



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE
NAME

CENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--

* 7 1 9 9 3 9 5 8 1 1 *

COMBINED SCIENCE

0653/03

Paper 3 (Extended)

October/November 2008

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	
2	
3	
4	
5	
6	
7	
8	
9	
Total	

This document consists of **18** printed pages and **2** blank pages.



BLANK PAGE

1 Fig. 1.1 shows a food web.

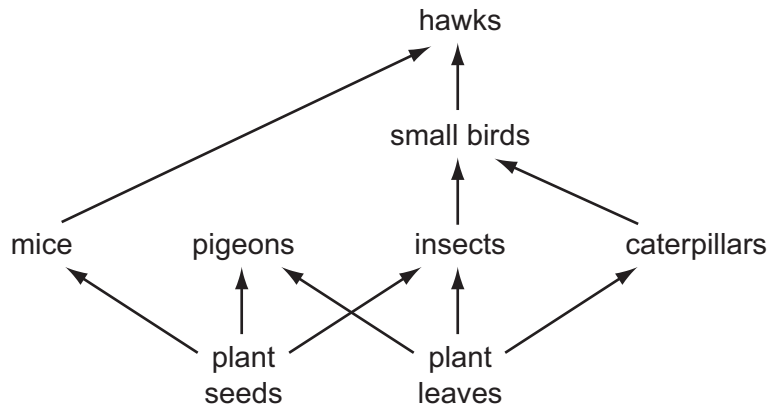


Fig. 1.1

(a) (i) State what the arrows in Fig. 1.1 represent.

..... [1]

(ii) The longest food chain in Fig. 1.1 has four organisms. Explain why it is rare for food chains to be longer than this.

.....

 [2]

(b) Describe how an atom of carbon in a glucose molecule in an insect could become part of a glucose molecule in a plant leaf.

.....

 [4]

- 2 (a) Two inflated rubber rings, one black and one white, are left on a hot beach in the sun.

For
Examiner's
Use

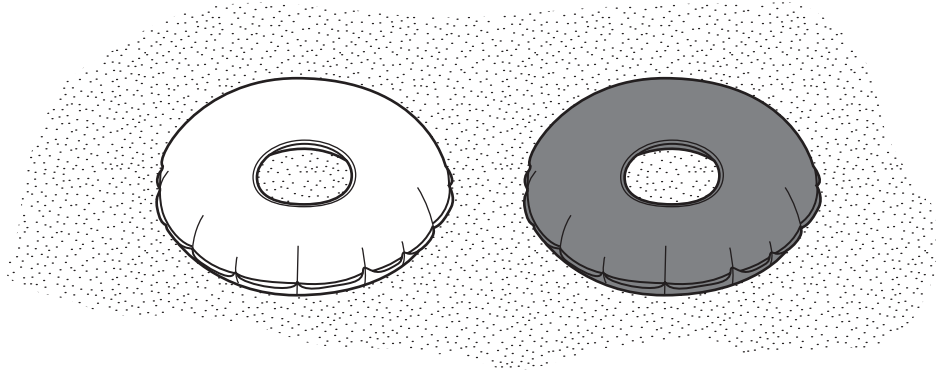


Fig. 2.1

Explain why the temperature of the air inside the black rubber ring rises more quickly than that in the white rubber ring.

.....

.....

..... [2]

- (b) Someone has left a glass bottle on the beach. The curved glass acts like a lens focussing the sun's rays.

Complete the light rays on Fig. 2.2 to show what happens to rays of light after they have passed through a convex lens.

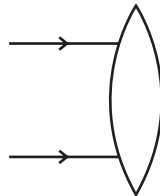


Fig. 2.2

[2]

(c) The power of the waves is used as a renewable source of energy.

Suggest how the motion of the waves can be converted to electrical energy.

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

(d) A girl collects two pebbles of the same size from the beach but one seems to be heavier than the other. How could she measure the densities of the two pebbles?

.....
.....
.....
..... [3]

*For
Examiner's
Use*

- 3 The chemical symbol of magnesium is shown below.



For
Examiner's
Use

- (a) Draw a labelled diagram of an atom of magnesium.

Your diagram should show the numbers of nucleons and the electron configuration.

[2]

- (b) Magnesium is produced industrially by the electrolysis of molten magnesium chloride. Fig. 3.1 shows a simplified diagram of this process.

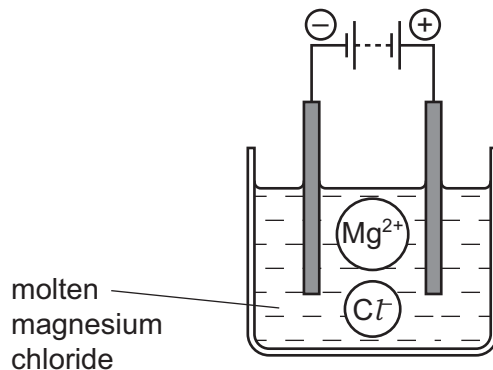


Fig. 3.1

- (i) Describe, in terms of ions and electrons, what happens at the surface of the cathode.

.....

 [2]

- (ii) Use the information in Fig. 3.1 to explain why the chemical formula of magnesium chloride is MgCl_2 .

For
Examiner's
Use

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

- (c) A student added magnesium to dilute hydrochloric acid as shown in Fig. 3.2.

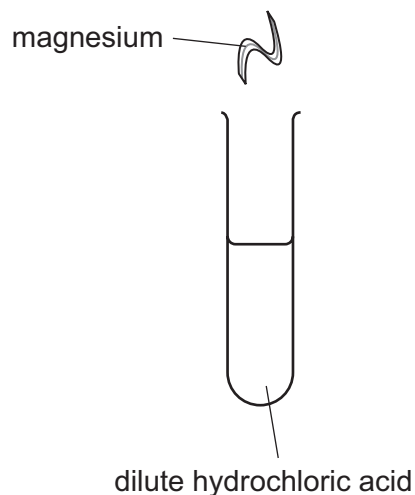


Fig. 3.2

- (i) Explain, in terms of electrons, why the magnesium atoms in the reaction in Fig. 3.2 are said to be oxidised.

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

- (ii) Explain, in terms of ions, why the pH of the mixture in Fig. 3.2 increases when magnesium is added to the acid.

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

BLANK PAGE

4 Fig. 4.1 shows part of the male reproductive system.

For
Examiner's
Use

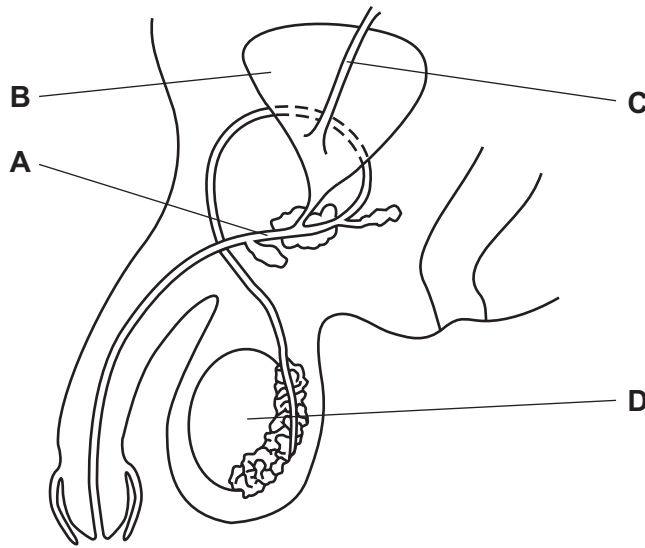


Fig. 4.1

(a) (i) Name the parts labelled **A** and **B**.

A

B

[2]

(ii) Describe the functions of parts **C** and **D**.

C

.....

D

..... [2]

(iii) On Fig. 4.1, write the letter **X** to show the part of the reproductive system which is cut or tied when a man has a sterilisation operation. [1]

(b) Humans reproduce using sexual reproduction. Sexual reproduction produces offspring that are genetically different from each other and from their parents.

Explain how this can be an advantage to a species of organism.

.....

.....

.....

..... [3]

- 5 (a) Fig. 5.1 shows two cars **A** and **B**.

Car **A** produces exhaust gases which appear black. The exhaust gases from car **B** cannot be seen. Both cars have engines which use diesel (gas oil) which is a hydrocarbon fuel.

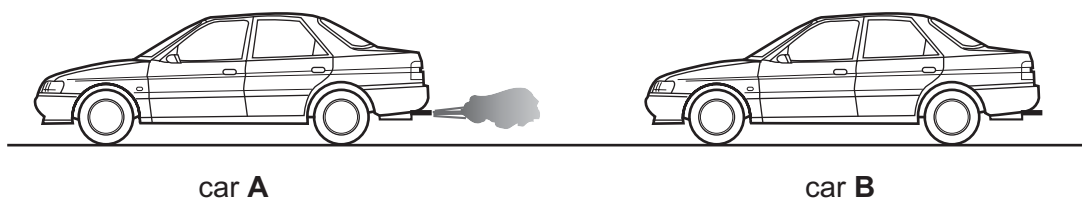


Fig. 5.1

- (i) Describe briefly how hydrocarbon fuels like diesel are obtained.

.....

 [2]

- (ii) The formula of a typical molecule in diesel is $C_{13}H_{28}$.

Calculate the relative molecular mass, M_r , of $C_{13}H_{28}$.

Show your working.

..... [2]

For
Examiner's
Use

- (b) The energy needed to move cars is provided by the combustion of the fuel. Air must be supplied to the engine for this combustion to occur.

For
Examiner's
Use

Fig. 5.2 shows a bar chart of the main gases in a sample of dry air.

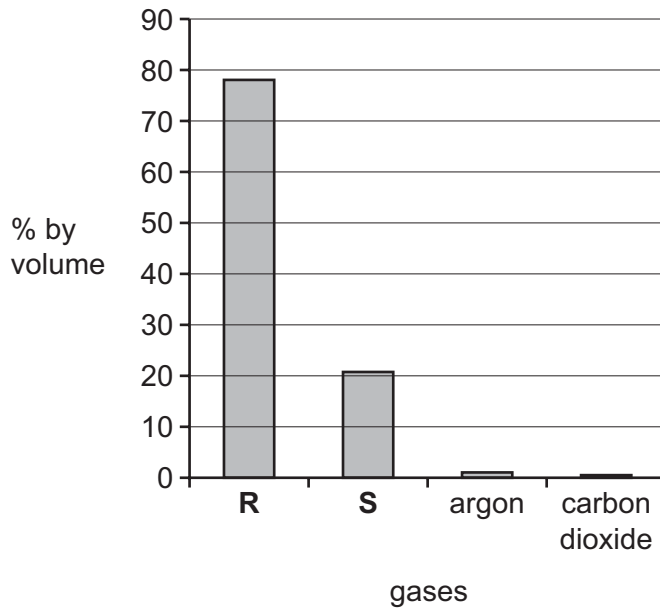


Fig. 5.2

- (i) Explain which gas shown in Fig. 5.2 reacts with the diesel fuel in car engines.

.....
 [1]

- (ii) Suggest the name of the black substance in the exhaust gases of car **A** in Fig. 5.1, and explain briefly how it is formed.

.....

 [2]

- (iii) Explain why car engines should never be left running for long periods of time in a garage or other enclosed space where there are people.

.....

 [2]

- 6 (a) The isotope radon-220 is radioactive. A sample was investigated to find its half-life. The activity of the isotope was measured every 30 seconds for 6 minutes. The results are shown in Fig. 6.1.

For
Examiner's
Use

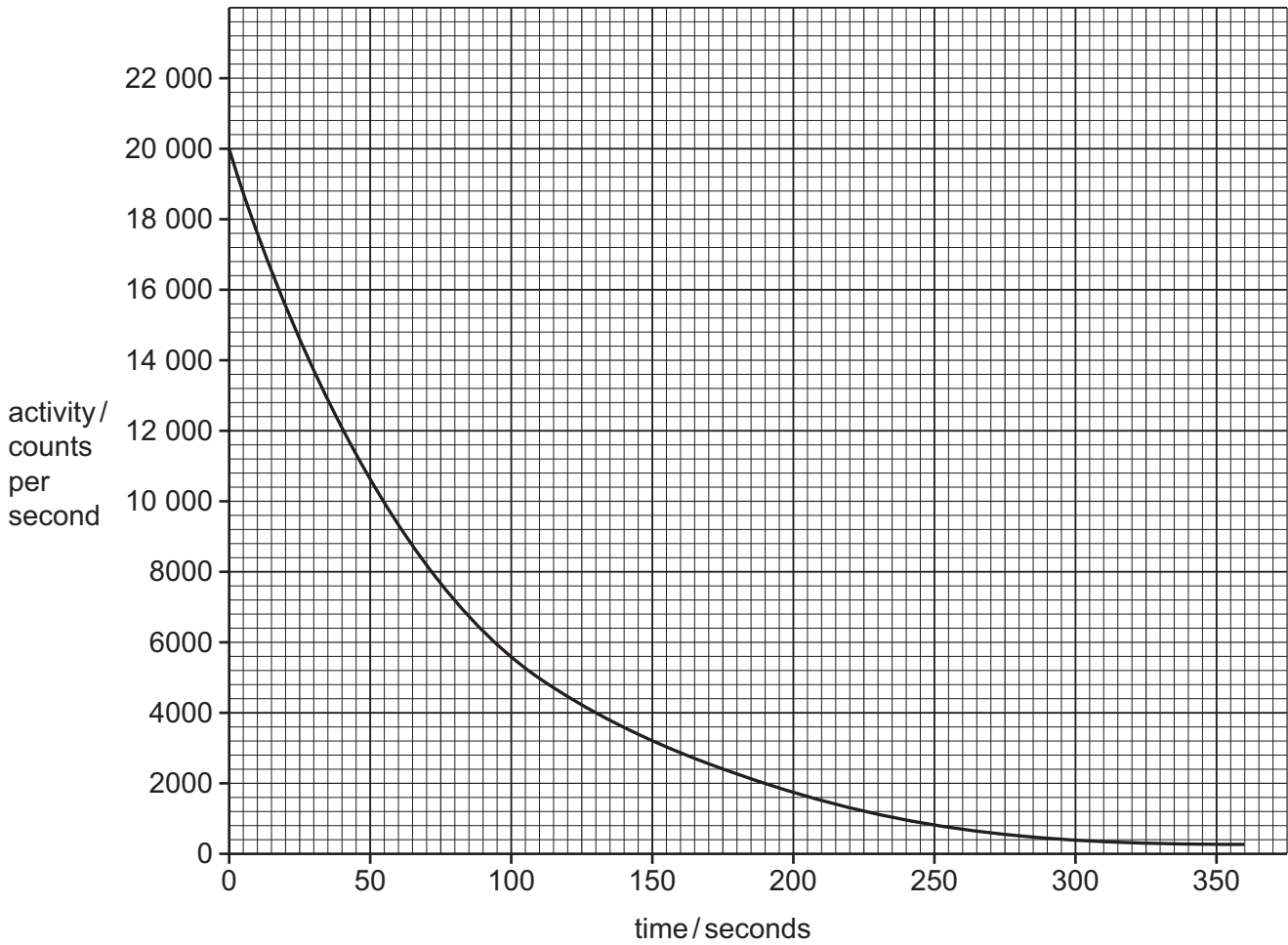


Fig. 6.1

Use the graph to calculate the half-life of the isotope. Show your working on the graph.

..... [2]

(b) There are several isotopes of radon.

State the meaning of the word *isotope*.

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

(c) Radon-220 emits alpha radiation.

Explain why alpha radiation is dangerous to human beings.

.....
.....
.....
.....
.....
..... [4]

For
Examiner's
Use

7 This article appeared in a newspaper in Pakistan in 2006.

For
Examiner's
Use

Many more people in Pakistan and India are developing diabetes. This is an illness where the regulation of blood glucose does not work properly. It is dangerous because rising levels of glucose in the blood can damage cells in many parts of the body, including the blood system and the eyes.

Doctors think that the increase in diabetes is happening because people are eating more fast food. Where they used to eat a lot of rice and lentils, they are now eating more fried foods and greasy take-aways. As well as increasing the risk of diabetes, it is causing an increase in obesity. This also increases the risk of heart disease.

(a) The regulation of blood glucose is part of homeostasis.

Explain the meaning of the term *homeostasis*.

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

(b) (i) Name the hormone that is produced when the blood glucose level rises, and which helps to bring it back down to normal.

..... [1]

(ii) Describe how the hormone reduces the amount of glucose in the blood.

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

(c) When a person with diabetes eats food containing sugar, the concentration of glucose in their blood increases.

Using what you know about osmosis, explain how this might cause damage to body cells.

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

(d) (i) Suggest why eating foods containing a lot of fat, rather than eating lentils and rice, can lead to obesity.

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

(ii) Explain how a poor diet can increase the risk of a heart attack.

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

8 (a) Fig. 8.1 shows part of the Periodic Table. The letters are **not** the chemical symbols of elements.

*For
Examiner's
Use*

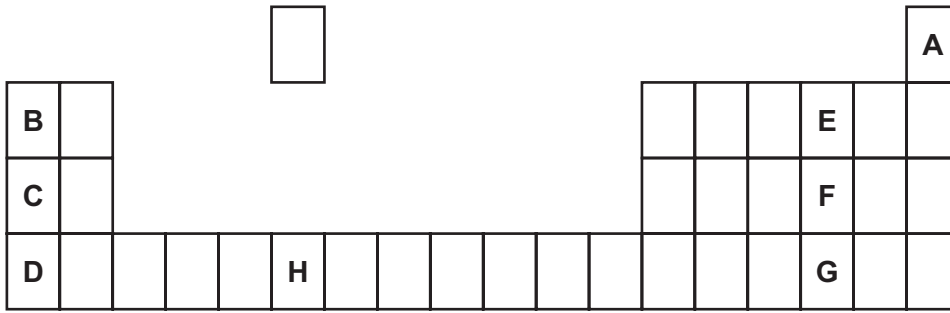


Fig. 8.1

Choose **one** of the letters from **A** to **H**, which shows

a metal which reacts vigorously with cold water

.....

an element whose atoms have only one electron shell

..... [2]

(b) Calcium carbonate, CaCO_3 , is an important compound used in many industries.

A student used the apparatus in Fig. 8.2 to investigate the thermal decomposition of calcium carbonate.

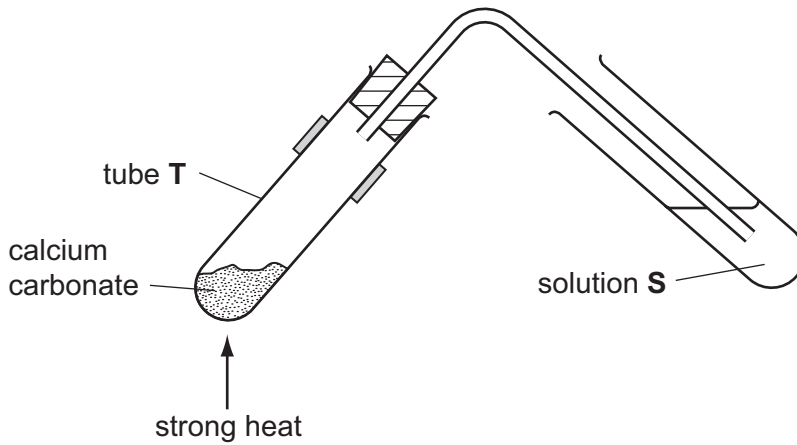


Fig. 8.2

- (i) Write a word equation and a balanced symbolic equation for the reaction which occurs when calcium carbonate is heated strongly.

word equation

.....

symbolic equation

..... [3]

- (ii) Name solution **S** in Fig. 8.2, and predict what would be observed during the reaction.

.....

..... [1]

- (iii) Describe how the student could test the solid which remains in tube **T** to find out if all the calcium carbonate had reacted.

.....

.....

.....

..... [2]

- (iv) Why are large amounts of calcium carbonate sometimes spread on soil which is going to be used for growing crops?

.....

..... [1]

9 (a) A student has six resistors as shown in Fig. 9.1.

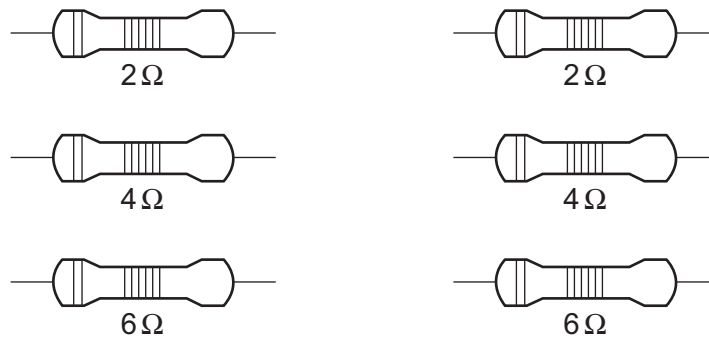


Fig. 9.1

(i) Describe how he can combine **two** of these resistors to get a total resistance of 10 ohms.

.....
 [1]

(ii) Explain how he can combine **two** of these resistors to get a total resistance of three ohms.

.....
 [3]

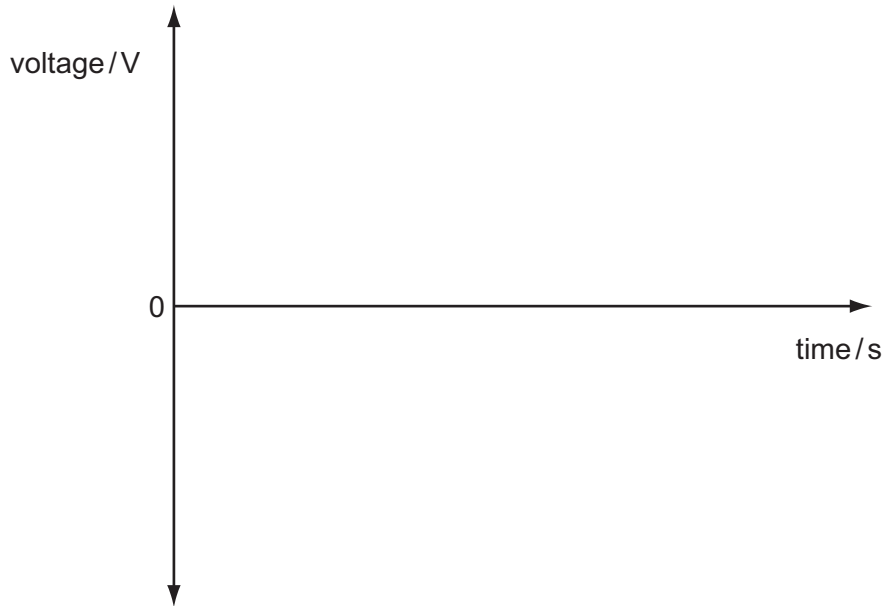
(b) Electricity can be generated by turning a coil of copper wire in a magnetic field.

(i) Describe **two** ways to increase the voltage produced by this generator.

1
 2 [2]

- (ii) Generators can supply an alternating current which has a frequency of 50 Hz.

On the grid below, sketch a graph to show the current produced by this alternating current generator during a period of 0.1 seconds.



[3]

- (c) Electricity is often transmitted through overhead power cables hung from pylons. If these cables are put up on a hot summer day, they are hung loosely from the pylons as shown in Fig. 9.2.

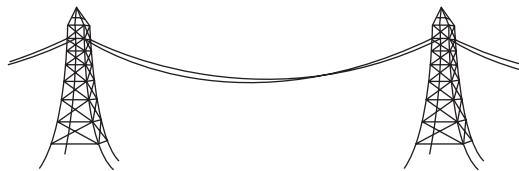


Fig. 9.2

Suggest why they are hung loosely.

.....

.....

..... [2]

DATA SHEET
The Periodic Table of the Elements

		Group																																															
		I	II	III	IV	V	VI	VII	0																																								
		<table style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td style="border: none;"></td> <td style="border: none;">1</td> <td colspan="6" style="border: none;"></td> <td style="border: none;">2</td> <td style="border: none;">4</td> </tr> <tr> <td style="border: none;"></td> <td style="border: none;">H</td> <td colspan="6" style="border: none;"></td> <td style="border: none;">He</td> <td style="border: none;">Helium</td> </tr> <tr> <td style="border: none;">1</td> <td style="border: none;">Hydrogen</td> <td colspan="6" style="border: none;"></td> <td style="border: none;">Ne</td> <td style="border: none;">Neon</td> </tr> </table>									1							2	4		H							He	Helium	1	Hydrogen							Ne	Neon										
	1							2	4																																								
	H							He	Helium																																								
1	Hydrogen							Ne	Neon																																								
7	9																																																
3	4	Li	Be							Ne	20																																						
23	12	Na	Mg							F	9																																						
11	12	Al	Si	P	S	Cl	Ar	35.5	17																																								
5	6	B	C	N	O	14	16	17	18																																								
13	14	Al	Si	P	S	15	16	17	18																																								
13	14	Al	Si	P	S	15	16	17	18																																								
19	20	K	Ca	Sc	Ti	V	Cr	Mn	Fe																																								
19	20	K	Ca	21	22	23	24	25	26																																								
37	38	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru																																								
37	38	Rb	Sr	39	40	41	42	43	44																																								
55	56	Cs	Ba	La	Hf	Ta	W	Re	Os																																								
55	56	Cs	Ba	57	72	73	74	75	76																																								
87	88	Fr	Ra	226	227	227	227	227	227																																								
87	88	Fr	Ra	Ac	Ad	Ad	Ad	Ad	Ad																																								
87	88	Fr	Ra	89	†	†	†	†	†																																								
		<table style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td style="border: none;">115</td> <td style="border: none;">116</td> <td style="border: none;">117</td> <td style="border: none;">118</td> <td style="border: none;">119</td> <td style="border: none;">120</td> <td style="border: none;">121</td> <td style="border: none;">122</td> <td style="border: none;">123</td> <td style="border: none;">124</td> </tr> <tr> <td style="border: none;">In</td> <td style="border: none;">Sn</td> <td style="border: none;">Sb</td> <td style="border: none;">Te</td> <td style="border: none;">Bi</td> <td style="border: none;">Po</td> <td style="border: none;">At</td> <td style="border: none;">Ts</td> <td style="border: none;">Og</td> <td style="border: none;">Lr</td> </tr> <tr> <td style="border: none;">49</td> <td style="border: none;">50</td> <td style="border: none;">51</td> <td style="border: none;">52</td> <td style="border: none;">53</td> <td style="border: none;">54</td> <td style="border: none;">55</td> <td style="border: none;">56</td> <td style="border: none;">57</td> <td style="border: none;">58</td> </tr> <tr> <td style="border: none;">49</td> <td style="border: none;">50</td> <td style="border: none;">51</td> <td style="border: none;">52</td> <td style="border: none;">53</td> <td style="border: none;">54</td> <td style="border: none;">55</td> <td style="border: none;">56</td> <td style="border: none;">57</td> <td style="border: none;">58</td> </tr> </table>								115	116	117	118	119	120	121	122	123	124	In	Sn	Sb	Te	Bi	Po	At	Ts	Og	Lr	49	50	51	52	53	54	55	56	57	58	49	50	51	52	53	54	55	56	57	58
115	116	117	118	119	120	121	122	123	124																																								
In	Sn	Sb	Te	Bi	Po	At	Ts	Og	Lr																																								
49	50	51	52	53	54	55	56	57	58																																								
49	50	51	52	53	54	55	56	57	58																																								
127	128	129	130	131	132	133	134	135	136																																								
I	Te	Bi	Po	At	Ts	Og	Lr	Og	Lr																																								
53	54	55	56	57	58	59	60	61	62																																								
53	54	55	56	57	58	59	60	61	62																																								
169	170	171	172	173	174	175	176	177	178																																								
Tm	Yb	Lu	Hf	Ta	W	Re	Os	Ir	Pt																																								
69	70	71	72	73	74	75	76	77	78																																								
69	70	71	72	73	74	75	76	77	78																																								
167	168	169	170	171	172	173	174	175	176																																								
Er	Tm	Yb	Lu	Hf	Ta	W	Re	Os	Ir																																								
68	69	70	71	72	73	74	75	76	77																																								
68	69	70	71	72	73	74	75	76	77																																								
165	166	167	168	169	170	171	172	173	174																																								
Ho	Er	Tm	Yb	Lu	Hf	Ta	W	Re	Os																																								
67	68	69	70	71	72	73	74	75	76																																								
67	68	69	70	71	72	73	74	75	76																																								
159	160	161	162	163	164	165	166	167	168																																								
Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Ta	W																																								
65	66	67	68	69	70	71	72	73	74																																								
65	66	67	68	69	70	71	72	73	74																																								
157	158	159	160	161	162	163	164	165	166																																								
Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Ta																																								
64	65	66	67	68	69	70	71	72	73																																								
64	65	66	67	68	69	70	71	72	73																																								
152	153	154	155	156	157	158	159	160	161																																								
Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf																																								
63	64	65	66	67	68	69	70	71	72																																								
63	64	65	66	67	68	69	70	71	72																																								
150	151	152	153	154	155	156	157	158	159																																								
Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu																																								
62	63	64	65	66	67	68	69	70	71																																								
62	63	64	65	66	67	68	69	70	71																																								
140	141	142	143	144	145	146	147	148	149																																								
Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho																																								
58	59	60	61	62	63	64	65	66	67																																								
58	59	60	61	62	63	64	65	66	67																																								
232	233	234	235	236	237	238	239	240	241																																								
Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es																																								
90	91	92	93	94	95	96	97	98	99																																								
90	91	92	93	94	95	96	97	98	99																																								

*58-71 Lanthanoid series

†90-103 Actinoid series

a = relative atomic mass

X = atomic symbol

b = proton (atomic) number

Key

a	X	b
---	---	---

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

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

University of Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.