Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

* 1 9 1 4 3 2 1 8 3 6 *

CO-ORDINATED SCIENCES **0654/22**

Paper 2 (Core) **May/June 2014**

2 hours

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 an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.
A copy of the Periodic Table is printed on page 28.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **28** printed pages.

IB14 06_0654_22/7RP

[Turn over

1 **(a)** Select elements from the list below to complete the left hand column in Table 1.1.

Each element may be used once, more than once or not at all.

aluminium **chlorine** **copper**

helium **potassium** **sulfur**

Table 1.1

element	use of element
	filling weather balloons
	making food containers
	sterilising drinking water

[3]

(b) Table 1.2 shows properties of four elements **A**, **B**, **C** and **D**.

Table 1.2

element	melting point / °C	electrical conductivity	reaction with water
A	–39	high	none
B	–220	very low	reacts quickly
C	–112	very low	none
D	181	high	reacts quickly

Use the information in Table 1.2 to suggest which of the elements **A**, **B**, **C** and **D** could be:

(i) non-metals, ... and .... [1]

(ii) an element in Group 0 of the Periodic Table, ... [1]

(iii) an element in Group I of the Periodic Table. .... [1]

(c) A student carries out an experiment involving copper chloride solution, using the apparatus shown in Fig. 1.1.

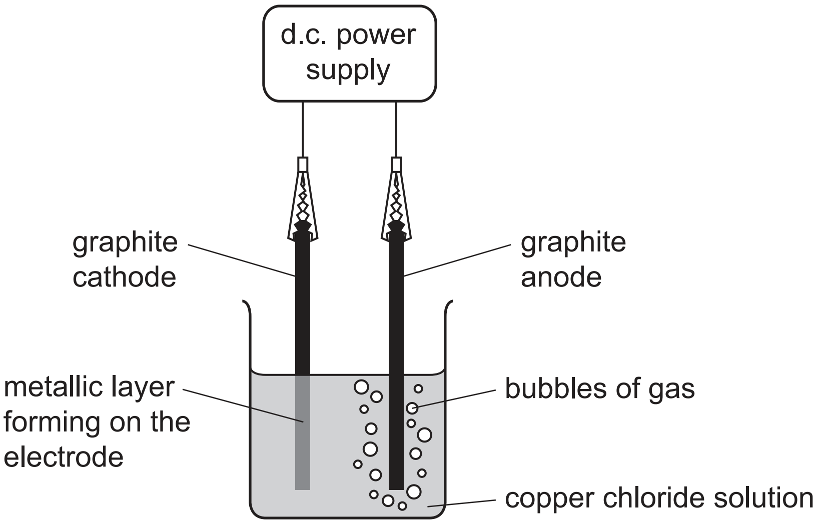


Fig. 1.1

(i) Name the process shown in Fig. 1.1. .... [1]

(ii) Write a **word** equation for the overall chemical reaction that occurs during the process shown in Fig. 1.1.

	→		+	

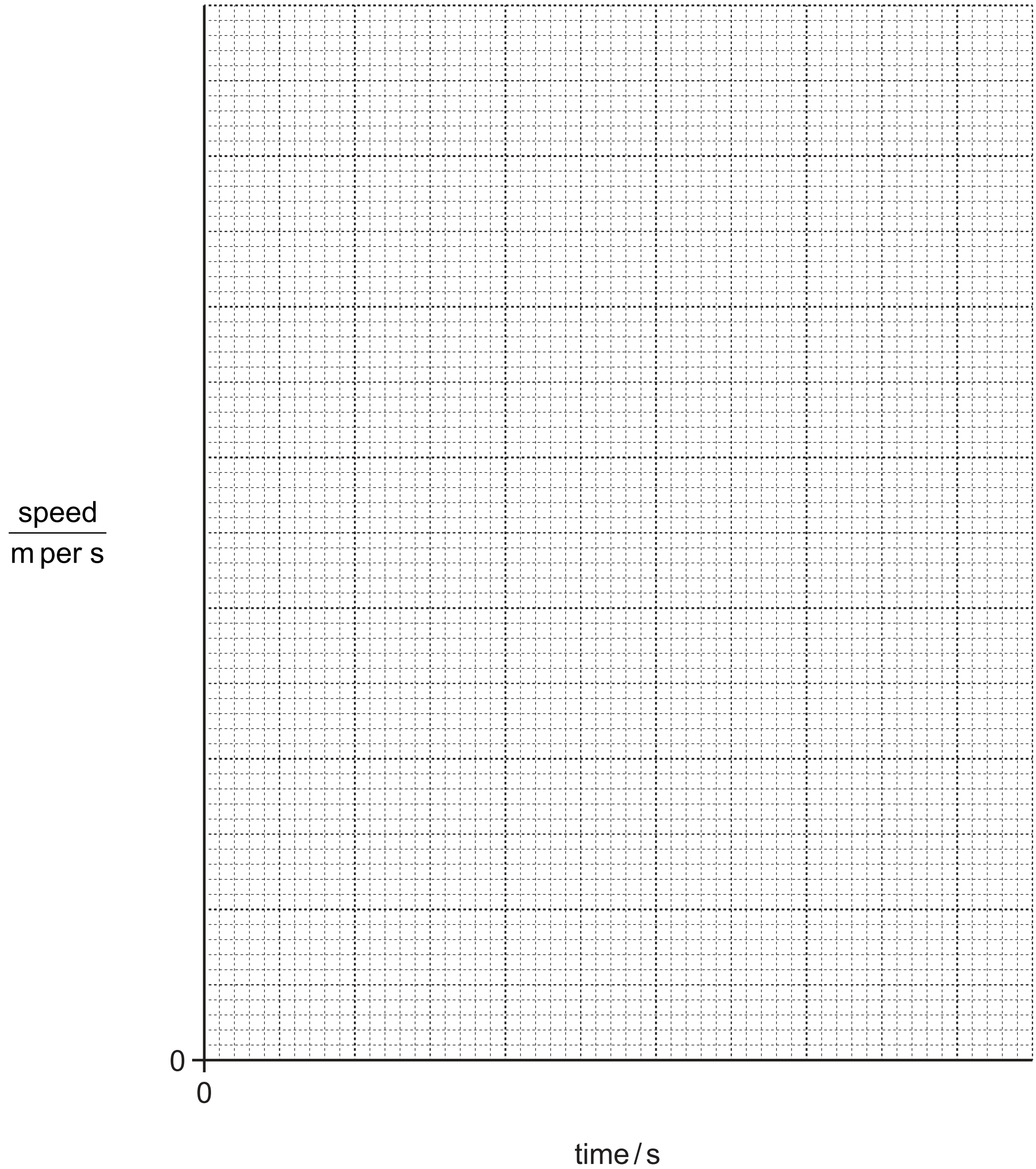
[2]

[Turn over

2 **(a)** A skier takes part in a downhill race.

He accelerates from rest. After 30 seconds, he reaches a maximum speed of 12 m / s. He continues at this speed for another 10 seconds. The race is then completed and he slows down and stops after a total time of 50 seconds.

On the grid, draw a speed / time graph of the motion of the skier. You will need to complete the scale on each axis.



[3]

(b) For 10 seconds, the skier travels at a constant speed of 12 m / s.

Calculate the distance travelled by the skier during the 10 seconds.

State the formula that you use and show your working.

formula

working

distance = ... m [2]

(c) The skier travels to the top of the slope using a chair lift.

(i) Name the type of the energy the chair lift has when it is moving.

.... [1]

(ii) Name the type of energy the skier has gained when he reached the top of the slope.

.... [1]

(iii) State the name of the unit used to measure energy and give its symbol.

unit = ... symbol = ... [1]

3 Fig. 3.1 shows a reflex arc involved in withdrawing the hand from a painful stimulus.

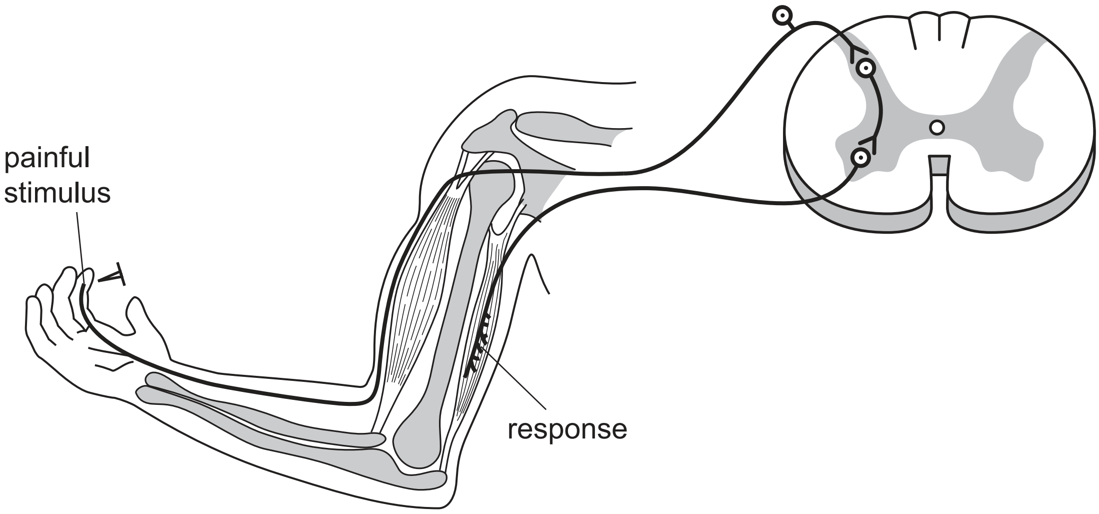


Fig. 3.1

(a) State **one** of the seven characteristics of living things which is being shown when someone withdraws their hand from a painful stimulus.

.... [1]

(b) (i) On the diagram, label the motor (effector) neurone, the relay (connector) neurone and the sensory neurone. [3]

(ii) Which of these neurones is entirely inside the central nervous system?

.... [1]

(iii) Explain the advantage of having the reflex arc going through the central nervous system, instead of having the receptor connected directly to the muscle.

....

.... [1]

(c) In another response, a person sees a sharp object coming towards their hand, and the person moves their hand away to avoid the object.

Describe how this type of response is different from a simple reflex action.

....

....

.... [2]

(d) Explain why reflex actions could be especially important to new-born animals in the wild.

....

.... [1]

4 **(a)** **(i)** Hydrogen and carbon are elements.

The gaseous hydrocarbon, propane, is a compound.

Use these examples to explain the difference between elements and compounds.

....

....

....

.... [2]

(ii) State **one** raw material from which hydrocarbons like propane can be obtained.

.... [1]

(iii) State the name of a process that can be used to separate propane gas from the raw material you have named in **(ii)**.

.... [1]

(iv) State **one** use of propane.

.... [1]

(b) Fig. 4.1 shows a simplified diagram of a process that is used to produce hydrocarbons known as alkenes.

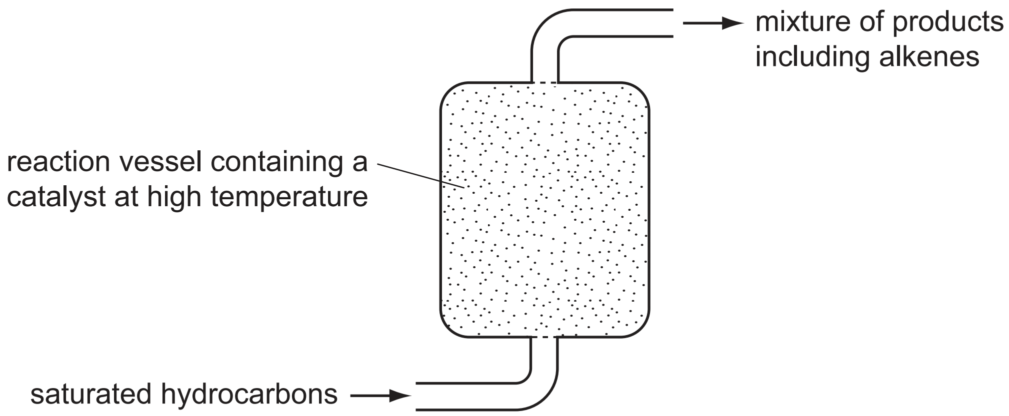


Fig. 4.1

(i) Name the process shown in Fig. 4.1.

.... [1]

(ii) State what is meant by the word *saturated* when it is used to describe hydrocarbon molecules.

....

.... [1]

(iii) Table 4.1 shows some of the compounds produced during the process shown in Fig. 4.1.

Table 4.1

compound produced
methane
ethene
propene

State which of the compounds shown in Table 4.1 are examples of alkenes.

.... [1]

(iv) Complete the diagram below to show the structure of one molecule of **ethene**.

[2]

5 A student carries out a series of experiments to investigate magnetism.

(a) Fig. 5.1 shows the apparatus used in the first experiment.

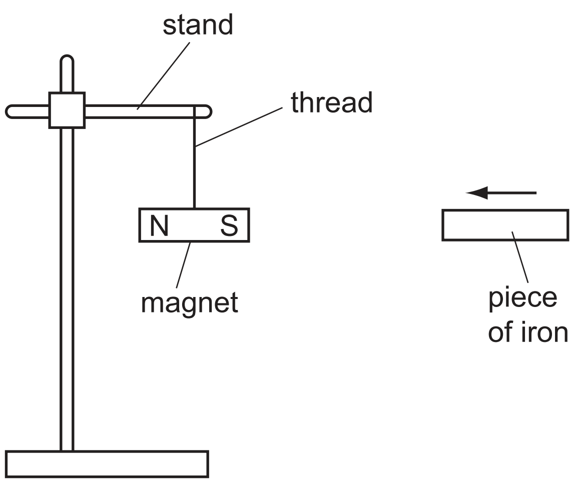


Fig. 5.1

A piece of unmagnetised iron is brought close to a suspended permanent magnet.

Describe what the student observes.

....

.... [1]

(b) **(i)** Fig. 5.2 shows the apparatus used in the second experiment.

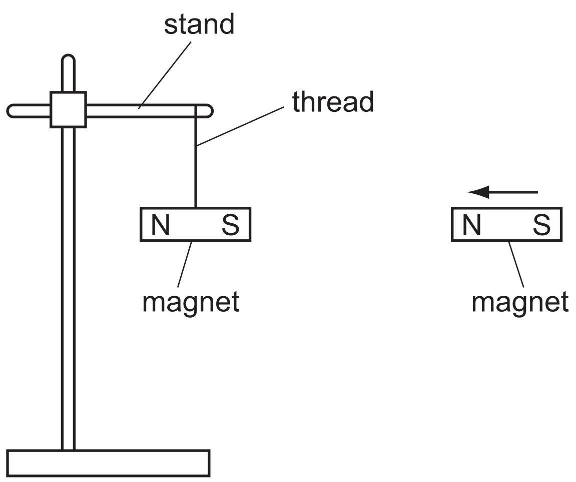


Fig. 5.2

Another permanent magnet is brought close to the suspended magnet.

Describe what the student observes.

....

.... [1]

(ii) Fig. 5.3 shows how the apparatus used in the second experiment is rearranged for the third experiment.

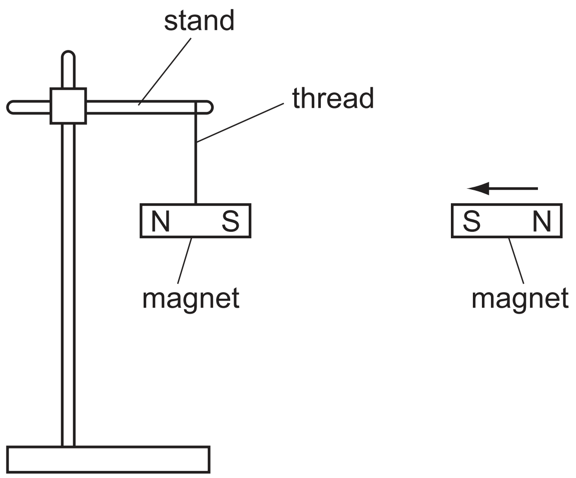


Fig. 5.3

Describe what the student observes.

....

.... [1]

(iii) State a general rule of magnetism shown by these experiments.

....

.... [1]

(c) Fig. 5.4 shows a circuit containing three lamps connected in series.

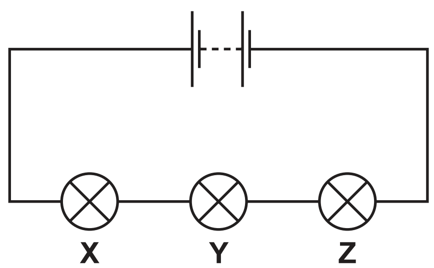


Fig. 5.4

(i) The current through lamp **X** is 0.5 A. State the current through lamp **Y**.

current = ... A [1]

(ii) The voltage across lamp **X** is 1.5 V. Show that the resistance of lamp **X** is 3 Ω.

State the formula that you use and show your working.

formula

working

resistance = ... Ω [2]

(iii) Each of the lamps has a resistance of 3 Ω.

Calculate the combined resistance of the three lamps in series.

Show your working.

resistance = ... Ω [2]

6 The graph in Fig. 6.1 shows the rate of removal of trees (deforestation) in a tropical rainforest in part of South America between the years 2000 and 2012.

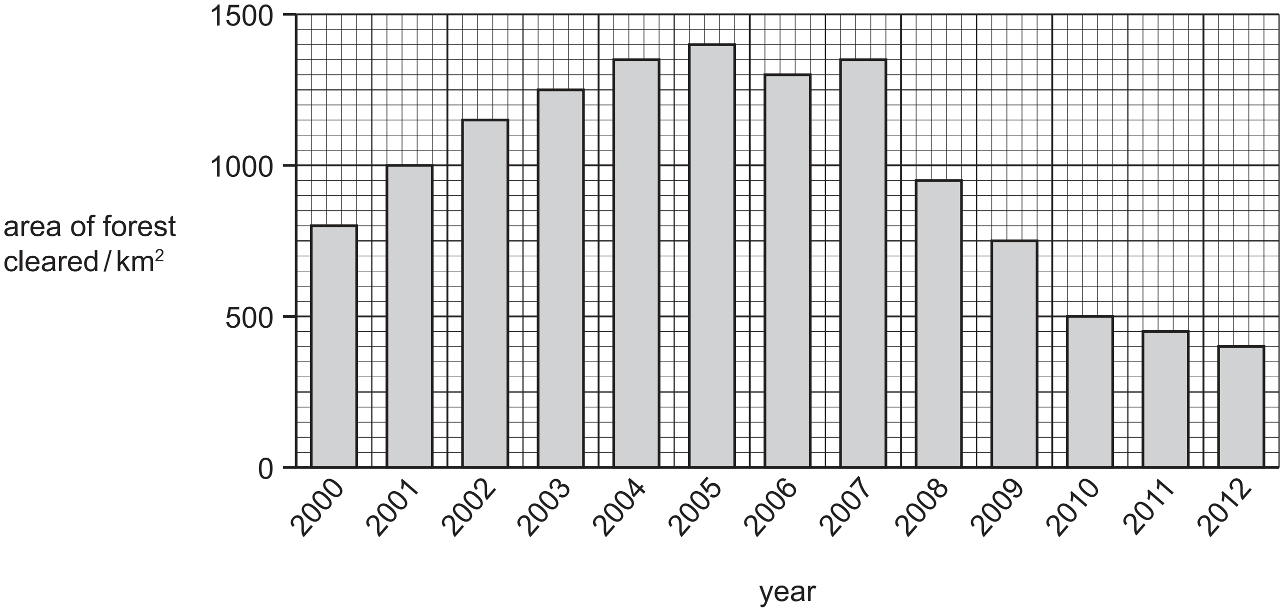


Fig. 6.1

(a) **(i)** Describe how the rate of clearing of the forest changed between 2007 and 2012.

....

....

.... [2]

(ii) Suggest a possible reason for the change in the rate of clearing between 2007 and 2012.

....

.... [1]

(b) One of the effects of deforestation is that it can contribute to an increase in the carbon dioxide concentration of the Earth's atmosphere.

(i) Explain why deforestation might have this effect.

....

....

.... [2]

(ii) Explain why an increase in the carbon dioxide concentration of the Earth's atmosphere is undesirable.

....

....

.... [2]

(c) State **two** other effects of deforestation, apart from causing an increase in atmospheric carbon dioxide.

1 ....

2 .... [2]

(d) Suggest **two** reasons why people cut down trees.

1 ....

2 .... [2]

7 The isotope technetium-99 is used in medical tests as a radioactive tracer. It emits γ-(gamma) radiation that medical equipment can detect in the human body.

(a) State the meaning of the term *isotope*.

....

.... [1]

(b) Fig. 7.1 shows the results of an experiment to measure how the radioactivity of technetium-99 changes with time.

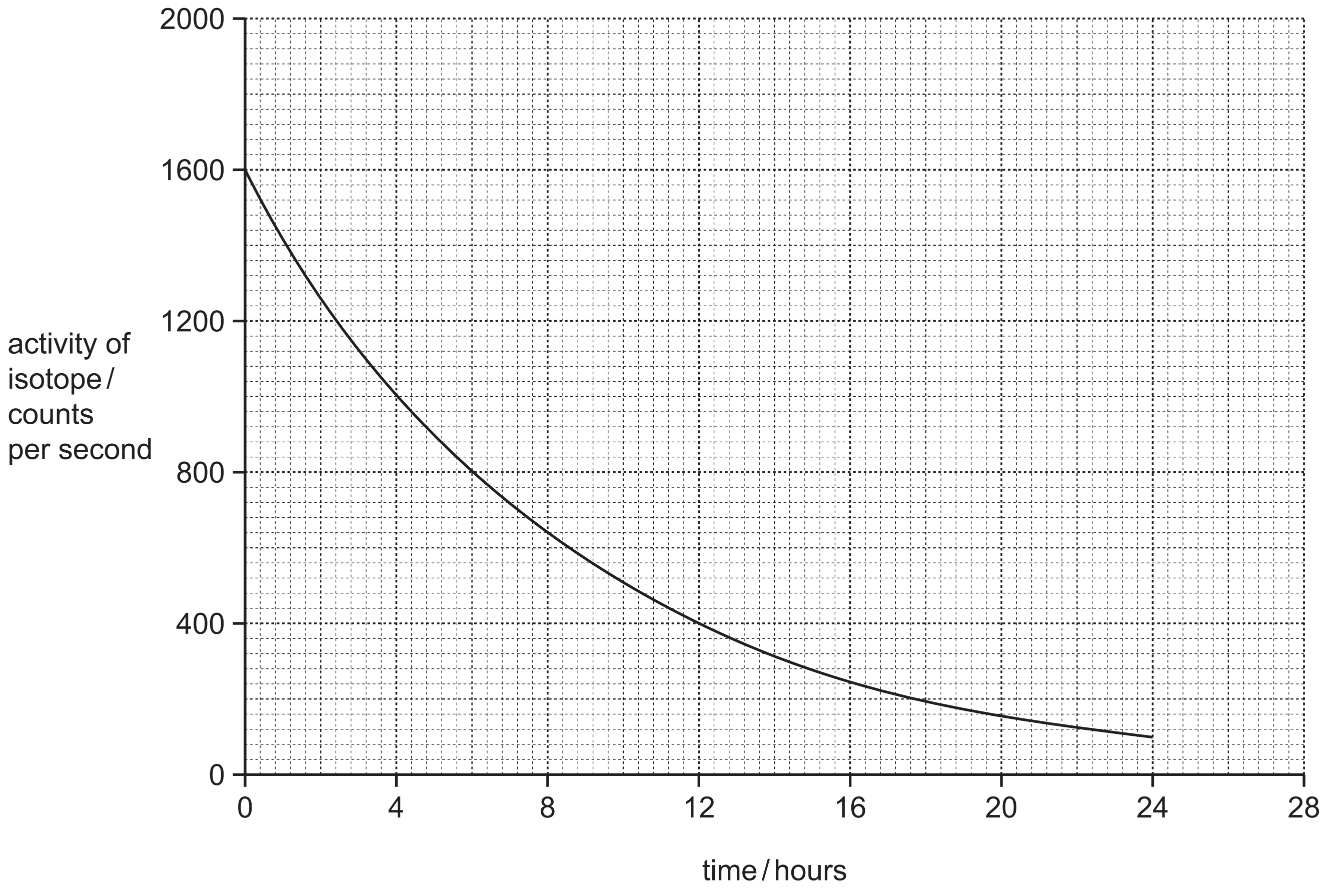


Fig. 7.1

The results plotted in Fig. 7.1 have already been corrected for a background radiation of 50 counts per second.

(i) Explain what is meant by the term *background radiation*.

....

.... [1]

(ii) Sketch on Fig. 7.1, the graph for the results before the correction for background radiation. [2]

(c) Use lines to link the three types of radiation on the left with their correct property on the right.

Draw only three lines.

radiation	property
α (alpha)	cannot pass through several sheets of paper
β (beta)	not dangerous
γ (gamma)	can pass through 1 cm of lead
	has a negative charge

[2]

(d) γ-rays are one part of the electromagnetic spectrum.

Fig. 7.2 shows an incomplete electromagnetic spectrum.

gamma-rays	X-rays		visible light	infra-red	microwaves	

Fig. 7.2

(i) Use words from the list to complete the electromagnetic spectrum in Fig. 7.2.

infra-sound **radio waves** **seismic waves** **ultrasound** **ultraviolet** **water waves**

[2]

(ii) State the part of the electromagnetic spectrum which has the shortest wavelength.

.... [1]

(e) Fig. 7.3 shows a balloon being rubbed by a cloth.

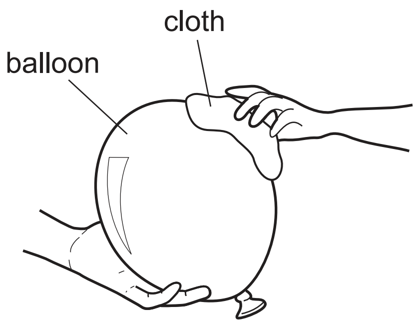


Fig. 7.3

The cloth becomes positively charged.

The balloon becomes negatively charged.

Explain in terms of electrons why this happens.

....

....

....

.... [2]

8 **(a)** State **two** reasons why plants need water.

1 ....

2 .... [2]

(b) Transpiration is the loss of water from a plant to the atmosphere.

(i) Name the part of the plant where most of this water loss occurs.

.... [1]

(ii) State the source of water used by plants to replace these losses in transpiration.

.... [1]

(c) Fig. 8.1 shows how the rate of transpiration from a mahogany tree varied over a period of two days.

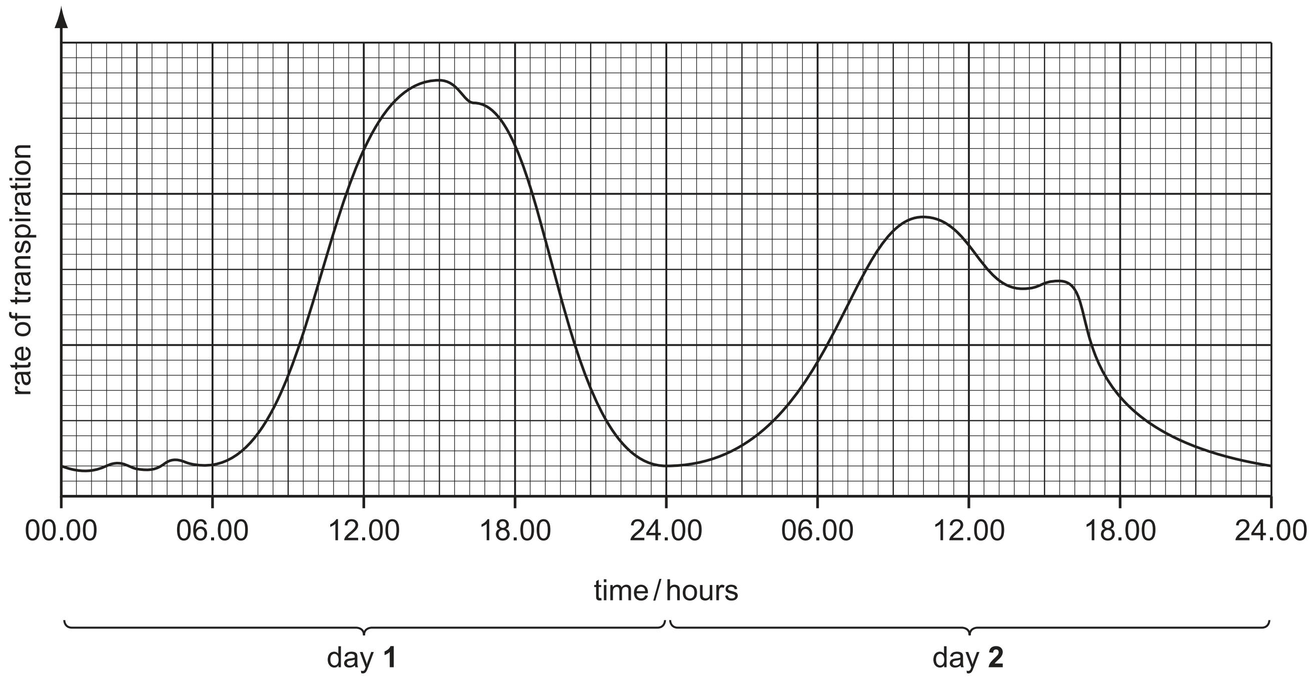


Fig. 8.1

(i) Describe how the rate of transpiration of the mahogany tree changed between 03.00 and 12.00 hours on day **1**.

....

....

.... [2]

(ii) State the time at which the rate of transpiration was highest on day **1**.

.... [1]

(iii) Suggest **one** reason why the rate of transpiration was highest at this time.

....

.... [1]

(iv) Between 10.00 and 13.00 on day **2**, the rate of transpiration decreased.

State how this could be explained by a change in the external conditions.

....

.... [1]

9 **(a)** Fig. 9.1 shows one atom of the element sulfur. This sulfur atom has a nucleon number of 32.

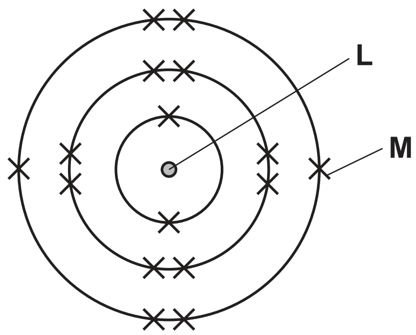


Fig. 9.1

(i) Name the parts labelled **L** and **M** in Fig. 9.1.

L ....

M .... [2]

(ii) State what is meant by the term *nucleon number of 32*.

....

....

.... [2]

(b) **(i)** Fig. 9.2 shows the structure of one molecule of sulfur dioxide.

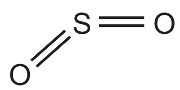


Fig. 9.2

Deduce whether ionic or covalent chemical bonds are present in a sulfur dioxide molecule.

Explain your answer.

type of bond ....

explanation ....

.... [1]

(ii) Explain why the presence of sulfur dioxide in the atmosphere causes the water in some lakes to become acidic.

....

....

....

.... [2]

(c) Fig. 9.3 shows apparatus used to measure the rate of reaction between magnesium and dilute sulfuric acid.

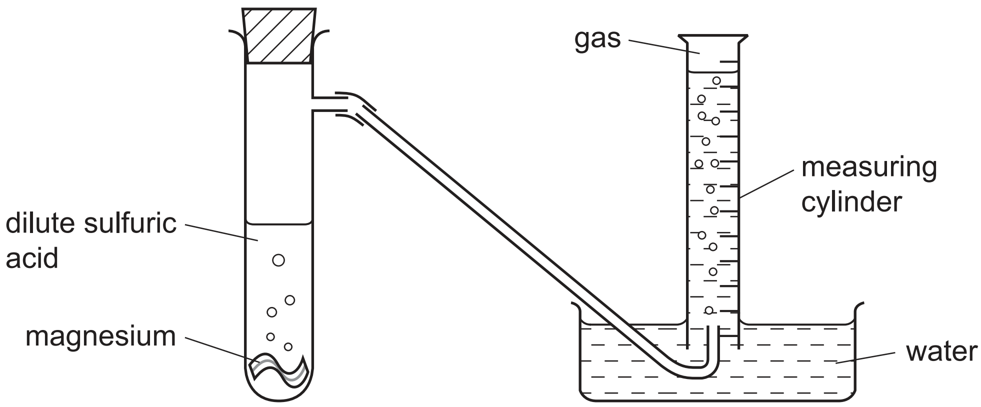


Fig. 9.3

(i) State **two** ways in which the rate of the reaction can be increased.

1 ....

....

2 ....

.... [2]

(ii) Name the **two** products of the reaction.

1 ....

2 .... [2]

10 **(a)** Drinks such as lemonade often contain sugar.

(i) Describe how sugar is used in the body.

....

.... [2]

(ii) Explain **one** way in which too much sugar in the diet can be harmful to health.

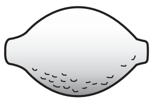
....

....

.... [2]

(b) Fig. 10.1 shows the ingredients of a canned lemonade drink, and nutritional information about the lemonade.

LEMONADE



Ingredients: water, sucrose, glucose syrup, citric acid, flavouring, colouring, preservative

Nutritional information (per 100 cm^3):

energy	145 kJ
protein	trace
fats	trace
carbohydrates	9.5 g
of which sugars	8.5 g
salt	trace
fibre	0.3 g

Fig. 10.1

(i) Most of the carbohydrate in the lemonade drink is sugar.

Describe how you could test the lemonade drink to see if it contains reducing sugar.

....

....

.... [2]

(ii) Explain what is meant by fibre, and state why fibre is important in the diet.

....

....

.... [2]

(iii) Although the drink is called 'lemonade', it does not contain any lemons.

Name a vitamin that would be in the drink if it contained lemons, and describe why this vitamin is important in the body.

vitamin ....

importance in the body ....

.... [2]

(c) Name a carbohydrate that is a large molecule made from smaller simple sugar units.

.... [1]

11 (a) Fig. 11.1 is a ray diagram showing a lens being used to light a fire.

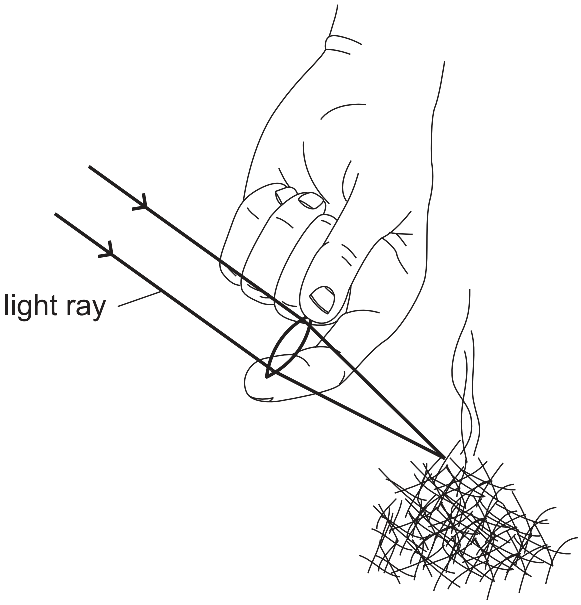


Fig. 11.1

(i) State the name that is given to the shape of the lens shown in Fig. 11.1.

.... [1]

(ii) State what name is given to the distance between the lens and the fire in Fig. 11.1.

.... [1]

(iii) On Fig. 11.1 label the principal focus with the letter **P**. [1]

(b) Fig. 11.2 shows a wave.

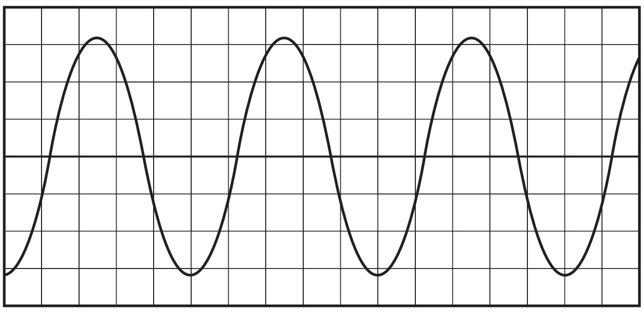


Fig. 11.2

On Fig. 11.2 mark and label

(i) **one** wavelength, [1]

(ii) the amplitude of the wave. [1]

(c) Table 11.1 lists the highest and lowest sound frequencies of some musical instruments.

Table 11.1

musical instrument	lowest frequency / Hz	highest frequency / Hz
flute	260	2640
guitar	70	1170
piano	30	4190
trumpet	170	1050
violin	200	3520

(i) A person's singing voice has a frequency range from 200 Hz to 900 Hz.

State which instrument has a similar frequency range.

.... [1]

(ii) State which instrument can produce the sound with the highest pitch.

.... [1]

(iii) State the lowest and highest values of frequency that can be heard by a human.

lowest .... Hz highest .... Hz [2]

(d) A trumpet is made of brass. The volume of the brass used to make the trumpet is 200 cm^3 and it has a mass of 1500 g.

Calculate the density of brass.

State the formula that you use and show your working.

State the unit of your answer.

formula

working

density = ... unit .... [3]

12 (a) (i) State **one** reason why fertilisers are added to soil in which crops are grown.

....

.... [1]

(ii) Some of the compounds in fertilisers contain the element nitrogen.

State **two** other elements, needed by growing crops, that are usually added to soil in fertilisers.

1 ....

2 .... [2]

(iii) Fertilisers contain compounds such as ammonium nitrate and urea.

Ammonium nitrate has the chemical formula NH_4NO_3.

Urea has the chemical formula $(NH_2)_2CO$.

Calculate the total number of atoms that are shown combined in the formula of urea.

.... [1]

(b) (i) A student is given a white solid and is told that it is either ammonium nitrate or ammonium sulfate. She adds sodium hydroxide solution to some of the solid contained in a test-tube, and then warms the mixture gently.

Fig. 12.1 shows what the student observed.

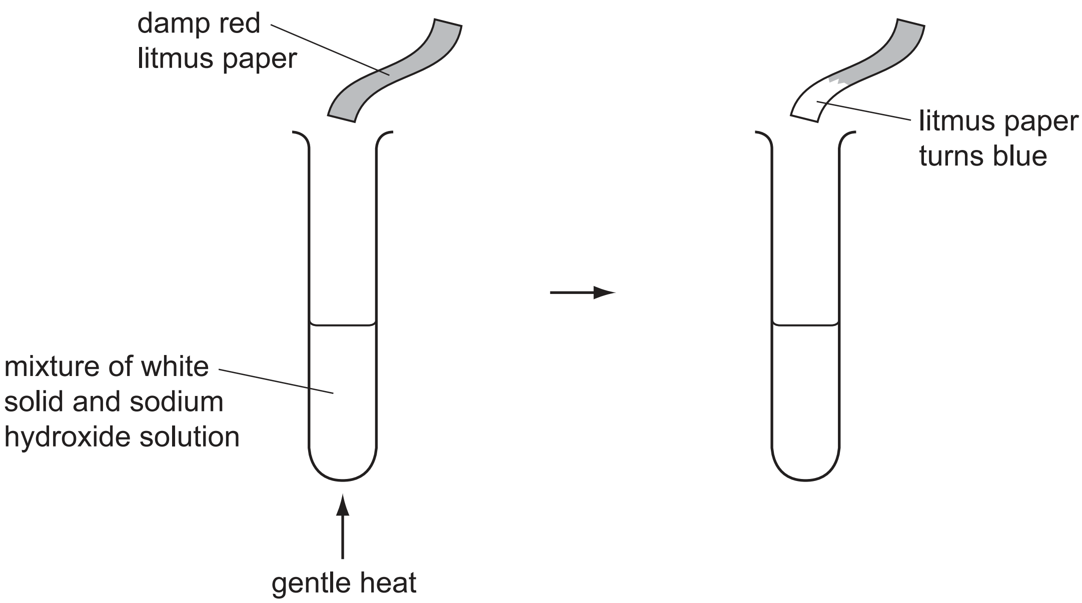


Fig. 12.1

Explain the observation shown in Fig. 12.1.

....

....

.... [2]

(ii) The student then makes an aqueous solution of the white solid and adds hydrochloric acid and barium chloride solution.

State what would be observed, if anything, if the white solid is

ammonium nitrate,

....

ammonium sulfate.

.... [2]

(c) Calcium carbonate is another compound that is sometimes added to soil.

State and explain how calcium carbonate can improve the quality of soil used for crops.

....

....

.... [2]

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	**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	**Po** Polonium 84	**At** Astatine 85	**Rn** Radon 86
Fr Francium 87	226 **Ra** Radium 88	227 **Ac** Actinium 89 †															

140 **Ce** Cerium 58	141 **Pr** Praseodymium 59	144 **Nd** Neodymium 60	**Pm** Promethium 61	150 **Sm** Samarium 62	152 **Eu** Europium 63	157 **Gd** Gadolinium 64	159 **Tb** Terbium 65	162 **Dy** Dysprosium 66	165 **Ho** Holmium 67	167 **Er** Erbium 68	169 **Tm** Thulium 69	173 **Yb** Ytterbium 70	175 **Lu** Lutetium 71
232 **Th** Thorium 90	**Pa** Protactinium 91	238 **U** Uranium 92	**Np** Neptunium 93	**Pu** Plutonium 94	**Am** Americium 95	**Cm** Curium 96	**Bk** Berkelium 97	**Cf** Californium 98	**Es** Einsteinium 99	**Fm** Fermium 100	**Md** Mendelevium 101	**No** Nobelium 102	**Lr** Lawrencium 103

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

Key

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

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