



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

* 6 3 1 9 2 0 2 0 5 9 *

COMBINED SCIENCE **0653/22**
Paper 2 (Core) **May/June 2013**
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 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.
Electrical 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) Fig. 1.1 shows some of the elements in Group 1 of the Periodic Table.

Li
Na
K

Fig. 1.1

(i) Name the gas which is given off when the metals in Fig. 1.1 react with water.

..... [1]

(ii) Describe how the rate of reaction between water and the metals in Fig. 1.1 changes as you go down the group.

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

(b) Fig. 1.2 shows some of the elements in Group 7 of the Periodic Table.

Cl
Br
I

Fig. 1.2

(i) Describe how the melting point of the elements in Fig. 1.2 changes as you go down the group.

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

(ii) A solution of potassium bromide is colourless and a solution of chlorine is almost colourless.

Describe and explain briefly what would be seen when these solutions are mixed.

what would be seen

explanation

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

(c) Phosphorus is a non-metallic, solid element.

One form of phosphorus is white, has the chemical formula P_4 and has to be kept under water.

Fig. 1.3 shows a bottle containing phosphorus.

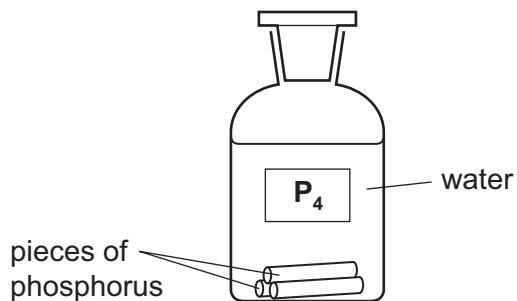


Fig. 1.3

(i) Suggest why white phosphorus has to be stored under water.

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

(ii) Explain the meaning of the chemical formula P_4 .

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

2 (a) Fig. 2.1 shows a child's toy. As the ball falls, the toy elephant moves across the table. For
winner's

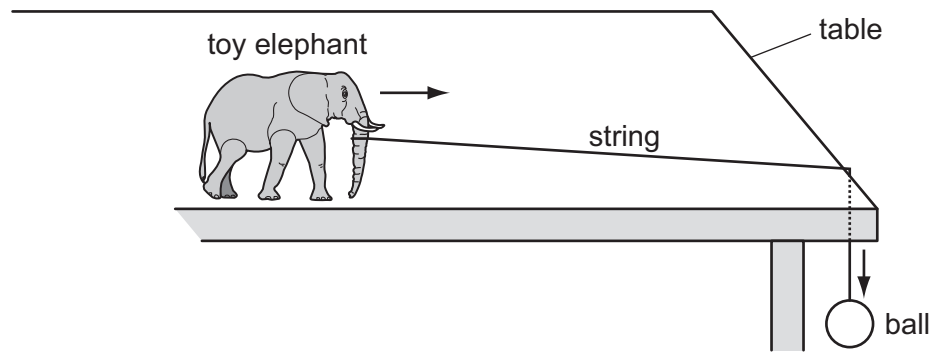


Fig. 2.1

(i) Name the main force that opposes the motion of the toy elephant.
 [1]

(ii) State the unit used to measure forces.
 [1]

(iii) Choose words from the list below to complete the sentences. You may use each word once, more than once or not at all.

- chemical electrical gravitational potential kinetic
 light sound thermal

The useful energy transfer for the toy is energy
 to energy.

The energy wasted by the toy is energy. [2]

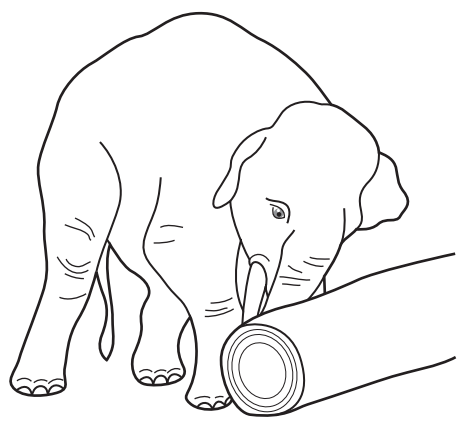
(iv) The toy elephant travels 1.2 metres in 3 seconds.
 Calculate the average speed of the elephant.
 State the formula that you use and show your working.

formula

working

..... m/s [2]

(b) An elephant of mass 5000 kg exerts a constant force to push a tree trunk along a horizontal surface at a steady speed of 1.5 m/s.



State the **two** quantities that would need to be measured to calculate the work done by the elephant.

..... and [2]

(c) An elephant can communicate with other elephants using infrasound. This is a very low frequency vibration which it is usually impossible for a human to hear.

(i) Suggest a possible frequency for this vibration and explain why you chose your answer.

frequency Hz

explanation

..... [2]

(ii) State the meaning of the term *frequency*.

.....

..... [1]

- 3 (a) Four sets of pea seeds were placed in Petri dishes containing either damp soil or damp filter paper. They were left in different conditions, shown in Table 3.1.

Table 3.1

set	conditions		
A	damp soil	cold	dark
B	damp filter paper	warm	light
C	damp filter paper	warm	dark
D	damp soil	cold	light

Predict which sets of seeds will germinate.

Explain your answer.

prediction

explanation

.....

..... [3]

- (b) A pea seed was planted in a pot. When the seed had grown into a young plant, the pot was placed on its side in a room where light was coming from all sides.

Fig. 3.1 shows the young pea plant three days after the pot had been placed on its side.

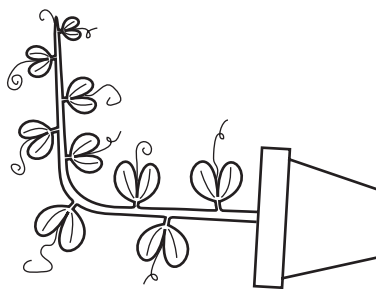


Fig. 3.1

- (i) Which **two** terms describe the response of the plant shown in Fig. 3.1?

Circle the correct answers.

geotropism

photosynthesis

phototropism

sensitivity

transpiration

[2]

(ii) Suggest how this response will help the plant to reproduce sexually when grown to maturity.

.....

.....

.....

..... [2]

4 Fig. 4.1 shows a microwave oven.

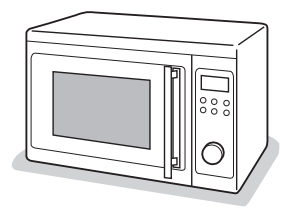


Fig. 4.1

(a) Microwaves cook food by transferring energy to the food.

(i) Choose words from the list to complete the sentences below. You may use each word once, more than once or not at all.

- | | | |
|------------------|-------------------|-------------------|
| chemical | conduction | convection |
| potential | radiation | thermal |

Microwaves are absorbed by the outer layers of food.

The microwave energy is transferred to water and fat molecules in these layers, increasing the energy of these layers.

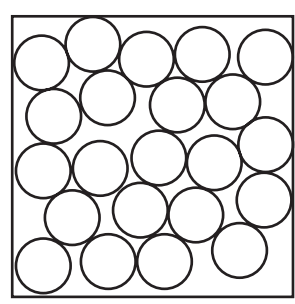
..... energy is mostly transferred to the centre of solid food by [2]

(ii) State **one** use for microwaves other than cooking.

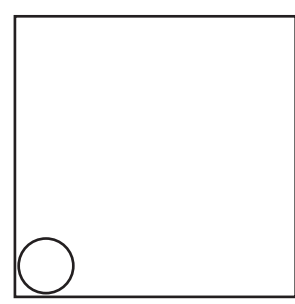
..... [1]

(b) Water can be heated in a microwave oven. The microwave oven is made of solids. The water is a liquid.

Complete Fig. 4.2 to show the arrangement of particles in a solid. The diagram for a liquid has been done for you.



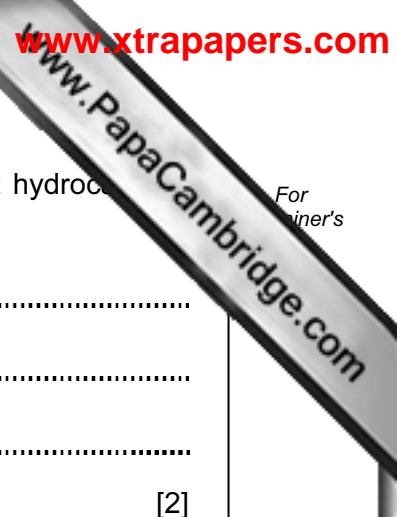
liquid



solid

[2]

Fig. 4.2



5 (a) (i) Explain why hydrogen and carbon are described as elements, but hydrocarbons such as methane and ethane are described as compounds.

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

(ii) Name the fossil fuel found in the Earth that is the main source of methane.

..... [1]

(iii) Name **one** type of fossil fuel that is a solid. [1]

(iv) Methane is used as a fuel because it reacts very quickly with oxygen, releasing heat.

Name the **two** compounds that are formed when methane undergoes complete combustion.

1
2 [2]

(b) Magnesium metal also reacts quickly with oxygen, releasing heat.

(i) Name the compound which is formed when magnesium reacts with oxygen.

..... [1]

(ii) Fig. 5.1 shows diagrams of a magnesium atom and an oxygen atom.

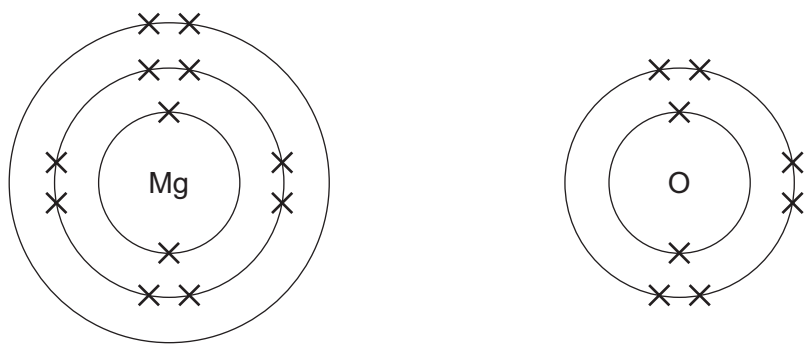


Fig. 5.1

When magnesium reacts with oxygen, the atoms shown in Fig. 5.1 first change into electrically charged atoms known as ions.

Describe what happens when these atoms change into ions.

magnesium

.....

oxygen

..... [2]

6 Fig. 6.1 shows a food chain. The arrows show how energy flows from one organism to another, along the chain.

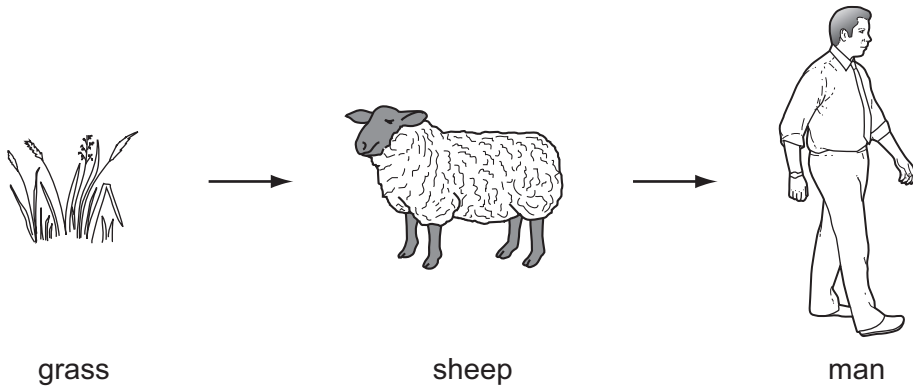


Fig. 6.1

(a) Energy enters the food chain as sunlight. Plant leaves use this energy to make food.

(i) Name the substance in the leaves of a plant that absorbs this energy.

..... [1]

(ii) Name the **two** raw materials that the plant uses to make food.

1 2 [2]

(iii) Name the gas released from plant leaves during this process.

..... [1]

(b) A sheep is a herbivore.

Define the term *herbivore*.

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

(c) Meat from the sheep contains protein.

Describe the importance of protein in the diet.

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

(d) The cells in the man's body use respiration to release useful energy from nutrients he has absorbed.

(i) Tick the processes in the list below that use energy.

the diffusion of oxygen from the lungs into the blood

the passage of nerve impulses along a nerve cell

muscle contraction

protein synthesis

[1]

(ii) A person living in a very cold climate generally needs to eat more than a person living in a hot climate.

Explain why.

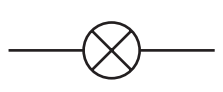
.....

.....

..... [2]

7 (a) The diagrams below show the circuit symbols for three components of an electrical circuit (flashlight).

(i) On the line below each diagram, state the name of the component.



..... [3]

(ii) Using **only** these symbols, draw a circuit diagram for a torch.

[1]

(b) Torches are usually powered by electrical cells. They can also be powered by energy from the Sun (solar energy).

Solar energy is a renewable energy resource.

(i) Name **one** other renewable energy resource.

..... [1]

(ii) Name **one** non-renewable energy resource.

..... [1]

(iii) Energy is transferred from the Sun to the Earth by radiation.

Explain why energy cannot be transferred from the Sun to the Earth by conduction.

..... [1]

(c) A ray of light from the torch is reflected by a mirror. This is shown in Fig. 7.1.

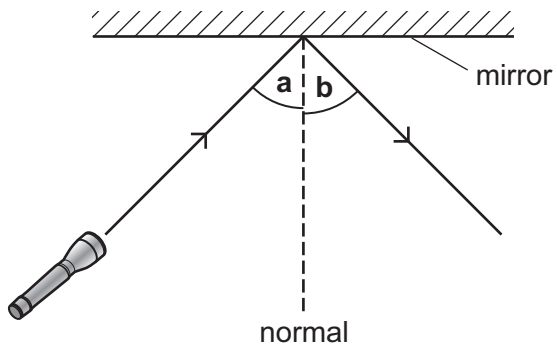


Fig. 7.1

Angle **a** has a value of 45° .

Name angle **b** and write down its value.

name

value $^\circ$

[2]

8 (a) A student added a solution of the same dilute acid to each of the test-tubes shown in Fig. 8.1.

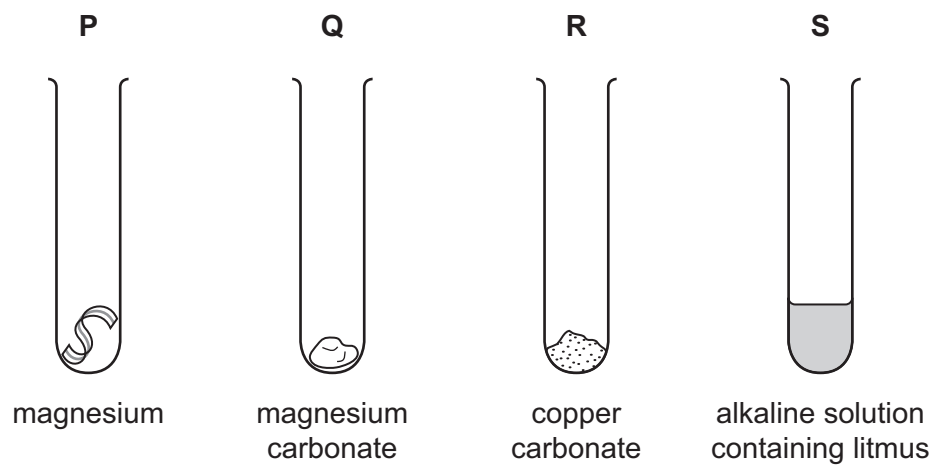


Fig. 8.1

Complete Table 8.1 by matching the test-tubes, **P**, **Q**, **R** and **S**, with the observations which are made when the dilute acid reacts with the contents.

One of the observations applies to more than one of the test-tubes. You may use each letter once, more than once or not at all.

Table 8.1

observations	test-tube(s)
Hydrogen gas is given off.	
A blue solution is formed.	
Carbon dioxide gas is given off.	

[3]

(b) The student used the apparatus shown in Fig. 8.2 to investigate neutralisation reactions involving three acids, **A**, **B** and **C**.

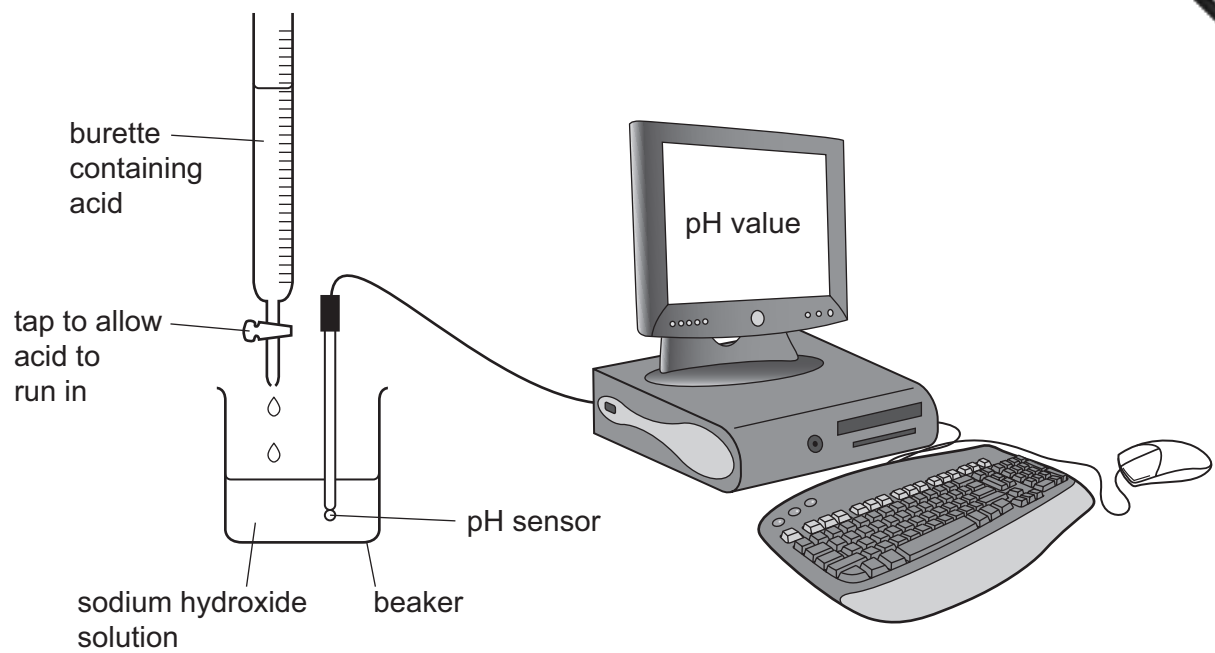


Fig. 8.2

25.0 cm³ of the same solution of the alkali, sodium hydroxide, were placed into each of three beakers.

Acid was slowly added to each of the beakers in turn, and the pH values of the mixtures were displayed on the computer screen.

Some of the measurements from the three experiments are shown in Table 8.2.

Table 8.2

acid	source of acid	volume required to neutralise the alkali / cm ³
A	sample taken from an acidic lake	42.0
B	sample taken from a car battery	15.0
C	acid from a chemical laboratory	60.0

(i) Suggest a possible pH value of the alkali before any acid was added.
..... [1]

(ii) Describe briefly what the student would observe when the acid had neutralised the alkali.
.....
..... [1]

(iii) State, with a reason, which acid, **A**, **B** or **C**, had the highest concentration.

acid

reason

..... [1]

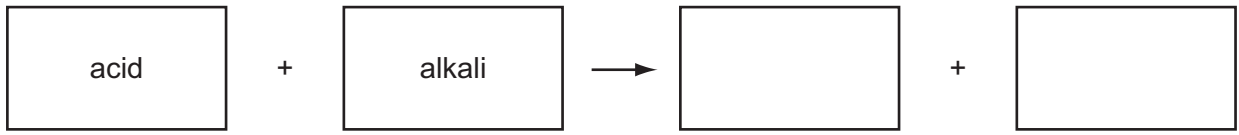
(iv) The student noticed that, in all three experiments, the temperature of the mixture increased as the acid was added.

Suggest why the temperature increased.

.....

..... [1]

(v) Complete the general word equation for the reaction which occurs between an acid and an alkali.



[2]

9 Fig. 9.1 shows a section through a small blood vessel.

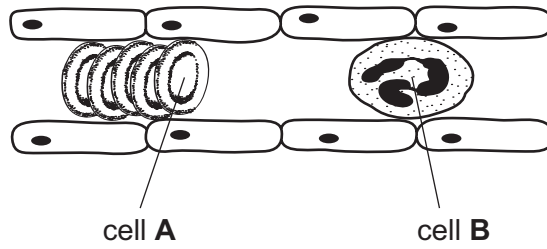


Fig. 9.1

(a) Cell A is a red blood cell.

(i) Outline **two** ways in which this cell differs from a liver cell.

- 1
- 2 [2]

(ii) Describe the function of a red blood cell.

.....

.....

.....

..... [2]

(b) Describe the function of cell B.

.....

.....

.....

..... [2]



(c) Complete the sentences about the functions of blood plasma, using words from the list. You may use each word once, more than once, or not at all.

- | | | | |
|-------------------|----------------|------------------|------------------------|
| adrenaline | enzymes | insoluble | small intestine |
| soluble | stomach | starch | vitamins |

Blood plasma transports nutrients such as sugars.

These nutrients enter the blood in the

Blood plasma also transports hormones such as [3]

DATA SHEET
The Periodic Table of the Elements

		Group																																																																							
		I	II	III	IV	V	VI	VII	0																																																																
		1 H Hydrogen 1																																																																							
7	9	Li Lithium 3	Be Beryllium 4																																																																						
23	24	Na Sodium 11	Mg Magnesium 12																																																																						
39	40	K Potassium 19	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	88	Rb Rubidium 37	Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	101 Ru Ruthenium 44	101 Rh Rhodium 45	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	137	Cs Caesium 55	Ba Barium 56	139 La Lanthanum 57	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	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	210 Po Polonium 84	210 At Astatine 85	210 Rn Radon 86																																																							
87	226	Fr Francium 87	Ra Radium 88	227 Ac Actinium 89																																																																					
		*58-71 Lanthanoid series																																																																							
		†90-103 Actinoid series																																																																							
		<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td style="width: 10%;"></td> <td style="width: 10%;"></td> <td style="width: 10%;">140</td> <td style="width: 10%;">141</td> <td style="width: 10%;">144</td> <td style="width: 10%;">150</td> <td style="width: 10%;">152</td> <td style="width: 10%;">157</td> <td style="width: 10%;">159</td> <td style="width: 10%;">162</td> <td style="width: 10%;">165</td> <td style="width: 10%;">167</td> <td style="width: 10%;">169</td> <td style="width: 10%;">173</td> <td style="width: 10%;">175</td> </tr> <tr> <td></td> <td></td> <td>Ce Cerium 58</td> <td>Pr Praseodymium 59</td> <td>Nd Neodymium 60</td> <td>Pm Promethium 61</td> <td>Sm Samarium 62</td> <td>Eu Europium 63</td> <td>Gd Gadolinium 64</td> <td>Tb Terbium 65</td> <td>Dy Dysprosium 66</td> <td>Ho Holmium 67</td> <td>Er Erbium 68</td> <td>Tm Thulium 69</td> <td>Yb Ytterbium 70</td> <td>Lu Lutetium 71</td> </tr> <tr> <td></td> <td></td> <td>232</td> <td>232</td> <td>238</td> <td>238</td> <td>238</td> <td>238</td> <td>238</td> <td>238</td> <td>238</td> <td>238</td> <td>238</td> <td>238</td> <td>238</td> </tr> <tr> <td></td> <td></td> <td>Th Thorium 90</td> <td>Pa Protactinium 91</td> <td>U Uranium 92</td> <td>Np Neptunium 93</td> <td>Pu Plutonium 94</td> <td>Am Americium 95</td> <td>Cm Curium 96</td> <td>Bk Berkelium 97</td> <td>Cf Californium 98</td> <td>Es Einsteinium 99</td> <td>Fm Fermium 100</td> <td>Md Mendelevium 101</td> <td>No Nobelium 102</td> <td>Lr Lawrencium 103</td> </tr> </table>												140	141	144	150	152	157	159	162	165	167	169	173	175			Ce Cerium 58	Pr Praseodymium 59	Nd Neodymium 60	Pm Promethium 61	Sm Samarium 62	Eu Europium 63	Gd Gadolinium 64	Tb Terbium 65	Dy Dysprosium 66	Ho Holmium 67	Er Erbium 68	Tm Thulium 69	Yb Ytterbium 70	Lu Lutetium 71			232	232	238	238	238	238	238	238	238	238	238	238	238			Th Thorium 90	Pa Protactinium 91	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
		140	141	144	150	152	157	159	162	165	167	169	173	175																																																											
		Ce Cerium 58	Pr Praseodymium 59	Nd Neodymium 60	Pm Promethium 61	Sm Samarium 62	Eu Europium 63	Gd Gadolinium 64	Tb Terbium 65	Dy Dysprosium 66	Ho Holmium 67	Er Erbium 68	Tm Thulium 69	Yb Ytterbium 70	Lu Lutetium 71																																																										
		232	232	238	238	238	238	238	238	238	238	238	238	238																																																											
		Th Thorium 90	Pa Protactinium 91	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																																																										
		<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td style="width: 10%;"></td> <td style="width: 10%;"></td> <td style="width: 10%;">a</td> <td style="width: 10%;">X</td> <td style="width: 10%;">b</td> </tr> <tr> <td colspan="2"></td> <td colspan="3">Key</td> </tr> <tr> <td colspan="2"></td> <td colspan="3">a = relative atomic mass</td> </tr> <tr> <td colspan="2"></td> <td colspan="3">X = atomic symbol</td> </tr> <tr> <td colspan="2"></td> <td colspan="3">b = proton (atomic) number</td> </tr> </table>												a	X	b			Key					a = relative atomic mass					X = atomic symbol					b = proton (atomic) number																																							
		a	X	b																																																																					
		Key																																																																							
		a = relative atomic mass																																																																							
		X = atomic symbol																																																																							
		b = proton (atomic) number																																																																							

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.