SCIENCE (PHYSICS, CHEMISTRY)   **5124/01**

Paper 1 Multiple Choice   **October/November 2009**

                                                    1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name, Centre number and index number on the Answer Sheet in the spaces provided unless this has been done for you.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
A copy of the Periodic Table is printed on page 16.

This document consists of **13** printed pages and **3** blank pages.

UNIVERSITY of CAMBRIDGE
International Examinations

[Turn over

1   What gives the most accurate value for the internal diameter of a test tube?

    A   a measuring tape

    B   a metre rule

    C   a micrometer screw gauge

    D   vernier calipers

2   The speed-time graph shows the journey of a train.

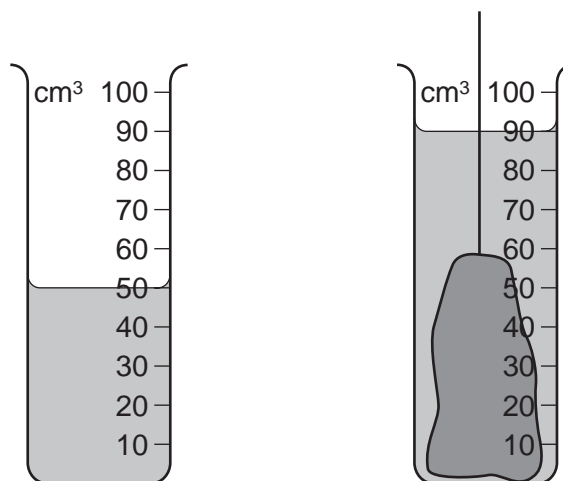   At which point does the acceleration have its highest value?
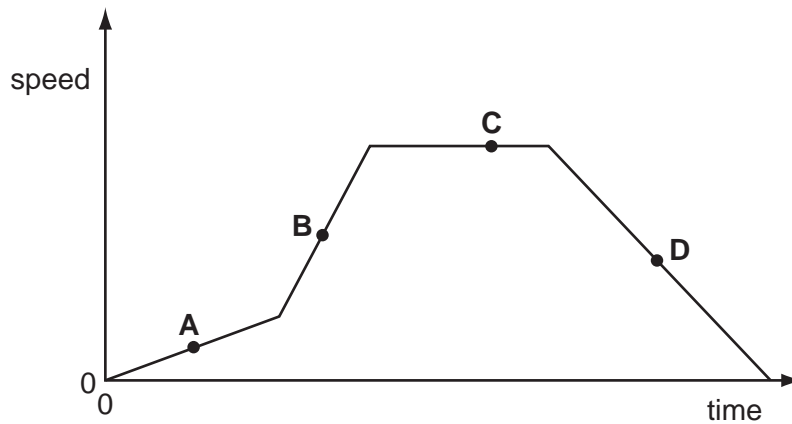
3   A horizontal force of 8 N is applied to a block of mass 2 kg, resting on a frictionless table.

    What is the acceleration of the block?

    A $0.25 \, \text{m/s}^2$ **B** $4.0 \, \text{m/s}^2$ **C** $6.0 \, \text{m/s}^2$ **D** $16 \, \text{m/s}^2$

4   An object of mass 100 g is immersed in water as shown in the diagram.

    What is the density of the material from which the object is made?

    A $0.4 \, \text{g/cm}^3$ **B** $0.9 \, \text{g/cm}^3$ **C** $1.1 \, \text{g/cm}^3$ **D** $2.5 \, \text{g/cm}^3$

5 If a nut and bolt are difficult to undo, it may be easier to turn the nut by using a longer spanner.

This is because the longer spanner gives

A a larger turning moment.

B a smaller turning moment.

C less friction.

D more friction.

6 A crane lifts a concrete block, whose weight is 60 000 N, to a height of 20 m in 30 s.

What power is achieved by the crane?

A 100 W **B** 4000 W **C** 40 000 W **D** 90 000 W

7 The earliest Ford cars were always painted black. This was because black paint dried more quickly than lighter colours when the cars were left in the sun to dry.

Which property of black paint makes it dry more quickly?

A It is the best absorber of heat.

B It is the best conductor of heat.

C It is the best insulator of heat.

D It is the best reflector of heat.

8 The volume of a fixed mass of liquid can be used to measure temperature.

Why is this?

A It can be coloured.

B It expands when it is heated.

C It is a poor conductor of heat.

D It is cheap.

9 The frequency of a certain v.h.f. radio transmitter is 2×10^8 Hz.

The speed of the waves is 3×10^8 m / s.

What is the wavelength?

A 0.67 m **B** 1.0 m **C** 1.5 m **D** 6.0 m

10 A ray of light travels from air into glass. The refractive index of the glass is 1.5.

Which of the following pairs could be values of the angle of incidence and the angle of refraction?

	angle of incidence	angle of refraction
A	21.5°	20.0°
B	40.0°	30.0°
C	60.0°	35.3°
D	80.0°	53.3°

11 A sonic 'tape measure' is used to measure the length of a room. It measures a time interval of 0.060 s between transmitting a sound pulse and receiving the echo. The speed of sound in air is 330 m / s.

How far is the reflecting wall from the 'tape measure'?

A 5.5 m   **B** 9.9 m   **C** 11 m   **D** 20 m

12 An electrical quantity is defined as 'the energy dissipated by a source in driving unit charge round a complete circuit.'

What is this quantity called?

A current

B electromotive force

C potential difference

D power

13 A wire has a resistance of 8 Ω. A second wire, made of the same material, has half the length and twice the cross-sectional area.

What is the resistance of the second wire?

**A** 1 Ω   **B** 2 Ω   **C** 8 Ω   **D** 16 Ω

14 A set of lights consists of 40 identical lamps connected in series to a 240 V mains supply.

What is the potential difference across each lamp?

A 6 V   **B** 40 V   **C** 240 V   **D** 9600 V

15 An electric kettle is plugged in and switched on. The fuse in the plug blows immediately.

Which single fault could cause this?

  A   The earth wire is not connected to the kettle.

  B   The live wire and neutral wire connections in the plug are swapped around.

  C   The live wire touches the metal case of the kettle.

  D   The wires connected to the plug are too thin.

16 In a simple a.c. generator, a coil is rotated about a horizontal axis XY between the poles of two bar magnets.
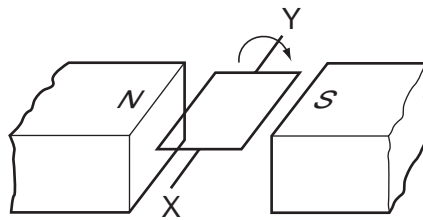
Which graph shows the e.m.f., *E*, induced in the coil during one complete revolution?
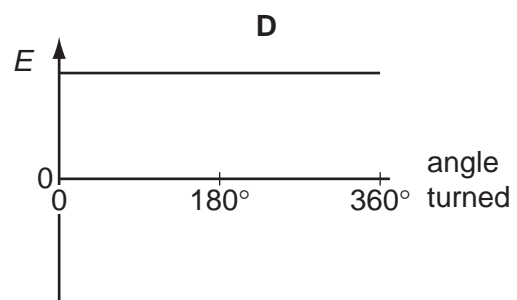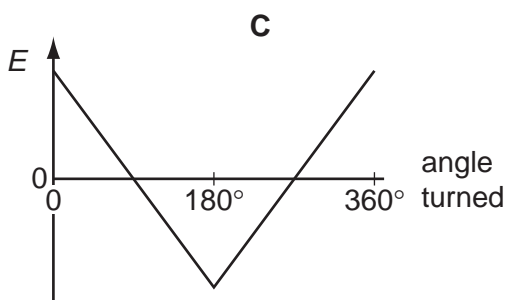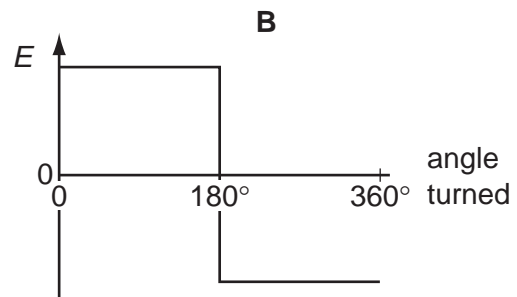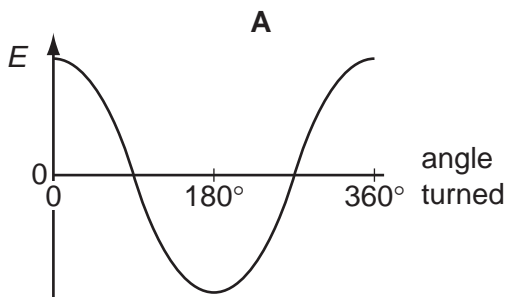
17 Which statement about the action of a transformer is correct?

  A   An e.m.f. is induced in the secondary coil when an alternating voltage is applied to the primary coil.

  B   An e.m.f. is induced in the secondary coil when there is a steady direct current in the primary coil.

  C   The current in the secondary coil is always larger than the current in the primary coil.

  D   The voltage in the secondary coil is always larger than the voltage in the primary coil.

18 Two nuclides of neon are represented by the symbols below.

$$^{20}_{10}\text{Ne} \qquad\qquad ^{22}_{10}\text{Ne}$$

One nuclide contains more particles than the other.

What are these extra particles?

A   electrons

B   ions

C   neutrons

D   protons

19 Radioactive decay occurs in some nuclei.

Which word describes these nuclei?

A   expanding
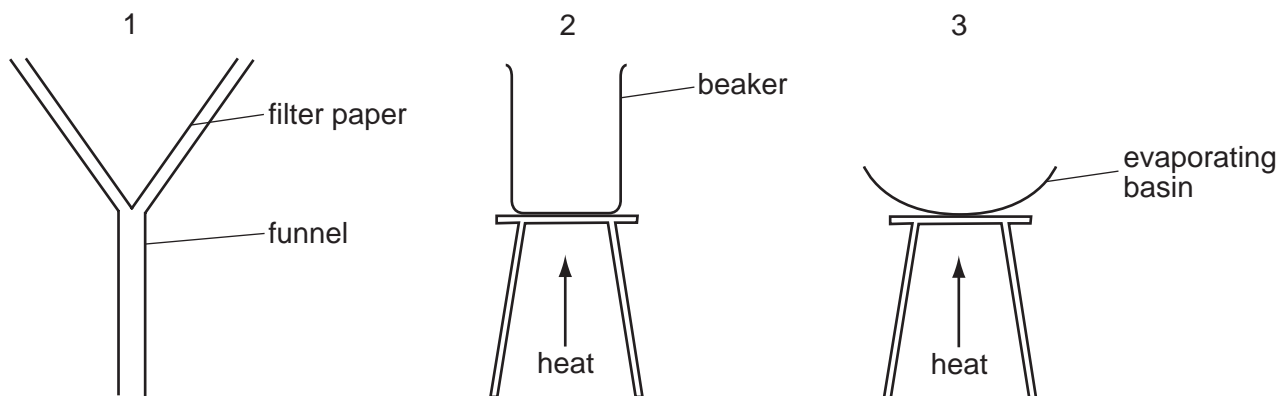
B   neutral

C   stable

D   unstable

20 The half-life of a radioactive material is 24 years.

The activity of a sample falls to a fraction of its initial value after 72 years.

What is the fraction?

A $\dfrac{1}{3}$ B $\dfrac{1}{4}$ C $\dfrac{1}{6}$ D $\dfrac{1}{8}$

21 The diagrams show three sets of apparatus.

What apparatus would be used to obtain separate samples of sand and salt from a mixture of sand and seawater?
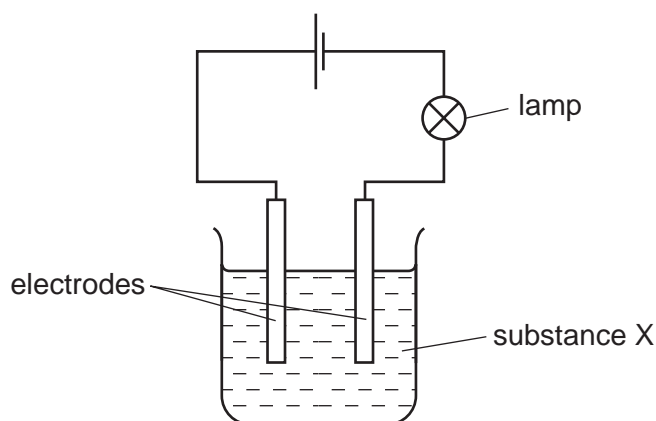
A   1 only   B   1 and 3   C   2 and 3   D   3 only

22 The symbol for an atom of potassium is $^{39}_{19}K$.

What does the number 39 represent for an atom of potassium?

A   the number of nucleons

B   the number of protons

C   its position in the Periodic Table

D   the number of electrons plus protons plus neutrons

23 In the circuit below, the lamp lights up.

What could substance X be?

A   a solution of ethanol in water

B   a solution of sodium chloride in water

C   liquid ethanol

D   solid sodium chloride

24 Which pair of elements form a compound by sharing electrons?

A   carbon and chlorine

B   lithium and iodine

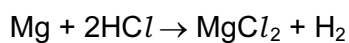**C**   neon and oxygen

D   potassium and bromine

25 The following equation is incomplete.

$$2KOH + H_2SO_4 \rightarrow X$$
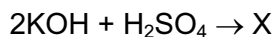
What is represented by X?

A $KSO_4 + H_2O$

B $K_2SO_4 + H_2O$

C $KSO_4 + 2H_2O$

D $K_2SO_4 + 2H_2O$

26 For the reaction shown, which volume of 1.0 mol / dm^3 hydrochloric acid is required to react completely with 3 g of magnesium?

$$Mg + 2HCl \rightarrow MgCl_2 + H_2$$

A $3\,cm^3$ **B** $6\,cm^3$ **C** $125\,cm^3$ **D** $250\,cm^3$

27 Which step in the diagram shows the process of photosynthesis?
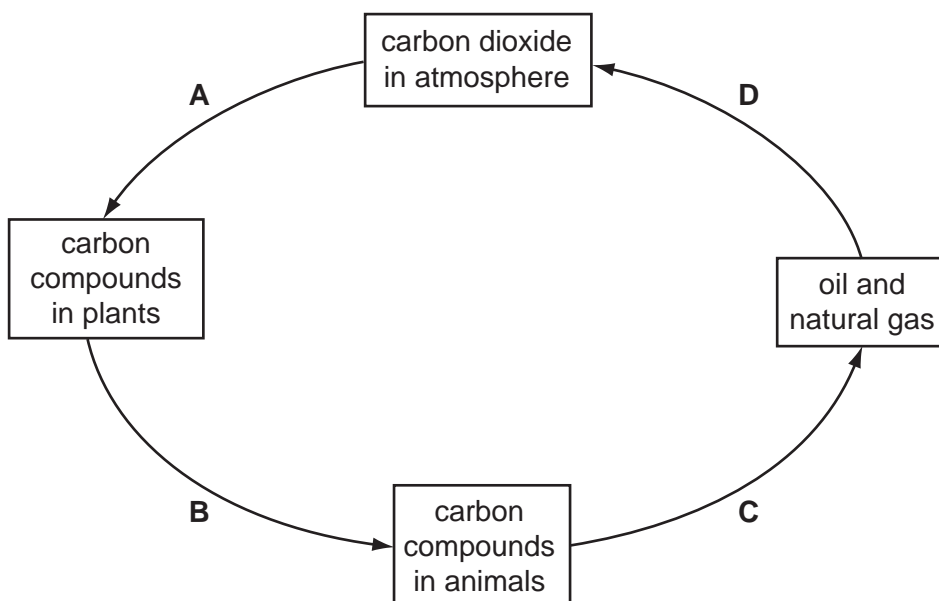
28 Calcium carbonate was reacted with an excess of dilute hydrochloric acid at room temperature.

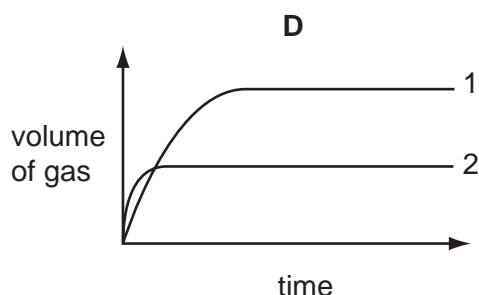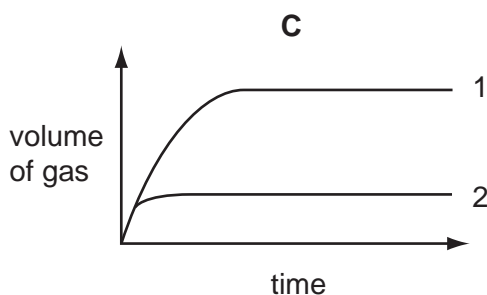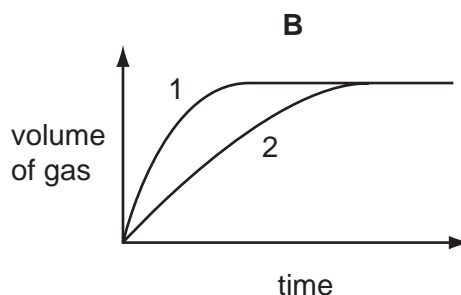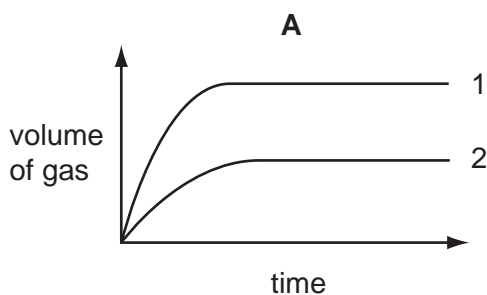$$CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$$

Two experiments were carried out.

Experiment 1   10 g of calcium carbonate in large lumps

Experiment 2   5 g of calcium carbonate as a fine powder

Which graph is correct?

29 Which reactants could be used safely to prepare potassium chloride?

A   aqueous potassium hydroxide and dilute hydrochloric acid

B   aqueous potassium sulfate and aqueous sodium chloride

C   potassium and aqueous sodium chloride

D   potassium and dilute hydrochloric acid

30 Caesium is in the same group of the Periodic Table as sodium and potassium.

What is a property of caesium?

A   It does not conduct electricity.

B   It forms an acidic oxide.

C   It forms an ionic chloride, $CsCl_2$.

D   It reacts with water, forming hydrogen.

31 Which row in the table gives a correct use for the metal stated?

	metal	use
A	aluminium	manufacture of aircraft
B	copper	galvanising dustbins
C	mild steel	cutlery
D	zinc	cooking utensils

32 Nickel is placed between zinc and iron in the reactivity series.

Which metal reduces the oxide of nickel?

A copper

B iron

C lead

D magnesium

33 Which shows both the correct source and the correct effect of the named pollutant?

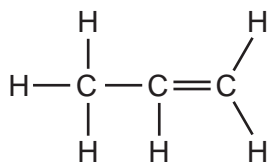|	pollutant	source	effect
A	carbon monoxide	incomplete combustion of carbon-containing materials	global warming
B	oxides of nitrogen	decaying vegetable matter	global warming
C	ozone	photochemical reactions	acid rain
D	sulfur dioxide	volcanoes	acid rain

34 Which compound provides two elements essential to plant growth?

A potassium chloride

B potassium nitrate
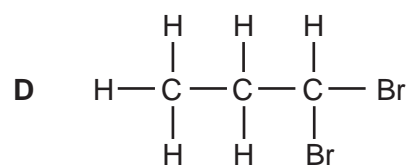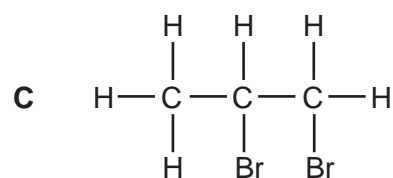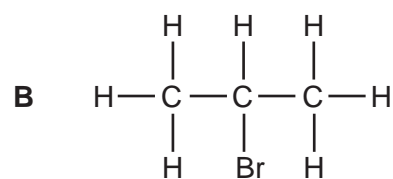
C sodium phosphate

D sodium sulfate

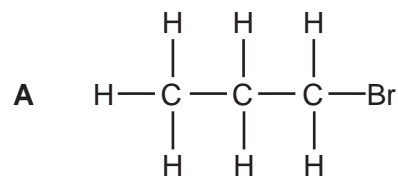**35** Methane the main constituent of

A diesel.

B naphtha.

C natural gas.

D petrol.

36 Propene is an unsaturated hydrocarbon. Its structure is shown.

$$H-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}=C\overset{\displaystyle H}{\underset{\displaystyle H}{<}}$$

What is produced when propene reacts with bromine?

A $H-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}-Br$

B $H-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle Br}{|}}{C}}-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}-H$

C $H-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle Br}{|}}{C}}-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle Br}{|}}{C}}-H$

D $H-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle Br}{|}}{C}}-Br$

37 The diagram represents an organic compound that contains three different elements.
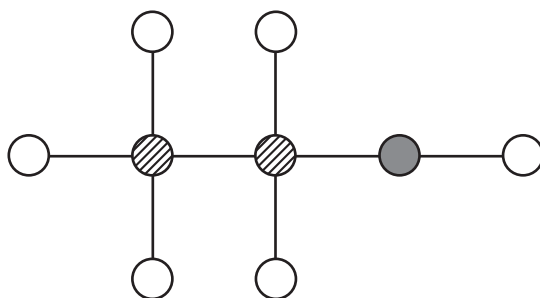
What could the compound be?

A   ethanoic acid

B   ethanol

C   propane

D   propene

38 Which statement about a compound means that it **must** be an alkane?

   A   It burns easily in air or in oxygen.

   B   It contains carbon and hydrogen only.

   C   It has the general formula C_nH_{2n+2}.

   D   It is generally unreactive.

39 A compound, X, has a molecular formula $C_4H_8O_2$ and can be prepared by the reactions shown.

| ethanol | $\xrightarrow{\text{oxidation}}$ | Y | $\xrightarrow{\text{+ ethanol}}$ | X |

   What is the structural formula of X?

   A $HCO_2CH_2CH_2CH_3$

   B $CH_3CO_2CH_2CH_3$

   C $CH_3CH_2CO_2CH_3$

   D $CH_3CH_2CH_2CO_2H$

40 In which pair of macromolecules are the linkages the same?

   A   fats and proteins

   B   nylon and fats

   C   nylon and proteins

   D   proteins and *Terylene*

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14

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DATA SHEET
The Periodic Table of the Elements

Group

I	II		III	IV	V	VI	VII	0
								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	...	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	...	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	...	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							

Transition elements:

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
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
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
227 **Ac** Actinium 89 †									

1 **H** Hydrogen 1

*58-71 Lanthanoid series:

| 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 |

†90-103 Actinoid series:

| 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 |

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.).

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