UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

5727661480

COMBINED SCIENCE **0653/33**

Paper 3 (Extended) **October/November 2011**

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 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	
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total	

This document consists of **20** printed pages.

For Examiner's Use

1 There are three states of matter – solid, liquid and gas.

Fig. 1.1 shows the arrangement of particles in a solid.

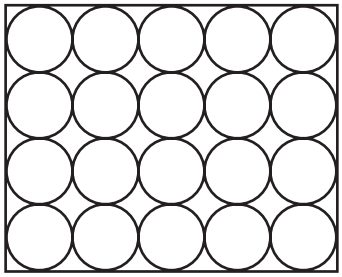
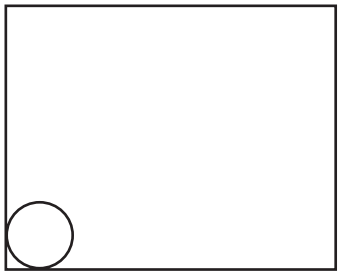
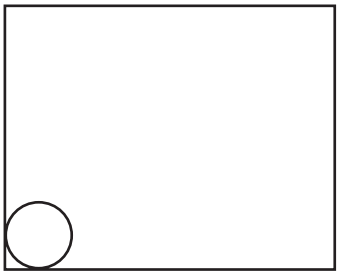


Fig. 1.1

(a) (i) Draw similar diagrams for a liquid and a gas.



liquid



gas

[2]

(ii) Explain the arrangements you have drawn in terms of the forces between the particles.

.....

.....

..... [2]

(b) Explain the following using the ideas of conduction, convection and radiation.

For Examiner's Use

(i) Houses in hot climates are often painted white.

.....

..... [1]

(ii) A saucepan has a metal base but a plastic or wooden handle.

.....

..... [1]

(iii) In a kettle, the water is heated at the bottom but all of the water in the kettle becomes hot.

.....

.....

..... [2]

2 **(a)** Fig. 2.1 shows a flowering plant, and two cells from the plant.

Fig. 2.1

(i) On Fig. 2.1, draw a line from each cell to a part of the plant in which it could be found. [2]

(ii) Explain why cell **A** contains the structures labelled **X**, but cell **B** does not.

.....

.....

.....

.....

..... [3]

(iii) Suggest how the shape of cell **B** adapts it for its function.

.....

.....

..... [2]

For Examiner's Use

(b) The colour of the flower petals is determined by a gene with two alleles, **R** and **r**. Allele **R** is dominant and produces red flowers, and allele **r** produces white flowers.

(i) Complete Table 2.1 to show the phenotype produced by each of the three possible genotypes.

Table 2.1

genotype	phenotype
RR	
Rr	
rr	

[1]

(ii) On Table 2.1, draw a circle around **one heterozygous** genotype. [1]

(iii) Predict the ratio of red to white flowers that would be produced if two plants with the genotypes **Rr** were crossed.

..... [1]

(c) A grower has a rare variety of orchid with unusual flowers. She decides to produce new plants from this orchid using an asexual method of propagation.

Suggest the advantages to the grower of using asexual propagation to produce new plants, rather than sowing seeds she has collected from the orchid plant.

.....

.....

..... [2]

3 **(a)** Fig. 3.1 shows apparatus a student used to investigate the electrolysis of a solution of potassium sulfate.

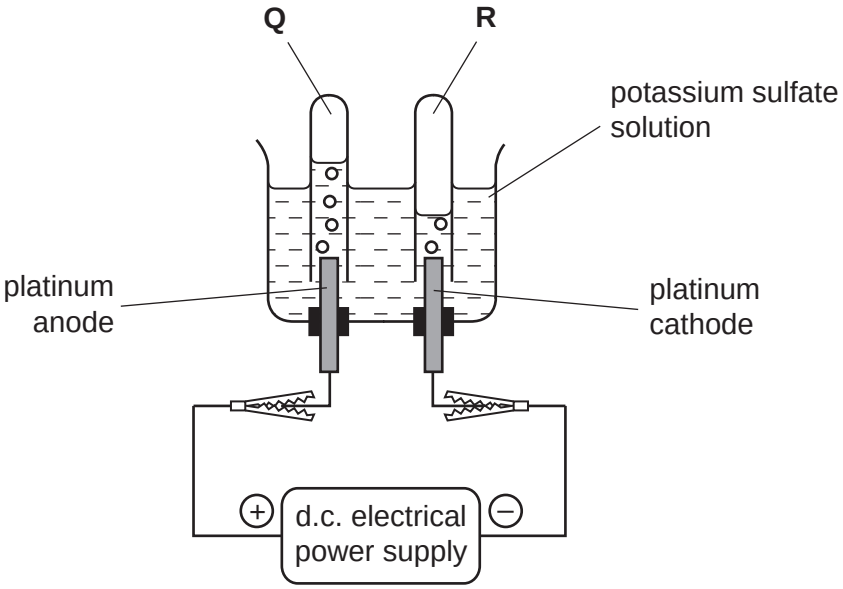


Fig. 3.1

During the experiment shown in Fig. 3.1, two different colourless gases, **Q** and **R**, collected in the small test-tubes. Neither of these gases contained any sulfur.

(i) Name gases **Q** and **R**.

Q .....

R ..... [2]

(ii) Choose **one** of the gases, **Q** or **R**, and describe how the student should test it for the gas you have named.

chosen gas .....

test .....

..... [1]

For Examiner's Use

(b) Potassium sulfate solution is made in a neutralisation reaction between an acid and an alkali.

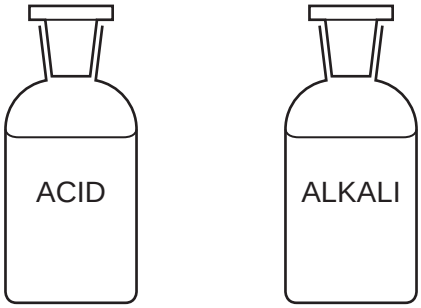
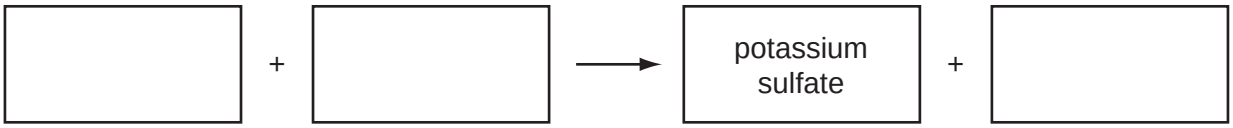


Fig. 3.2

(i) Suggest a **word** chemical equation for a reaction between a suitable acid and alkali that would produce potassium sulfate.



[2]

(ii) Describe how a **neutral** solution of potassium sulfate could be obtained using suitable solutions of an acid and an alkali.

.....

.....

.....

.....

..... [3]

(iii) State the **ionic** equation which describes the neutralisation reaction between any aqueous acid and any aqueous alkali.

..... [2]

4 **(a)** Five types of radiation are listed below.

alpha radiation **beta radiation** **gamma radiation**

infra–red radiation **ultraviolet radiation**

(i) State which of these types of radiation is a stream of electrons.

..... [1]

(ii) State which of these types of radiation are forms of electromagnetic radiation.

.....

..... [2]

(iii) State **one** use for gamma radiation.

..... [1]

(iv) Complete Table 4.1 to compare alpha, beta and gamma radiations.

Tick **one** box in each row of the table.

Table 4.1

	alpha	**beta**	**gamma**
most penetrating			
most ionising			
not deflected by an electric field			

[2]

(b) Some students measured the level of radiation from a radioactive source for 42 days. Table 4.2 shows the results corrected for background radiation.

For Examiner's Use

Table 4.2

time / days	**0**	**7**	**14**	**21**	**28**	**35**	**42**
level of radiation / average counts per minute	64	45	33	23	16	12	8

Describe and explain the pattern in these results.

.....

.....

..... [2]

5 PTFE is an important plastic which has many uses in the home and industry. PTFE is made of polymer molecules.

Fig. 5.1 shows the displayed formula of the monomer that reacts to produce PTFE.

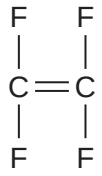


Fig. 5.1

(a) (i) Explain why the molecule shown in Fig. 5.1 is **not** a hydrocarbon.

.....

..... [1]

(ii) Fig. 5.2 shows the outer shell electrons in a carbon atom and a fluorine atom.

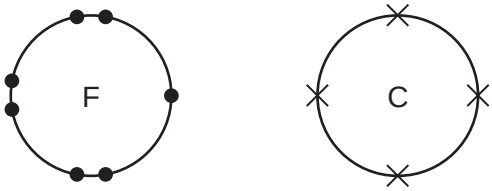
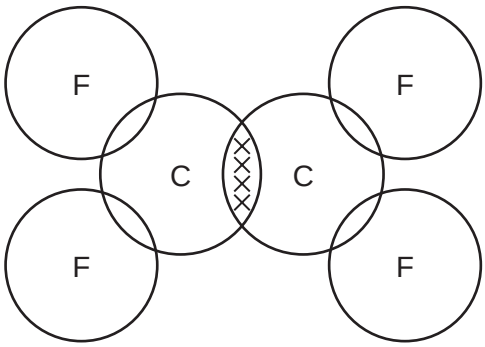


Fig. 5.2

Complete the bonding diagram below to show how the outer electrons are arranged in the molecule whose displayed formula is shown in Fig. 5.1.



[2]

For Examiner's Use

(iii) Complete the diagram below to show the displayed formula of a small section of a PTFE molecule.

Your completed formula must contain eight fluorine atoms.

[3]

(b) The element, fluorine, is a halogen in Group 7 of the Periodic Table.

(i) Use your knowledge of the physical states of the other halogens to predict and explain whether fluorine is a solid, a liquid or a gas at room temperature.

prediction .....

explanation .....

.....

..... [2]

(ii) Use your knowledge of the reactivities of the other halogens to predict and explain whether or not the following halogen displacement reaction will occur.

bromine + sodium fluoride → sodium bromide + fluorine

.....

.....

..... [2]

For Examiner's Use

6 Fig. 6.1 shows the human digestive system.

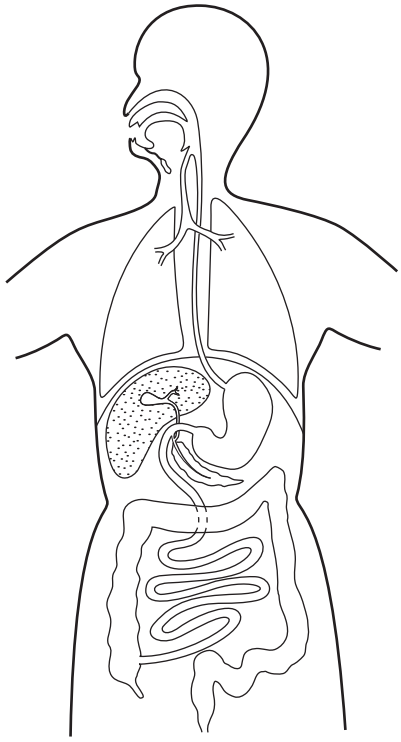


Fig. 6.1

(a) On Fig. 6.1, use label lines to label

the stomach,

the colon. [2]

(b) On Fig. 6.1, label and name **one** part of the digestive system that food does **not** pass through on its way from mouth to anus. [1]

(c) Describe how digestion takes place inside the stomach.

.....

.....

..... [2]

(d) Fig. 6.2 shows a food web involving humans.

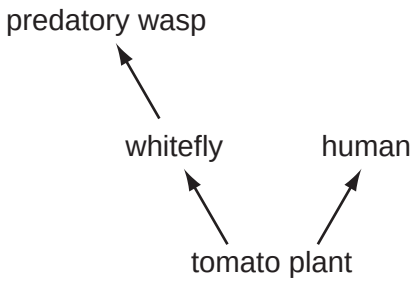


Fig. 6.2

If there are a lot of whitefly feeding on the tomato plants, there will be fewer tomatoes for humans to eat.

(i) Use the information in Fig. 6.2 to suggest how biological control could be used to control the whitefly population.

.....

..... [1]

(ii) State **two** reasons, other than cost, why this could be a better way of controlling the whitefly than using pesticides.

1 .....

.....

2 .....

..... [2]

7 Some coffee drinks are sold in self-heating cans.

Fig. 7.1 shows a cross-sectional diagram of one design of self-heating can.

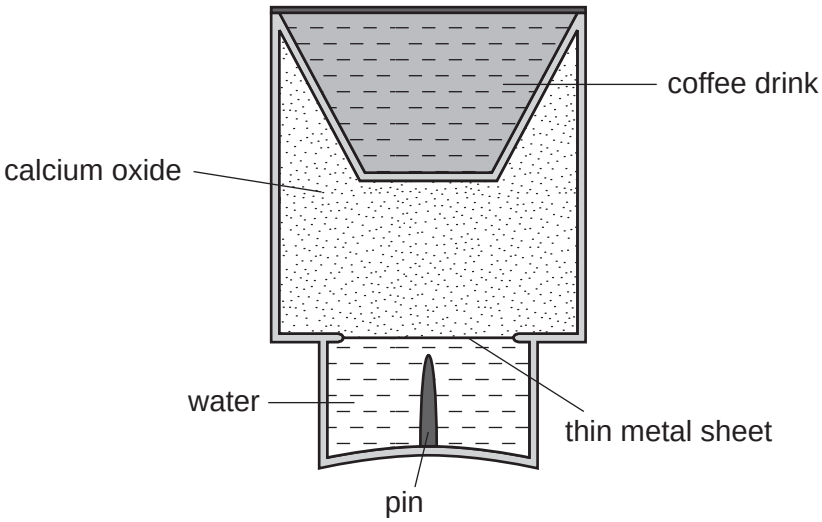


Fig. 7.1

Fig. 7.2 shows the can after it has been turned upside down and the pin pushed through the thin metal sheet. This allows the water to fall into the calcium oxide.

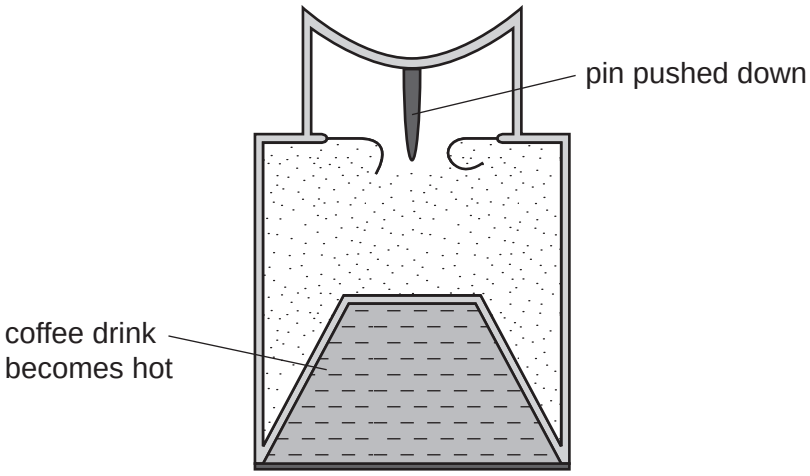


Fig. 7.2

(a) Explain briefly why the coffee drink in the self-heating can becomes hot when the water and calcium oxide mix.

.....

.....

.....

..... [2]

(b) (i) Use the position of calcium in the Periodic Table to explain why the electrical charge of a calcium ion is +2.

For Examiner's Use

.....

.....

.....

.....

..... [3]

(ii) The reaction between calcium oxide and water produces the ionic compound calcium hydroxide, $Ca(OH)_2$.

Deduce the electrical charge of the hydroxide ion.

Show how you obtained your answer.

.....

..... [2]

8 **(a)** A student set up the circuit shown in Fig. 8.1 to investigate the relationship between the voltage across resistor **R** and the current through resistor **R**.

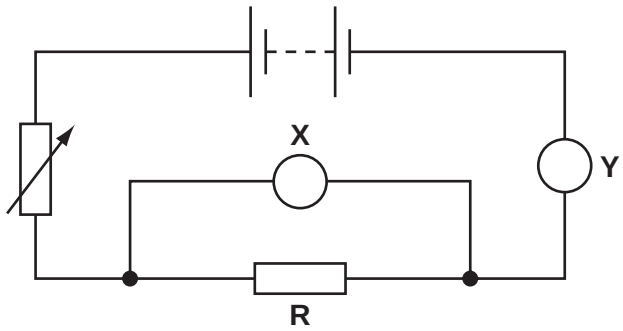


Fig. 8.1

(i) Name the meters labelled **X** and **Y**.

X .....

Y ..... [1]

(ii) Explain the purpose of the variable resistor in the circuit.

.....

..... [1]

(iii) Fig. 8.2 shows a graph of the results.

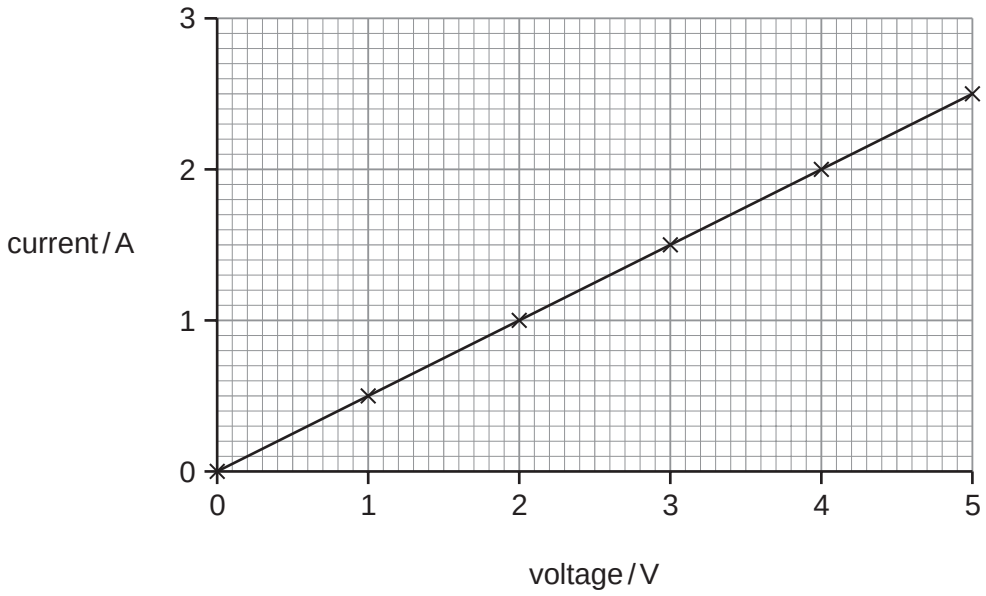


Fig. 8.2

Use the data on the graph to calculate the resistance of resistor **R**.

State the formula that you use and show your working.

formula used

working

..... [2]

(b) Two 10 ohm resistors are placed in parallel in a circuit.

Calculate their total resistance.

State the formula that you use and show your working.

formula used

working

..... [3]

(c) Fig. 8.3 shows a battery-operated d.c. electric motor driving a fan. When an electric current passes through the coil it rotates.

For Examiner's Use

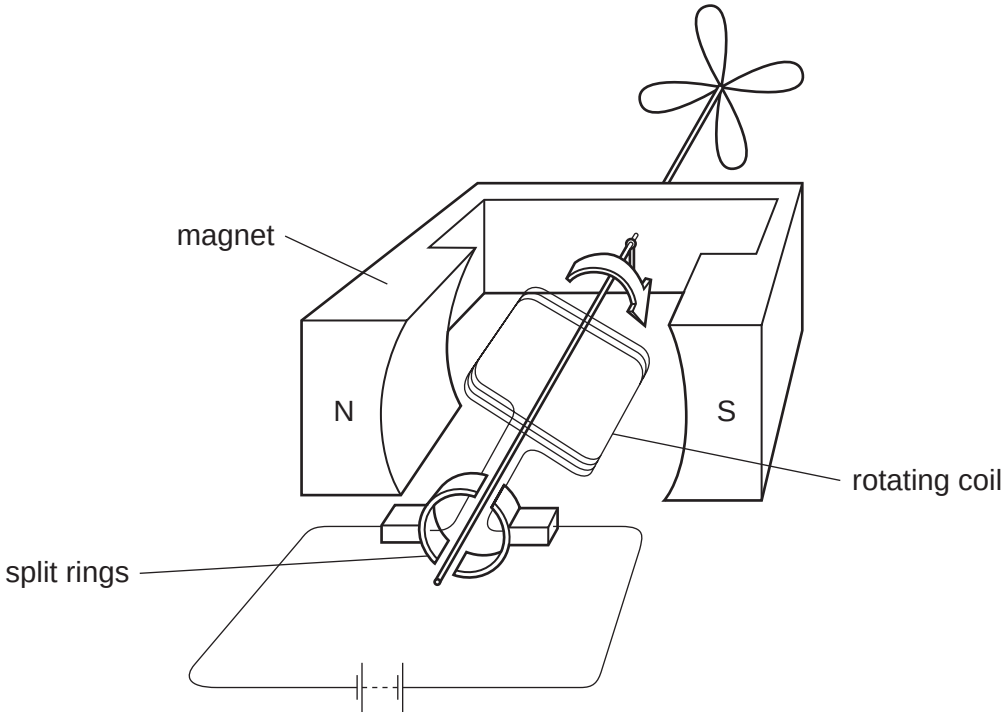


Fig. 8.3

(i) Describe what happens to the coil if the poles of the magnets are reversed and the rest of the circuit remains the same.

.....

.....

[1]

(ii) Describe what happens if a greater electric current is passed through the coil.

.....

.....

[1]

(iii) Explain the purpose of the split rings.

.....

.....

.....

.....

[2]

For Examiner's Use

9 A man walking along a road decided to cross to the other side. As he was walking across the road, a car sounded its horn, which made him jump. He then crossed the rest of the road more quickly.

(a) For each of the actions that the man took, state whether it was a **reflex** action or a **voluntary** action.

walking along the road .....

walking across the road .....

jumping in response to the car horn .....

crossing the road more quickly ..... [2]

(b) Explain **one** advantage and **one** disadvantage of reflex actions over voluntary actions.

advantage .....

.....

disadvantage .....

..... [2]

(c) State the roles of each of the following parts of the nervous system in a reflex action.

receptor .....

.....

motor neurone .....

..... [2]

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 †															

*58-71 Lanthanoid series
†90-103 Actinoid 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
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.).