UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

1002886569

PHYSICAL SCIENCE **0652/02**

Paper 2 (Core) **October/November 2009**

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 16.

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	
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13	
Total	

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

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UNIVERSITY *of* CAMBRIDGE
International Examinations

For Examiner's Use

1 **(a)** Name the type of bonding in a hydrogen molecule, H_2.

.... [1]

(b) Draw a dot and cross diagram to show the arrangement of the outer electrons in a molecule of hydrogen chloride gas, HCl.

[1]

(c) Give two characteristic properties of ionic compounds.

1. ....

2. .... [2]

For iner's

2 Fig. 2.1 shows a circuit diagram, with a battery of e.m.f. 6.0 V and three identical re **R_1**, **R_2** and **R_3**.

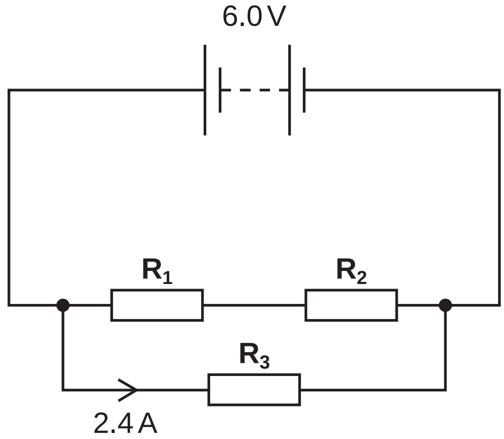


Fig. 2.1

(a) The current through **R_3** is 2.4 A. Calculate the resistance of **R_3**.

resistance = ... Ω [2]

(b) Calculate the combined resistance of **R_1**, and **R_2**.

resistance = ... Ω [1]

(c) Use your answer to **(b)** to calculate the current through **R_1**, and **R_2**.

current = ... A [2]

3 **(a)** State what is meant by the term *fuel*.

.... [1]

(b) **(i)** Suggest two reasons why hydrogen makes a good fuel.

1. ....

2. .... [2]

(ii) Suggest **one** reason why hydrogen is **not** widely used as a fuel.

.... [1]

(c) Ethanol is a useful fuel which can be made from sugar.

(i) Name the process used to make ethanol from sugar.

.... [1]

(ii) Describe how you could show that carbon dioxide is produced in this reaction.

....

....

.... [2]

(iii) Name the process used to separate ethanol from the resulting mixture from **c(i)**.

.... [1]

4 A microphone is connected to a cathode ray oscilloscope.
Fig. 4.1 shows the pattern produced on the cathode ray oscilloscope when a guitar string is plucked.

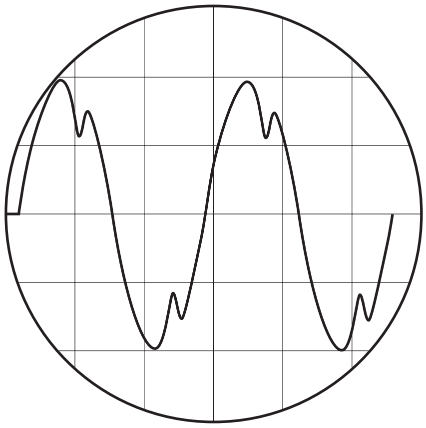


Fig. 4.1

(a) **(i)** State how the trace changes if a louder note, of the same pitch, is played.

.... [1]

(ii) State how the trace changes if a higher pitched note is played.

.... [1]

(b) Bats navigate by emitting short high pitched sounds, above the threshold of human hearing.

(i) State the maximum frequency that the human ear can detect.

.... Hz [1]

(ii) Sound travels at 320 m/s in air.
A bat emits a pulse of sound and hears the echo from a wall 0.075 s later.

Calculate the distance from the bat to the wall.

Show your working.

distance = ... m [3]

5 **(a)** A fisherman is steering his boat using a single oar as shown in Fig. 5.1a.
Fig. 5.1b shows the same boat viewed from above.
To keep the oar stationary the fisherman applies a force of 250 N to the end of the oar.

Fig. 5.1a

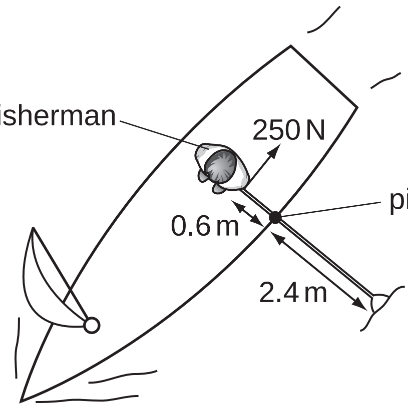


Fig. 5.1b

(i) Calculate the moment produced by the fisherman about the pivot.

Show your working.

moment = ... Nm [2]

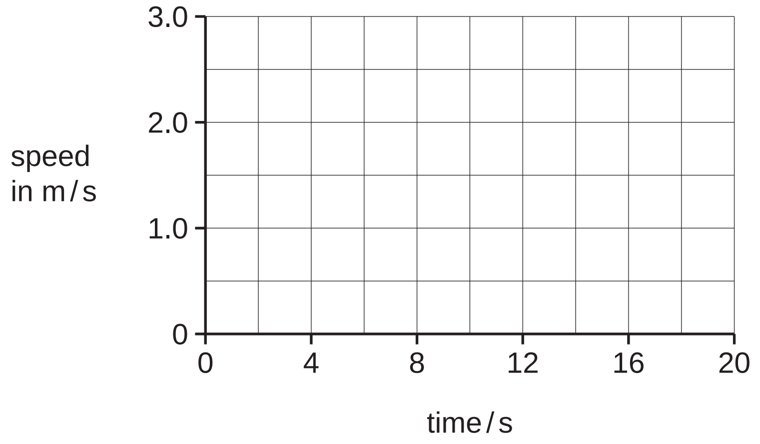
(ii) Use your answer from **(a)(i)** to calculate the force the oar produces on the water.

Show your working.

force = ... N [2]

(b) The boat moves through the water at a steady speed of 2.5 m / s for 12 s. It then decelerates to rest at a uniform rate in a further 8.0 s.

(i) On Fig. 5.2 draw a speed-time graph to show this motion.



[2]

Fig. 5.2

(ii) Calculate the total distance travelled by the boat.

Show your working.

distance travelled = ... m [3]

6 Bronze, an alloy containing copper and tin, is used to make statues.

(a) State what is meant by the term *alloy*.

.... [1]

(b) Name another alloy of copper and give a use for it.

alloy ....

use .... [2]

(c) Car bodies can be made from mild steel.

(i) State how car manufacturers try to prevent car bodies from rusting.

.... [1]

(ii) Suggest a reason why copper is not suitable for use in making car bodies.

.... [1]

7 A solar power station is designed for use in desert countries.
Fig. 7.1 shows the steps involved in the production of electricity.

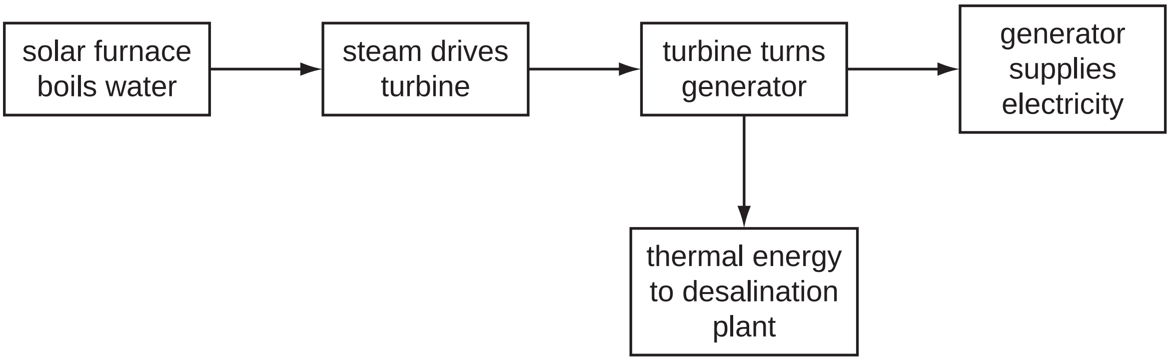


Fig. 7.1

(a) A solar furnace consists of many mirrors. These mirrors are arranged so that sunlight is reflected onto a large container of water, as shown in Fig. 7.2.

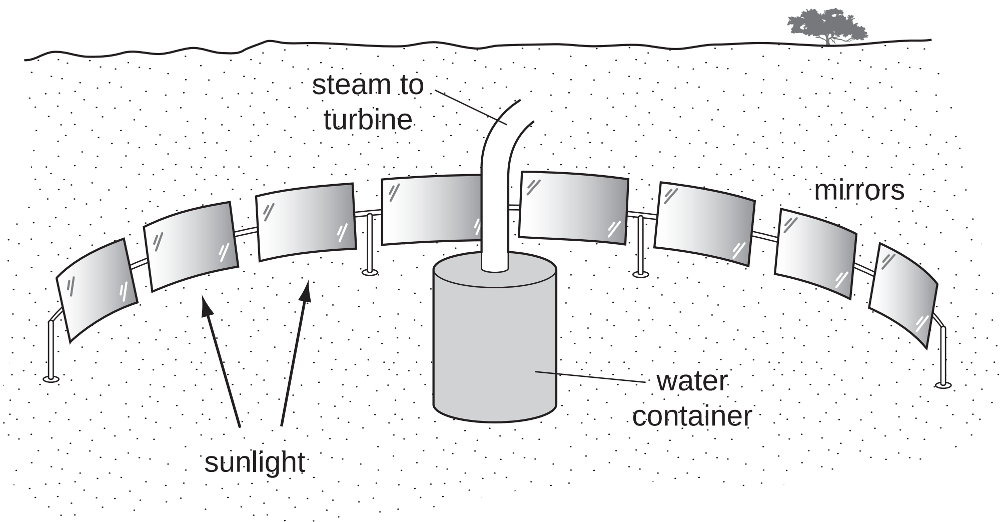


Fig. 7.2

(i) Name the process by which the Sun's energy is transmitted to Earth.

.... [1]

(ii) Fig. 7.3 shows a ray of sunlight incident on a mirror.

Complete the diagram to show the ray after it is reflected from the mirror.

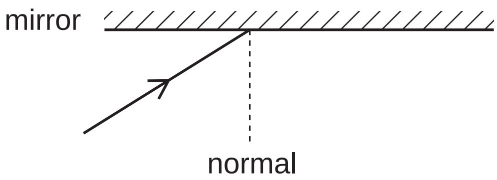


Fig. 7.3

[1]

(iii) On Fig. 7.3, mark and label the angle of incidence and the angle of reflection. [1]

(iv) State the relationship between the angle of incidence and the angle of reflection.

.... [1]

(b) (i) Name the process by which the energy is passed through the wall of the water container.

.... [1]

(ii) Explain why the water at the top of the water container is hotter than the water at the bottom of the container.

....

....

.... [2]

(c) (i) At the desalination plant the thermal energy from the turbine is used to recover pure water from sea water.

Name the process by which pure water is recovered from sea water in this desalination plant.

.... [1]

(ii) Explain the advantage of combining the desalination plant with the power station.

....

.... [1]

8 Test-tubes **A**, **B** and **C** contain dilute hydrochloric acid.
A different substance is added to each tube as shown in Fig. 8.1.

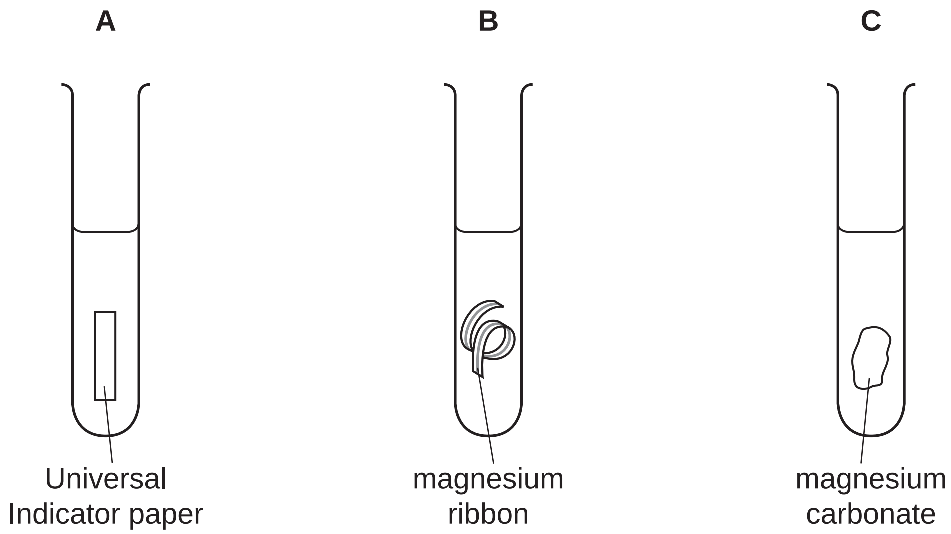


Fig. 8.1

(a) Complete Table 8.1 to show what you would observe in each test-tube and name any gases produced.
If no gas is produced write 'no gas' in the table.

Table 8.1

test-tube	observation	gas
A		
B		
C		

[6]

(b) State any difference if sulfuric acid is used instead of hydrochloric acid.
Explain your answer.

....

....

.... [2]

9 **(a)** The isotope uranium-236 is unstable and undergoes fission.

Explain what is meant by the term fission.

....

....

.... [2]

(b) State one advantage and one disadvantage of using nuclear energy to generate electricity.

advantage ....

....

disadvantage ....

.... [2]

10 Ammonium sulfate, $(NH_4)_2SO_4$, and ammonium nitrate NH_4NO_3 are important fertilizers.

(a) In the first column of Table 10.1 complete the list of elements in ammonium sulfate, $(NH_4)_2SO_4$.
In the second column write the number of atoms of each element.

Table 10.1

name of element	number of atoms
nitrogen	

[4]

(b) Calculate the mass of nitrogen in one mole of ammonium nitrate, NH_4NO_3.

mass = ... g [2]

11 Fig. 11.1 shows the apparatus used to measure the half-life of the isotope, phosphor[…] which decays by emitting a β-particle.

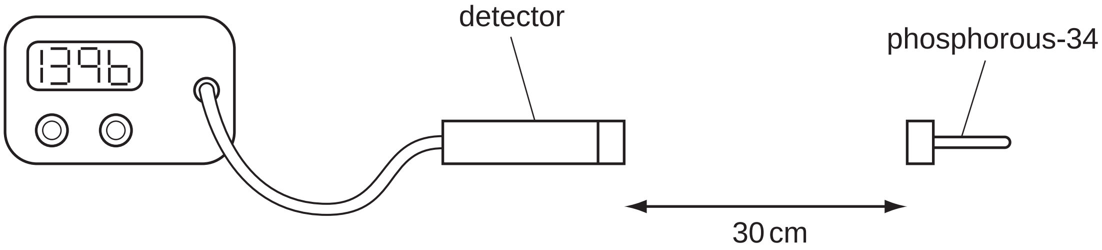


Fig. 11.1

(a) Explain how the apparatus would need to be altered if the isotope decayed by emitting an α-particle.

....

.... [2]

(b) Fig. 11.2 shows part of the table of readings taken in the experiment.

time / s	number of counts per second	corrected counts per second
0	1396	1368
5	1072	1044
10	814	786
15	636	608

Fig. 11.2

(i) Explain why a corrected count rate is included.

....

.... [2]

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(ii) The readings are plotted on Fig. 11.3.
Complete the graph by drawing the best fit curve.

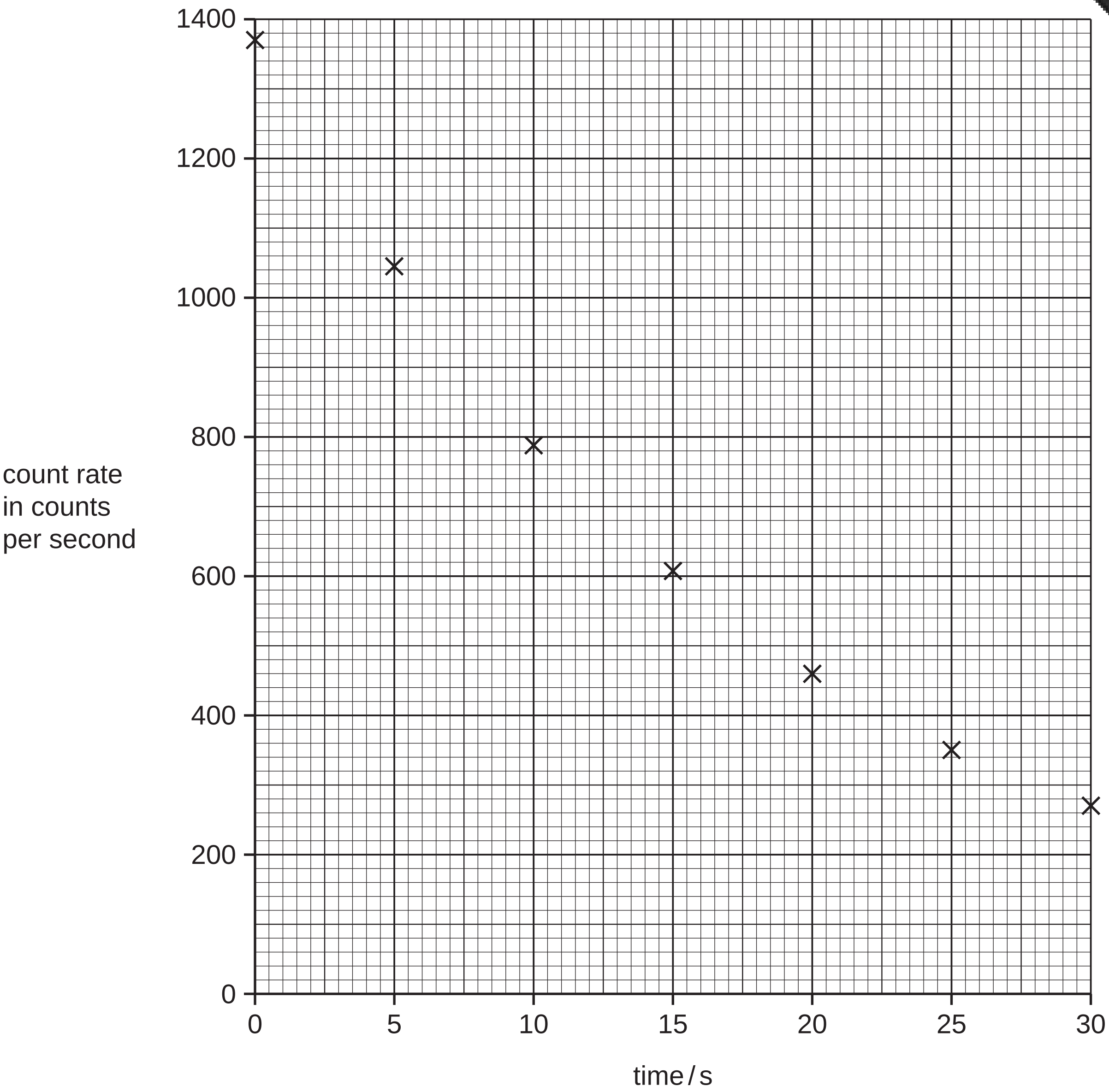

Fig. 11.3

[1]

(iii) Use the graph to find the half-life of the isotope.

Show your working.

half life = ... [2]

12 Many modern cars have a catalytic converter in the exhaust system.

(a) State the effect the catalyst has on the reactions taking place between the gases in the catalytic converter.

.... [1]

(b) The catalyst is spread very thinly on the surface of a ceramic material.

(i) State why a ceramic material is used.

.... [1]

(ii) State why the catalyst is spread very thinly.

.... [1]

(c) State why the catalyst lasts for a long time.

.... [1]

(d) Carbon monoxide, CO, and nitrogen monoxide, NO, react together in catalytic converters to form carbon dioxide, CO_2, and nitrogen, N_2.

Write a balanced equation for this reaction.

.... [1]

13 **(a)** Complete Table 13.1 which is about sub-atomic particles.

Table 13.1

particle	**relative mass**	**relative charge**
electron	....	....
neutron	1	....
....	....	+ 1

[3]

(b) What is meant by the *proton number* of an element?

.... [1]

DATA SHEET
The Periodic Table of the Elements

Group																	
I	II											III	IV	V	VI	VII	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 **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.).