UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

4719596603

PHYSICAL SCIENCE **0652/33**

Paper 3 (Extended) **October/November 2012**

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	
10	
Total	

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

For Examiner's Use

1 Table 1.1 shows elements in a period of the Periodic Table.

Table 1.1

group	I	II	III	IV	V	VI	VII
element	Na	Mg	A*l*	Si	P	S	C*l*

(a) Describe how the electronic structure of successive elements differs across the period.

.....

[1]

(b) Complete Table 1.2 to show which of these elements are metals and which are non-metals.

Table 1.2

metals	**non-metals**

[1]

(c) Calcium forms an ion Ca^{2+}. Chlorine form an ion Cl^{-}.

(i) Deduce the formula for the ionic compound calcium chloride.

.....

[1]

(ii) Describe, in terms of electrons, how calcium and chlorine atoms form calcium chloride.

.....

.....

.....

.....

.....

[3]

(d) Sulfur dioxide is a covalent molecule.

For Examiner's Use

In the box below, draw a diagram to show the arrangement of all the outer electrons of the atoms in a molecule of sulfur dioxide.

[3]

2 Fig. 2.1a shows a high jumper about to leave the ground. Fig. 2.1b shows the same high jumper at the top of his flight.

For Examiner's Use

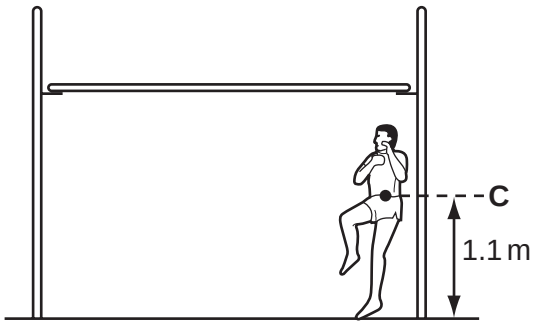


Fig. 2.1a

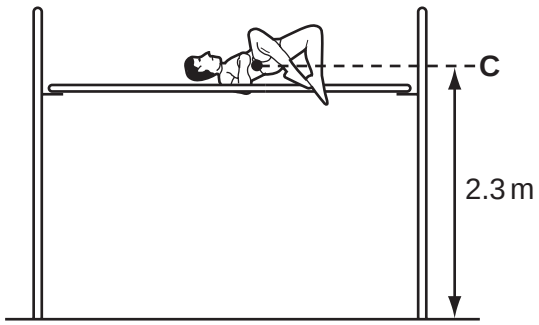


Fig. 2.1b

The high jumper has a mass of 75 kg. Point **C** shows the centre of mass of the high jumper.

(a) Explain what is meant by the term *centre of mass*.

.....

.....

..... [2]

(b) (i) Calculate the increase in the gravitational potential energy of the high jumper from when he leaves the ground to when he reaches the top of his flight.

[g = 10 N / kg]

increase in gravitational potential energy = ... [2]

(ii) State the minimum kinetic energy with which the high jumper must leave the ground.

kinetic energy = ... [1]

For Examiner's Use

(c) On a second jump the same high jumper leaves the ground with kinetic energy of 750 J.

Calculate the speed at which he leaves the ground.

speed = ... [3]

(d) The gain in potential energy of the high jumper is less than the work he does in his take off.

Suggest a reason for this.

.....

..... [1]

For Examiner's Use

3 Magnesium sulfate is a salt that is soluble in water.

It can be made in the laboratory from solid magnesium oxide, MgO, and dilute sulfuric acid, H_2SO_4.

(a) Describe how you would make pure dry crystals of magnesium sulfate from solid magnesium oxide and dilute sulfuric acid.

.....

.....

.....

.....

..... [4]

(b) Write a balanced equation for the reaction between magnesium oxide and sulfuric acid.

Include state symbols in your equation.

..... [3]

(c) Magnesium sulfate can also be made from magnesium hydroxide and sulfuric acid.

$$Mg(OH)_2 + H_2SO_4 \longrightarrow MgSO_4 + 2H_2O$$

What is the maximum mass of magnesium sulfate that could be made from 5.0 g magnesium hydroxide?

[Relative atomic masses: A_r: H,1; Mg,24; O,16; S,32]

Show your working in the box.

mass of magnesium sulfate = ... g [3]

For Examiner's Use

4 Fig. 4.1 shows a wind powered generator which has an efficiency of 30 %.

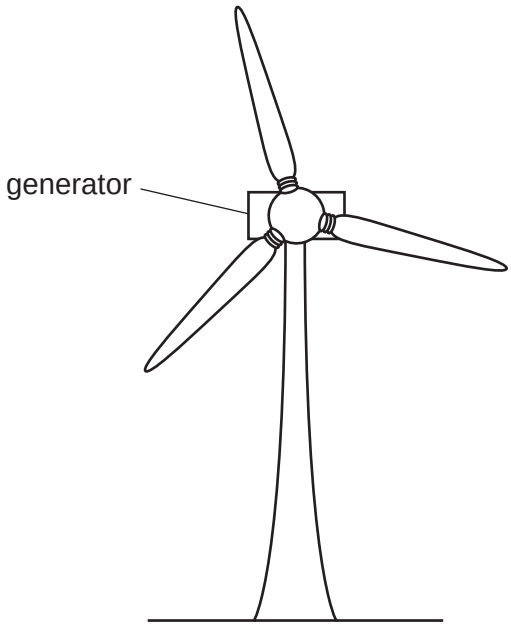


Fig. 4.1

(a) The generator depends on a form of energy possessed by the wind.

Name this form of energy and briefly explain your answer.

.....

.....

..... [2]

(b) Explain what is meant by the phrase *the generator has an efficiency of 30 %*.

.....

.....

..... [2]

(c) The generator has a maximum output of 4500 W at 230 V.

Calculate the maximum current that can be taken from the generator.

current = ... [2]

5 A student uses the apparatus shown in Fig. 5.1 to investigate the reaction between magnesium and hydrochloric acid.

For Examiner's Use

$$Mg + 2HCl \longrightarrow MgCl_2 + H_2$$

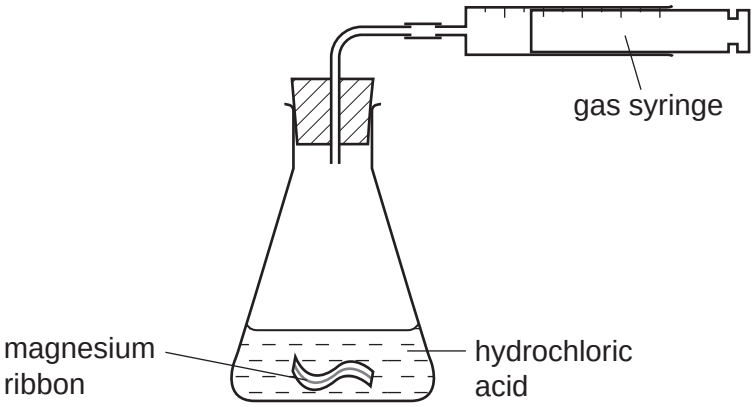


Fig. 5.1

She measures, at room temperature and pressure, the hydrogen given off when magnesium ribbon reacts with an excess of dilute hydrochloric acid.

Results of her investigation are shown in Fig. 5.2.

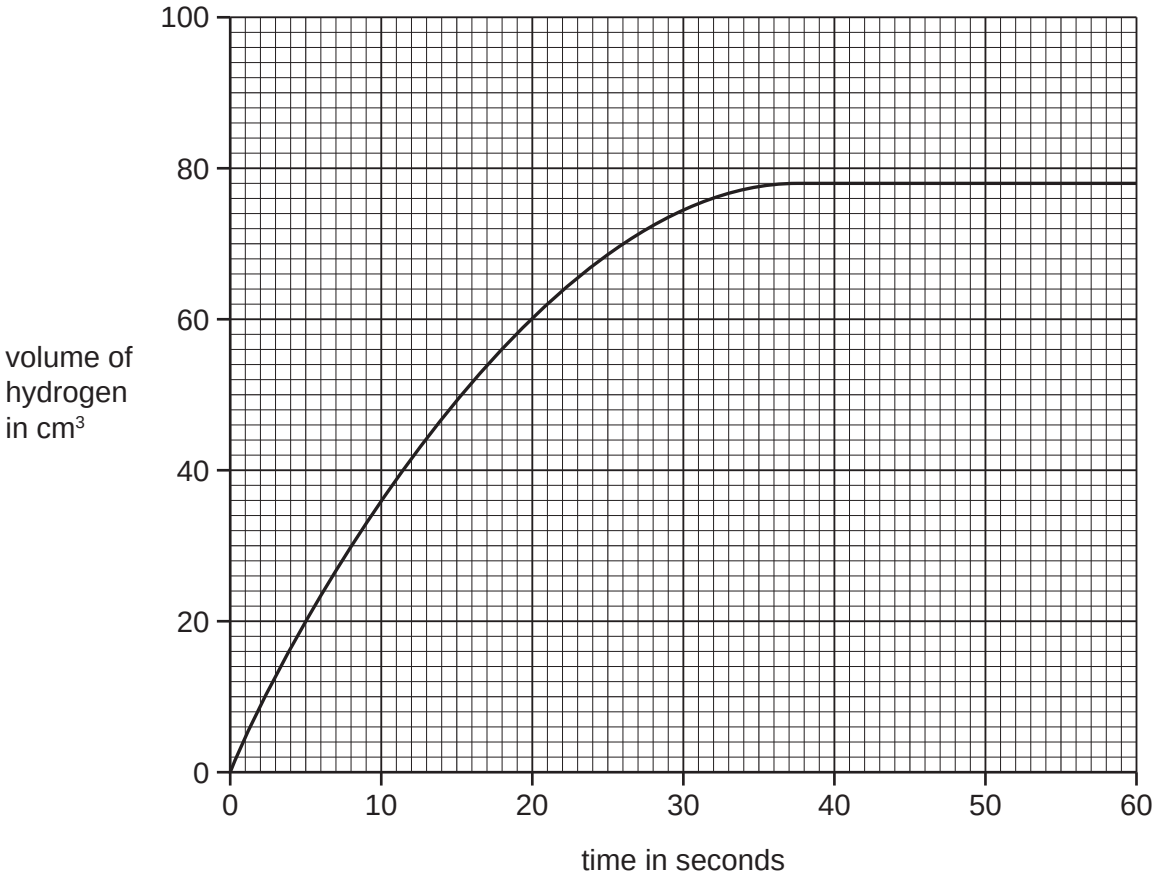


Fig. 5.2

(a) (i) State the time at which the reaction stopped.

.....[1]

(ii) Explain why the reaction stopped.

.....[1]

(b) The experiment is repeated using the same mass of magnesium ribbon and a more concentrated solution of hydrochloric acid.

On Fig. 5.2, sketch the line you would expect for this second experiment. [2]

(c) Calculate the mass of magnesium used in the reaction.

[Relative atomic masses: A_r: H,1; C*l*,35.5; Mg,24.]

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure.

Show your working in the box.

mass of magnesium = ... g [4]

[Turn over

For Examiner's Use

6 **(a)** Fig. 6.1 shows a parallel beam of light incident on a converging lens.

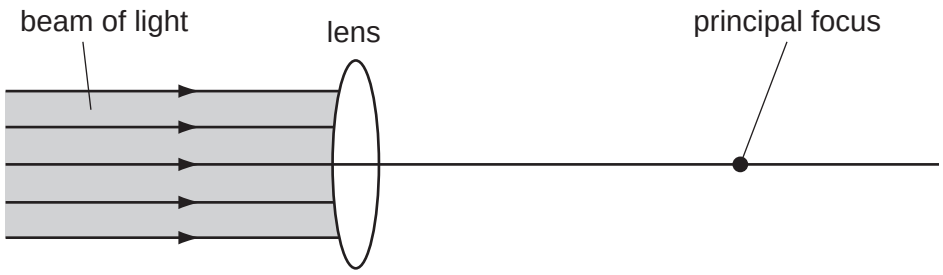


Fig. 6.1

(i) On Fig. 6.1, draw rays to show the path of the light after it passes through the lens. [3]

(ii) On Fig. 6.1, draw an arrow to show the focal length of the lens. [1]

(b) **(i)** Jan uses a converging lens of focal length 10.5 cm to study a small insect. Point **P** on the insect is 5.0 cm from the centre of the lens.

On Fig. 6.2, draw **two** rays from point **P** to show how and where the image of the insect is formed. [3]

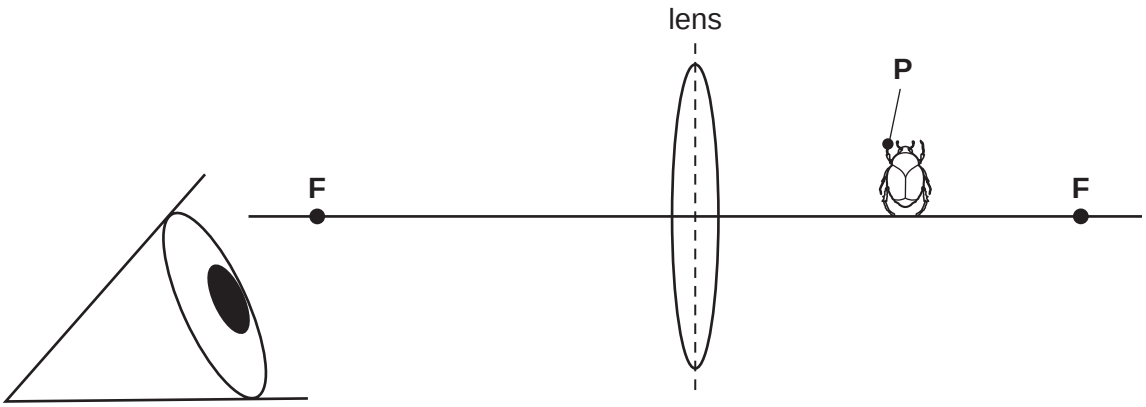


Fig. 6.2

(ii) Give a full description of the image.

.... [2]

For Examiner's Use

7 Zinc and copper are two commonly used metals.

(a) Zinc is mixed with copper to make the alloy brass.

Brass is stronger than either pure metal. Explain why.

.....

.....

.....

.....

..... [3]

(b) Zinc is used to make galvanised steel.

(i) What is galvanised steel?

..... [1]

(ii) Explain how galvanised steel is more useful than steel that has not been galvanised.

..... [1]

(iii) Explain how zinc makes this improvement to steel.

.....

.....

.....

..... [2]

(c) Copper is used to make saucepans.

State which property of copper makes it a good choice for this application.

..... [1]

For Examiner's Use

8 Daniel is investigating the resistance of a length of nichrome wire. He builds the circuit shown in Fig. 8.1.

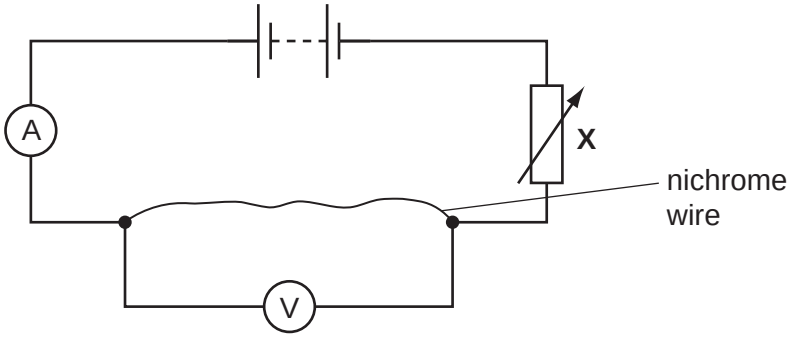


Fig. 8.1

(a) He takes a series of readings of the current with different potential differences across the nichrome wire. He uses his results to draw the graph shown in Fig. 8.2.

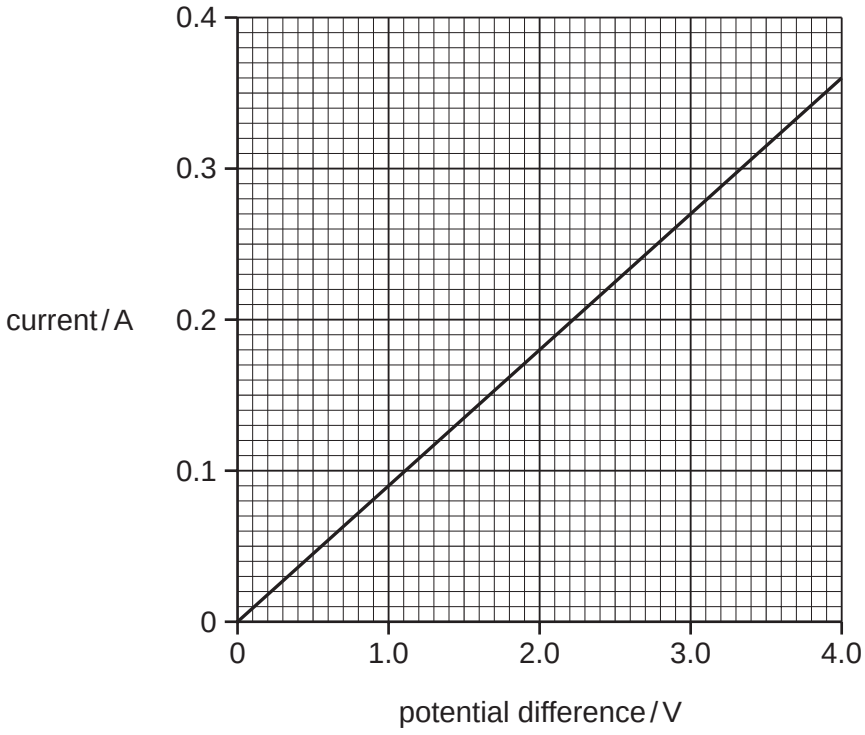


Fig. 8.2

(i) Describe how he varies the potential difference across the nichrome wire.

.....

..... [1]

For Examiner's Use

(ii) Use the graph to determine the resistance of the nichrome wire.

Show your working.

resistance = ... [3]

(b) Daniel then uses a second piece of nichrome wire half the diameter of the original wire.

Calculate the resistance of this piece of wire.

resistance = ... [2]

For Examiner's Use

9 Poly(ethene) is made from ethene, C_2H_4.

(a) Ethene is an unsaturated compound.

Explain the meaning of the term *unsaturated*.

.....

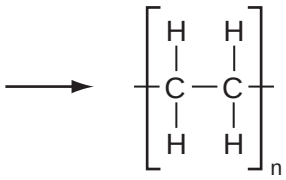
..... [1]

(b) Describe how the ethene for this process is made.

.....

..... [2]

(c) Complete this equation to show the formation of poly(ethene) from ethene.



[2]

Please turn over for Question 10.

10 Fig. 10.1 shows a transformer.

For Examiner's Use

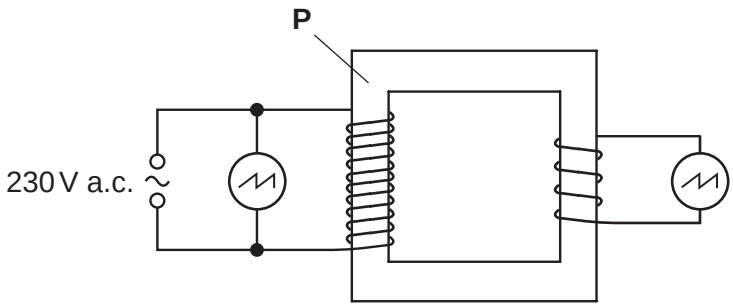


Fig. 10.1

The input is connected to a cathode ray oscilloscope (c.r.o.) and the output is connected to another c.r.o.

(a) (i) The transformer works by electromagnetic induction.

Explain what is meant by *electromagnetic induction*.

.....

.....

..... [2]

(ii) Explain why the input to the transformer must be an alternating voltage.

.....

.....

..... [2]

(iii) **P** is the transformer core.

Name the material that **P** is made from. ..... [1]

(iv) Outline the role of **P** in the operation of the transformer. Your answer should include the properties of the material which make it suitable.

.....

.....

..... [2]

(b) (i) This transformer allows an appliance designed to be used on a 115 V supply to be used on a 230 V supply.

Calculate the turns ratio of the primary coil to the secondary coil ($N_{primary}$: $N_{secondary}$).

($N_{primary}$: $N_{secondary}$) = ... [1]

(ii) Fig. 10.2 shows the screen of the c.r.o. that is connected to the input.

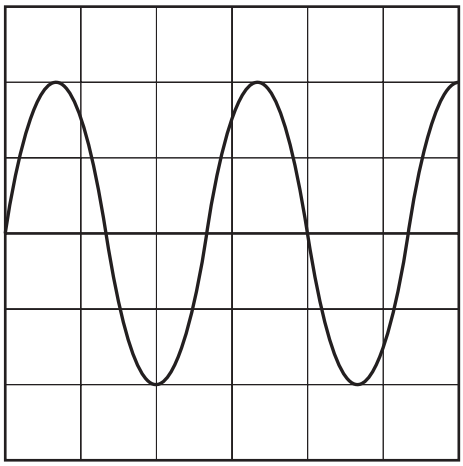


Fig. 10.2

On Fig. 10.2, draw the trace that would be obtained on the c.r.o. connected to the output.

You should assume that the time base and y-gain settings of the two cathode ray oscilloscopes are the same. [2]

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DATA SHEET
The Periodic Table of the Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 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 †															

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

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

Key: a over **X** over 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.).