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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

9417894738

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.

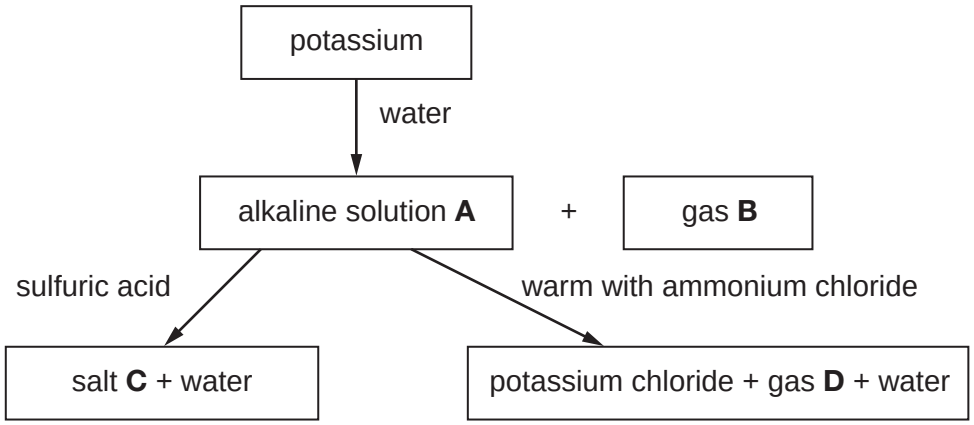
At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use

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

1 Study the following reaction scheme.

For Examiner's Use



(a) Identify substances **A**, **B**, **C** and **D**.

alkaline solution **A** .....

gas **B** .....

salt **C** .....

gas **D** ..... [4]

(b) Name the ion present in solution **A** that makes it alkaline.

.....[1]

(c) Universal Indicator is added to solution **A**.
State its final colour.

..... [1]

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

For Examiner's Use

(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.

For Examiner's Use

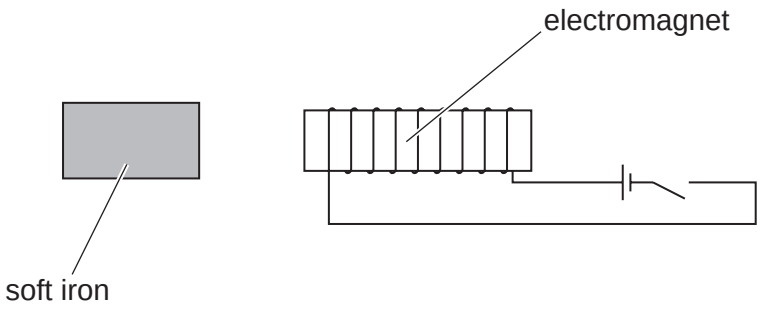


Fig. 3.1

(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]

For Examiner's Use

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]

5 The following is a list of metals.

For Examiner's Use

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.

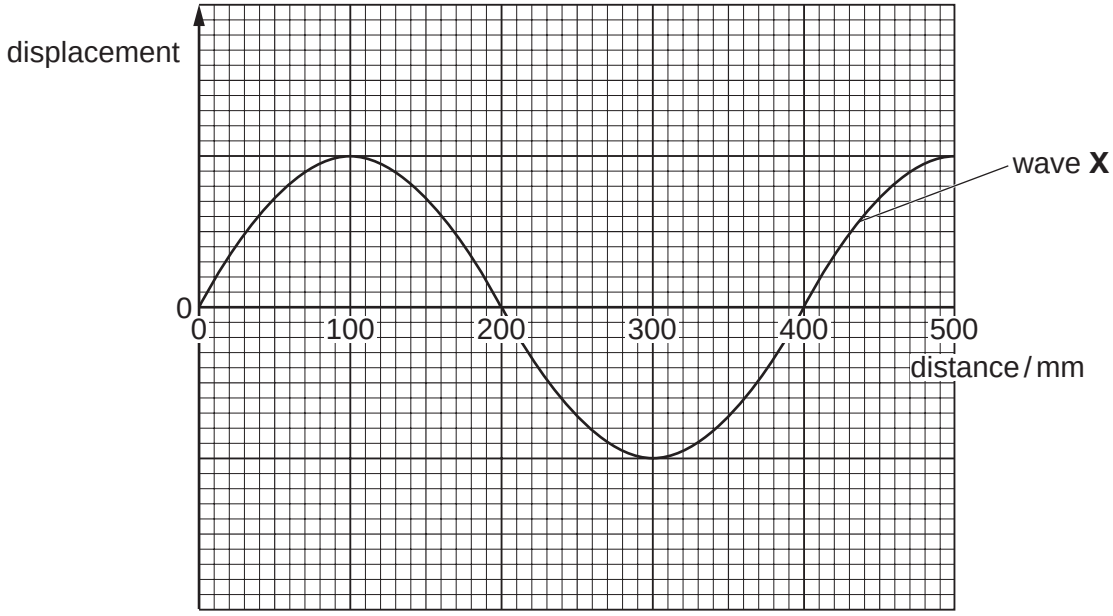


Fig. 6.1

(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.

For Examiner's Use

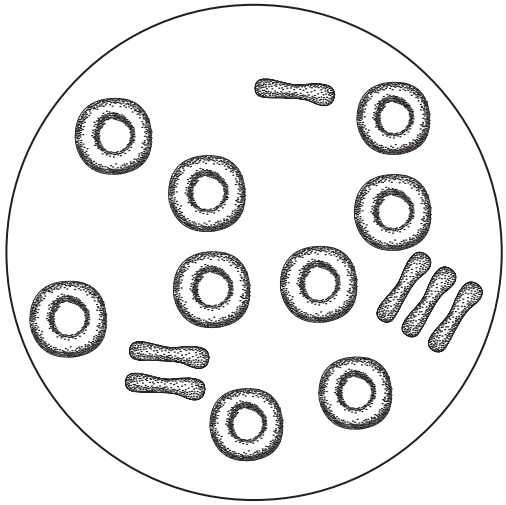


Fig. 7.1

(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.

For Examiner's Use

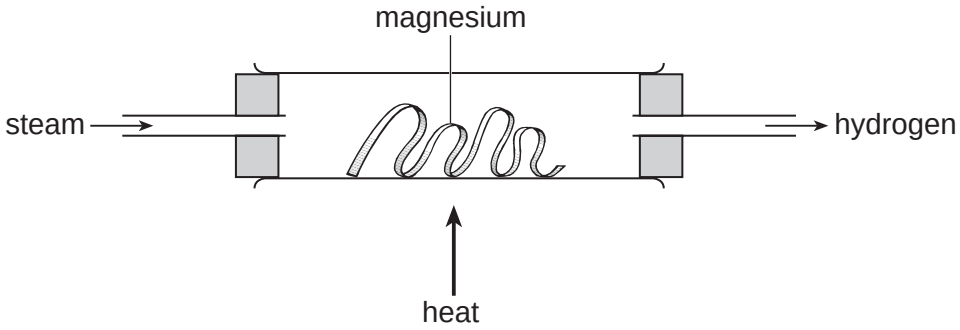


Fig. 8.1

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.

For Examiner's Use

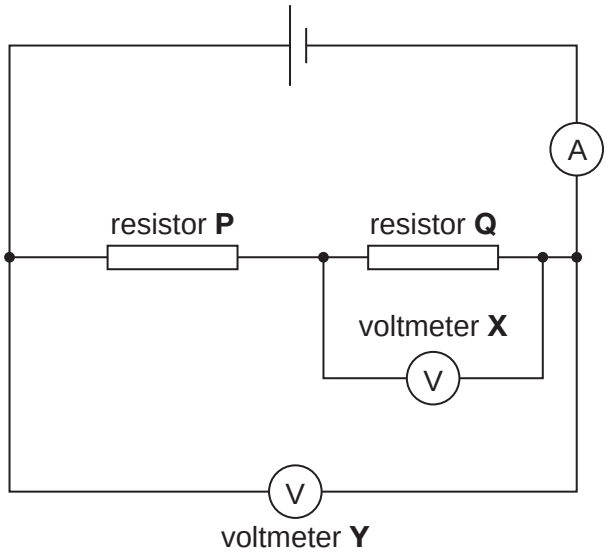


Fig. 9.1

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]

[Turn over

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

For Examiner's Use

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.

For Examiner's Use

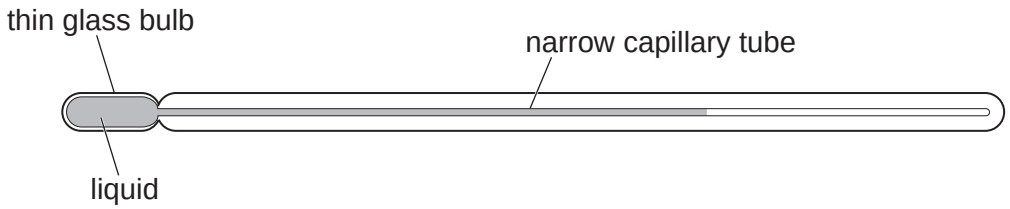


Fig. 12.1

(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.

.....

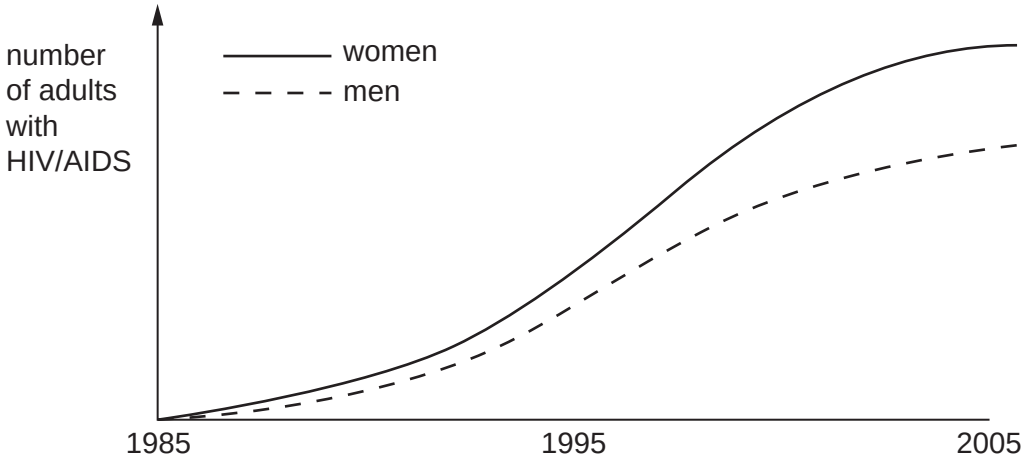
..... [1]

(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.

For Examiner's Use



(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.

For Examiner's Use

(a) (i) Complete the following sentences.

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

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

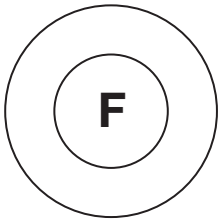
(ii) Fluorine is a non-metal.
How can this be deduced from the symbol $^{19}_{9}F$?

.....

.....

.....[2]

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



[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.

For Examiner's Use

(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.

For Examiner's Use

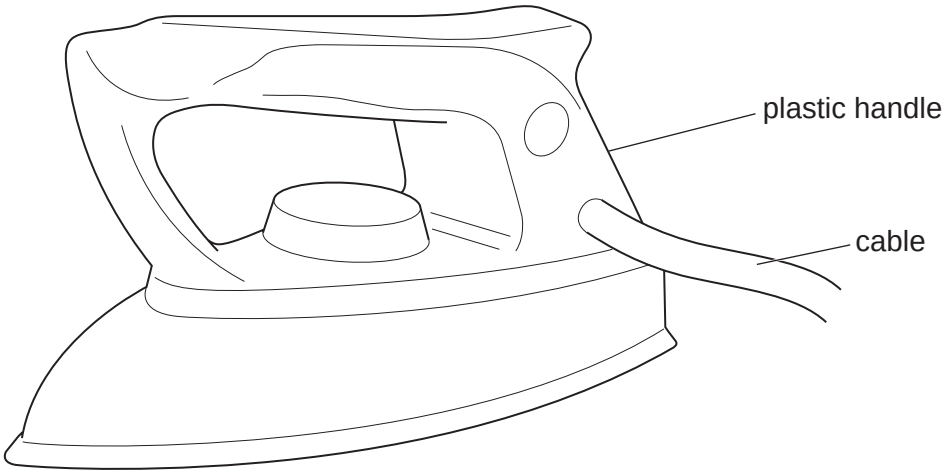


Fig. 16.1

The iron is rated as 2000 W.

(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.

For Examiner's Use

(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.

For Examiner's Use

(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.

For Examiner's Use

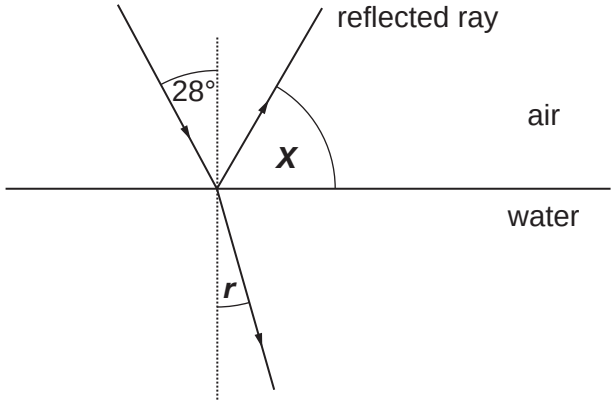


Fig. 19.1

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.

For Examiner's Use

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 dm^3 at room temperature and pressure (r.t.p.).