Centre Number	Candidate Number	Name

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

PHYSICAL SCIENCE **0652/02**

Paper 2

May/June 2004

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 in the spaces provided on the Question Paper.
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.

Answer **all** questions.
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.
A copy of the Periodic Table is printed on page 16.

If you have been given a label, look at the details. If any details are incorrect or missing, please fill in your correct details in the space given at the top of this page.

Stick your personal label here, if provided.

FOR EXAMINER'S USE	
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Total	

This document consists of **16** printed pages.

1 Fig. 1.1(a) shows a spring used in the suspension of a cart.

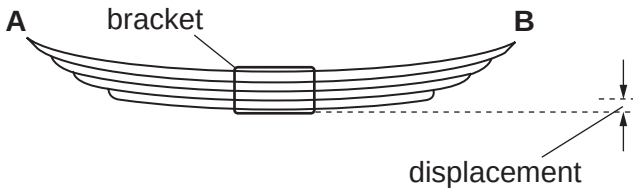


Fig. 1.1(a)

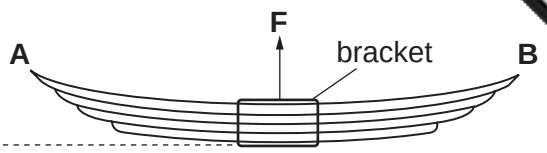


Fig. 1.1(b)

A student supports the ends **A** and **B**. He applies an upward force **F** to the bracket, as shown in Fig. 1.1(b), and records the displacement at the centre of the spring. The table in Fig. 1.2 shows the results.

force / N	displacement / cm
0	0
200	3.0
400	5.9
600	9.1
800	12.0
1000	15.1
1200	18.0

Fig. 1.2

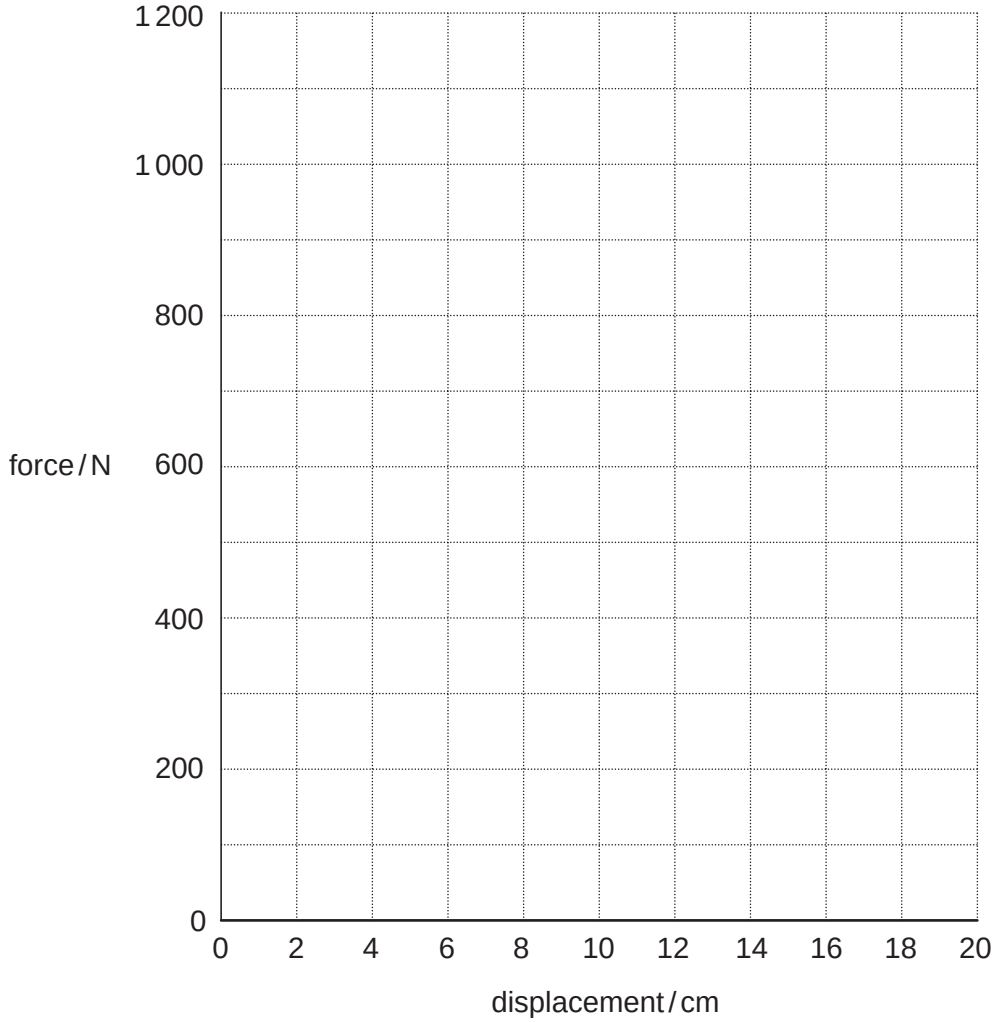


Fig. 1.3

(a) Plot a graph of the force against displacement using the grid in Fig. 1.3. [3]

(b) The instructions for building a cart state that the spring must not be displaced by more than 0.8 cm nor less than 0.6 cm for every 50 N that is added to the force.

Use the graph to help you to explain whether the spring is suitable.

.....

.....

.....[3]

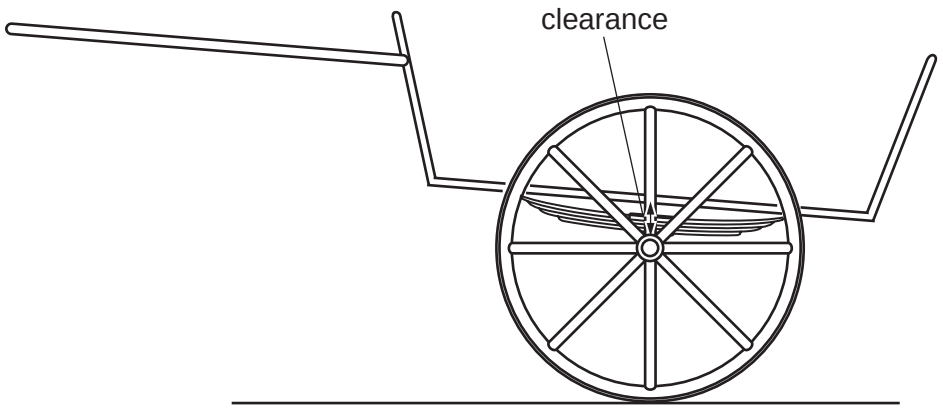


Fig. 1.4

(c) Fig. 1.4 shows the spring, which supports the axle, attached to the cart.

The maximum displacement that the spring can have is 14 cm.

Use your graph to find this load.

load = ... N [2]

2 **(a)** Oxygen in the air consists mainly of the isotope $^{16}_{8}O$ with some $^{18}_{8}O$.

Complete the table for these isotopes.

	$^{16}_{8}O$	$^{18}_{8}O$
number of protons in nucleus		
number of neutrons in nucleus		
arrangement of electrons in shells in the atom		

[2]

(b) In terms of covalent bonding, explain how oxygen and hydrogen form a molecule of water, H_2O. Draw a diagram to help your explanation.

.....

.....[2]

3 **(a)** Methanol, CH_3OH, burns in excess air to form carbon dioxide and water.

methanol + oxygen $\longrightarrow$ carbon dioxide + water

Balance the chemical equation for this reaction.

$2CH_3OH + \ldots O_2 \longrightarrow 2CO_2 + 4H_2O$ [1]

(b) Use the information in the Periodic Table on page 16 to calculate the relative molecular mass, M_r, of methanol.

Show your working.

M_r = ... [2]

(c) The relative molecular mass for carbon dioxide is greater than for methanol yet carbon dioxide is a gas and methanol a liquid at room temperature.

Suggest a reason for this physical difference.

.....

.....[1]

4 **(a)** Some solids are safe when they are in large lumps, but burn explosively in air when in a fine powder.

Explain why the size of the pieces has this effect.

.....

.....

.....[2]

(b) Some solids can react explosively when added to an acid.

State how to make these reactions safer by altering

(i) the concentration of the acid,

.....[1]

(ii) the temperature of the acid.

.....[1]

5 Fig. 5.1 shows an electronic system for locking a safe door. The diagram shows the the locked position with the spring pushing the bolt firmly into the wall.

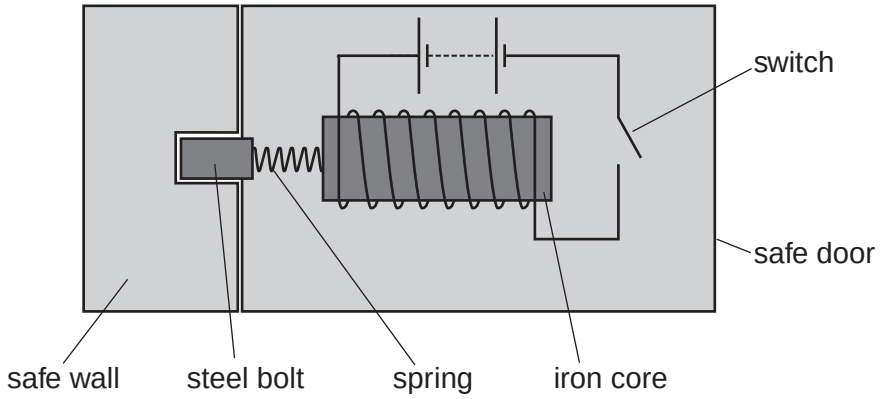


Fig. 5.1

(a) Explain why the door can be opened when the switch is closed.

.....

.....[2]

(b) Explain why iron is a suitable material from which to make the core.

.....

.....[2]

(c) A burglar attempts to open the safe by cutting the wires from the battery. Explain why this will **not** work.

.....

.....[2]

6 **(a)** Steam is condensed to water during a distillation experiment.

Use the kinetic particle theory of matter to explain why energy must be **removed** to condense a gas to form a liquid.

.....

.....

.....[2]

(b) Two liquids **P** and **Q** are cooled to form solids. The temperature and time are recorded during each experiment and graphs are plotted, as shown in Fig. 6.1.

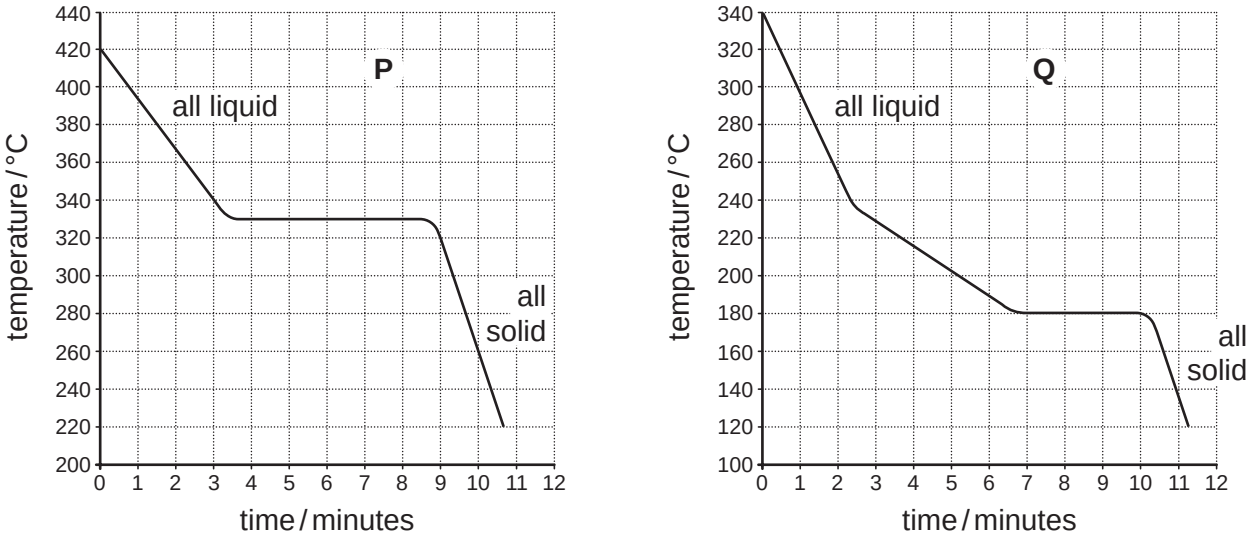


Fig. 6.1

(i) Use Fig. 6.1 to determine the melting point of **P**. ..... °C [1]

(ii) Explain how these cooling curves show that **P** is a pure substance and that **Q** is a mixture of substances.

.....

.....

.....[2]

7 Magnesium reacts slowly with water at room temperature.

Potassium reacts vigorously with water at room temperature.

(a) Explain this difference of reaction in terms of the reactivity series of metals.

.....[1]

(b) The reaction between potassium and water is exothermic and produces an alkaline solution and hydrogen.

(i) Explain the meaning of *exothermic*.

.....[1]

(ii) Describe how to test for the alkaline solution.

test .....

result .....[2]

(iii) A student collects some of the hydrogen in a test-tube.

Describe how to test for the hydrogen produced.

test .....

result .....[2]

8 Fig. 8.1 shows a child's toy aeroplane. The plane is powered by turning the propeller a rubber band.

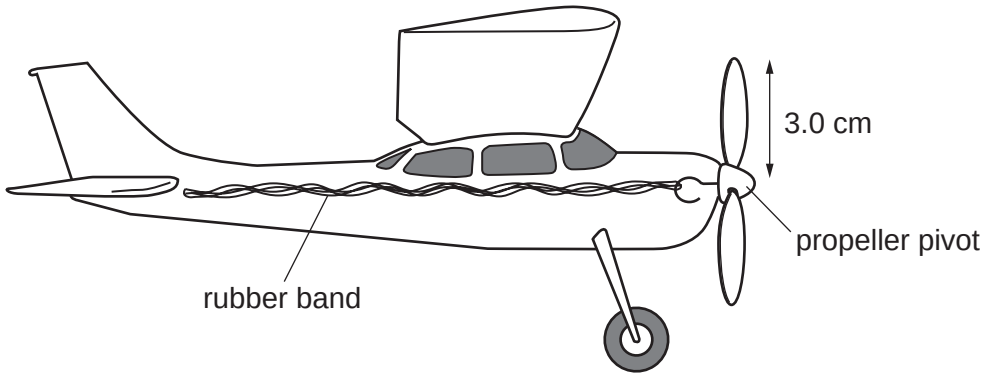


Fig. 8.1

(a) Complete the sentences below.

The twisted rubber band has ..... energy. This is converted into mainly ..... energy as it begins to untwist and turn the propeller, although some is lost to the surroundings as waste ..... energy. To wind the rubber band up again the child must do ..... in twisting it. [4]

(b) The child has to apply a perpendicular force of 2.5 N at 3 cm from the propeller pivot in order to turn the propeller.

Calculate the moment of this force about the pivot. Show your working and include the unit.

moment = ... [3]

(c) When the child releases the aeroplane it travels a distance of 48 m in 16 s.

Calculate the average speed at which the aeroplane travelled. Show your working and include the unit.

speed = ... [3]

9 Common pollutants in the air are carbon monoxide and sulphur dioxide.

(a) Explain why carbon monoxide can have an adverse effect on human health.

.....

.....

.....[2]

(b) Explain why sulphur dioxide can have an adverse effect on buildings.

.....

.....

.....[2]

10 **(a)** Draw the structures of ethanol, C_2H_6O, and ethanoic acid, $C_2H_4O_2$.

ethanol ethanoic acid

[4]

(b) State two uses of ethanol.

1 .....

2 .....[2]

11 Fig. 11.1 shows a circuit which could be used to investigate the current-voltage charac of a metallic wire.

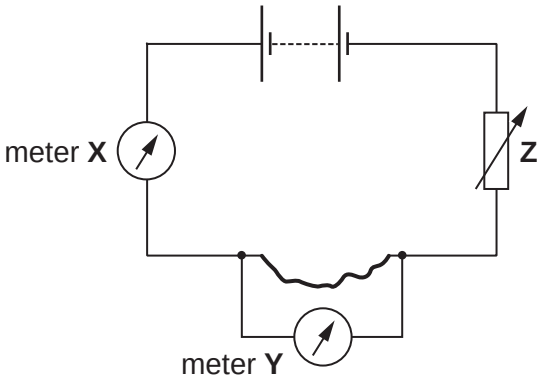


Fig. 11.1

(a) Name the components **X**, **Y** and **Z**.

X .....

Y .....

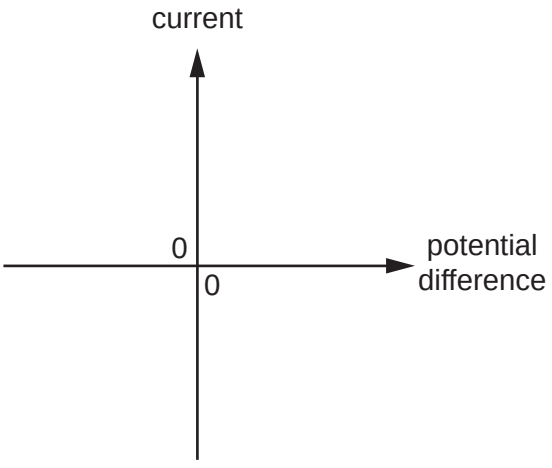
Z ..... [3]

(b) Explain the purpose of component **Z**.

.....

.....[2]

(c) On the axes in Fig. 11.2 complete the graph to show the characteristics of a metallic conductor.



[2]

Fig. 11.2

12 A student adds a small quantity of a solid oxide to water in a test-tube. She tests the s produced with Universal Indicator paper. The pH is 3.

Use words from the list below to complete the following sentences.

acidic **basic** **left** **metal** **non-metal** **right**

The type of oxide used in this experiment is ..... . The element forming this oxide is a ..... . This element is likely to be found on the ..... of the Periodic Table. [3]

13 The tungsten wire in a lamp bulb is heated electrically to such a high temperature that it emits light.

(a) Explain why the bulb is filled with argon.

.....

.....

.....[2]

(b) The atomic number of tungsten is 74, its density is 19 g / cm^3 and its melting point is 3400 °C.

How does this information support the fact that tungsten is a **transition** element?

.....

.....

.....[2]

14 Fig. 14.1 shows a tube used to demonstrate thermionic emission.

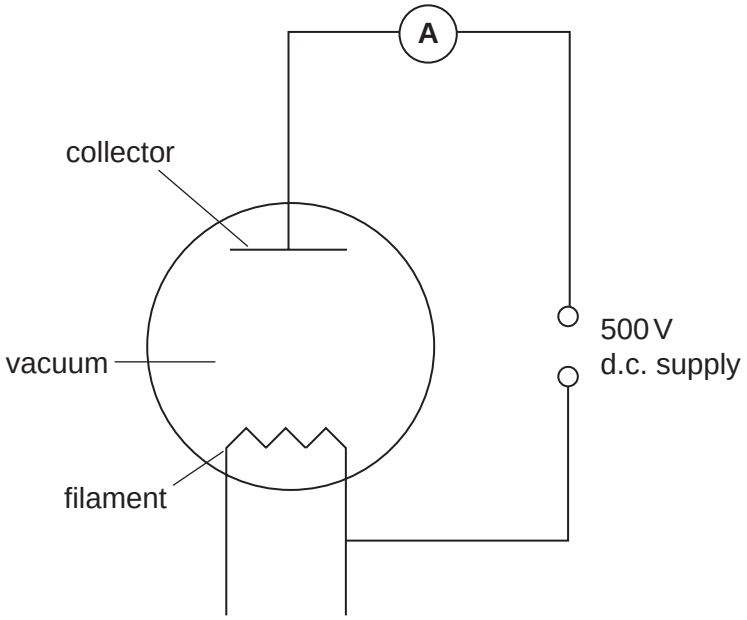


Fig. 14.1

The reading on the ammeter is zero when the collector electrode is negative, and 4.8 mA when the collector is positive.

(a) (i) State with a reason whether the charges emitted from the filament are positive or negative.

.....

.....

(ii) Name the particles that are emitted.

..... [3]

Fig. 14.2 shows the outline of a cathode ray tube.

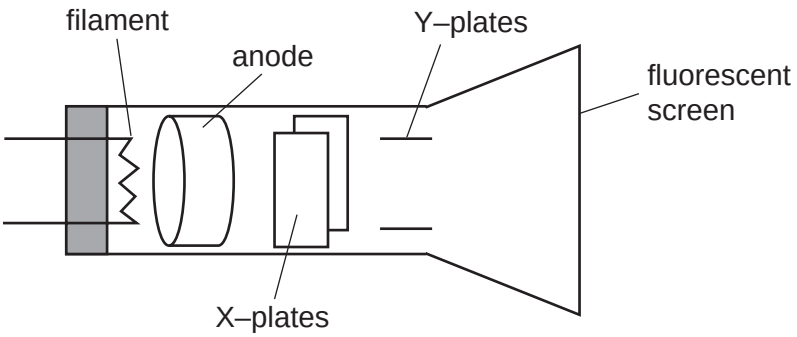


Fig. 14.2

(b) Explain the purpose of the X-plates and the Y-plates.

X-plates .....

.....

Y-plates .....

.....[3]

(c) Fig. 14.3(i) shows the screen of the cathode ray tube being used to display a waveform.

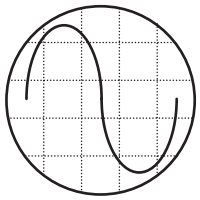


Fig. 14.3(i)

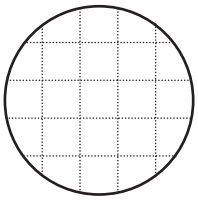


Fig. 14.3(ii)

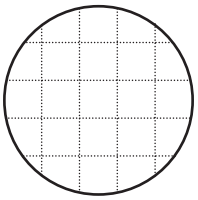


Fig. 14.3(iii)

(i) On Fig. 14.3(ii) draw a wave of the same frequency as Fig. 14.3(i) but of smaller amplitude.

(ii) On Fig. 14.3(iii) draw a wave of the same amplitude as Fig. 14.3(i) but of greater frequency.

[3]

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	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	24 Mg Magnesium 12						27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K otassium	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	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	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	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 Lawre 103

3-71 Lanthanoid series
0-103 Actinoid series

y

a
X
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.).