



Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

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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.

- 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.

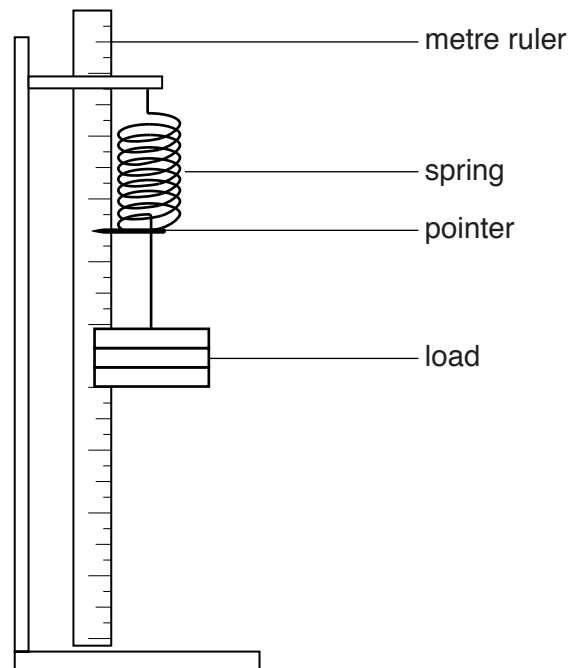


Fig. 1.1

- (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 2.0N and complete the table.

[1]

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

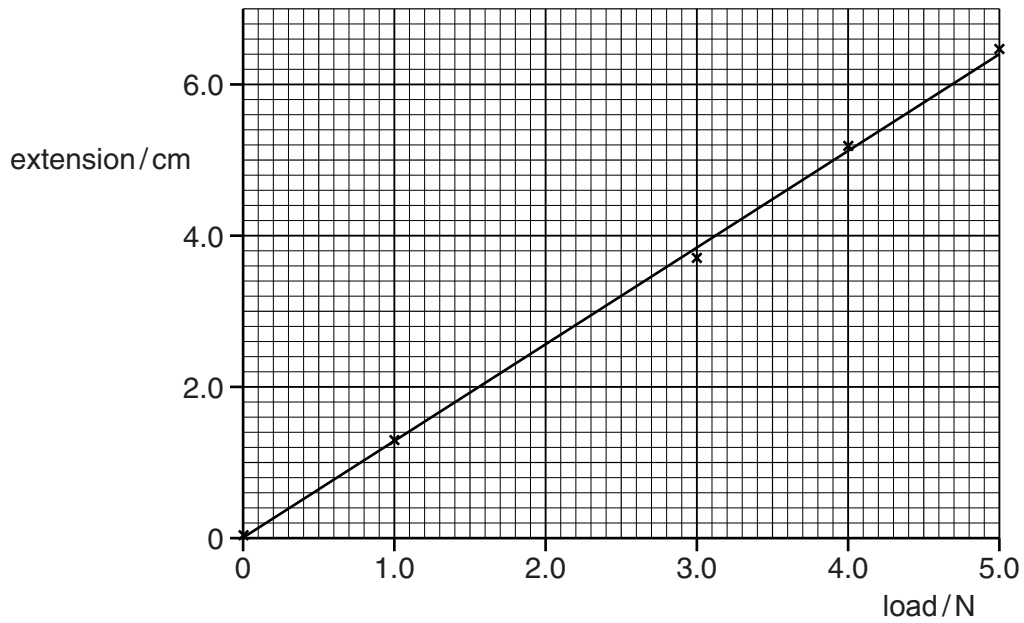


Fig. 1.2

(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.

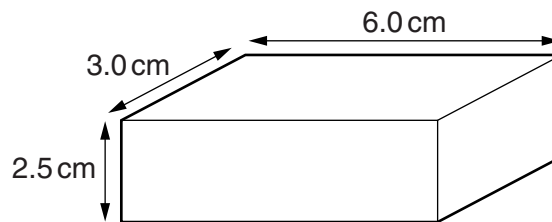


Fig. 1.3

(i) Calculate the volume of the block.

volume = cm³ [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]

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.

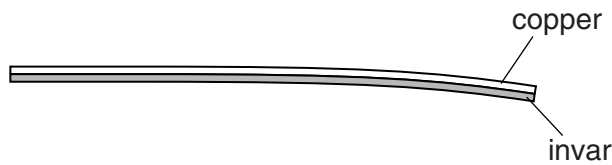


Fig. 4.2

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.

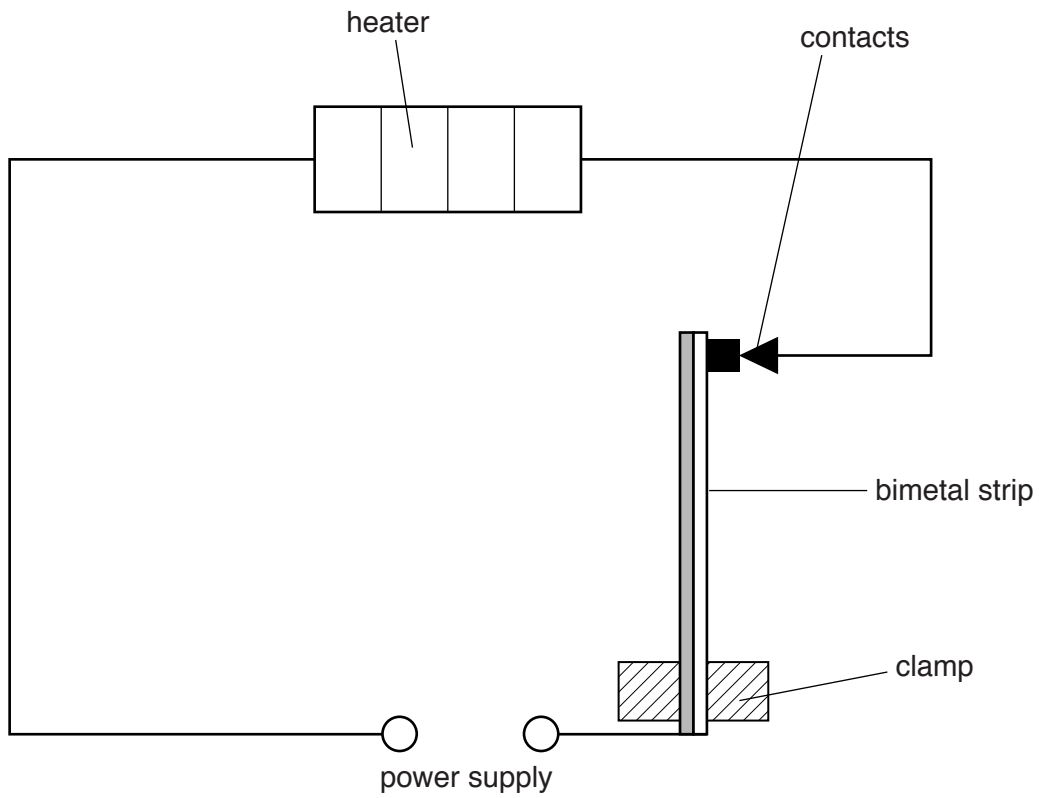


Fig. 4.3

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]

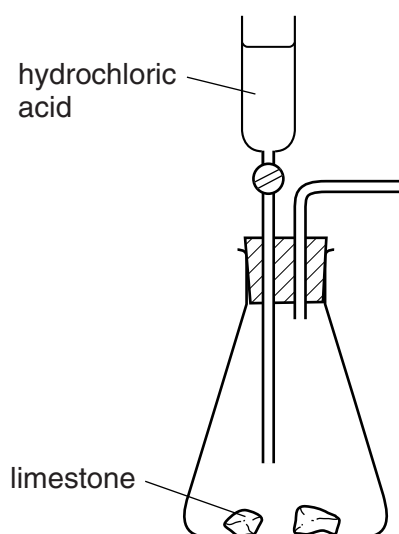


Fig. 5.1

- (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.

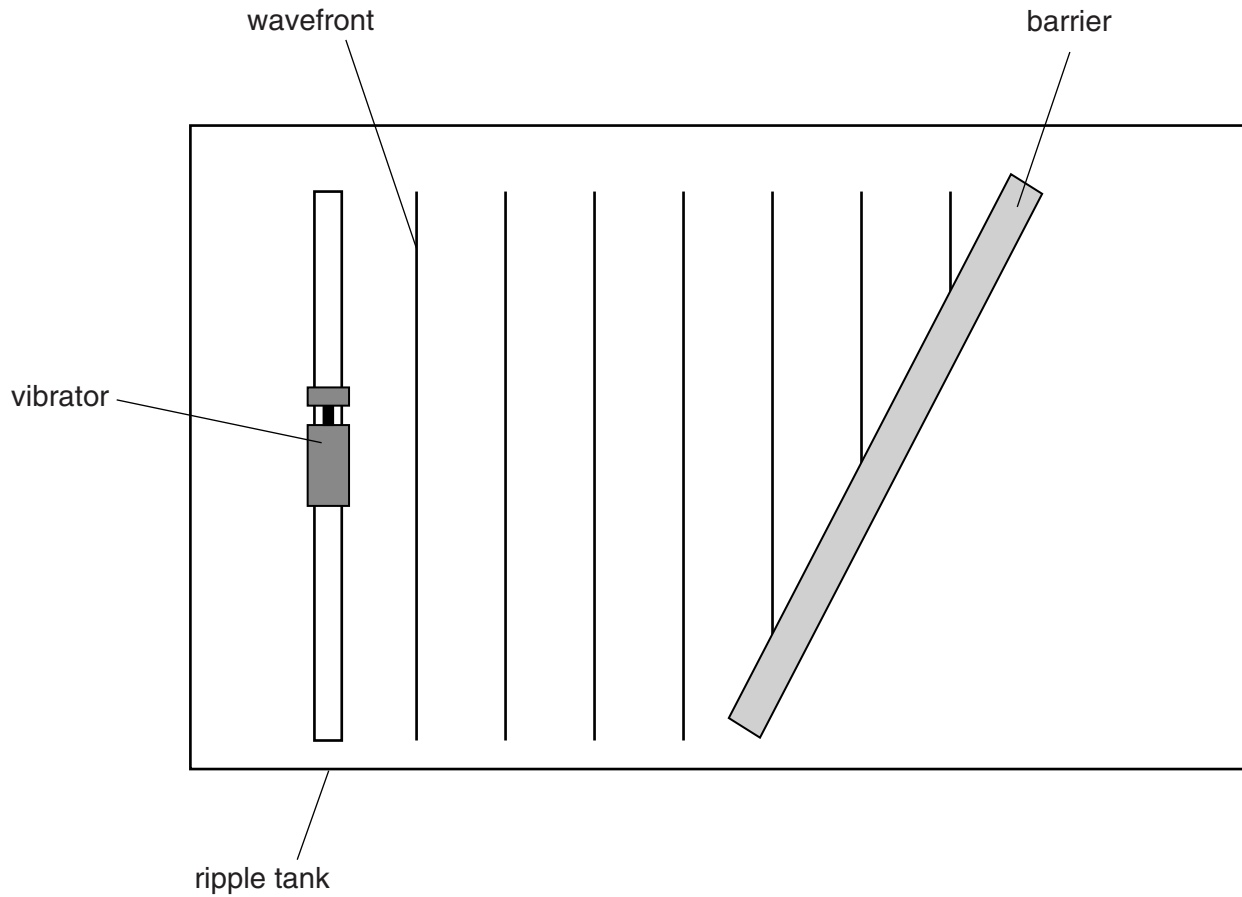


Fig. 6.1

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

(a) On the diagram, draw an arrow (\leftrightarrow) 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.

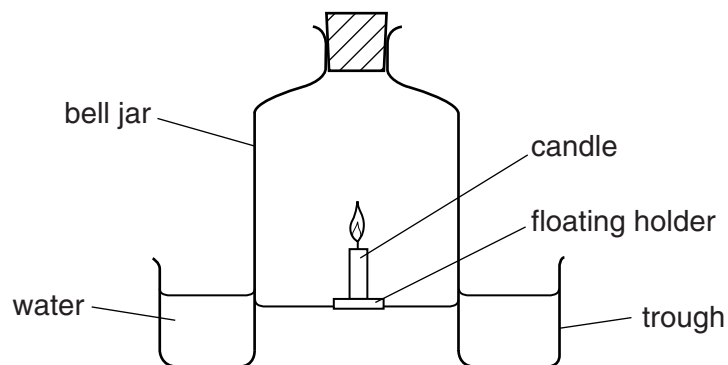


Fig. 7.1

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.

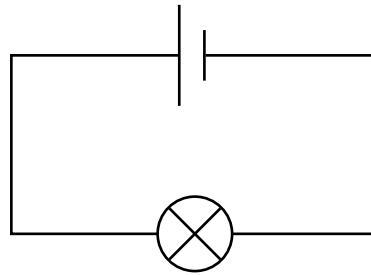


Fig. 9.1

- (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.

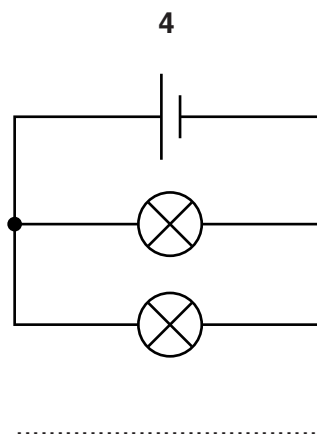
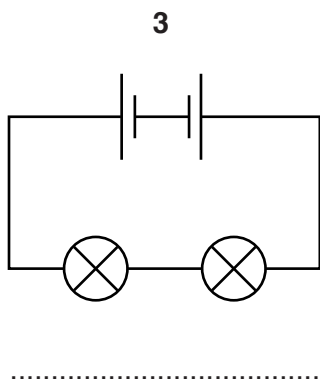
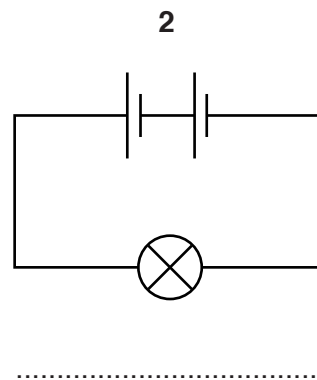
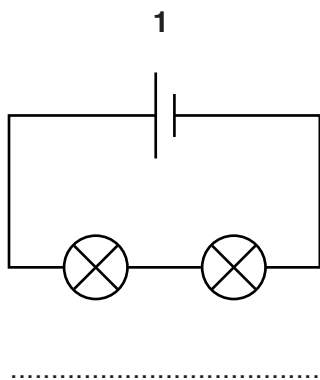


Fig. 9.2

[4]

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

Explain your answer.

circuit

explanation

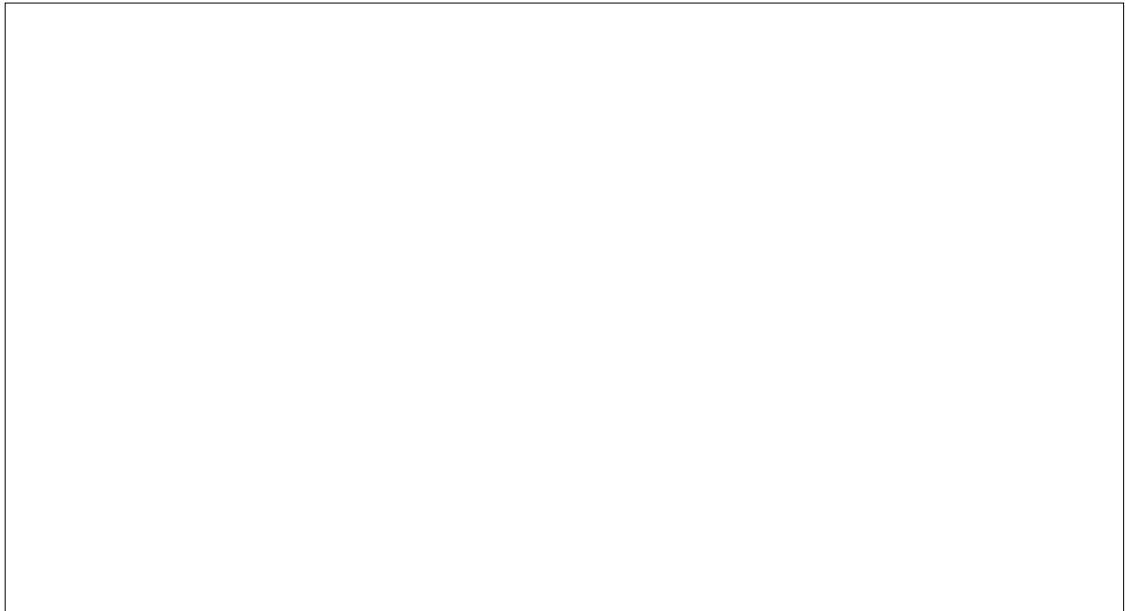
.....[2]

(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.

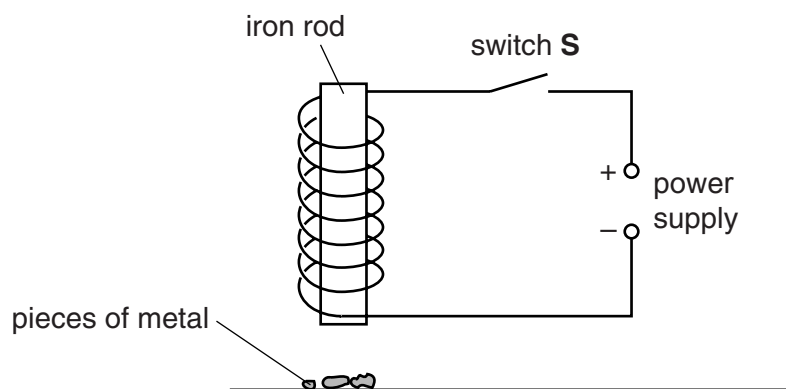


Fig. 10.1

(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.

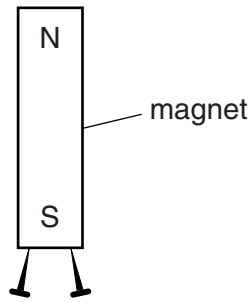


Fig. 10.2

The pins hang at an angle to each other.

Explain why the pins do not hang vertically.

.....

.....

.....

..... [3]

11 Carbon-12, $^{12}_6\text{C}$, and carbon-14, $^{14}_6\text{C}$, 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	$^{12}_6\text{C}$
carbon-14	$^{14}_6\text{C}$

[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.



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.

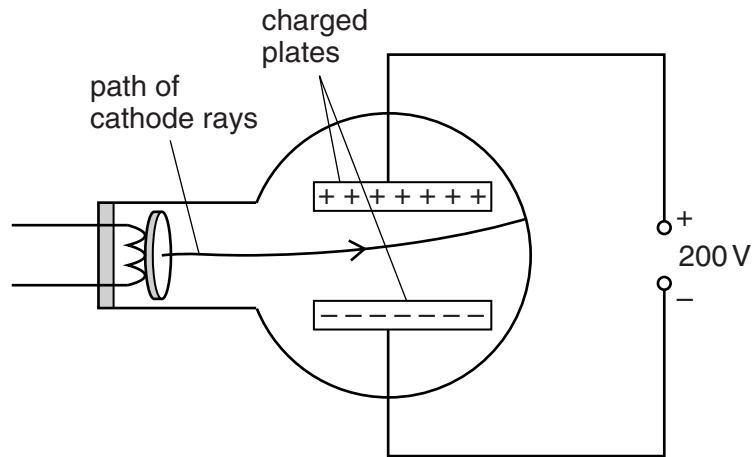


Fig. 12.1

(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.

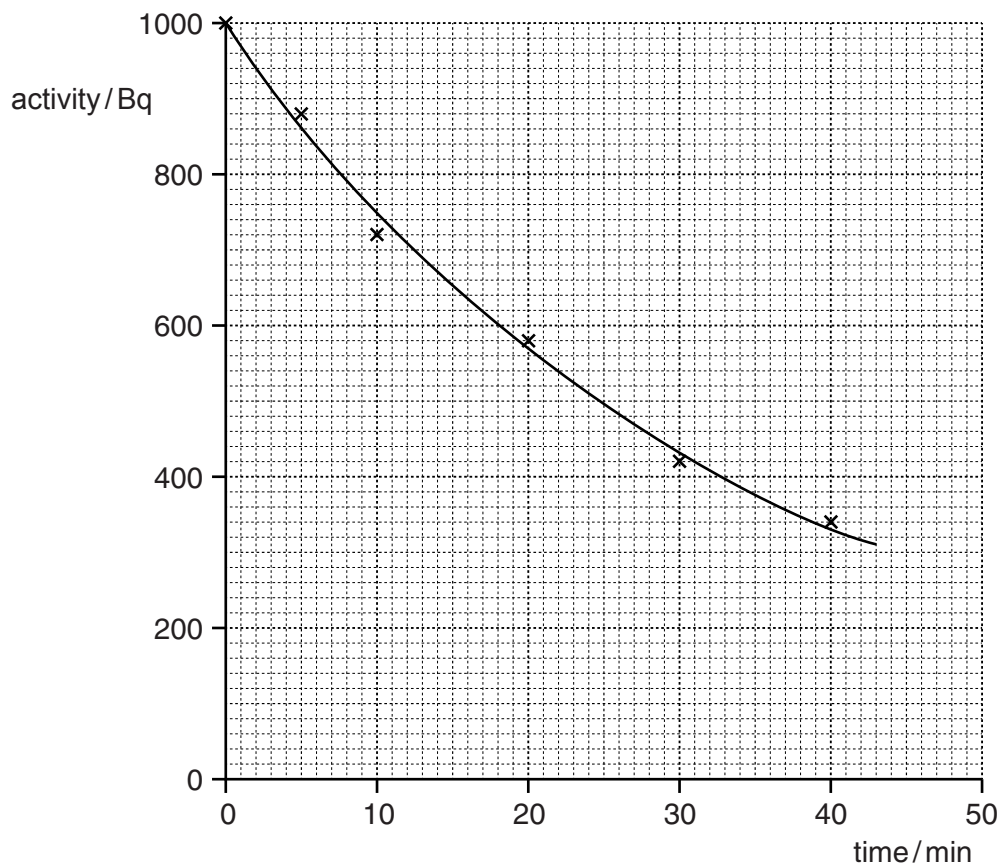


Fig. 13.1

(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																	20 Ne Neon 10				
23 Na Sodium 11	24 Mg Magnesium 12	11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9											35.5 Cl Chlorine 17					
39 K Potassium 19	40 Ca Calcium 20	27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	79 Se Selenium 34	80 Br Bromine 35											84 Kr Krypton 36			
85 Rb Rubidium 37	88 Sr Strontium 38	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	112 Cd Cadmium 48	119 Sn Tin 50	122 Sb Antimony 51	127 I Iodine 53											131 Xe Xenon 54	
137 Ba Barium 56	139 La Lanthanum 57	204 Pb Lead 82	207 Tl Thallium 81	209 Bi Bismuth 83	201 Hg Mercury 80	197 Au Gold 79	204 Pb Lead 82	207 Tl Thallium 81	209 Bi Bismuth 83	84 Po Polonium 84	85 At Astatine 85											86 Rn Radon 86
226 Ra Radium 88	227 Ac Actinium 89																	86 Rn Radon 86				

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

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

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	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	238 U Uranium 92	238 Pa Protactinium 91	94 Pu Plutonium 94	95 Am Americium 95	96 Cm Curium 96	97 Bk Berkelium 97	99 Es Einsteinium 99	100 Fm Fermium 100	101 Md Mendelevium 101	102 No Nobelium 102	103 Lr Lawrencium 103

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

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