



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
General Certificate of Education Ordinary Level

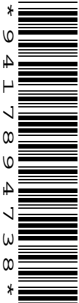
CANDIDATE  
NAME

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NUMBER

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**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.

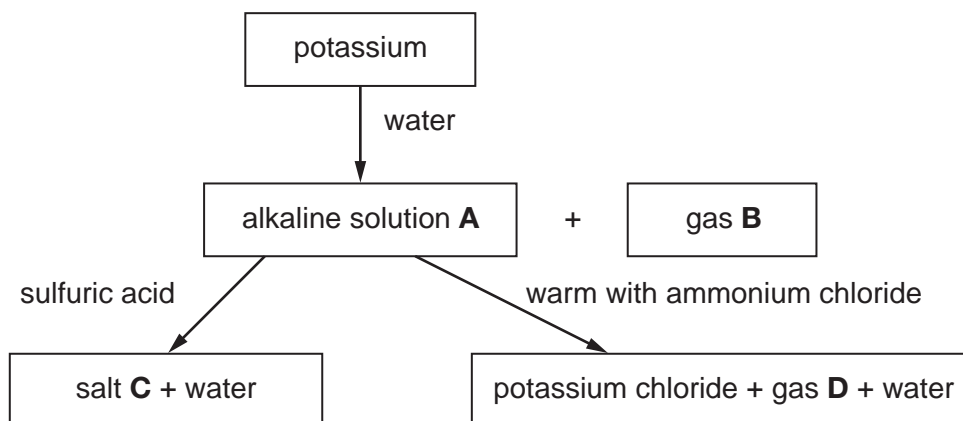
**For Examiner's Use**

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



1 Study the following reaction scheme.



(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.

(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.

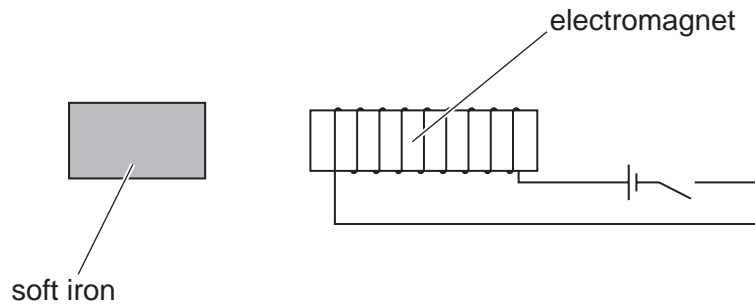
State the change, if any, in

(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.



**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]

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.

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.

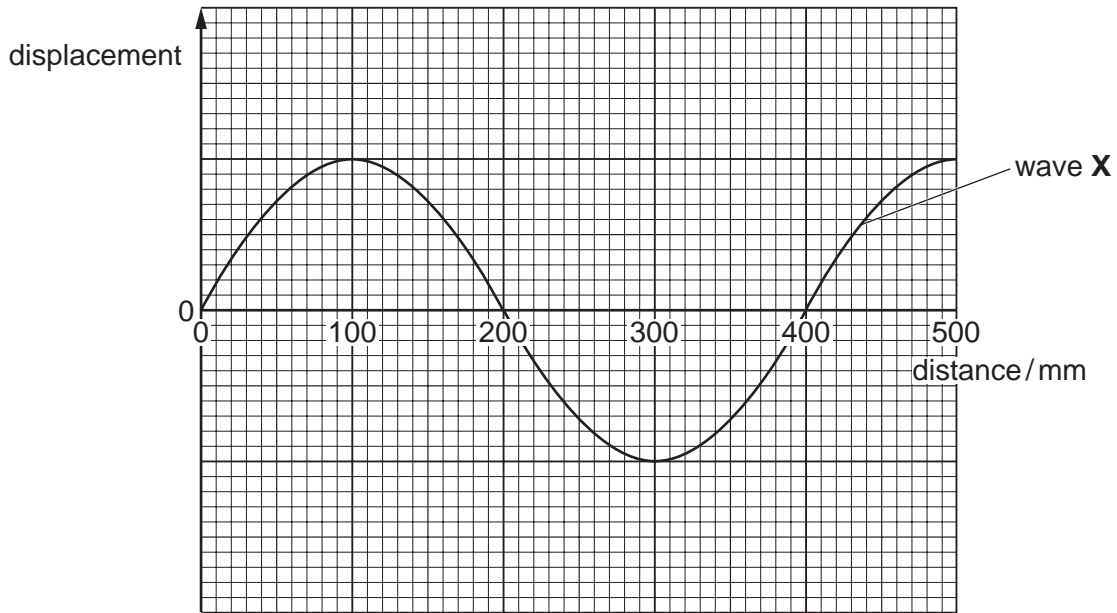


Fig. 6.1

- (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 340m/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.

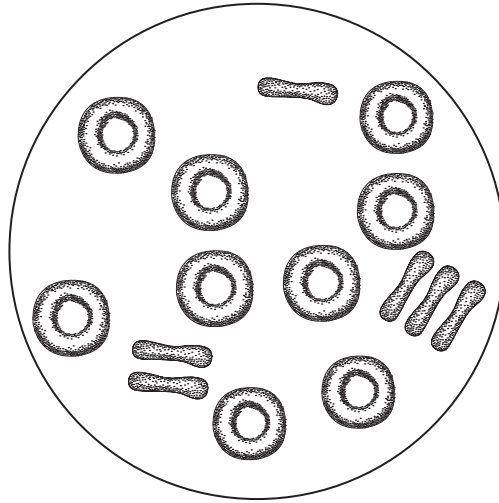


Fig. 7.1

- (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.

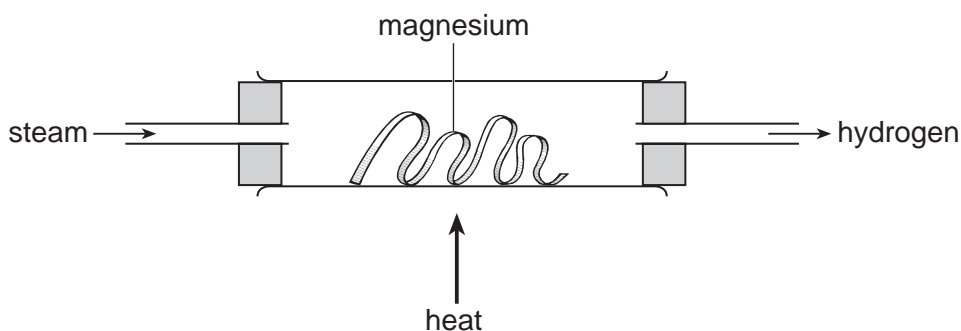
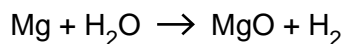


Fig. 8.1

The equation for the reaction is



- (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]

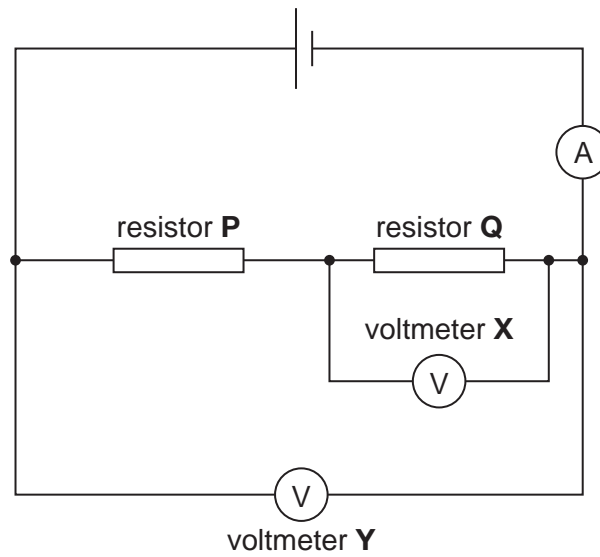
- (d) (i) Calculate the relative molecular mass of magnesium oxide.  
( $A_r$ : Mg, 24; O, 16.)

.....[1]

- (ii) Calculate the mass of magnesium oxide produced when 1.8g 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 = .....  $\Omega$  [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.

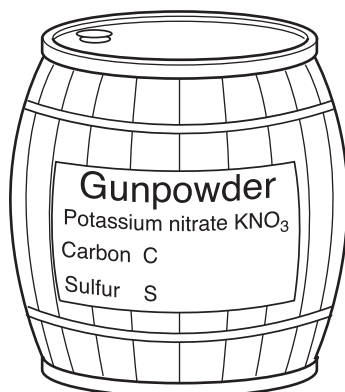


Fig. 11.1

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.

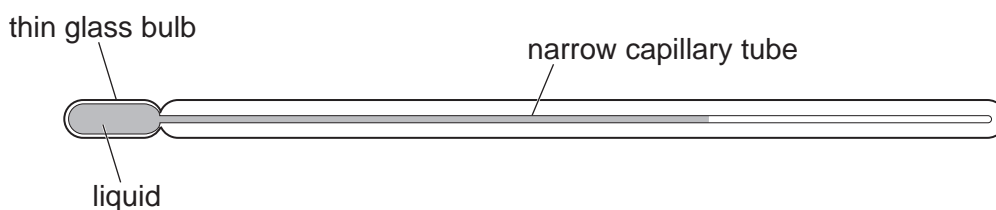


Fig. 12.1

(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]

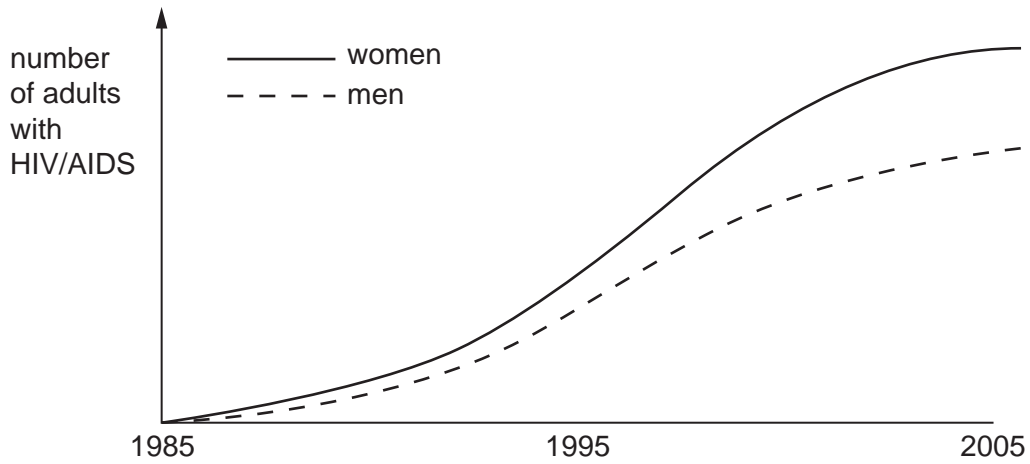
(b) State **one** change that could be made to the capillary tube to make a liquid-in-glass thermometer more sensitive.

.....  
 ..... [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.



(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  ${}^{19}_{9}\text{F}$ .  
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  ${}^{19}_{9}\text{F}$ ?

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

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

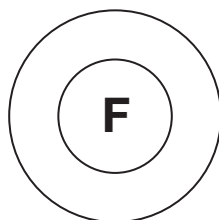


Fig. 14.1

[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 their 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.

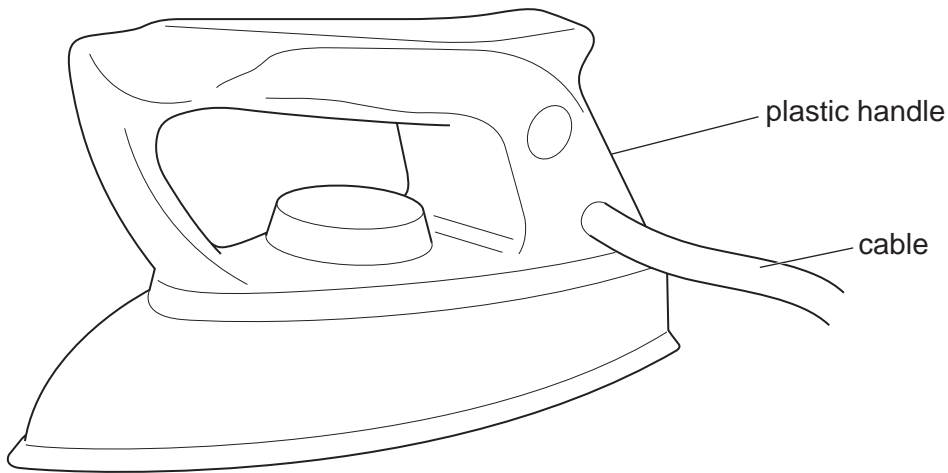


Fig. 16.1

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<sup>2</sup> 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]

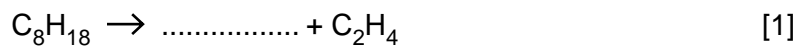
18 Ethene,  $C_2H_4$ , is made by decomposing a long-chain hydrocarbon over a hot catalyst.

(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.



(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  $28^\circ$  on a water surface as shown in Fig. 19.1.

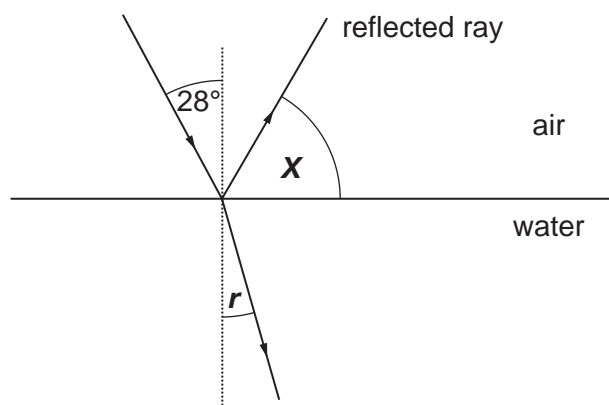


Fig. 19.1

The light is partly reflected and partly refracted.

- (a) Calculate angle  $X$ .

$$X = \dots\dots\dots^\circ \quad [1]$$

- (b) The refractive index of the water is 1.33. The angle of incidence is  $28^\circ$ . Calculate the angle of refraction  $r$ .

$$\text{angle} = \dots\dots\dots^\circ \quad [3]$$

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 <b>A</b>	135
field <b>B</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]





**DATA SHEET**  
**The Periodic Table of the Elements**

		Group										
I	II	III	IV	V	VI	VII	0					
7 <b>Li</b> Lithium 4	9 <b>Be</b> Beryllium 4	1 <b>H</b> Hydrogen 1	11 <b>B</b> Boron 5	12 <b>C</b> Carbon 6	13 <b>Al</b> Aluminium 13	14 <b>Si</b> Silicon 14	15 <b>P</b> Phosphorus 15	16 <b>S</b> Sulfur 16	17 <b>Cl</b> Chlorine 17	18 <b>Ar</b> Argon 18	19 <b>F</b> Fluorine 9	20 <b>Ne</b> Neon 10
23 <b>Na</b> Sodium 12	24 <b>Mg</b> Magnesium 12	27 <b>Fe</b> Iron 26	28 <b>Ni</b> Nickel 28	29 <b>Cu</b> Copper 29	30 <b>Zn</b> Zinc 30	31 <b>Ga</b> Gallium 31	32 <b>Ge</b> Germanium 32	33 <b>As</b> Arsenic 33	34 <b>Se</b> Selenium 34	35 <b>Br</b> Bromine 35	36 <b>Kr</b> Krypton 36	40 <b>Ca</b> Calcium 20
39 <b>K</b> Potassium 20	40 <b>Ca</b> Calcium 20	41 <b>Ti</b> Titanium 22	42 <b>Cr</b> Chromium 24	43 <b>Mn</b> Manganese 25	44 <b>Fe</b> Iron 26	45 <b>Co</b> Cobalt 27	46 <b>Ni</b> Nickel 28	47 <b>Cu</b> Copper 29	48 <b>Zn</b> Zinc 30	49 <b>Ga</b> Gallium 31	50 <b>Ge</b> Germanium 32	51 <b>As</b> Arsenic 33
85 <b>Rb</b> Rubidium 38	86 <b>Sr</b> Strontium 38	87 <b>Y</b> Yttrium 39	88 <b>Zr</b> Zirconium 40	89 <b>Nb</b> Niobium 41	90 <b>Mo</b> Molybdenum 42	91 <b>Tc</b> Technetium 43	92 <b>Ru</b> Ruthenium 44	93 <b>Rh</b> Rhodium 45	94 <b>Pd</b> Palladium 46	95 <b>Ag</b> Silver 47	96 <b>Cd</b> Cadmium 48	97 <b>In</b> Indium 49
133 <b>Cs</b> Caesium 56	137 <b>Ba</b> Barium 56	138 <b>La</b> Lanthanum 57	139 <b>Ce</b> Cerium 58	140 <b>Pr</b> Praseodymium 59	141 <b>Nd</b> Neodymium 60	142 <b>Pm</b> Promethium 61	143 <b>Sm</b> Samarium 62	144 <b>Eu</b> Europium 63	145 <b>Gd</b> Gadolinium 64	146 <b>Tb</b> Terbium 65	147 <b>Dy</b> Dysprosium 66	148 <b>Ho</b> Holmium 67
223 <b>Fr</b> Francium 88	226 <b>Ra</b> Radium 88	227 <b>Ac</b> Actinium 89	228 <b>Th</b> Thorium 90	231 <b>Pa</b> Protactinium 91	232 <b>U</b> Uranium 92	233 <b>Np</b> Neptunium 93	234 <b>Pu</b> Plutonium 94	235 <b>Am</b> Americium 95	236 <b>Cm</b> Curium 96	237 <b>Bk</b> Berkelium 97	238 <b>Cf</b> Californium 98	239 <b>Es</b> Einsteinium 99
287 <b>Og</b> Oganesson 118	288 <b>Ts</b> Tennessine 117	289 <b>Lr</b> Lawrencium 103	290 <b>Uu</b> Ununennium 119	291 <b>Uub</b> Unbibium 120	292 <b>Uuq</b> Unquadrium 124	293 <b>Uubk</b> Unbikium 125	294 <b>Uuql</b> Unquadium 126	295 <b>Uuqo</b> Unquadium 127	296 <b>Uuql</b> Unquadium 128	297 <b>Uuqo</b> Unquadium 129	298 <b>Uuql</b> Unquadium 130	299 <b>Uuqo</b> Unquadium 131

		Group										
I	II	III	IV	V	VI	VII	0					
175 <b>Lu</b> Lutetium 71	176 <b>Hf</b> Hafnium 72	177 <b>Ta</b> Tantalum 73	178 <b>Hf</b> Hafnium 72	179 <b>Rf</b> Rutherfordium 104	180 <b>Db</b> Dubnium 105	181 <b>Sg</b> Seaborgium 106	182 <b>Bh</b> Bohrium 107	183 <b>Hs</b> Hassium 108	184 <b>Mt</b> Meitnerium 109	185 <b>Ds</b> Darmstadtium 110	186 <b>Rg</b> Roentgenium 111	187 <b>Cn</b> Copernicium 112
260 <b>Lr</b> Lawrencium 103	261 <b>Hf</b> Hafnium 72	262 <b>Ta</b> Tantalum 73	263 <b>Hf</b> Hafnium 72	264 <b>Rf</b> Rutherfordium 104	265 <b>Db</b> Dubnium 105	266 <b>Sg</b> Seaborgium 106	267 <b>Bh</b> Bohrium 107	268 <b>Hs</b> Hassium 108	269 <b>Mt</b> Meitnerium 109	270 <b>Ds</b> Darmstadtium 110	271 <b>Rg</b> Roentgenium 111	272 <b>Cn</b> Copernicium 112

58–71 Lanthanoid series  
90–103 Actinoid series

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

The volume of one mole of any gas is 24 dm<sup>3</sup> at room temperature and pressure (r.t.p.).