UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

COMBINED SCIENCE   **5129/02**

Paper 2   **May/June 2009**

2 hours 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 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 24.

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.
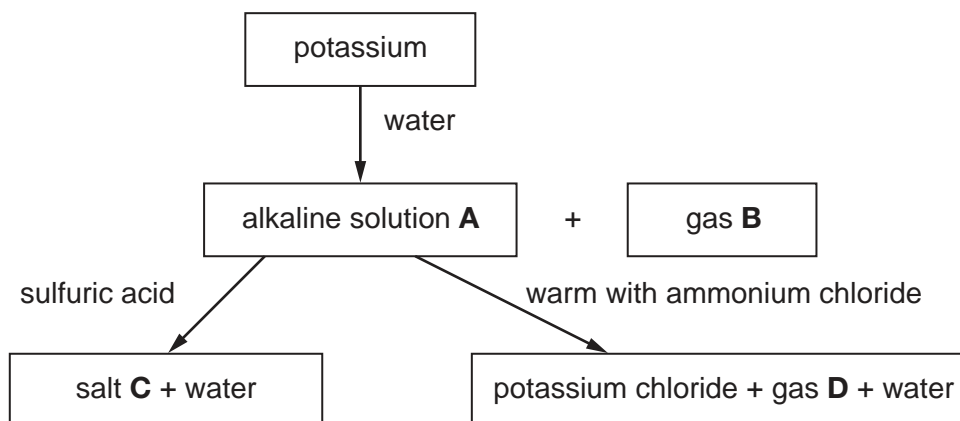
For Examiner's Use

This document consists of **22** printed pages and **2** blank pages.

UNIVERSITY *of* CAMBRIDGE
International Examinations

[Turn over

2 A stone has a mass of 2.0 kg.
The gravitational field strength, g, on the Earth's surface is 10 N/kg.

(a) Calculate the weight of the stone on the Earth's surface.

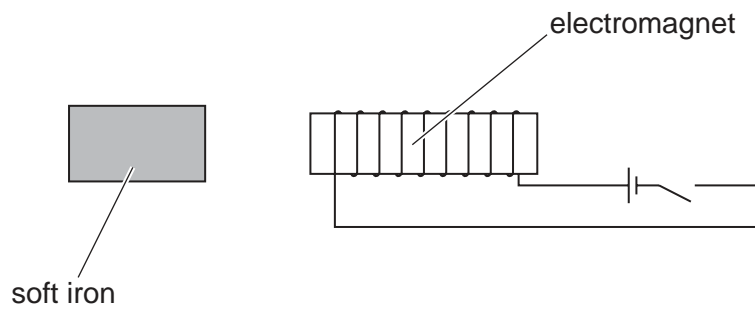weight = ... N [1]

(b) On the Moon, the gravitational field strength is less than on the Earth. The stone is taken to the Moon.
State the change, if any, in

(i) the mass of the stone, ...

(ii) the weight of the stone. ....

[2]

3   An electromagnet and a piece of soft iron are shown in Fig. 3.1.

electromagnet

soft iron

Fig. 3.1

(a) When the current in the electromagnet is switched on, the soft iron is attracted.
The current in the electromagnet is reversed.
State the effect, if any, on the attraction of the soft iron.

....

....[1]

(b) Electromagnet cores are usually made of soft iron rather than steel.
State the difference between the magnetic properties of soft iron and steel.

....

....[2]

5

4 **(a)** Define *osmosis*.

....

....

....[2]

(b) How does osmosis result in the uptake of water by plants?

....

....[1]

(c) An area of farmland has been flooded with seawater.

Suggest and explain the effect of this flooding on the crops growing on this land.

....

....

....[2]

6

5 The following is a list of metals.

           aluminium   **calcium**   **copper**   **iron**   **zinc**

(a) From the list, select the metal that

    (i) is protected from corrosion by an oxide layer,

       .... [1]

    (ii) forms an amphoteric oxide,

       .... [1]

   (iii) is a catalyst in the manufacture of ammonia.

       .... [1]

(b) Which metals are mixed together to form brass?

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

6 The displacement of particles in wave **X** varies with distance along the wave as shown in Fig. 6.1.
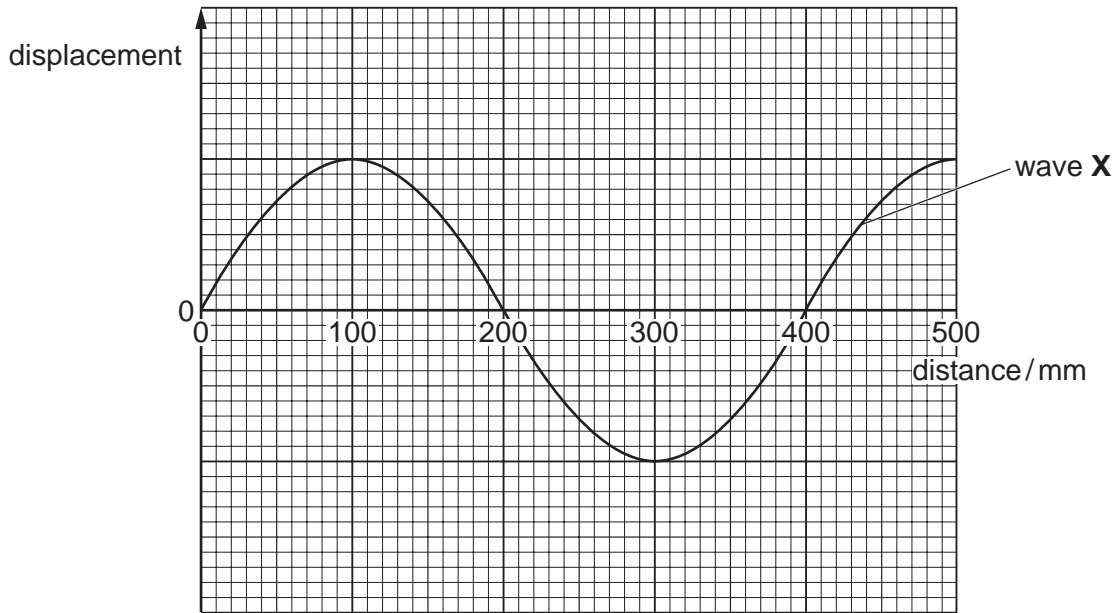
Fig. 6.1

(a) Use Fig. 6.1 to determine the wavelength of wave **X**. .... mm [1]

(b) A second wave, **Y**, has the same wavelength as wave **X** and half the amplitude.
On Fig. 6.1, draw a line to show how the displacement of wave **Y** varies with distance.
[1]

(c) **(i)** State the unit of frequency.

....[1]

(ii) A wave has a speed of 340 m/s and a wavelength of 1.7 m.
Calculate the frequency of this wave.

frequency = ... [2]

7 Some red blood cells, as seen through a microscope, are shown in Fig. 7.1.
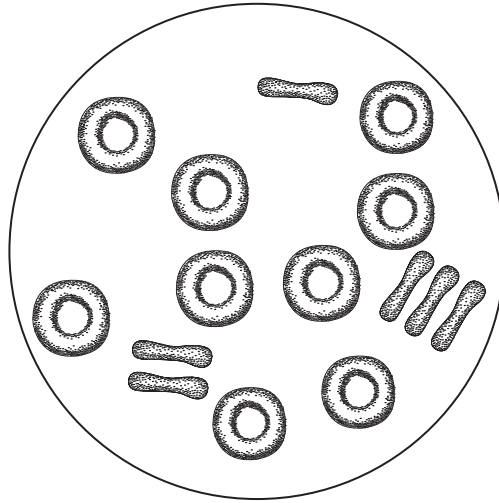
Fig. 7.1

(a) (i) Name **one** structure, normally present in cells, that is **not** present in red blood cells.

....[1]

(ii) Name two other structures, **not** present in these cells, that would normally be present in **plant cells**.

1. ....

2. ....[2]

(b) Blood also contains white blood cells, platelets and plasma.

State one function of

(i) white blood cells, ...

(ii) platelets, ...

(iii) plasma. ....
[3]

8 Apparatus used to react magnesium with steam is shown in Fig. 8.1.
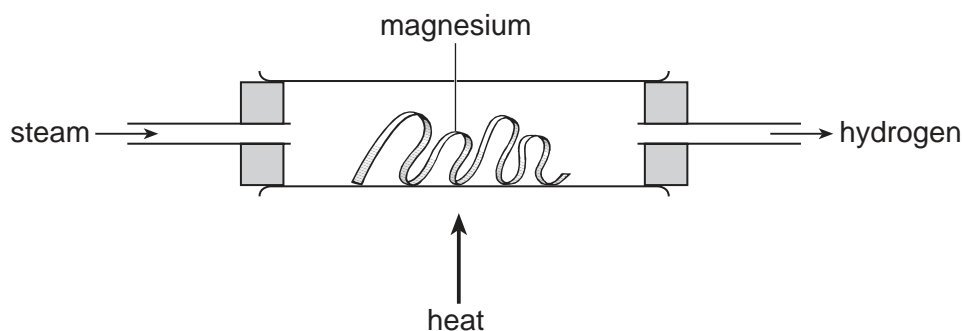
Fig. 8.1

The equation for the reaction is

$$Mg + H_2O \rightarrow MgO + H_2$$
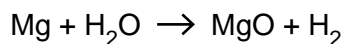
(a) What does the reaction tell you about the relative reactivity of magnesium and hydrogen?

....[1]

(b) Describe a test to show that the gas produced is hydrogen.

test ....

result ....[2]

(c) State **one** large-scale use of hydrogen.

....[1]

(d) (i) Calculate the relative molecular mass of magnesium oxide.
(A_r: Mg, 24; O, 16.)

....[1]

(ii) Calculate the mass of magnesium oxide produced when 1.8 g of magnesium is reacted with excess steam.

mass = ... g [2]

9 Fig. 9.1 shows two resistors, **P** and **Q**, in series.
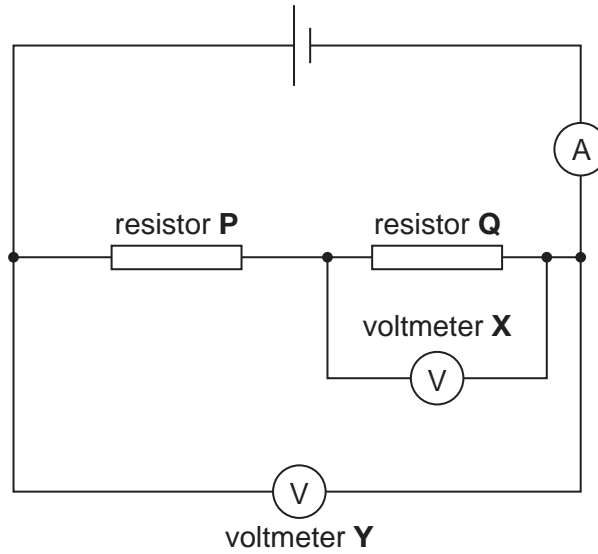
Fig. 9.1

The ammeter reads 0.20 A. Voltmeter **X** reads 1.2 V and voltmeter **Y** reads 2.0 V.

(a) Calculate the potential difference across resistor **P**.

potential difference = ... V [1]

(b) Calculate the resistance of resistor **Q**.

resistance = ... Ω [2]

(c) Calculate the charge passing through the ammeter in 2 minutes.

charge = ... unit .... [3]

10 (a) A balanced diet contains sufficient quantities of protein, carbohydrate, fat, fibre and water.

(i) Name two other different essential components of a balanced diet.

1. ....

2. ....[2]

(ii) Explain the importance of fibre in the diet.

....

....[1]

(b) Food provides the energy needed by the body.

The energy taken in and used by three people is shown in Fig. 10.1.

	average daily energy intake/kJ	average daily energy used/kJ
Rajiv	9700	9700
Kapilisha	6800	6850
Sanjay	10500	9600

Fig. 10.1

(i) Give a possible reason for the difference in the amounts of energy used by Rajiv and Kapilisha.

....

....[1]

(ii) Sanjay continues to eat the same diet for many years.
Suggest a likely effect of this diet on his health.

....

....[1]

11 A barrel of gunpowder is shown in Fig. 11.1.
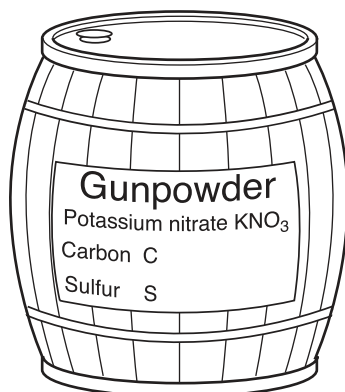
Fig. 11.1

Gunpowder is a mixture of carbon, sulfur and potassium nitrate.
Carbon and sulphur are insoluble in water. Potassium nitrate is soluble in water.

Describe how you would obtain a sample of solid potassium nitrate from the gunpowder.

....

....

....

....[3]

12 An unmarked liquid-in-glass thermometer is shown in Fig. 12.1.

thin glass bulb

narrow capillary tube
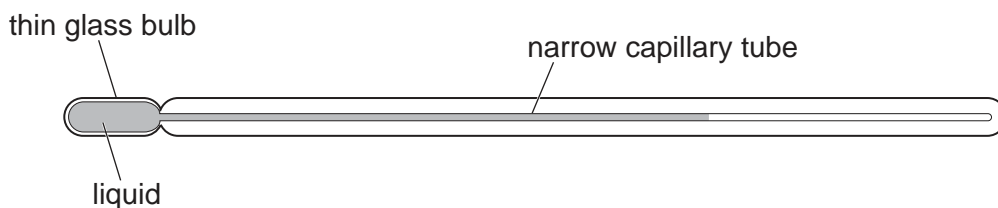
liquid

Fig. 12.1

(a) The thermometer is to have a scale marked on it.
Explain why the thermometer is placed in melting ice and then placed in boiling water.

....

....

....[2]

(b) State **one** change that could be made to the capillary tube to make a liquid-in-glass thermometer more sensitive.

....

....[1]

(c) The volume of the liquid in the thermometer changes with change in temperature.
Name **one** physical property of matter, other than volume, that also changes with change in temperature.

....   [1]

13 The graph shows the number of adults with HIV/AIDS in sub-Saharan Africa between 1985 and 2005.

number of adults with HIV/AIDS

——— women
– – – – men

1985   1995   2005
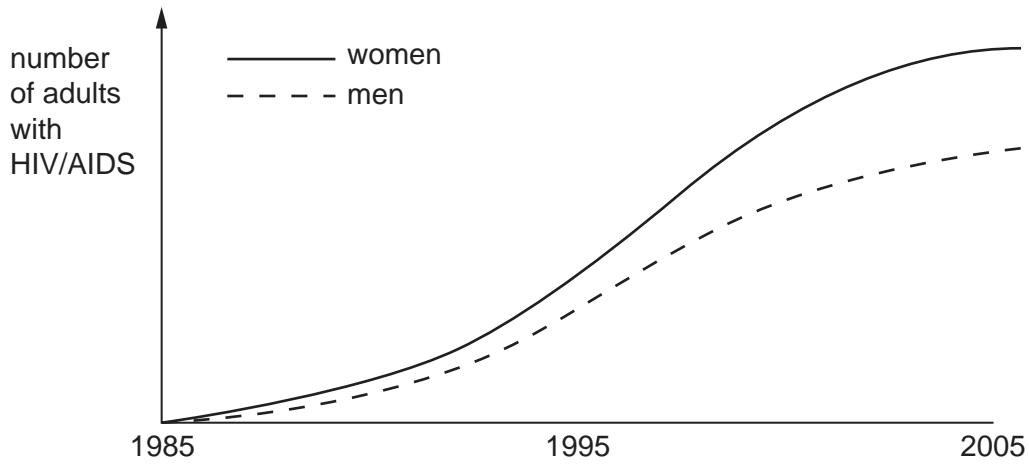
(a) State three trends shown by the graph.

1. ....

....

2. ....

....

3. ....

....[3]

(b) Suggest two ways by which the spread of HIV/AIDS may be reduced.

1. ....

....

2. ....

....[2]

(c) State why the abuse of heroin may contribute to the spread of HIV/AIDS.

....

....[1]

14 An atom of fluorine is represented by $^{19}_{9}$F.
The numbers 19 and 9 provide information about the structure of this fluorine atom.

(a) **(i)** Complete the following sentences.

The number 19 is the .... number of fluorine.

The number 9 is the .... number of fluorine. [2]

(ii) Fluorine is a non-metal.
How can this be deduced from the symbol $^{19}_{9}$F?

....

....

....[2]

(iii) Complete Fig. 14.1 to show the electronic structure of fluorine.

F

[1]
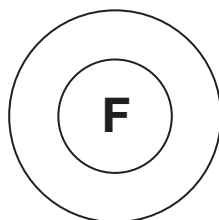
Fig. 14.1

(b) Fluorine reacts violently with sodium to produce a white substance.

(i) State the name of the substance produced.

....

(ii) State the type of bonding present in this substance.

....

[2]

15 Radioactive sources may emit alpha-particles, beta-particles or gamma-rays from the nucleus.

(a) Name apparatus that is used to detect alpha-particles.

....[1]

(b) State which of alpha-particles, beta-particles or gamma-rays are

(i) the most penetrating, ...

(ii) the most ionising, ...

(iii) electrons. ....

[3]

16 An electric iron is shown in Fig. 16.1.

plastic handle
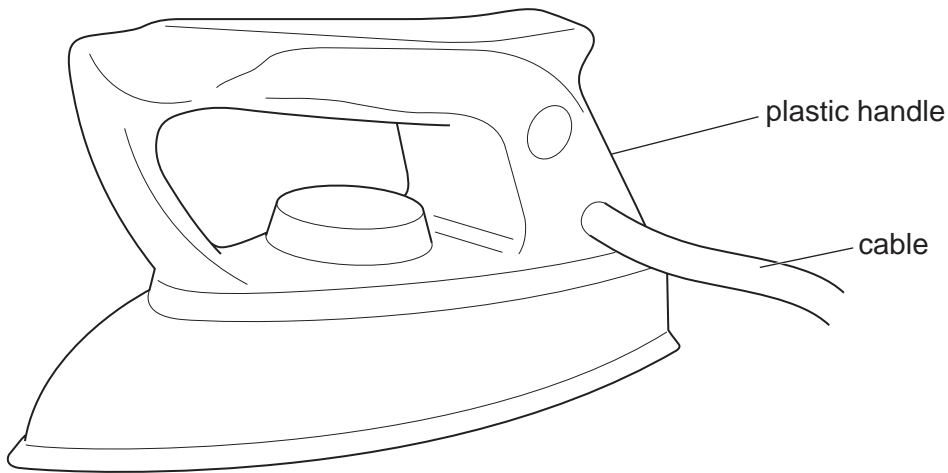
cable

Fig. 16.1

The iron is rated as 2000W.

(a) Calculate the amount of electrical energy changed into heat energy by the iron in 20 minutes.

energy = ... unit .... [3]

(b) The insulation of the cable may become damaged.
State and explain why this is hazardous.

....

....[2]

17 Human activities are destroying the Amazonian rainforest at a rate of about $50\,000\,km^2$ per year.

(a) Suggest two reasons why rainforests are being destroyed by human activities.

1. ....

....

2. ....

....[2]

(b) Suggest the possible harmful effects of deforestation on

(i) the Earth's atmosphere,

....

....

(ii) animals living in the area,

....

....

(iii) the soil.

....

....

[3]

18 Ethene, C_2H_4, is made by decomposing a long-chain hydrocarbon over a hot catalyst.

(a) (i) Name the process used to decompose this hydrocarbon.

....[1]

(ii) One of these hydrocarbons is octane.

Complete the equation for the decomposition of octane.

$$C_8H_{18} \rightarrow \text{.................} + C_2H_4$$ [1]
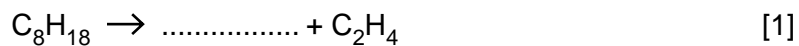
(iii) Draw the structure of ethene.

[1]

(b) Ethanol, C_2H_5OH, is made industrially from ethene.

Name the substance added to ethene to make ethanol.

....[1]

(c) State **one** use of ethanol. ....[1]

19 A ray of light is incident at an angle of 28° on a water surface as shown in Fig. 19.1.
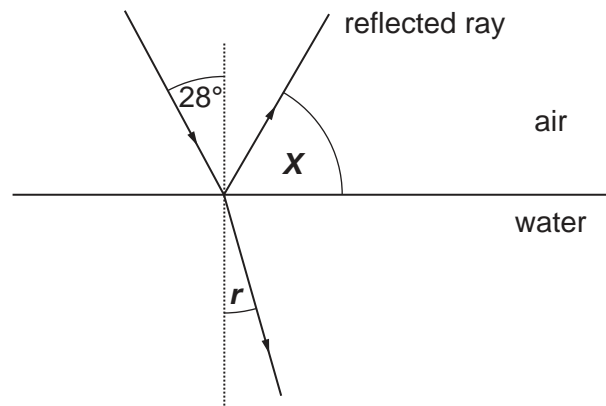
Fig. 19.1

The light is partly reflected and partly refracted.

(a) Calculate angle **X**.

X = ...° [1]

(b) The refractive index of the water is 1.33. The angle of incidence is 28°.
Calculate the angle of refraction **r**.

angle = ...° [3]

20 A farmer analyses the nitrogen content of the soil in two of his fields.

The results of this analysis are shown in Fig. 20.1.

	nitrogen content (arbitrary units)
field **A**	135
field **B**	30
recommended level	120

Fig. 20.1

(a) Explain why plants need nitrogen.

....

....[1]

(b) (i) The plants in field **B** do not grow well. In what other way would the appearance of the plants differ from normal?

....[1]

(ii) How could the nitrogen content of field **B** be increased to the recommended level?

....[1]

(c) In many parts of the world, not enough food is produced to feed everyone.

(i) Suggest **one** reason why this problem has become worse over the past 100 years.

....

....[1]

(ii) To feed a large number of people, it is better to grow plant crops, rather than raising animals for meat.

Use ideas about food chains to explain why.

....

....[2]

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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	209 **Po** Polonium 84	210 **At** Astatine 85	222 **Rn** Radon 86
223 **Fr** Francium 87	226 **Ra** Radium 88	227 **Ac** Actinium 89 †																

140 **Ce** Cerium 58	141 **Pr** Praseodymium 59	144 **Nd** Neodymium 60	147 **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	231 **Pa** Protactinium 91	238 **U** Uranium 92	237 **Np** Neptunium 93	244 **Pu** Plutonium 94	243 **Am** Americium 95	247 **Cm** Curium 96	247 **Bk** Berkelium 97	251 **Cf** Californium 98	252 **Es** Einsteinium 99	257 **Fm** Fermium 100	258 **Md** Mendelevium 101	259 **No** Nobelium 102	260 **Lr** Lawrencium 103

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

Key

a	a = relative atomic mass
X	X = atomic symbol
b	b = atomic (proton) number

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

5129/02/M/J/09