



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

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COMBINED SCIENCE

0653/21

Paper 2 (Core)

October/November 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	
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4	
5	
6	
7	
8	
9	
Total	

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



- 1 (a) State the word equation for photosynthesis.



[2]

- (b) (i) Name the green pigment found in plant leaves which absorbs energy from sunlight.

[1]

- (ii) Fig. 1.1 is a diagram of a plant cell.

On the diagram, draw a label line to where this green pigment would be found, and label it **P**.

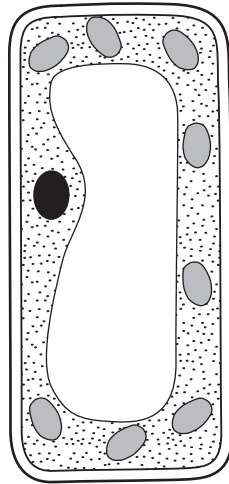


Fig. 1.1

[1]

- (c) A student fixed a piece of black paper over a leaf, which was still attached to the plant. He left the plant in the sun for two days.

He then removed the leaf from the plant and tested it for starch, after removing the paper.

- (i) Using the letters given, list the correct sequence of the steps he took.

A Add iodine solution to the leaf.

B Place the leaf in boiling water.

C Dip the leaf into water to soften it.

D Place the leaf in hot ethanol.

E Spread the leaf on a white tile.

[3]

- (ii) Fig. 1.2 shows the leaf before and after he did the starch test.

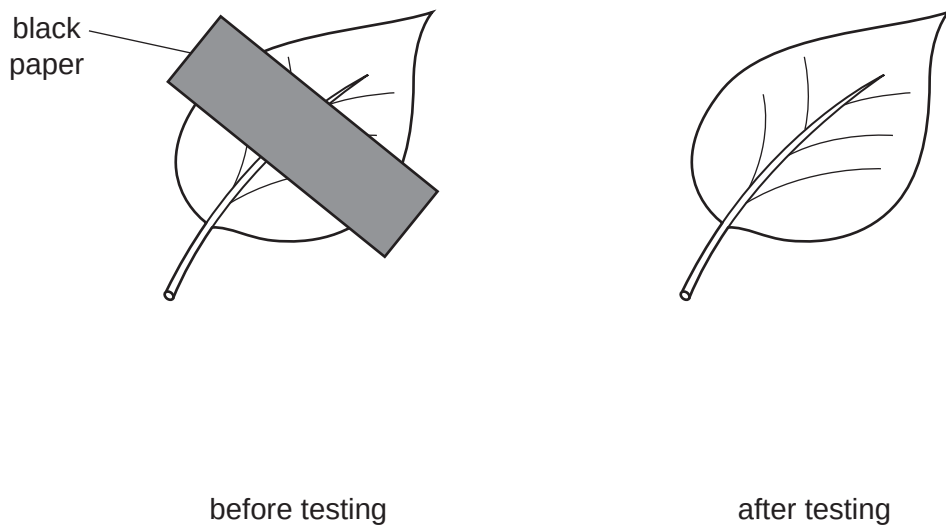


Fig. 1.2

Iodine solution is orange-brown. It turns blue-black when it is in contact with starch.

Complete the diagram of the leaf after testing in Fig. 1.2. Do **not** colour the diagram.

Use labels to show which parts would look orange-brown and which parts would look blue-black.

[2]

- 2 Fig. 2.1 shows the apparatus a student used to measure the rate of reaction between powdered metal and dilute hydrochloric acid.

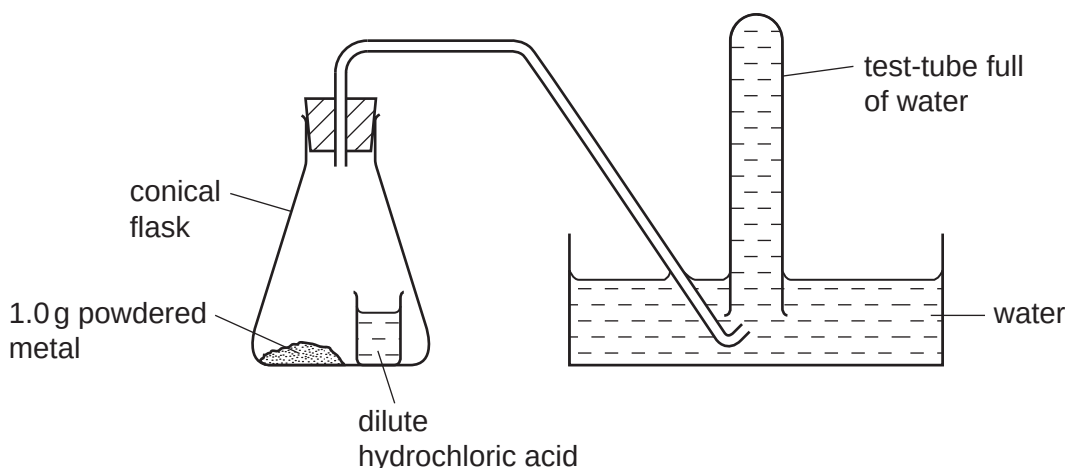


Fig. 2.1

When the student tilted the conical flask, the acid mixed with the powdered metal. If a reaction occurred, any gas which was produced bubbled up into the test-tube, pushing the water out. The student timed how long it took for the test-tube to fill with gas.

- (a) Describe how the student could test the gas to show that it was hydrogen.

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

- (b) The student used the apparatus in Fig. 2.1 to compare the rates of reaction between dilute hydrochloric acid and three powdered metals, **X**, **Y** and **Z**.

The results the student obtained are shown in Table 2.1.

Table 2.1

metal	mass of metal / g	time for gas to fill the test-tube / seconds
X	1.0	150
Y	1.0	45
Z	1.0	no gas was produced

- (i) One of the metals used was copper.

State and explain which metal, **X**, **Y** or **Z**, was copper.

metal

explanation

[2]

- (ii) Suggest **two** ways, other than using a catalyst, in which the student **increase** the rate of reaction between metal **X** and dilute hydrochloric acid.

1

2

..... [2]

- (c) Fig. 2.2 shows another experiment in which the student added zinc carbonate to dilute sulfuric acid. A gas was given off and, when the bubbling stopped, some solid zinc carbonate remained in the mixture.

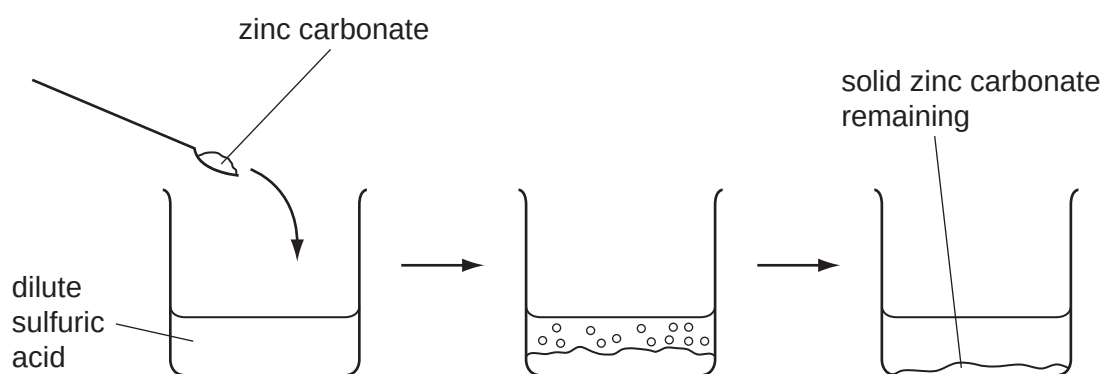


Fig. 2.2

- (i) State the chemical formula of sulfuric acid.

..... [1]

- (ii) Explain why the reaction eventually stopped even though some zinc carbonate powder remained.

.....

..... [1]

- 3 Fig. 3.1 shows a rock that is falling from the top of a cliff into the river below.

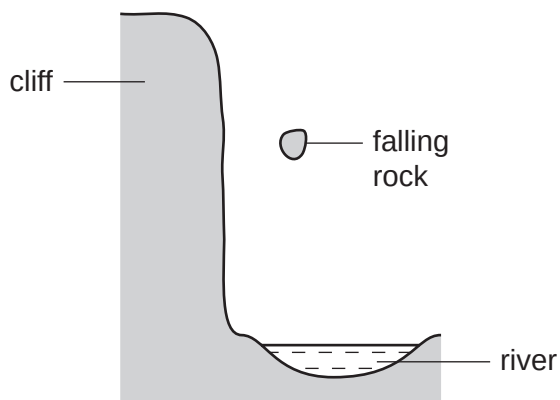


Fig. 3.1

- (a) (i) As the rock falls, it gains kinetic energy.

Name the form of energy the rock had at the top of the cliff.

..... [1]

- (ii) Suggest what happens to the kinetic energy of the rock when the rock hits the water.

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

- (b) Fig. 3.2 shows a speed-time graph for the motion of the rock.

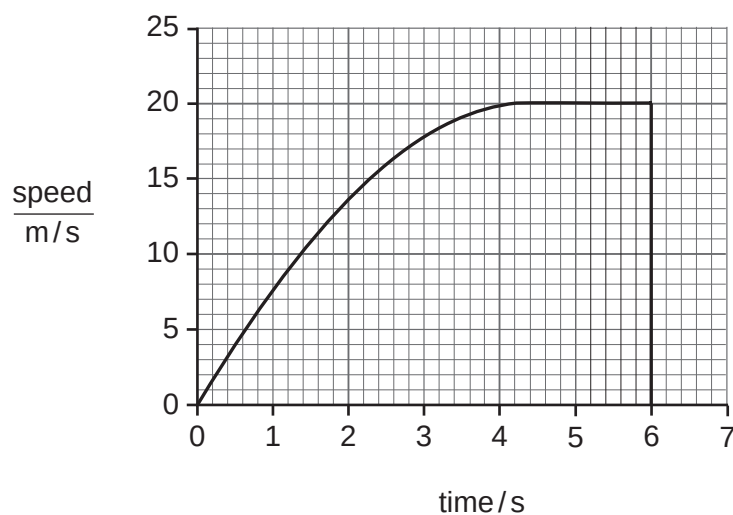


Fig. 3.2

- (i) After how many seconds was the speed of the rock 15 m/s?

.....s [1]

- (ii) The rock is accelerating. Explain the meaning of the term *accelerating*.

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

- (c) The rock contains radioactive substances emitting high levels of ionising radiation.

- (i) State how the radioactivity could be detected.

..... [1]

- (ii) Explain why it would be dangerous for a person to handle this rock without proper protection.

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

4 Copper metal reacts with oxygen gas to form the black solid, copper oxide.

(a) (i) Use this example to describe **one** difference between *elements* and *compounds*.

.....

 [2]

(ii) State why this reaction is an example of *oxidation*.

.....
 [1]

(iii) Name the type of chemical bonding found in copper oxide.

..... [1]

(b) Fig. 4.1 shows apparatus used in the electrolysis of copper chloride solution.

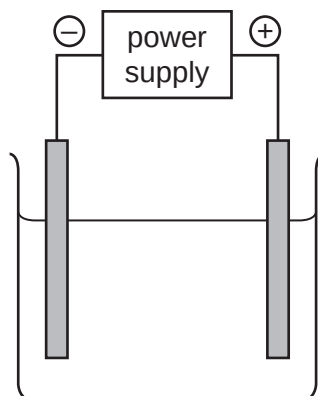


Fig. 4.1

(i) On the diagram, clearly label the **anode** and the **electrolyte**. [2]

(ii) Copper chloride solution contains copper ions and chloride ions in water.

State briefly **two** differences between a chlorine *atom* and a chloride *ion*.

.....

 [2]

- (iii) Copper is a pink/orange metal and chlorine is a gas.

Describe what would be **observed** at the positive and negative electrodes during electrolysis of copper chloride solution.

observation at positive electrode

.....

observation at negative electrode

..... [2]

- 5 (a) Fig. 5.1 shows some of the different types of radiation in the electromagnetic spectrum.

gamma		ultra-violet	visible light	infra-red		radio waves
-------	--	--------------	---------------	-----------	--	-------------

Fig. 5.1

Write the names of the missing types of radiation in the two empty spaces. [2]

- (b) Fig. 5.2 shows a ray of light hitting a mirror.

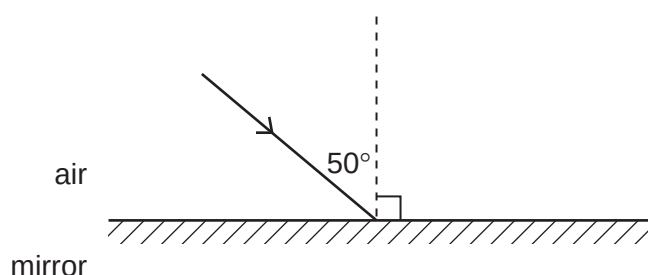
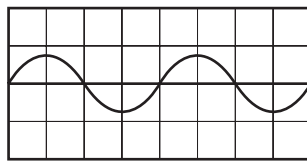


Fig. 5.2

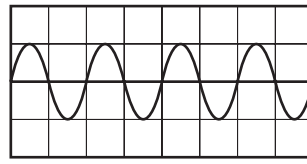
- (i) On Fig. 5.2, label the normal. [1]
- (ii) On Fig. 5.2, draw the reflected ray. [1]
- (iii) State the value of the angle of reflection.° [1]
- (c) A sound wave has a frequency of 500 Hz.
- (i) Explain the meaning of the term *frequency*.

 [1]
- (ii) State the approximate range of audible frequencies detected by the normal human ear.
 [1]

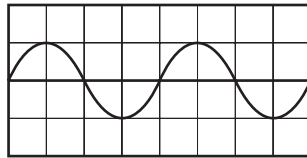
(d) Fig. 5.3 shows the wave traces made by four sounds.



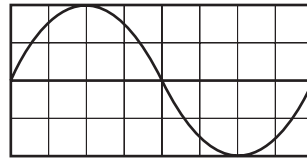
trace **A**



trace **B**



trace **C**



trace **D**

Fig. 5.3

(i) Which trace shows the sound wave with the lowest pitch?

..... [1]

(ii) Which trace shows the sound wave with the smallest amplitude?

..... [1]

- 6 (a) Complete the sentences about the human nervous system, using some of the words from the list.

biceps

brain

detectors

effectors

nerves

receptors

Specialised cells in the human nervous system detect external stimuli. These cells are called They convert the stimulus into electrical impulses in, which carry the impulse to the central nervous system.

The central nervous system then sends impulses to parts of the body that respond to the stimulus, such as muscles or glands. These parts are called [3]

- (b) When we smell food, the salivary glands respond by secreting saliva.

Saliva contains the enzyme amylase, which breaks down large starch molecules to smaller sugar molecules.

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

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

- (ii) Name the process by which large molecules are broken down to small ones in the alimentary canal.

..... [1]

- (iii) Explain why this process is necessary.

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

- 7 (a) Complete Table 7.1 to show the correct symbols of these electrical components. The symbol for the lamp has been drawn for you.

Table 7.1

component	electrical symbol
lamp	
ammeter	
fixed resistor	

[2]

- (b) A student set up the electric circuit in Fig. 7.1.

It contained three lamps **L1**, **L2** and **L3**.

It contained three switches **S1**, **S2** and **S3**.

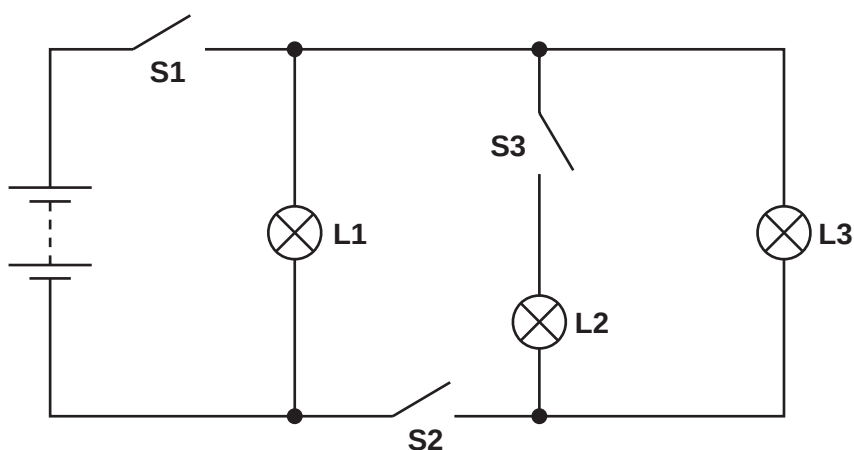


Fig. 7.1

In Table 7.2, write the words 'on' or 'off' to show when each lamp is lit or not lit for each set of switch positions.

Table 7.2

switch position			lamp 'on' or 'off'		
S1	S2	S3	L1	L2	L3
closed	closed	closed			
closed	closed	open			
closed	open	open			

[3]

- (c) The student then set up another electric circuit shown in Fig. 7.2.

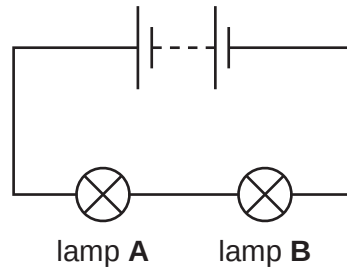


Fig. 7.2

She noticed that neither lamp **A** nor lamp **B** lit up. She found nothing wrong with lamp **A** but the filament in lamp **B** was broken.

- (i) Explain why lamp **A** did not light up.

.....
 [1]

- (ii) She replaced lamp **B** with a new lamp **C**. The resistance of both lamp **A** and lamp **C** was 5 ohms when lit.

Calculate the combined resistance of both lamps in the working circuit.

State the formula that you use and show your working.

formula used

working

..... ohms [2]

(d) Fig. 7.3 shows an electrical device.

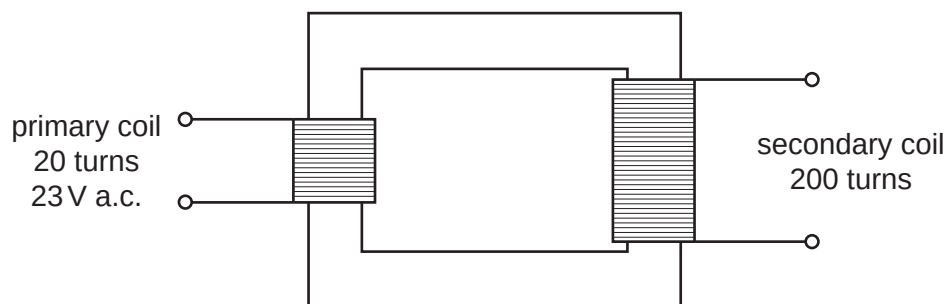


Fig. 7.3

(i) Name the device. [1]

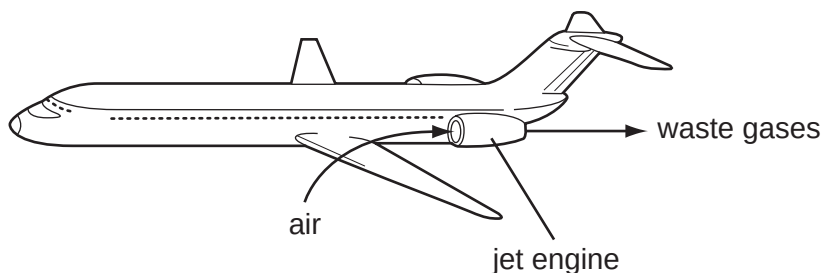
(ii) Calculate the output voltage.

Use the formula $V_p/V_s = N_p/N_s$.

Show your working.

..... V [1]

- 8 In jet engines, hydrocarbon molecules from the jet fuel mix with air and burn. This releases a large amount of energy and produces a mixture of waste gases. These waste gases pass out through the back of the jet engine into the atmosphere.



- (a) Fig. 8.1 shows a molecule of octane, which is a typical hydrocarbon molecule in jet fuel.

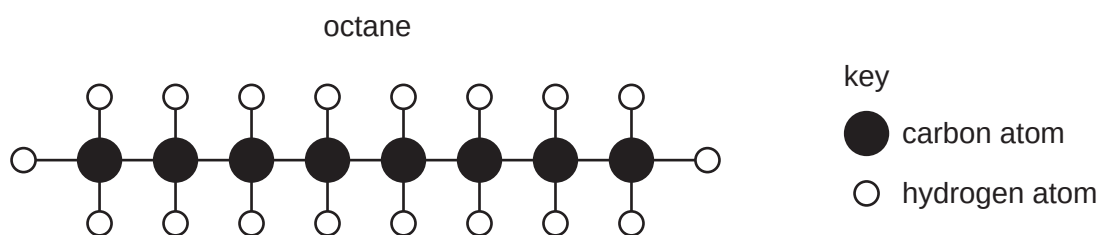
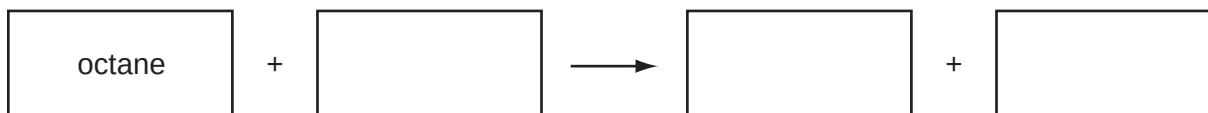


Fig. 8.1

- (i) State the chemical formula of octane.

..... [1]

- (ii) Complete the word equation below for the complete combustion of octane.



[2]

- (iii) Explain why the mixture of gases coming from the rear of the jet engine contains a large amount of nitrogen.

.....

 [2]

- (iv) Explain why the metallic parts of the jet engine become hot when it is working.

.....
 [1]

- (b) (i) A carbon atom has a proton (atomic) number 6 and a nucleon (mass) number 12.

State the number of neutrons and electrons in this carbon atom.

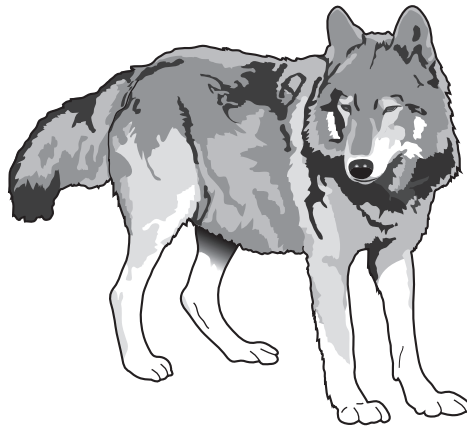
number of neutrons

number of electrons [2]

- (ii) State the chemical symbol of another element which is in the same **group** in the Periodic Table as carbon.

..... [1]

- 9 The gray wolf is a predator that lives in North America.



- (a) The gray wolf's diet consists mainly of white-tailed deer, beavers and snowshoe hares.

These are all herbivores. They eat plants.

- (i) Construct a food web including all the organisms mentioned above.

[3]

- (ii) State what the arrows in your food web represent.

..... [1]

- (iii) Name the producers in the food web you have drawn.

..... [1]

- (b) Some of the chemicals in a gray wolf's body contain carbon. When a wolf dies, its body is broken down by decomposers and the carbon is returned to the air.

(i) Name **one** type of chemical in a wolf's body that contains carbon.

..... [1]

(ii) Explain how the carbon from a wolf's body is returned to the air after the wolf dies.

.....

.....

..... [2]

- (c) Some gray wolves are born with darker fur than others. They can pass this fur colour to their offspring.

If wolves live in cold places, they grow longer fur than wolves that live in warm places. They cannot pass their fur length to their offspring.

Tick **two** boxes to show the cause of each of these types of variation in wolves' fur.

cause	fur colour	fur length
genes only		
environment only		
genes and environment		

[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	128 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																							
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																							
238 Pa Protactinium 91																							
232 Th Thorium 90																							
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																							

a

X

b

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

Key

a	X	a = relative atomic mass
b	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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COMBINED SCIENCE

0653/22

Paper 2 (Core)

October/November 2010

1 hour 15 minutes

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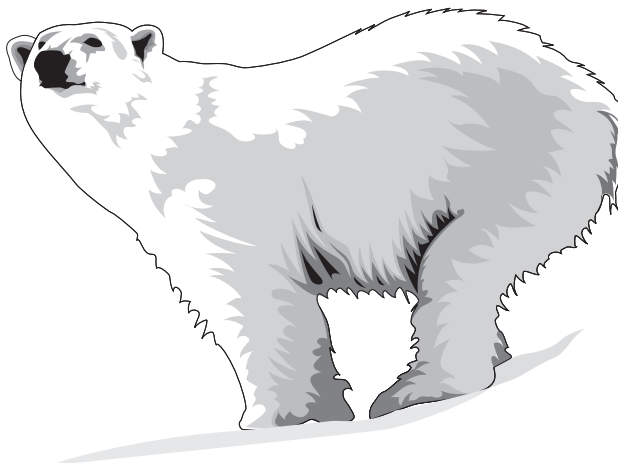
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This document consists of **21** printed pages and **3** blank pages.



- 1 (a) Polar bears live in the cold, arctic region. They have thick, white fur.



Describe how fur keeps a polar bear warm.

.....

.....

..... [2]

- (b) (i) Above the arctic region the ozone layer is decreasing, allowing more ultraviolet radiation, which can cause chemical changes, to reach the surface of the Earth.

State **one** danger to human beings of being exposed to large quantities of ultraviolet radiation.

..... [1]

- (ii) Ultraviolet radiation is part of the electromagnetic spectrum.

Name **one** other radiation which is part of the electromagnetic spectrum and state a use of this radiation.

name

use [2]

- 2 (a) The apparatus shown in Fig. 2.1 can be used to react lead oxide and carbon.

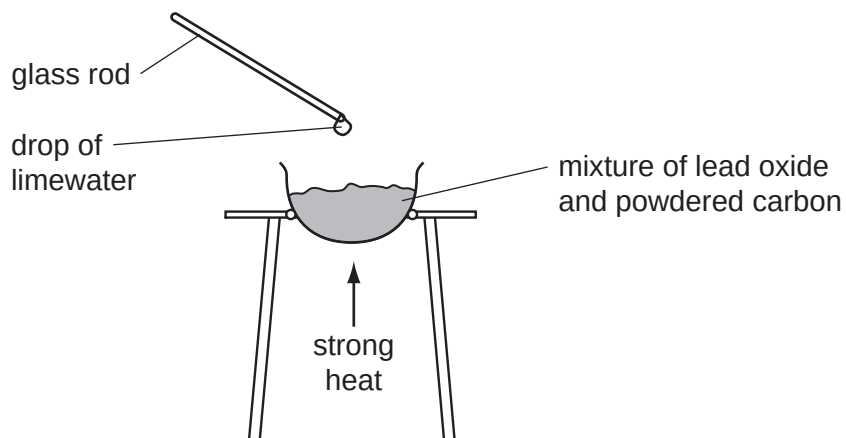


Fig. 2.1

When the mixture is heated, molten metal is formed in the container and the drop of lime water on the end of the glass rod becomes cloudy.

- (i) Suggest the **word** equation for the reaction between lead oxide and carbon. Do **not** write a symbolic equation.

..... [2]

- (ii) State **one** substance, shown in your equation in (i), which is a compound.

Explain why this substance is described as a compound and **not** as an element.

substance

explanation

..... [3]

- (b) Fig. 2.2 shows some of the apparatus used in the electrolysis of copper chloride solution.

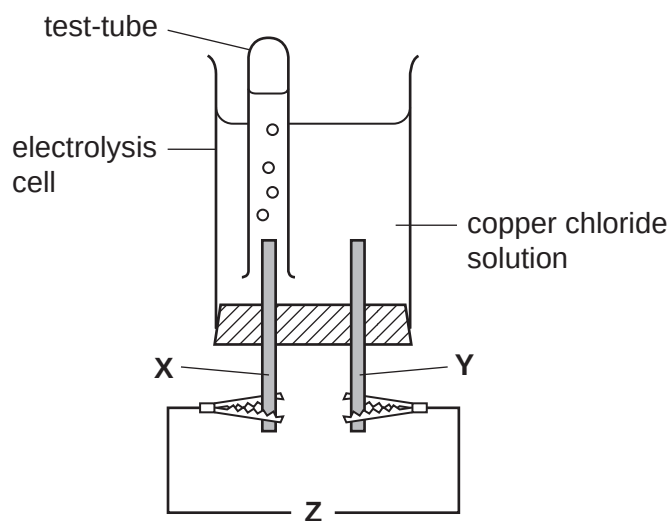


Fig. 2.2

- (i) What is missing from position **Z** in Fig. 2.2?

..... [1]

- (ii) Name the gas which collects in the test-tube, and explain whether electrode **X** is the anode or the cathode.

gas

Electrode **X** is the because

.....

..... [2]

- 3 A healthy plant growing in a pot was watered and placed in a sunny window. A transparent plastic bag was placed over the plant, as shown in Fig. 3.1.

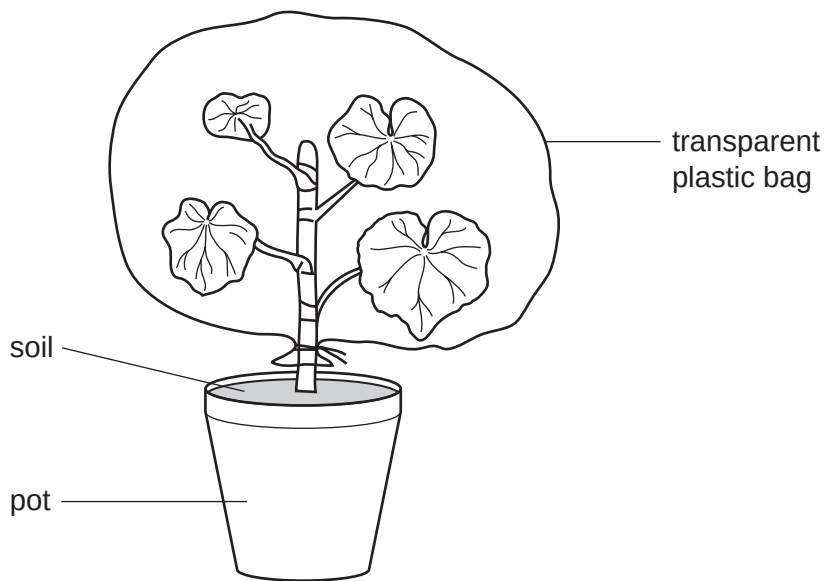


Fig. 3.1

- (a) The temperature near the window fell overnight. The next morning, small droplets of liquid water were visible on the inside of the plastic bag.

(i) Name the process by which plant leaves lose water vapour.

..... [1]

(ii) Name the small holes in the leaf through which the water vapour is lost.

..... [1]

(iii) Explain why the water formed droplets of liquid on the plastic bag.

.....

 [2]

(b) Fig. 3.2 shows a cell from the plant leaf.

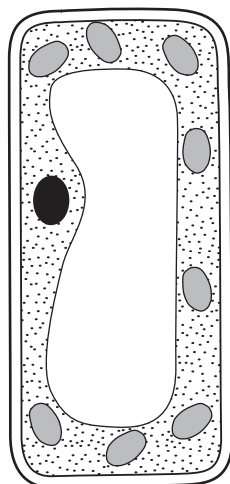


Fig. 3.2

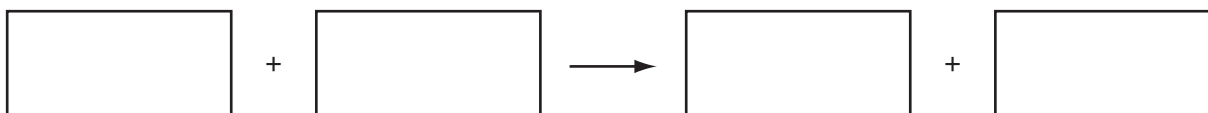
(i) On the diagram of the cell in Fig. 3.2, label and name **two** structures that would **not** be present in an animal cell. [2]

(ii) Name the part of the leaf in which this cell could be found.

..... [1]

(iii) The cell in Fig. 3.2 can photosynthesise.

Write the word equation for photosynthesis.



[2]

- 4 (a) Fig. 4.1 shows the speed-time graph for a train.

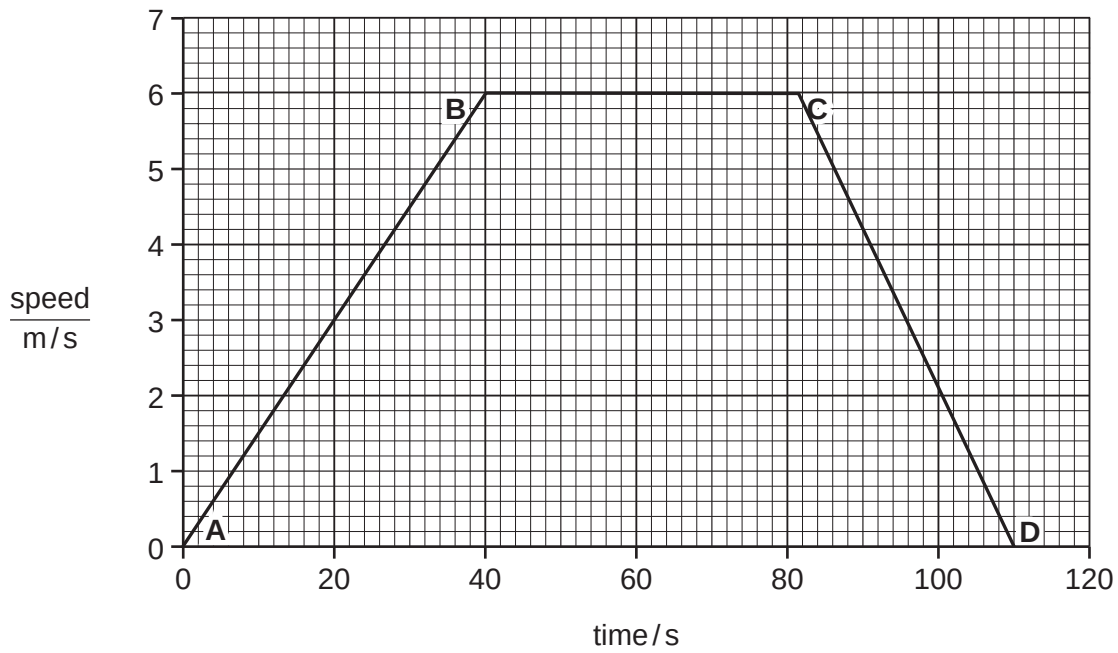


Fig. 4.1

The brakes are applied at C. Calculate how long it takes the train to stop.

.....s [1]

- (b) Another train, on a journey lasting 10 minutes, travelled at a constant speed of 9 m/s.

- (i) Show that the distance travelled by the train during this journey was 5400 m.

State the formula that you use and show your working.

formula used

working

- (ii) The average force needed for the train to maintain the speed of 9 m/s was 10 000 N.

Calculate the work done by the train over 10 minutes.

State the formula that you use and show your working.

formula used

working

..... J [2]

- 5 Fig. 5.1 shows some stages in the formation of a human fetus.

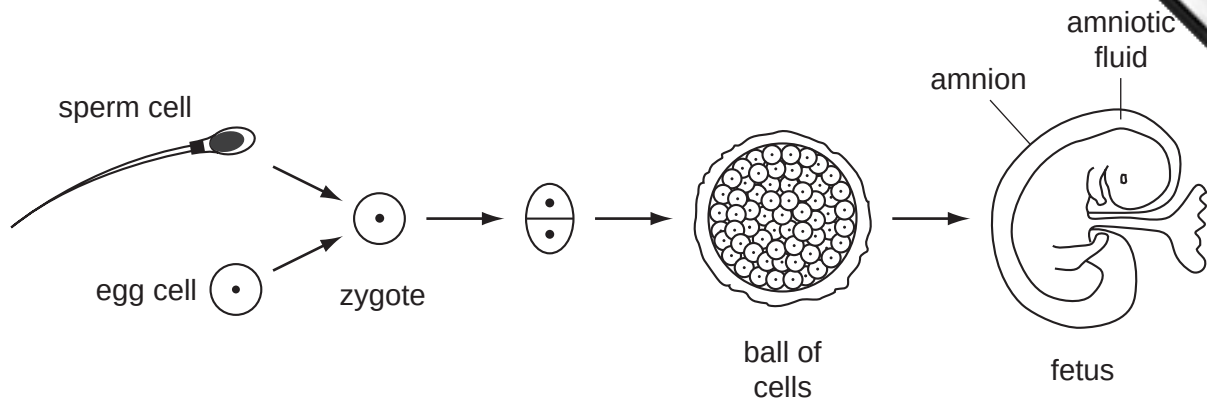


Fig. 5.1

- (a) Most human cells contain 46 chromosomes, but egg cells and sperm cells contain only 23 chromosomes each.

Suggest a reason for this.

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

- (b) Name the part of the reproductive system in which each of these events takes place.

(i) Eggs are produced. [1]

(ii) Fertilisation. [1]

- (c) Describe the function of the amnion.

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

(d) The fetus develops in the uterus.

It is attached to the uterus by the umbilical cord and placenta.

It obtains nutrients from its mother's blood, through the placenta.

Suggest why a pregnant woman should have more iron and calcium in her diet than when she is not pregnant.

iron

.....

calcium

..... [3]

- 6 (a) Electrical equipment can be dangerous, especially when it is handled with wet hands. For
miner's

Explain why you are quite likely to be electrocuted if you handle an electrical device with wet hands rather than dry hands.

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

- (b) Fig. 6.1 shows a simple electric circuit.

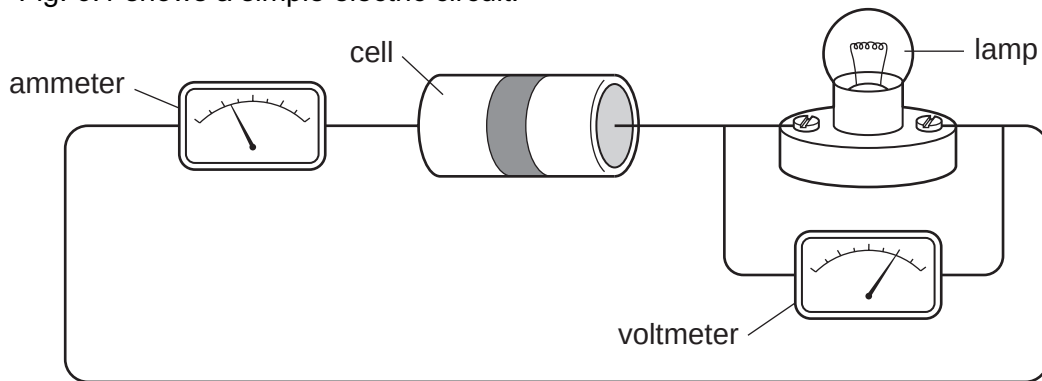


Fig. 6.1

Draw the circuit diagram for the circuit in Fig. 6.1 using the correct symbols.

[3]

(c) Fig. 6.2 shows a circuit built by a student.

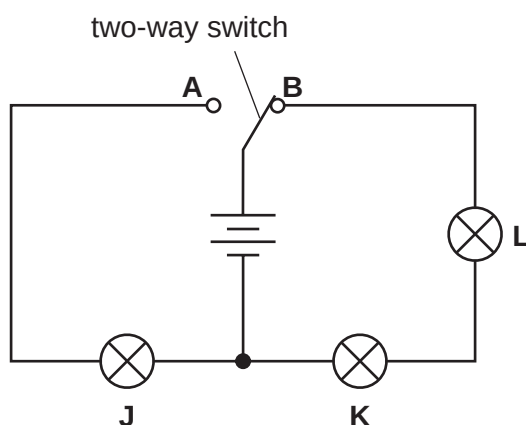


Fig. 6.2

(i) The switch is at position **B**.

Which lamps will be lit?

[1]

(ii) The switch is then moved to position **A**.

What happens to lamps **J**, **K** and **L**?

lamp **J**

lamp **K**

lamp **L**

[2]

(d) The student has six resistors as shown in Fig. 6.3.

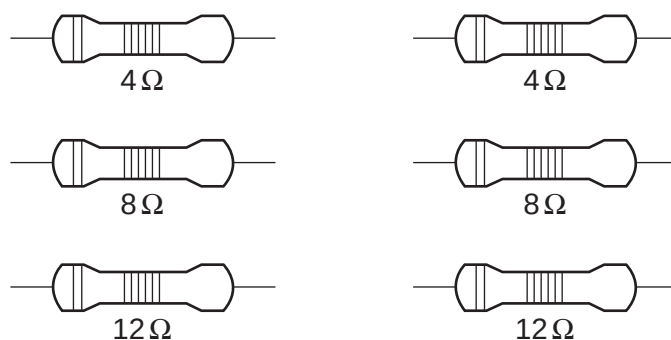


Fig. 6.3

Describe how he can combine **two** of these resistors to get a total resistance of 20 ohms.

.....
 [1]

(e) Power stations produce electricity.

Six stages in the production of electricity at a coal-fired power station are shown below.

- A** electricity produced
- B** coal burned
- C** steam produced
- D** turbine driven by steam
- E** turbine turns generator
- F** water boils

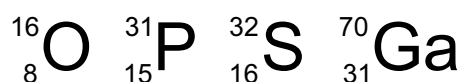
Using the letters **A** to **F**, list the stages in the correct order in the boxes below. Two have been done for you.



[2]

Please turn over for Question 7.

- 7 (a) The chemical symbols for the atoms shown below include proton (atomic) number and nucleon (mass) numbers.



- (i) State which of these symbols represent atoms of elements in the same **group** of the Periodic Table

..... [1]

- (ii) Complete Table 7.1 which shows the names and the numbers of protons and neutrons in two of the atoms shown above.

Table 7.1

element name	protons	neutrons
oxygen		
	15	16

[2]

- (b) Chlorine and hydrogen combine to form hydrogen chloride which dissolves in water to produce hydrochloric acid.

- (i) Suggest a substance which reacts with hydrochloric acid to form the salt, copper chloride.

..... [1]

- (ii) Suggest an element from the third period of the Periodic Table which reacts **safely** with hydrochloric acid to produce hydrogen gas.

..... [1]

- (c) Ethene is a gaseous compound of carbon and hydrogen.

Fig. 7.2 shows two different chemical reactions, **1** and **2**, involving ethene.

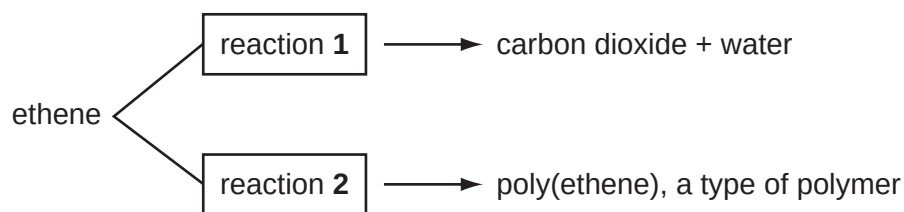


Fig. 7.2

- (i) For reactions **1** and **2**, deduce the type of chemical reaction which occurs.

reaction **1**

reaction **2** [2]

- (ii) For reaction **2**, describe briefly what happens to the molecules of ethene during the reaction.

.....

..... [1]

- 8 Soya beans are an important crop in many tropical and subtropical countries, because they contain a lot of protein.

(a) Fig. 8.1 shows how the yield of soya beans is affected by the pH of the soil in which they are grown.

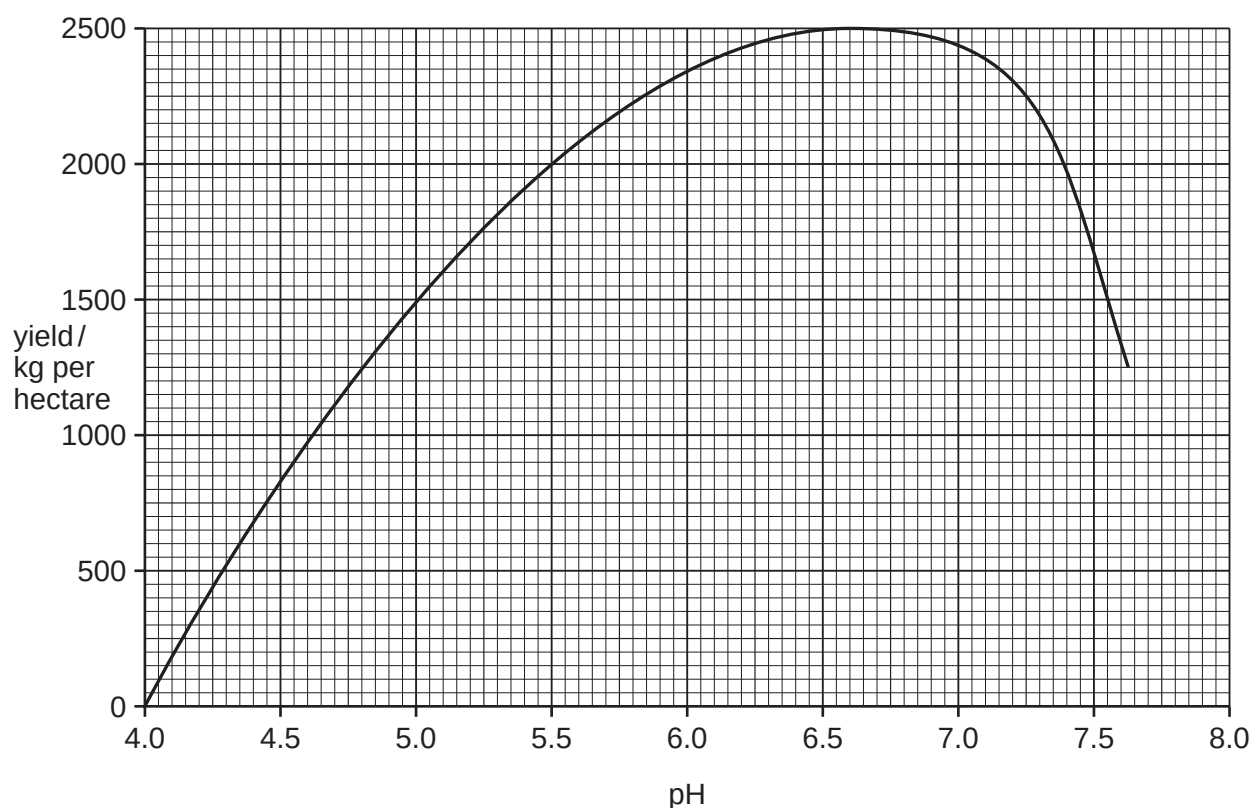


Fig. 8.1

A farmer grows soya beans in a field where the soil has a pH of 5.5.

- (i) What yield of beans could he get from his crop?

..... kg per hectare [1]

- (ii) State the pH range in which soya beans grow best.

between and [1]

- (iii) The farmer decides to add calcium carbonate to the soil in his field.

Explain why this would help him to achieve a higher yield of soya beans.

.....

 [2]

- (b) The field is on a steep slope.

Describe **two** things the farmer could do to reduce the risk of soil erosion.

- 1
.....
2
..... [2]

- (c) Soya beans are seeds. They grow after the flowers on the soya plants have been pollinated.

- (i) Soya flowers often have violet-coloured petals.

Suggest how soya flowers are pollinated.

..... [1]

- (ii) Explain why soya beans only grow after the flowers have been pollinated.

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

- (iii) Describe how you would test a soya bean seed for protein. State the result you would expect.

test
.....
result [2]

- 9 (a) Complete Table 9.1 to show the properties of alpha, beta and gamma radiations.

Table 9.1

	description	charge	range in air	ionising ability
alpha		positive	5 cm	very strong
beta	electron		50 cm	
gamma	wave		many kilometres	weak

[4]

- (b) Many people have smoke detectors in their houses.

Smoke detectors contain a radioactive source which emits alpha radiation.

Explain why the alpha radiation from the smoke detector is not dangerous to people living in the house.

.....

.....

..... [1]

- 10 In many countries, river water is collected and treated to make it safe for humans to drink.
- (a) State and explain which **two** of the processes shown below are used to treat river water so that it becomes safe to drink.

adding chlorine

chromatography

evaporation

filtration

first process

explanation

.....

second process

explanation

..... [4]

- (b) Sulfur dioxide is a gaseous compound which is released into the air when fossil fuels containing sulfur compounds are burned.

- (i) Describe how sulfur dioxide gas could cause pollution of water in rivers and lakes.

.....

.....

.....

..... [3]

- (ii) Suggest **one** way in which sulfur dioxide emissions into the atmosphere are being reduced.

.....

..... [1]

(c) Fig. 10.1 shows a diagram of a water molecule, H_2O .

Choose words or phrases from the following list to complete the labelling of the diagram.

covalent bond

hydrogen atom

ionic bond

nucleus

oxygen atom

proton

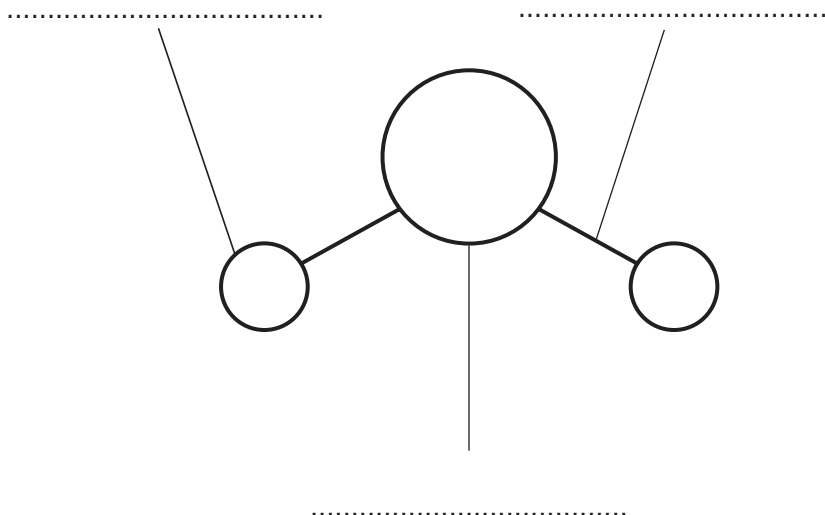


Fig. 10.1

[3]

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	131 I Iodine 53	136 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						
Fr Francium 87	Ra Radium 88	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																							
238 Pa Protactinium 91																							
232 Th Thorium 90																							
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																							

a

X

b

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

Key

a	X	a = relative atomic mass
b	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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COMBINED SCIENCE

0653/23

Paper 2 (Core)

October/November 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.

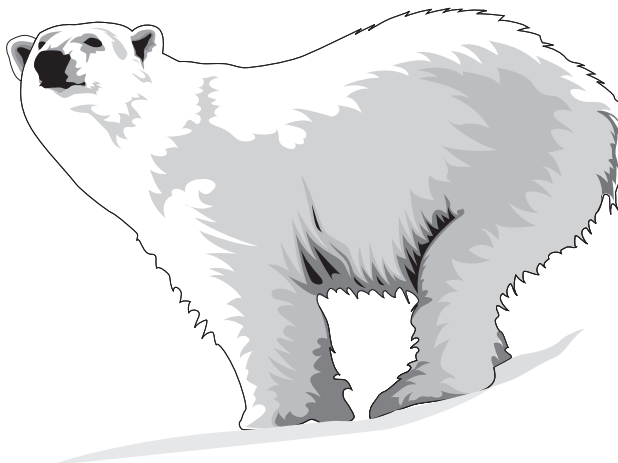
For Examiner's Use

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2	
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8	
9	
10	
Total	

This document consists of **21** printed pages and **3** blank pages.



- 1 (a) Polar bears live in the cold, arctic region. They have thick, white fur.



Describe how fur keeps a polar bear warm.

.....

.....

..... [2]

- (b) (i) Above the arctic region the ozone layer is decreasing, allowing more ultraviolet radiation, which can cause chemical changes, to reach the surface of the Earth.

State **one** danger to human beings of being exposed to large quantities of ultraviolet radiation.

..... [1]

- (ii) Ultraviolet radiation is part of the electromagnetic spectrum.

Name **one** other radiation which is part of the electromagnetic spectrum and state a use of this radiation.

name

use [2]

- 2 (a) The apparatus shown in Fig. 2.1 can be used to react lead oxide and carbon.

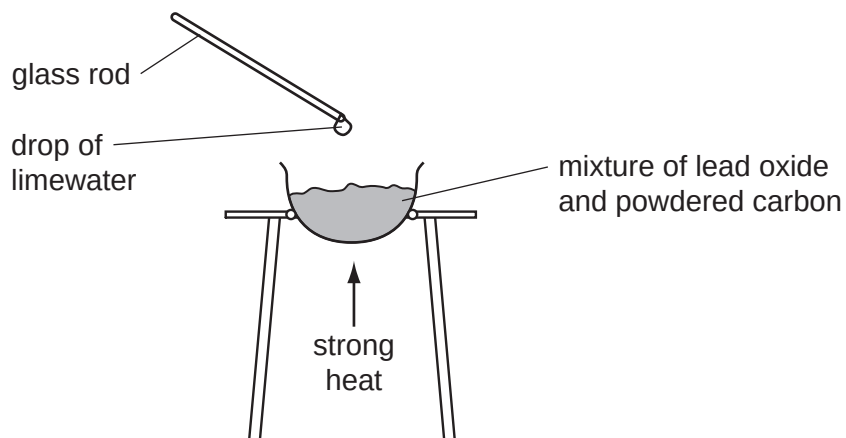


Fig. 2.1

When the mixture is heated, molten metal is formed in the container and the drop of lime water on the end of the glass rod becomes cloudy.

- (i) Suggest the **word** equation for the reaction between lead oxide and carbon. Do **not** write a symbolic equation.

..... [2]

- (ii) State **one** substance, shown in your equation in (i), which is a compound.

Explain why this substance is described as a compound and **not** as an element.

substance

explanation

..... [3]

- (b) Fig. 2.2 shows some of the apparatus used in the electrolysis of copper chloride solution.

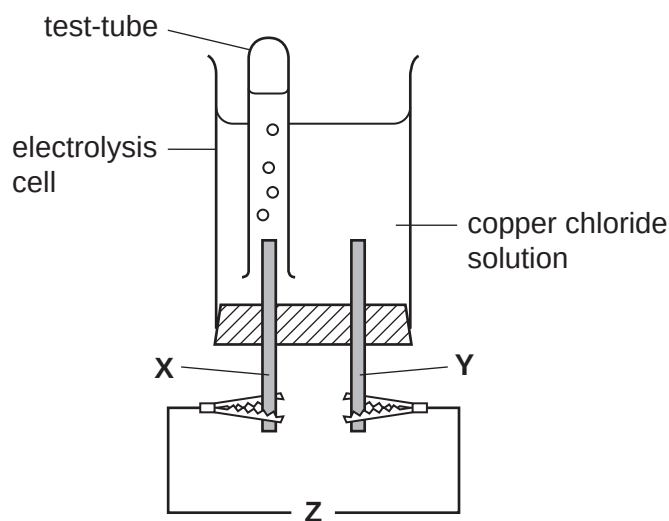


Fig. 2.2

- (i) What is missing from position **Z** in Fig. 2.2?

..... [1]

- (ii) Name the gas which collects in the test-tube, and explain whether electrode **X** is the anode or the cathode.

gas

Electrode **X** is the because

.....

..... [2]

- 3 A healthy plant growing in a pot was watered and placed in a sunny window. A transparent plastic bag was placed over the plant, as shown in Fig. 3.1.

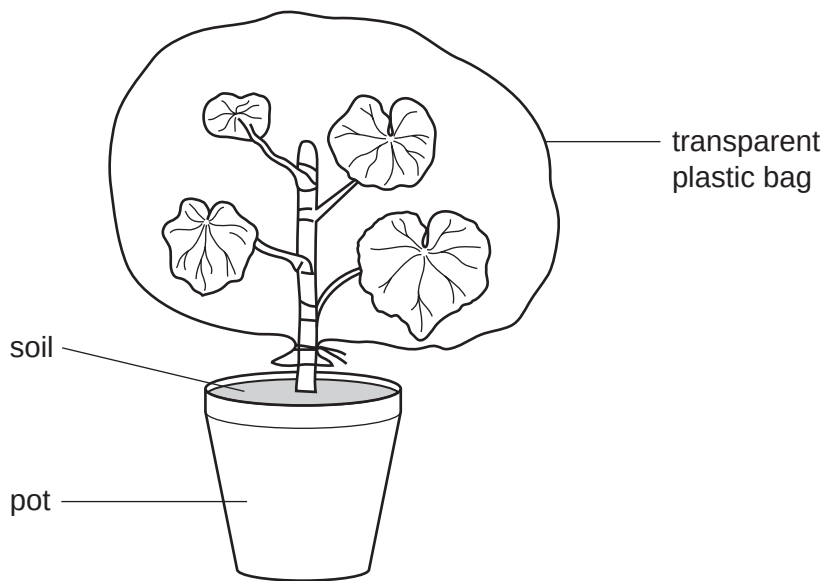


Fig. 3.1

- (a) The temperature near the window fell overnight. The next morning, small droplets of liquid water were visible on the inside of the plastic bag.

(i) Name the process by which plant leaves lose water vapour.

..... [1]

(ii) Name the small holes in the leaf through which the water vapour is lost.

..... [1]

(iii) Explain why the water formed droplets of liquid on the plastic bag.

.....

.....

..... [2]

(b) Fig. 3.2 shows a cell from the plant leaf.

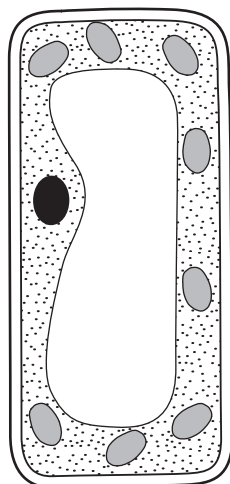


Fig. 3.2

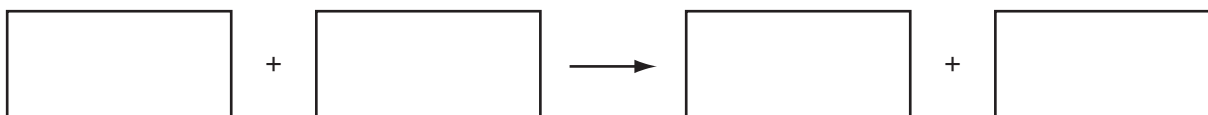
(i) On the diagram of the cell in Fig. 3.2, label and name **two** structures that would **not** be present in an animal cell. [2]

(ii) Name the part of the leaf in which this cell could be found.

..... [1]

(iii) The cell in Fig. 3.2 can photosynthesise.

Write the word equation for photosynthesis.



[2]

- 4 (a) Fig. 4.1 shows the speed-time graph for a train.

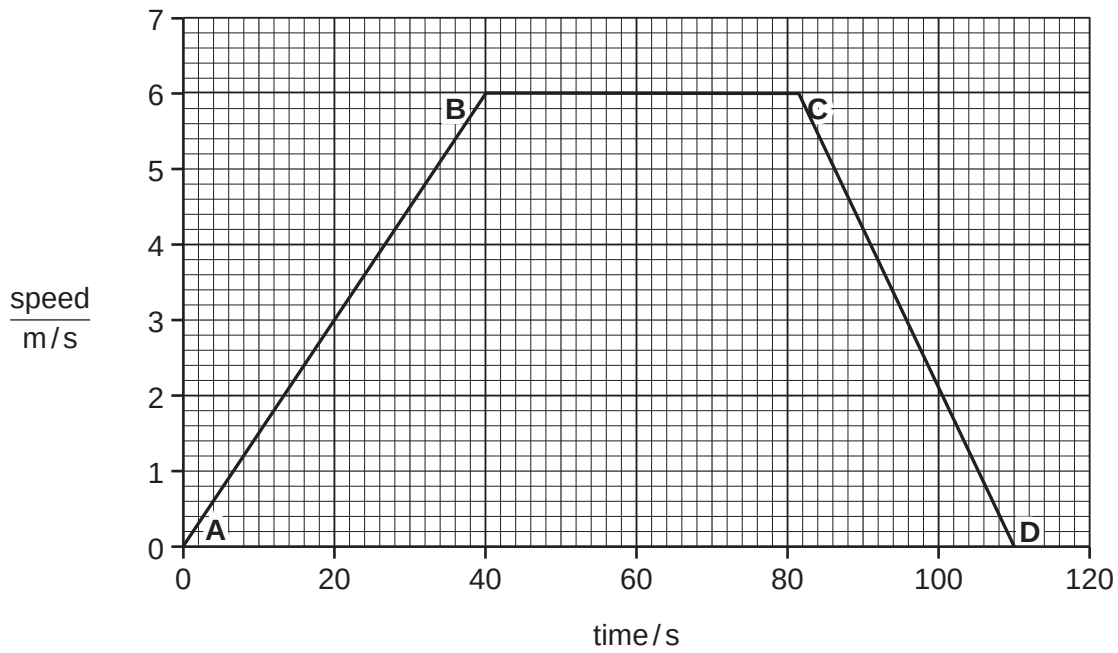


Fig. 4.1

The brakes are applied at C. Calculate how long it takes the train to stop.

.....s [1]

- (b) Another train, on a journey lasting 10 minutes, travelled at a constant speed of 9 m/s.

- (i) Show that the distance travelled by the train during this journey was 5400 m.

State the formula that you use and show your working.

formula used

working

- (ii) The average force needed for the train to maintain the speed of 9 m/s was 10 000 N.

Calculate the work done by the train over 10 minutes.

State the formula that you use and show your working.

formula used

working

..... J [2]

- 5 Fig. 5.1 shows some stages in the formation of a human fetus.

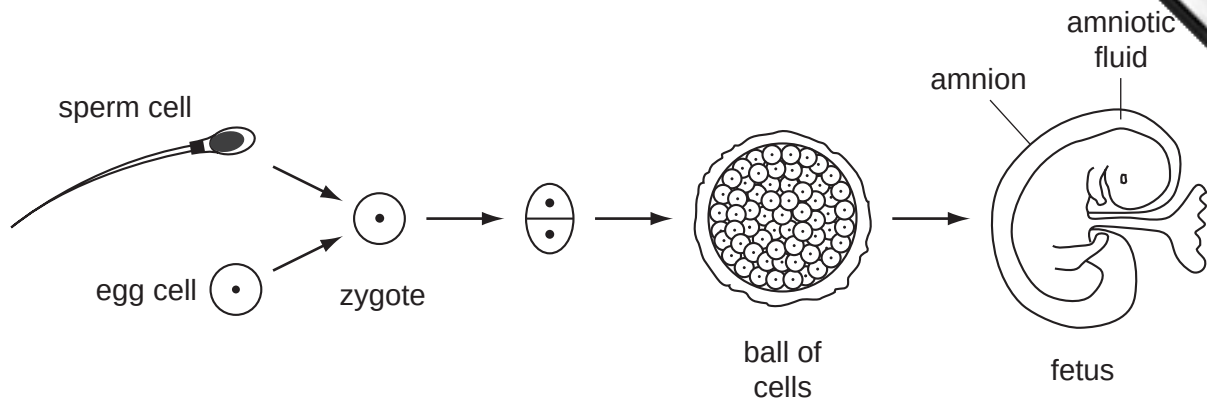


Fig. 5.1

- (a) Most human cells contain 46 chromosomes, but egg cells and sperm cells contain only 23 chromosomes each.

Suggest a reason for this.

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

- (b) Name the part of the reproductive system in which each of these events takes place.

(i) Eggs are produced. [1]

(ii) Fertilisation. [1]

- (c) Describe the function of the amnion.

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

(d) The fetus develops in the uterus.

It is attached to the uterus by the umbilical cord and placenta.

It obtains nutrients from its mother's blood, through the placenta.

Suggest why a pregnant woman should have more iron and calcium in her diet than when she is not pregnant.

iron

.....

calcium

..... [3]

- 6 (a) Electrical equipment can be dangerous, especially when it is handled with wet hands. Explain why you are quite likely to be electrocuted if you handle an electrical device with wet hands rather than dry hands.

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

- (b) Fig. 6.1 shows a simple electric circuit.

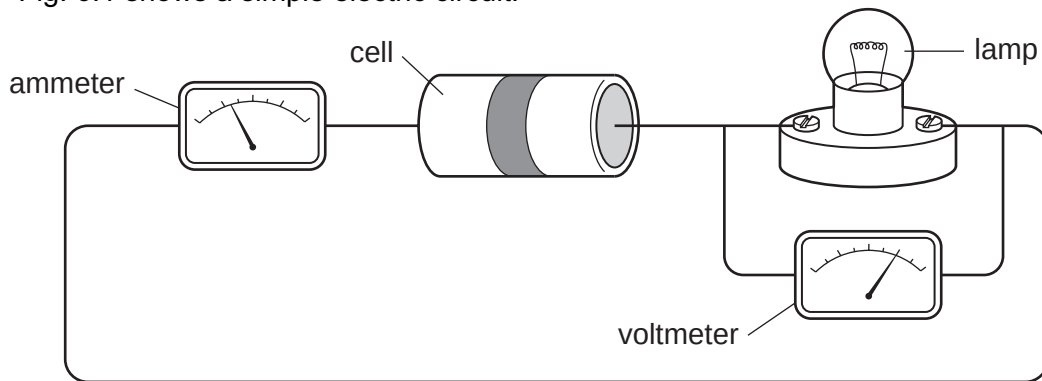


Fig. 6.1

Draw the circuit diagram for the circuit in Fig. 6.1 using the correct symbols.

[3]

(c) Fig. 6.2 shows a circuit built by a student.

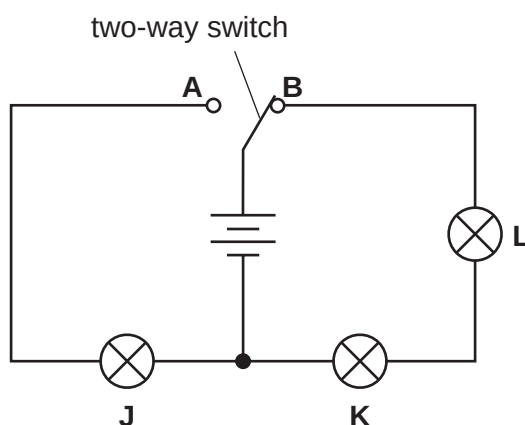


Fig. 6.2

- (i) The switch is at position **B**.

Which lamps will be lit?

[1]

- (ii) The switch is then moved to position **A**.

What happens to lamps **J**, **K** and **L**?

lamp **J**

lamp **K**

lamp **L**

[2]

(d) The student has six resistors as shown in Fig.6.3.

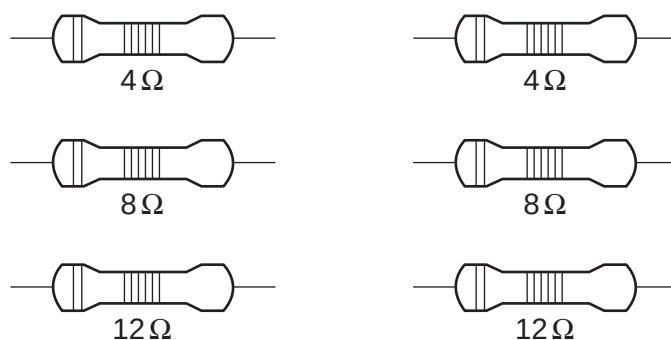


Fig.6.3

Describe how he can combine **two** of these resistors to get a total resistance of 20 ohms.

.....
 [1]

(e) Power stations produce electricity.

Six stages in the production of electricity at a coal-fired power station are shown below.

- A** electricity produced
- B** coal burned
- C** steam produced
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- F** water boils

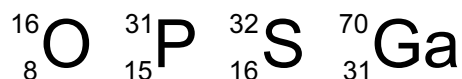
Using the letters **A** to **F**, list the stages in the correct order in the boxes below. Two have been done for you.



[2]

Please turn over for Question 7.

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- (i) State which of these symbols represent atoms of elements in the same **group** of the Periodic Table

..... [1]

- (ii) Complete Table 7.1 which shows the names and the numbers of protons and neutrons in two of the atoms shown above.

Table 7.1

element name	protons	neutrons
oxygen		
	15	16

[2]

- (b) Chlorine and hydrogen combine to form hydrogen chloride which dissolves in water to produce hydrochloric acid.

- (i) Suggest a substance which reacts with hydrochloric acid to form the salt, copper chloride.

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- (ii) Suggest an element from the third period of the Periodic Table which reacts **safely** with hydrochloric acid to produce hydrogen gas.

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Fig. 7.2 shows two different chemical reactions, **1** and **2**, involving ethene.

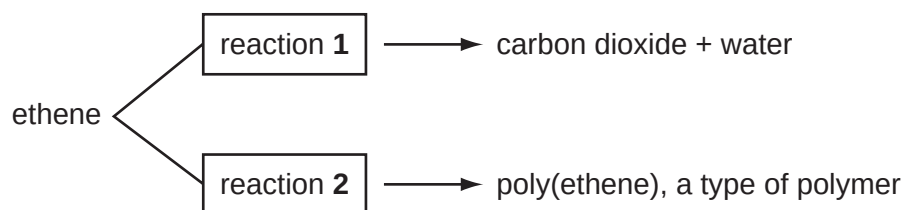


Fig.7.2

- (i) For reactions **1** and **2**, deduce the type of chemical reaction which occurs.

reaction **1**

reaction **2** [2]

- (ii) For reaction **2**, describe briefly what happens to the molecules of ethene during the reaction.

.....

..... [1]

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(a) Fig. 8.1 shows how the yield of soya beans is affected by the pH of the soil in which they are grown.

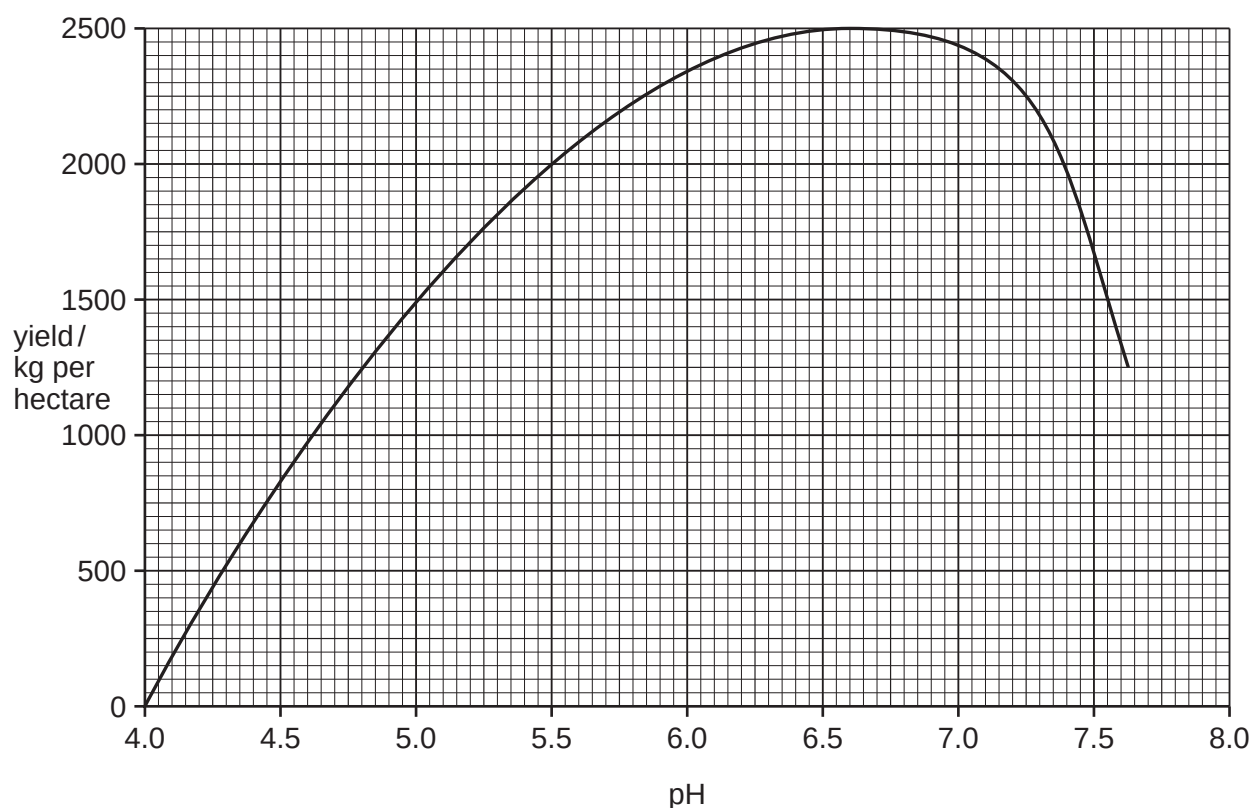


Fig. 8.1

A farmer grows soya beans in a field where the soil has a pH of 5.5.

- (i) What yield of beans could he get from his crop?

..... kg per hectare [1]

- (ii) State the pH range in which soya beans grow best.

between and [1]

- (iii) The farmer decides to add calcium carbonate to the soil in his field.

Explain why this would help him to achieve a higher yield of soya beans.

.....

 [2]

- (b) The field is on a steep slope.

Describe **two** things the farmer could do to reduce the risk of soil erosion.

1

.....

2

..... [2]

- (c) Soya beans are seeds. They grow after the flowers on the soya plants have been pollinated.

- (i) Soya flowers often have violet-coloured petals.

Suggest how soya flowers are pollinated.

..... [1]

- (ii) Explain why soya beans only grow after the flowers have been pollinated.

.....

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.....

.....

..... [1]

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chromatography

evaporation

filtration

first process

explanation

.....

second process

explanation

..... [4]

- (b) Sulfur dioxide is a gaseous compound which is released into the air when fossil fuels containing sulfur compounds are burned.

- (i) Describe how sulfur dioxide gas could cause pollution of water in rivers and lakes.

.....

.....

.....

..... [3]

- (ii) Suggest **one** way in which sulfur dioxide emissions into the atmosphere are being reduced.

.....

..... [1]

(c) Fig. 10.1 shows a diagram of a water molecule, H_2O .

Choose words or phrases from the following list to complete the labelling of the diagram.

covalent bond

hydrogen atom

ionic bond

nucleus

oxygen atom

proton

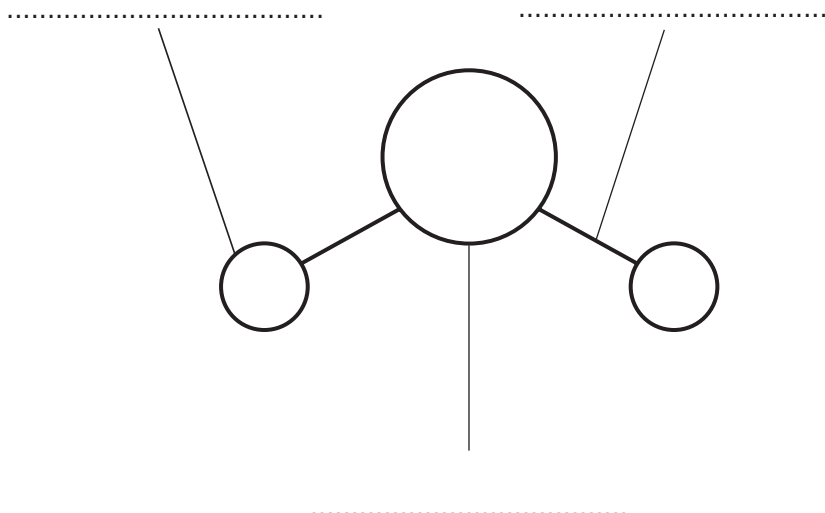


Fig. 10.1

[3]

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The Periodic Table of the Elements

Group																							
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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																							
238 Pa Protactinium 91																							
232 Th Thorium 90																							
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																							

a

X

b

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

Key

a	X	a = relative atomic mass
b	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.).