1 shows an astronaut on a space walk. His space suit is designed to protect him from dangerous electromagnetic radiation from the Sun reaching the astronaut's body.

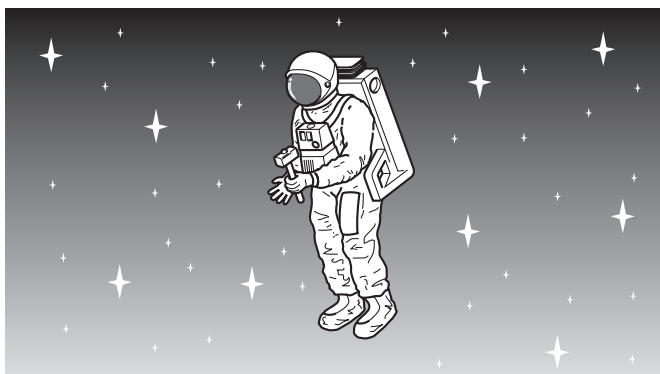


Fig. 3.1

- (i) Name **two** types of electromagnetic radiation that can harm the body.

1

2 [2]

- (ii) State **one** way in which electromagnetic radiation can harm the body.

..... [1]

- (b) Two astronauts are in a rocket being launched to the Moon. One of the astronauts has a mass of 96 kg. The gravitational field strength on the Moon is about one sixth of that on Earth.

State the difference, if any, between

- (i) the mass of the astronaut on the Earth and on the Moon,

..... [1]

- (ii) the weight of the astronaut on the Earth and on the Moon.

..... [1]

- (c) The astronauts land on the Moon, which has no atmosphere. They use radio signals to talk to each other.

Explain why sound waves need a medium, such as air, to travel through.

.....

..... [2]

- (d) A rock on the moon weighs 6 N. The astronaut lifts it up by 2 metres.

Calculate the work done on the rock.

State the formula that you use and show your working.

formula

working

..... J [2]

- 4 (a) A student investigated the conditions needed for the germination of mustard seeds.

Fig. 4.1 shows the apparatus at the start of his experiment.

Tubes **A** to **E** were placed in the laboratory at room temperature. Tube **E** was placed in a freezer at -4°C .

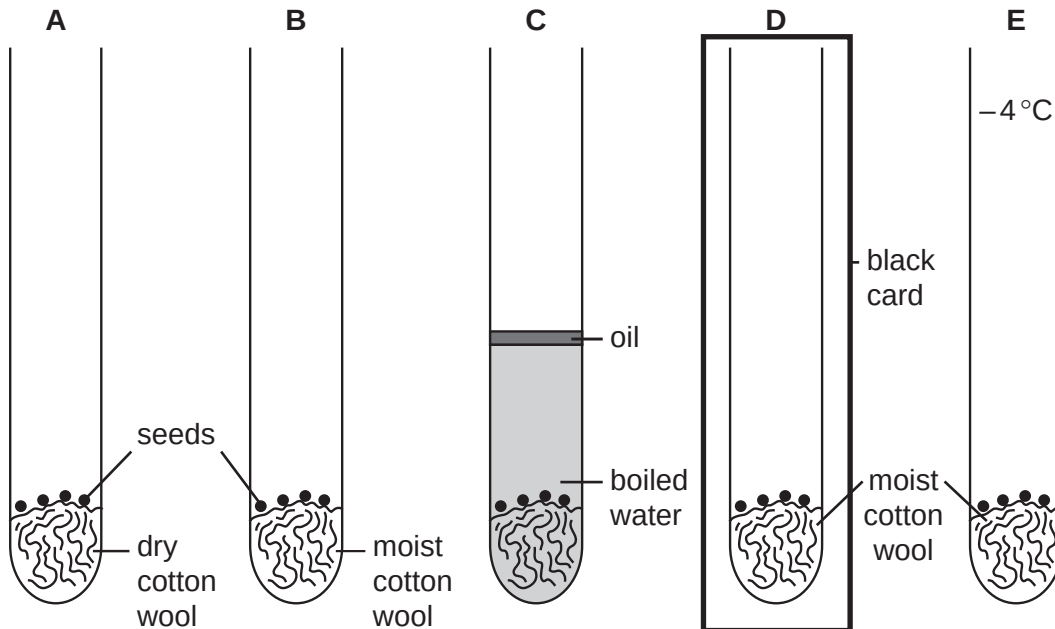


Fig. 4.1

- (i) Which **one** of these factors should the student have kept the same for all of the tubes? Circle the correct answer.

age of seeds

amount of water

temperature

[1]

- (ii) After three days, the seeds in tubes **B** and **D** had germinated.

The seeds in all the other tubes had not germinated.

Use these results to deduce the conditions needed for the germination of mustard seeds.

.....

.....

.....

..... [3]

- (b) In a tropical rainforest, the trees often grow very closely together, which reduces the amount of light reaching the forest floor.

The seeds of many species of rainforest trees will not germinate unless they get plenty of light.

- (i) Suggest why this is an advantage to the seedlings.

.....
 [1]

- (ii) In a separate experiment the student used seeds of rainforest trees.

State the tube in Fig. 4.1 in which the result would differ from those he obtained for mustard seeds.

..... [1]

- (c) (i) Tropical rainforests have a very large number of different plant species.

Suggest how this could lead to a high species diversity of animals in tropical rainforests.

.....

 [2]

- (ii) When rainforests are cut down, species diversity is reduced.

Explain how else cutting down rainforests may damage the environment.

.....

 [3]

5 Some fuels are listed below.

animal dung

coal

methane

wood

(a) (i) State **one** fuel from the list which is an example of a fossil fuel.

Explain your answer.

example of a fossil fuel

explanation

.....

..... [2]

(ii) The chemical formulae of some substances which can be used as fuels are shown below.

C_2H_6O

H_2

CO

C_2H_2

C

Explain which **one** of these formulae represents one molecule of a *hydrocarbon*.

.....

.....

..... [2]

(b) At an oil refinery, useful products are separated from petroleum (crude oil).

Complete the sentences by choosing terms from the list below.

boiling points

colours

catalytic cracking

filtration

filtered

fractional distillation

heated

stirred

The process used to separate petroleum into useful products is called

.....

In this process, petroleum is

Different products separate because they have different

.....

[3]

- (c) A student suggested that when the liquid fuel ethanol is burned, carbon dioxide should be produced.

Fig. 5.1 shows apparatus which he used to find out if this was true.

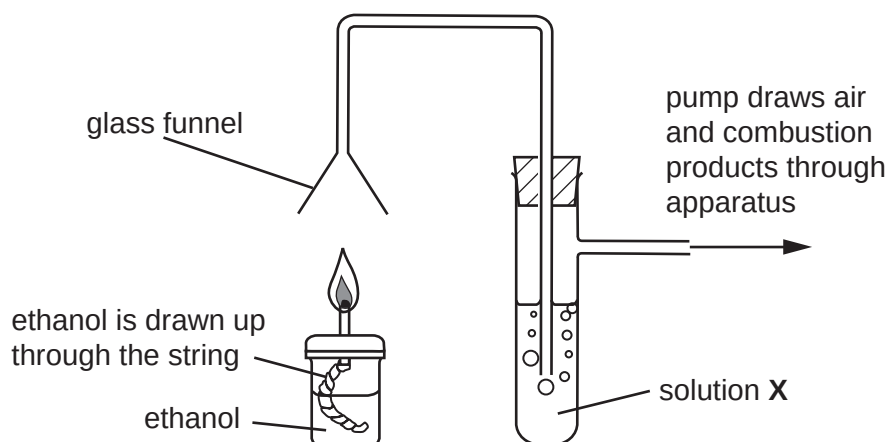


Fig. 5.1

- (i) Solution **X** is used to test for carbon dioxide.

Name solution **X**, and describe what would be observed if the combustion of ethanol does produce carbon dioxide.

solution **X**

observation

[2]

- (ii) Explain why the combustion of ethanol is an example of an oxidation reaction.

.....

..... [1]

6 Fig. 6.1 shows a cube.

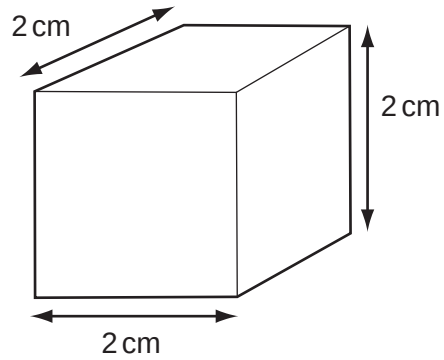


Fig. 6.1

(a) (i) Name a suitable piece of apparatus for measuring the length of the cube.

..... [1]

(ii) Calculate the volume of the cube. cm^3 [1]

(iii) The mass of the cube is 21.6 g.

Calculate the density of the cube.

State the formula that you use and show your working.

formula

working

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

- (b) The solid cube is made up of very small particles.

Fig. 6.2 shows their arrangement.

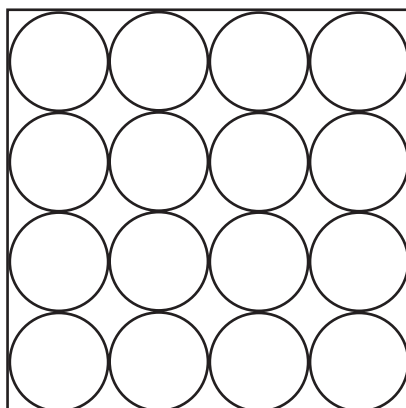
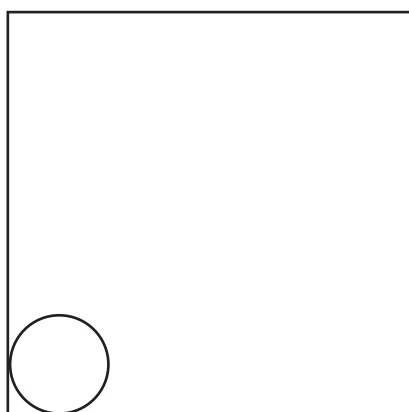
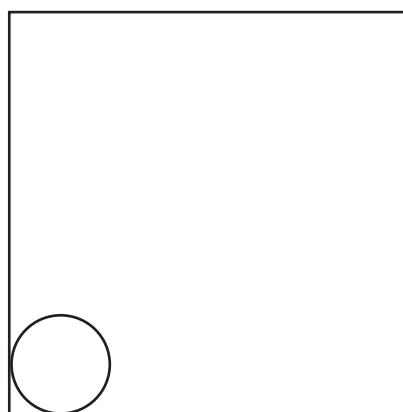


Fig. 6.2

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



liquid



gas

[2]

- (c) (i) Explain, in terms of particles, why a solid expands when heated.

.....
 [1]

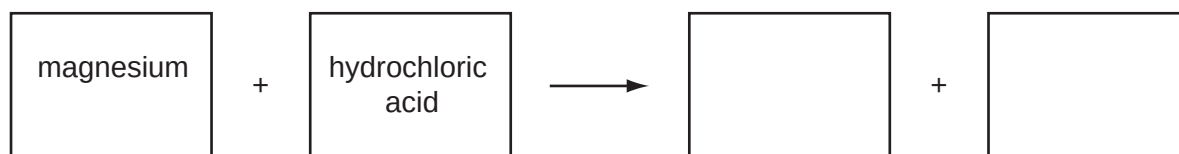
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(b) A student used the apparatus in Fig. 7.1 to investigate the rate of this reaction.

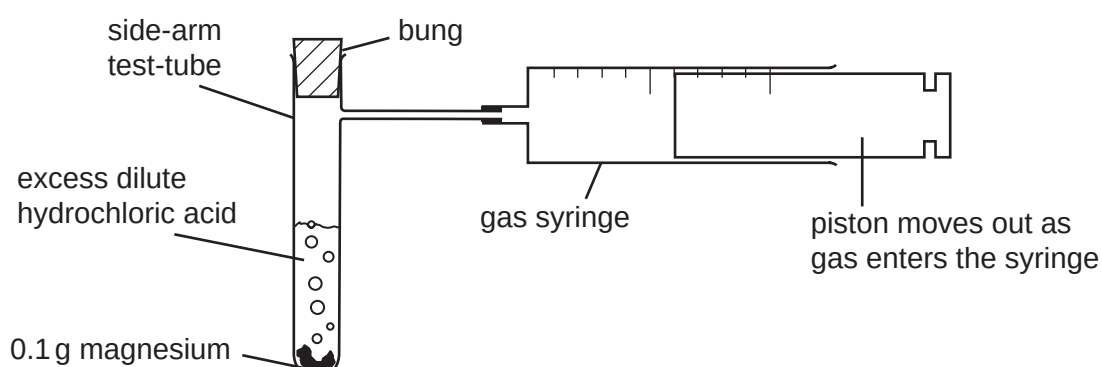


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- (ii) Suggest **two** ways in which the rate of reaction between magnesium and hydrochloric acid could be increased.

1

.....

2

..... [2]

- (iii) Sodium is an alkali metal in Group 1 of the Periodic Table.

Explain why the student must not attempt the experiment shown in Fig. 7.1 using sodium instead of magnesium.

.....

.....

..... [2]

- 8 (a) A torch (flash light) contains two cells providing a total voltage of 3.0 V across the lamp. When the torch is lit, the current flowing through the lamp is 0.3 A.

- (i) Calculate the resistance of the lamp.

State the formula that you use, show your working, and state the units of resistance.

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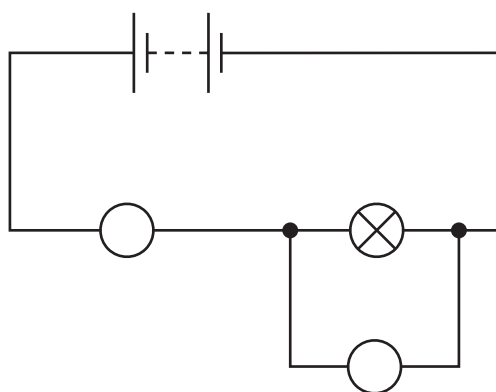


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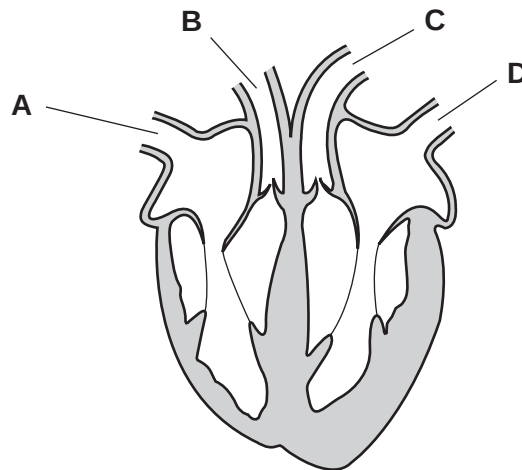


Fig. 9.1

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Describe the function of the cardiac muscle in the heart.

.....

 [2]

- (ii) State the name of the blood vessels that supply the cardiac muscle with oxygen.

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- (iii) Give the letters of the **two** labelled blood vessels in Fig. 9.1 that contain oxygenated blood.

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- (b) Plants also have transport systems in which liquids flow through vessels. However, they do not have a heart.

Instead, transpiration pulls water up through the plant.

- (i) Explain what is meant by the term *transpiration*.

.....

 [2]

- (ii) Name the vessels through which water travels up a plant.

..... [1]

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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	
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Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89																
58-71 Lanthanoid series																		
90-103 Actinoid series																		
140 Ce Cerium 58 141 Pr Praseodymium 59 144 Nd Neodymium 60 150 Sm Samarium 62 157 Gd Gadolinium 64 162 Dy Dysprosium 66 165 Ho Holmium 67 167 Er Erbium 68 169 Tm Thulium 69 175 Lu Lutetium 71																		
232 Th Thorium 90 238 U Uranium 92 238 Pa Protactinium 91 238 Np Neptunium 93 238 Pu Plutonium 94 238 Am Americium 95 238 Cm Curium 96 238 Bk Berkelium 97 238 Cf Californium 98 238 Es Einsteinium 99 238 Fm Fermium 100 238 Md Mendelevium 101 238 No Nobelium 102 238 Lr Lawrencium 103																		
Key	X ^a	a = relative atomic mass																
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Key

a	X	a = relative atomic mass
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The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).