



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.

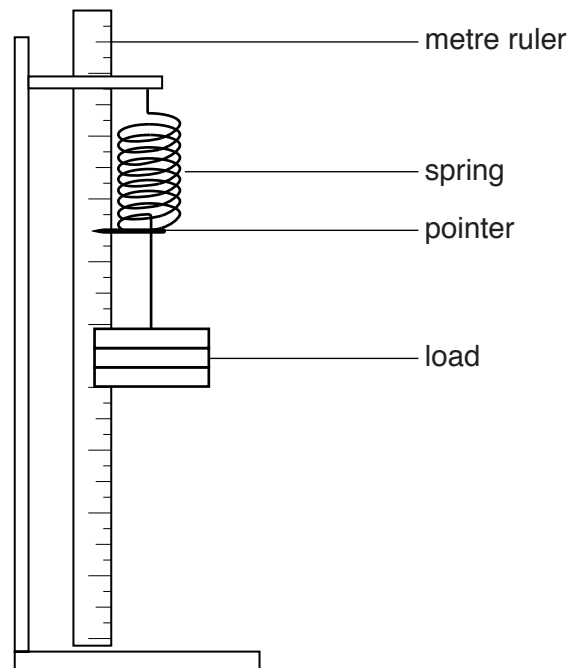


Fig. 1.1

- (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.

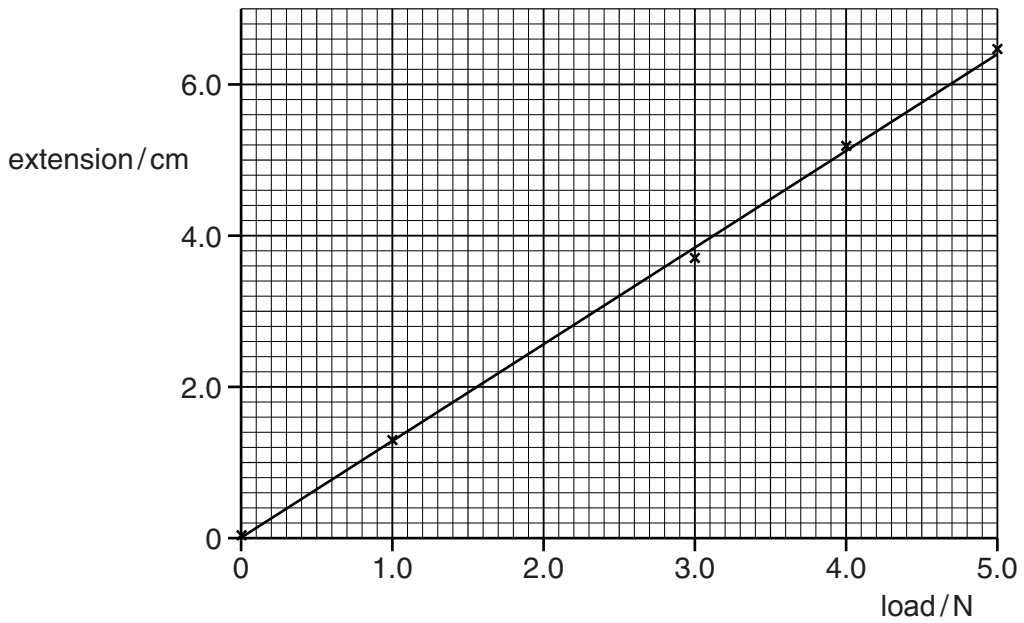


Fig. 1.2

(i) Using your answer to part (a), plot the point on the graph for a load of 2.0N. [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 63g and dimensions 3.0 cm by 6.0 cm by 2.5 cm.

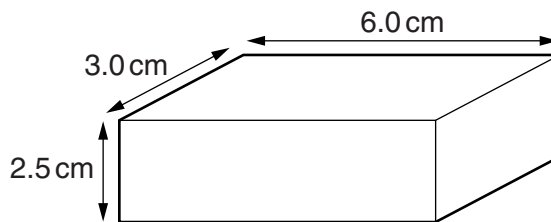


Fig. 1.3

(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.

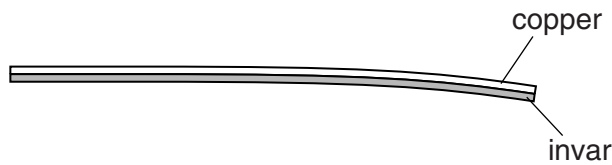


Fig. 4.2

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.

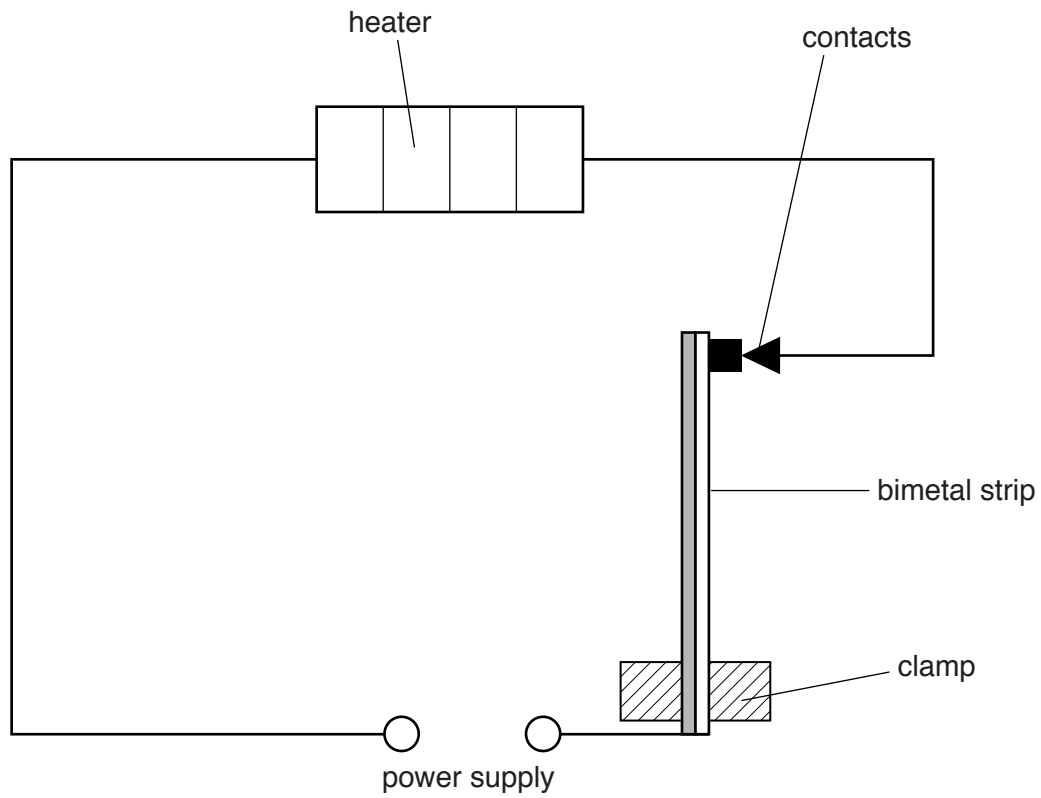


Fig. 4.3

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]

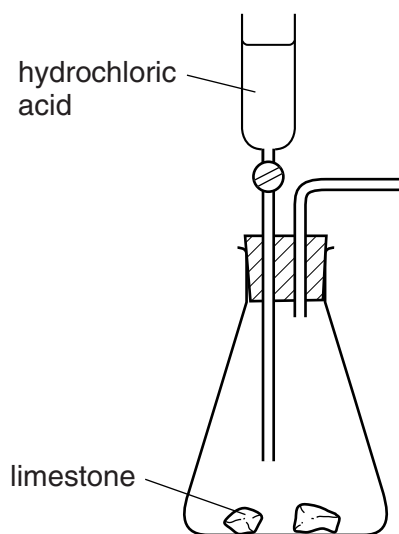


Fig. 5.1

- (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.

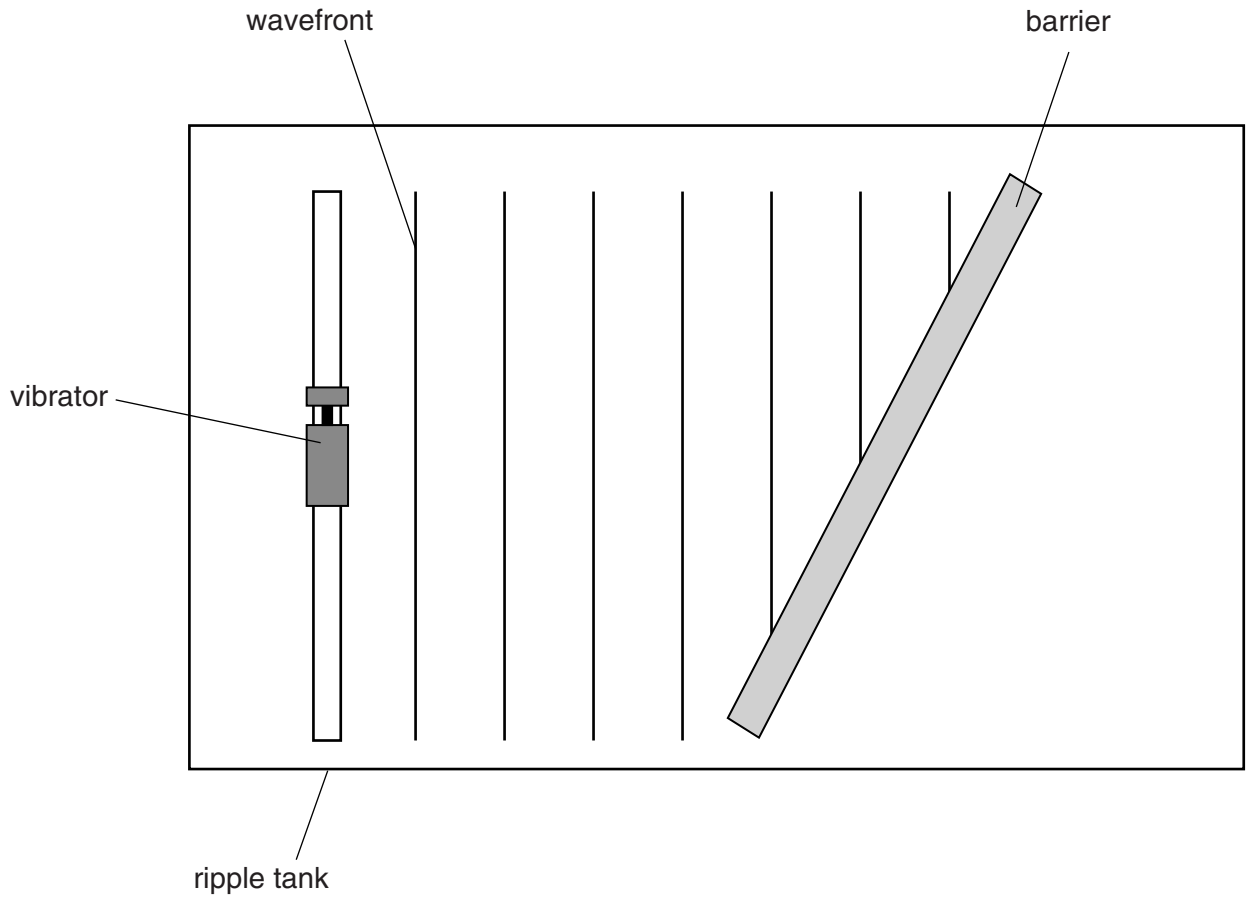


Fig. 6.1

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.

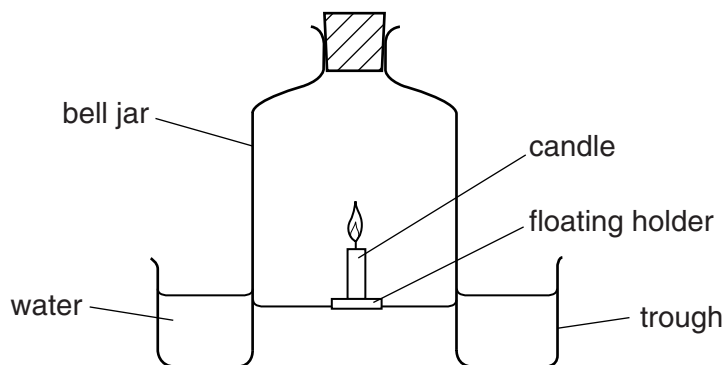


Fig. 7.1

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.

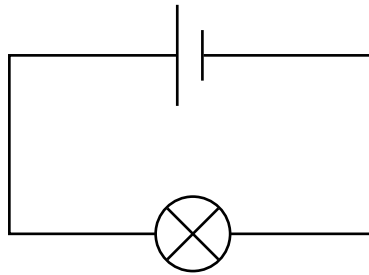


Fig. 9.1

- (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.

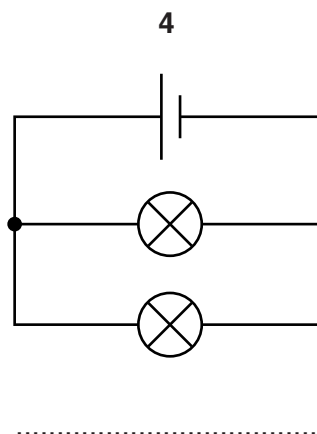
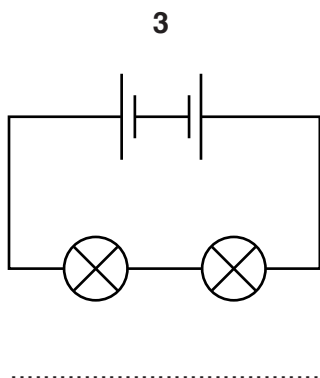
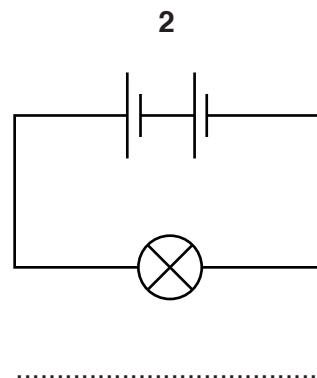
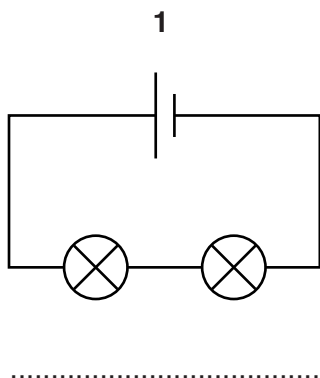


Fig. 9.2

[4]

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

Explain your answer.

circuit

explanation

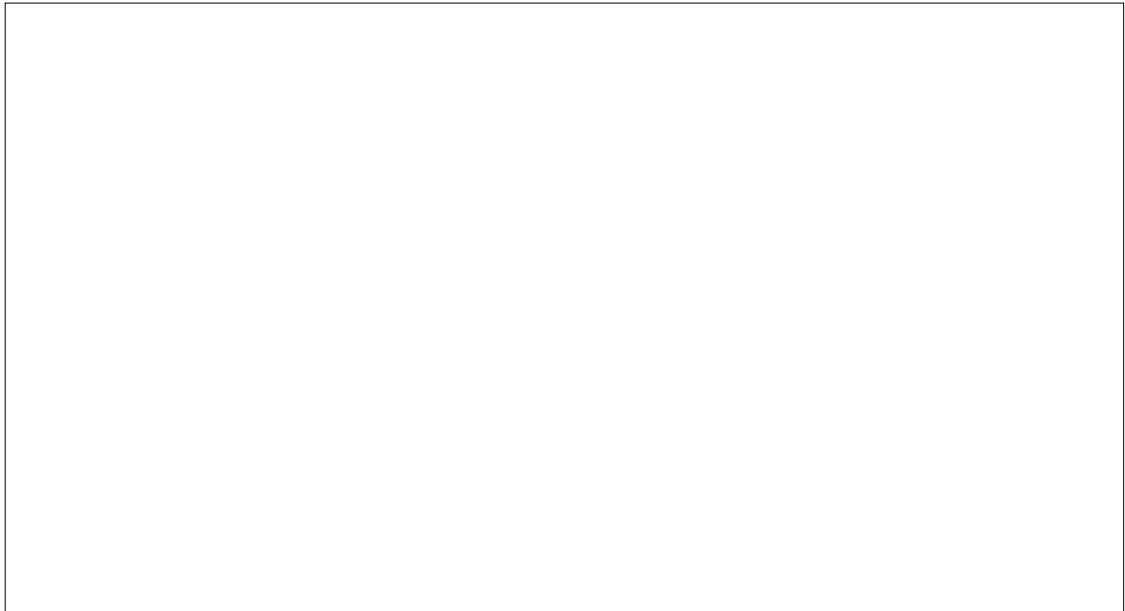
.....[2]

(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.

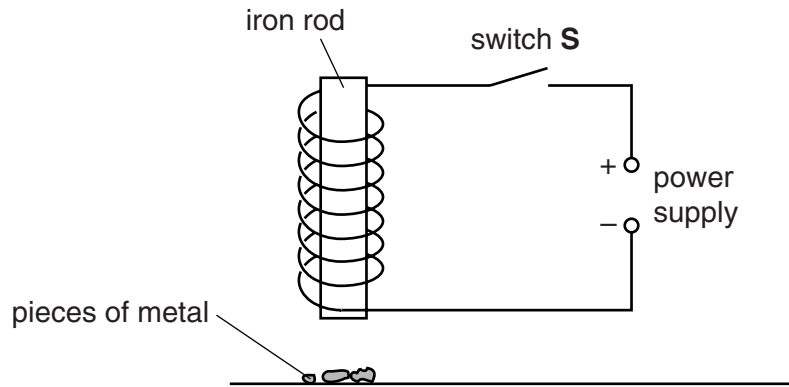


Fig. 10.1

(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.

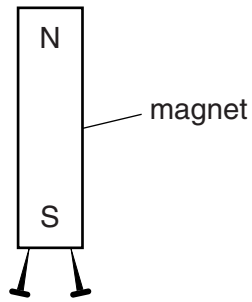


Fig. 10.2

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.

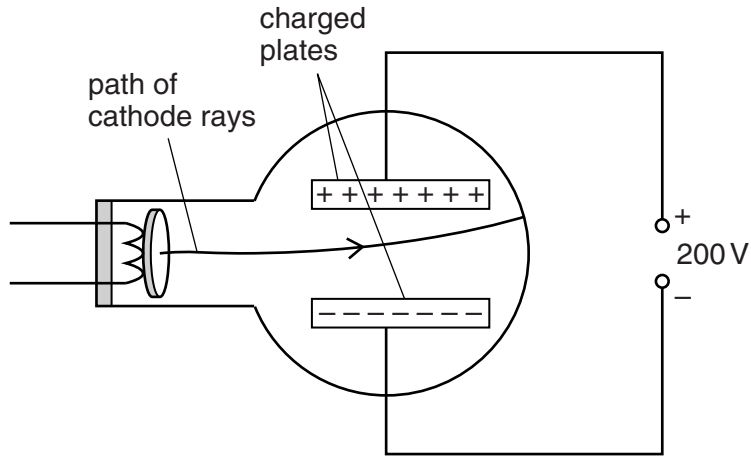


Fig. 12.1

(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.

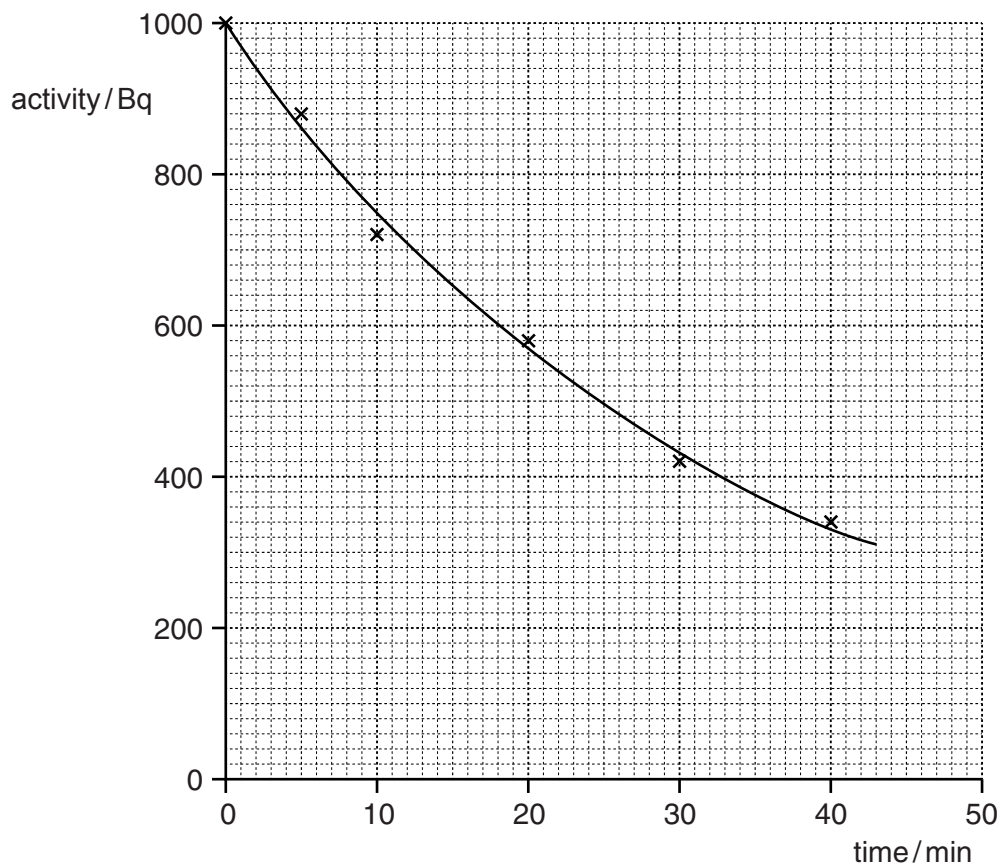


Fig. 13.1

(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	VIII	IX	X	XI
		1 H Hydrogen 1										
		4 He Helium 2										
7	3	9	4									
Li Lithium	Be Beryllium	B Boron	C Carbon	N Nitrogen	O Oxygen	F Fluorine	Ne Neon					
23	11	24	12	13	14	15	16	17	18			
Na Sodium	Mg Magnesium	Al Aluminium	Si Silicon	P Phosphorus	S Sulfur	Cl Chlorine	Ar Argon					
39	19	40	20	21	22	23	24	25	26	27	28	29
K Potassium	Ca Calcium	Sc Scandium	Ti Titanium	V Vanadium	Cr Chromium	Mn Manganese	Fe Iron	Co Cobalt	Ni Nickel	Cu Copper	Zn Zinc	Ga Gallium
85	37	88	38	89	39	90	40	91	41	92	42	43
Rb Rubidium	Sr Strontium	Y Yttrium	Zr Zirconium	Nb Niobium	Mo Molybdenum	Tc Technetium	Ru Ruthenium	Rh Rhodium	Pd Palladium	Ag Silver	Cd Cadmium	In Indium
133	55	137	56	139	57	140	58	141	59	142	60	61
Cs Caesium	Ba Barium	La Lanthanum	Hf Hafnium	Ta Tantalum	W Tungsten	Re Rhenium	Os Osmium	Ir Iridium	Pt Platinum	Au Gold	Hg Mercury	Tl Thallium
226	88	227	89	228	90	229	91	230	92	231	93	232
Fr Francium	Ra Radium	Ac Actinium										

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

Key

a	X
b	

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

140	58	141	59	142	60	143	61	144	62	145	63	146	64	147	65	148	66	149	67	150	68	151	69	152	70	153	71	154	72	155	73	156	74	157	75	158	76	159	77	160	78	161	79	162	80	163	81	164	82	165	83	166	84	167	85	168	86	169	87	170	88	171	89	172	90	173	91	174	92	175	93
Ce Cerium	Pr Praseodymium	Nd Neodymium	Pm Promethium	Sm Samarium	Eu Europium	Gd Gadolinium	Tb Terbium	Dy Dysprosium	Ho Holmium	Er Erbium	Tm Thulium	Yb Ytterbium	Lu Lutetium	Th Thorium	Pa Protactinium	U Uranium	Np Neptunium	Pu Plutonium	Am Americium	Cm Curium	Bk Berkelium	Cf Californium	Es Einsteinium	Fm Fermium	Md Mendelevium	No Nobelium	Lr Lawrencium																																												

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

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