Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

3510438591

PHYSICAL SCIENCE **0652/21**

Paper 2 (Core) **October/November 2014**

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 an HB soft pencil for any diagrams, graphs, tables or rough working.
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 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.

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

CAMBRIDGE International Examinations

1 A student is investigating the stretching of a spring.

She sets up the apparatus as shown in Fig. 1.1 and measures the length of the spring with different loads.

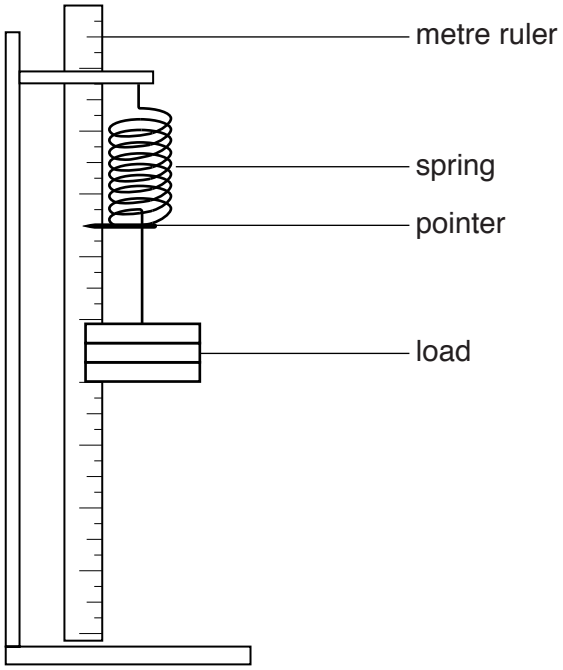


Fig. 1.1

(a) Table 1.1 shows some of the student's results.

Table 1.1

load / N	length of spring / cm	extension / cm
0	12.0	0
1.0	13.3	1.3
2.0	14.8	

Calculate the extension when the load is 2.0 N and complete the table. [1]

(b) The student takes three more sets of readings and draws the best-fit line in Fig. 1.2.

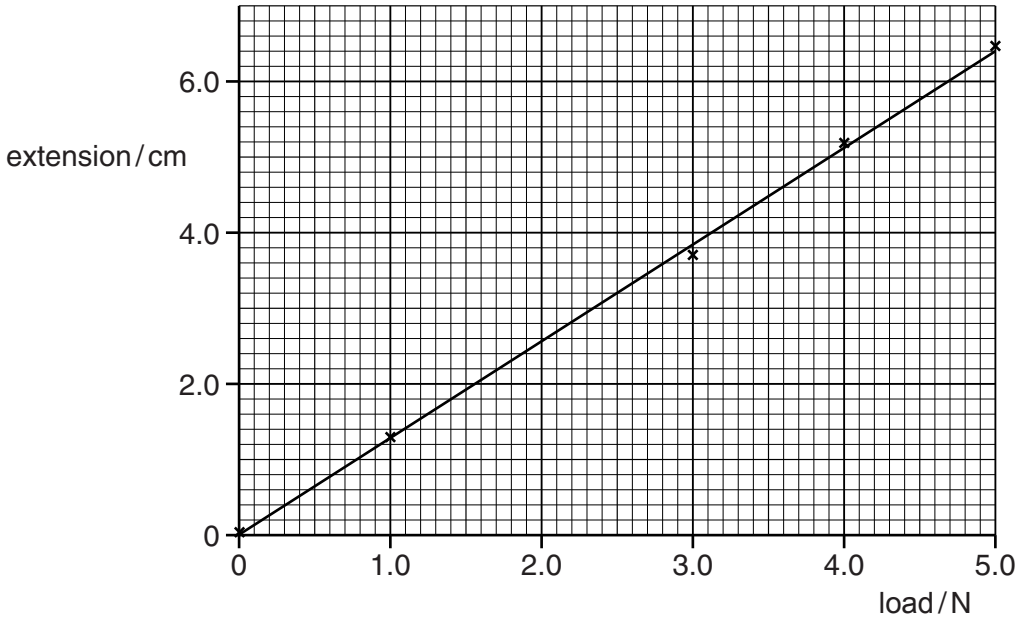


Fig. 1.2

(i) Using your answer to part **(a)**, plot the point on the graph for a load of 2.0 N. [1]

(ii) State the relationship between the load and the extension shown by the best-fit line.

.....

.....[1]

(c) Fig. 1.3 shows a rectangular block of mass 63 g and dimensions 3.0 cm by 6.0 cm by 2.5 cm.

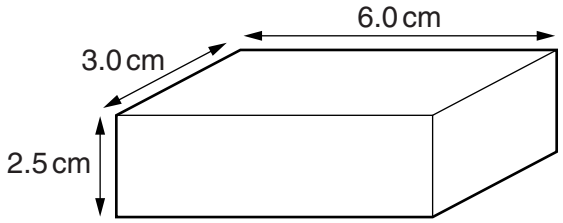


Fig. 1.3

(i) Calculate the volume of the block.

volume = ... cm^3 [1]

(ii) Calculate the density of the block and state the unit.

density = ... unit ..... [2]

2 Copper(II) oxide is added to dilute sulfuric acid until there is no further reaction.

The mixture is filtered to obtain a blue solution (filtrate).

(a) Describe how the positive metal ions in this blue solution can be identified.

reagent .....

result .....

.....[2]

(b) Explain how dry crystals of a blue solid can be obtained from this blue solution.

.....

.....

.....

.....[3]

(c) Name this blue solid.

.....[1]

3 The burning of hydrogen is a reaction which gives out heat energy.

(a) State the term used to describe reactions which give out heat energy.

.....[1]

(b) Write a balanced equation for the burning of hydrogen in air.

.....[2]

(c) **(i)** State which bonds are broken and which are formed during this reaction.

bonds broken .....

.....

bonds formed .....

..... [3]

(ii) Energy is taken in to break chemical bonds.
Energy is released when chemical bonds are formed.

Suggest how a chemical reaction can result in an overall release of energy.

.....

.....

.....[1]

[Turn over

4 Fig. 4.1 shows a bimetallic strip made from copper and an alloy called invar.

Fig. 4.1

(a) Explain what is meant by *an alloy*.

.....

.....[1]

(b) When the strip is heated it bends as shown in Fig. 4.2.

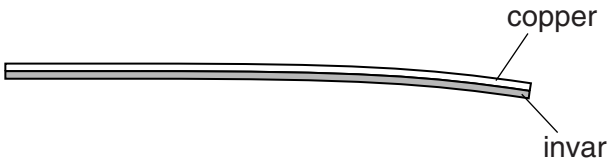


Fig. 4.2

Explain why the strip bends in the direction shown in Fig. 4.2.

.....

.....

.....[2]

(c) Fig. 4.3 shows the bimetallic strip used as part of a thermostat switch in an electric oven.

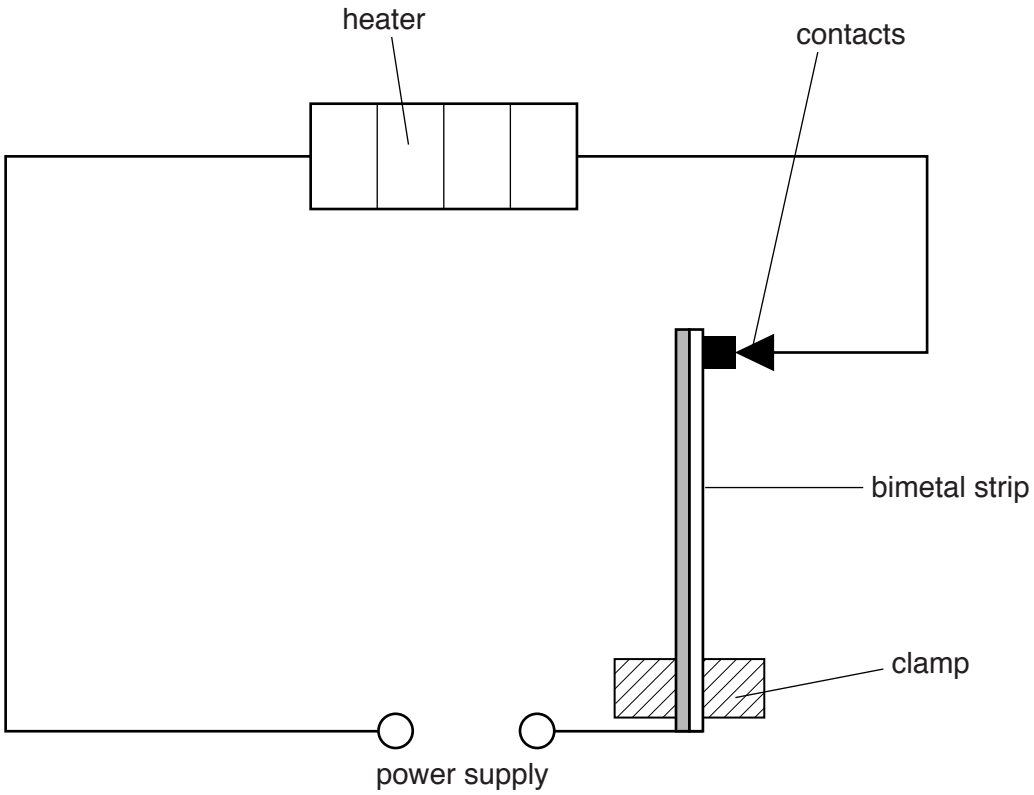


Fig. 4.3

Explain what happens when the temperature reaches the level set.

.....

.....

.....[2]

5 Reacting limestone with hydrochloric acid produces carbon dioxide.

(a) Complete Fig. 5.1 to show how the carbon dioxide could be collected and its volume measured. [2]

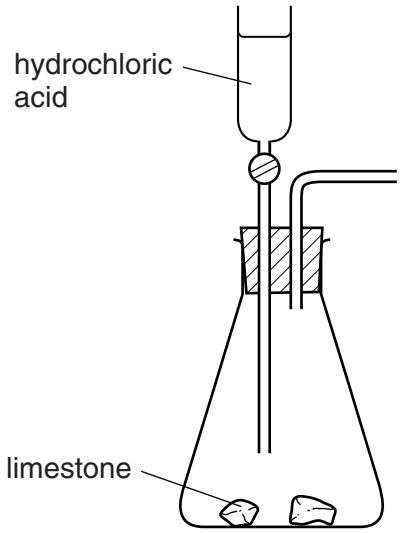


Fig. 5.1

(b) The main component of limestone is calcium carbonate, $CaCO_3$.

Use its formula to show that calcium carbonate contains 12% of carbon by mass.

[A_r: Ca, 40; C, 12; O, 16]

[2]

6 A teacher demonstrates the properties of waves using a ripple tank.

A barrier is placed in the ripple tank.

Fig. 6.1 shows a view of the ripple tank from above.

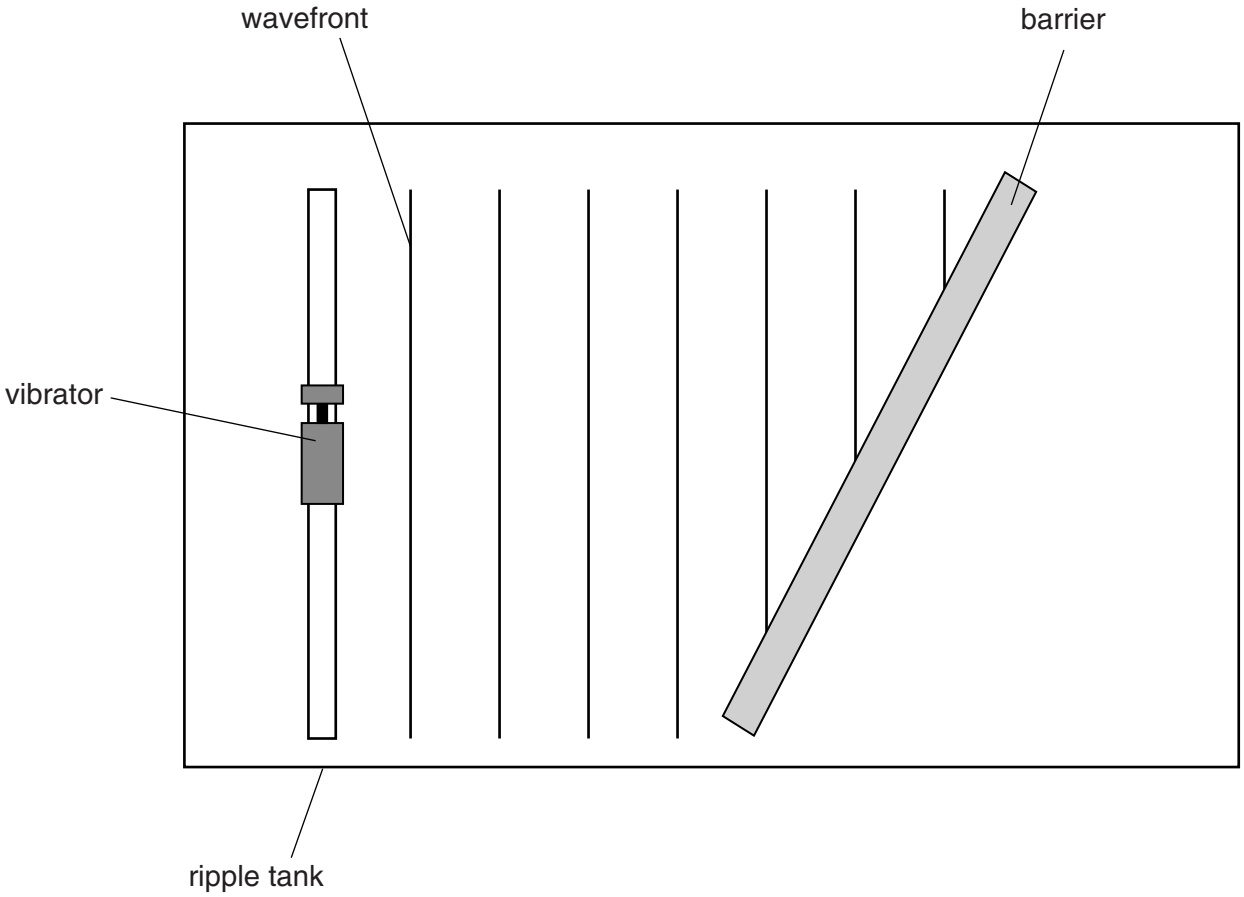


Fig. 6.1

The vibrator produces a series of waves of constant frequency. These waves move towards the barrier.

(a) On the diagram, draw an arrow (↔) to show **one** wavelength. [1]

(b) (i) Draw on Fig. 6.1 **three** wavefronts after they hit the barrier. [3]

(ii) Name the property of waves shown by the change in direction of these wavefronts.

..... [1]

7 Carbon dioxide gas is much more soluble in water than oxygen gas.

Fig. 7.1 shows a candle burning inside a bell jar of air. The bell jar is placed in a trough of water.

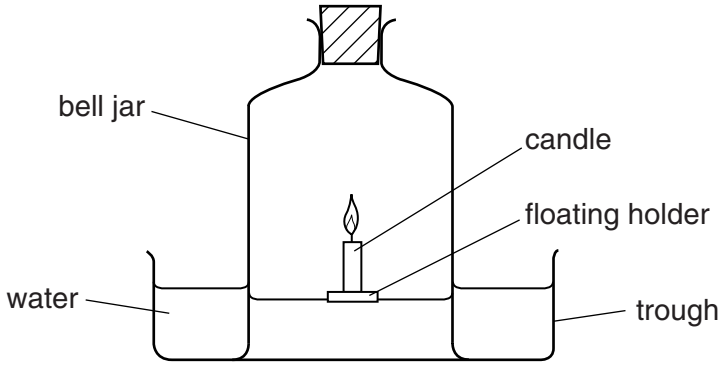


Fig. 7.1

As the candle burns the water level rises up inside the bell jar.

(a) Explain how burning the candle causes the water level to rise.

.....

.....

.....[2]

(b) After several minutes the candle stops burning.

Name the main gas in the bell jar after the candle has stopped burning.

.....[1]

(c) Candles are made from wax which is a compound of carbon.

Explain why it can be dangerous to burn wax in a limited supply of air.

.....

.....

.....[2]

8 Sodium is a member of Group I of the Periodic Table.

(a) State two observations made when sodium reacts with water.

1 .....

2 .....[2]

(b) Name two other members of Group I, one which is more reactive than sodium and one which is less reactive than sodium.

one which is more reactive than sodium

.....

one which is less reactive than sodium

.....[2]

(c) Name a metal and a non-metal in the same **period** as sodium.

metal .....

non-metal .....[2]

(d) Sodium reacts with chlorine to form sodium chloride, an ionic compound.

Draw a diagram to show the electron arrangement of the ions present in sodium chloride.
Show all of the electrons in each ion.
Label your diagram with the names of the ions.

[3]

9 Fig. 9.1 shows a circuit with a lamp and a cell in series.

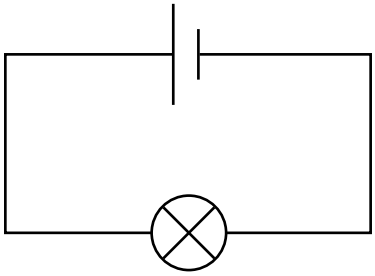


Fig. 9.1

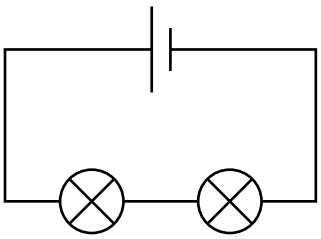
(a) Fig. 9.2 shows four more circuits.

The cells and lamps are identical to those in Fig. 9.1.

(i) Compared with the lamp in Fig. 9.1, state under each diagram whether each lamp in the circuit is

brighter,
less bright,
as bright,
not lit.

1



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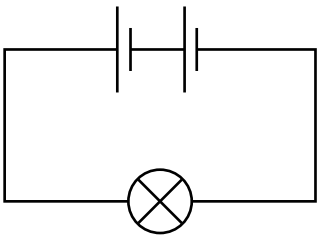
2



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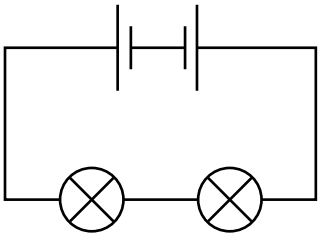
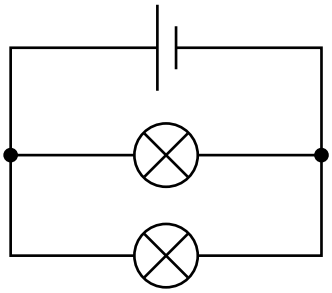


.....

4



.....

[4]

Fig. 9.2

(ii) State in which circuit in Fig. 9.2 the cell(s) stop working the most quickly.

Explain your answer.

circuit .....

explanation .....

.....[2]

(b) A student wishes to measure the current from the cell in circuit **4**.

(i) Name the instrument used to measure current.

.....[1]

(ii) In the box below, redraw circuit **4** to include the measuring instrument.

[3]

10 Fig. 10.1 shows an iron rod with a coil of wire wrapped around it.

The coil is attached to a power supply.

A mixture of small pieces of different types of metal are on the bench near the iron rod.

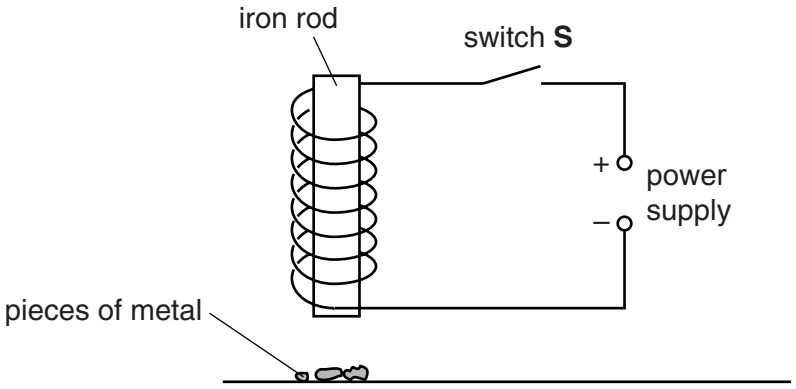


Fig. 10.1

(a) (i) State what happens to the iron rod when switch **S** is closed.

.....[1]

When switch **S** is closed, some of the pieces of metal are attracted to the iron rod and stick to it. The other pieces of metal stay on the bench.

(ii) Explain why some of the pieces of metal are attracted to the iron rod and some are not attracted.

.....

.....

.....[2]

(b) In a separate experiment, a magnet is used to pick up two metal pins as shown in Fig. 10.2.

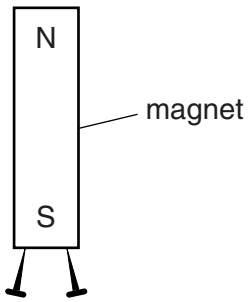


Fig. 10.2

The pins hang at an angle to each other.

Explain why the pins do not hang vertically.

.....

.....

.....

.....[3]

11 Carbon-12, $^{12}_{6}C$, and carbon-14, $^{14}_{6}C$, are isotopes of carbon.

(a) Complete Table 11.1 to show the number of protons, electrons and neutrons in atoms of carbon-12 and carbon-14.

Table 11.1

isotope		protons	electrons	neutrons
carbon-12	$^{12}_{6}C$	.....	.....	.....
carbon-14	$^{14}_{6}C$	.....	.....	.....

[2]

(b) Ethane and ethene are hydrocarbons. They each contain two carbon atoms per molecule.

(i) Complete **Fig. 11.1** to show the structural formulae of ethane and ethene.

C C C C

ethane ethene [3]

Fig. 11.1

(ii) Describe a chemical test to distinguish between ethane and ethene.

test .....

result with ethane .....

result with ethene .....[3]

(iii) State one use of ethene.

.....[1]

12 Fig. 12.1 shows a cathode ray tube.

There is an electric field between the charged plates.

The cathode rays are deflected by this electric field.

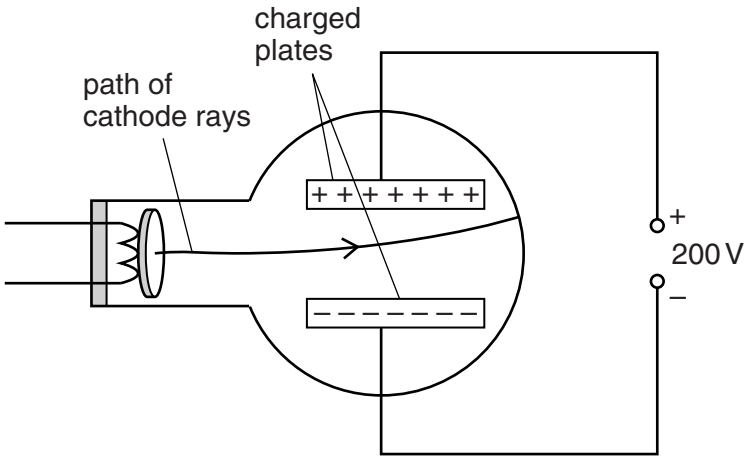


Fig. 12.1

(a) Describe the evidence which suggests that the particles which make up cathode rays are negatively charged.

.....

.....

.....[2]

(b) Name the type of particle which forms cathode rays.

..... [1]

13 A student measures the half-life of a radioactive isotope.

She records the results and draws the graph in Fig. 13.1.

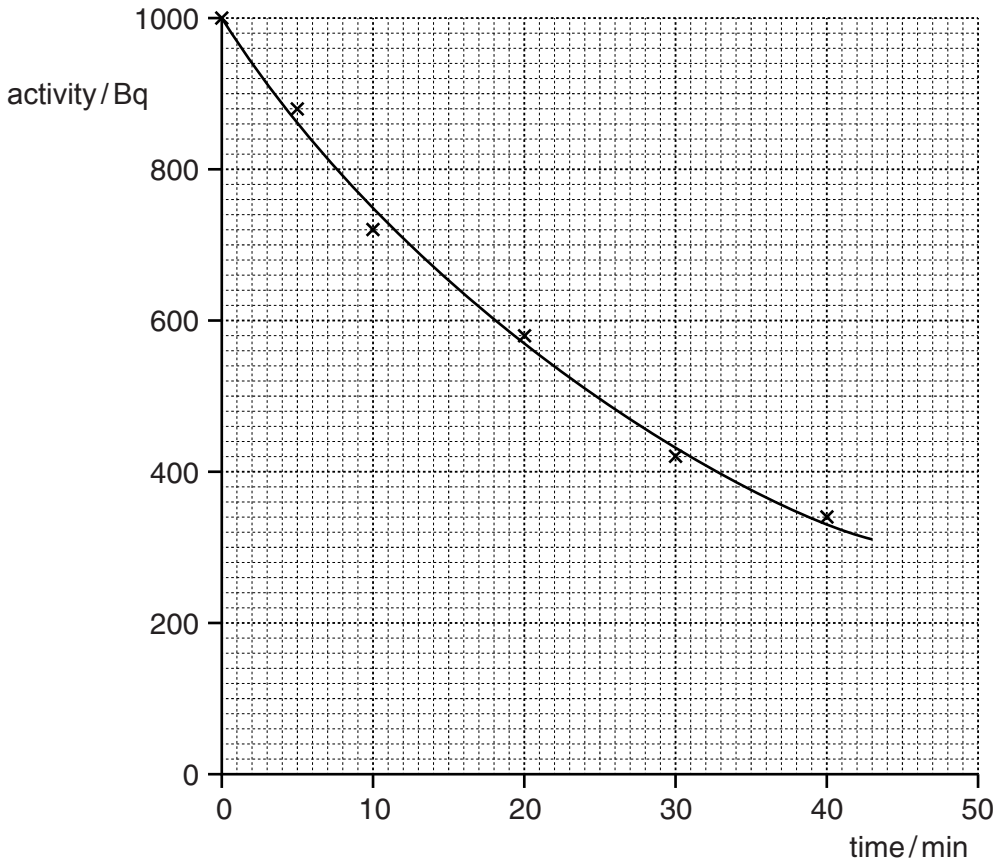


Fig. 13.1

(a) The points are not exactly on a smooth curve.

State the property of radioactive decay which causes this scatter.

.....

.....[1]

(b) Use the graph to determine the half life of the isotope.

Show clearly on the graph in Fig. 13.1, how you obtained this value.

half-life = ... min [2]

(c) The isotope decays by emitting an α-particle (alpha-particle).

Describe the nature of an α-particle.

.....

.....

.....[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 †															

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

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

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.).