UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

5910681856

CO-ORDINATED SCIENCES **0654/02**

Paper 2 (Core) **October/November 2007**

2 hours

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	
10	
11	
Total	

This document consists of **21** printed pages and **3** blank pages.

For Examiner's Use

1 **(a)** Complete the following sentences choosing from the words below.

amps **coulombs** **current** **parallel**

potential difference **resistance** **series**

Electric charge is measured in ..... .

A flow of electric charge is called a ..... .

A voltmeter is used to measure ..... .

A voltmeter is connected in ..... with the component. [4]

(b) A student measures the current passing through a wire when a potential difference is applied across it.

(i) Calculate the resistance of the wire when a potential difference of 0.3 V is applied and the current measured is 0.4 A.

State the formula that you use and show your working.

formula used

working

..... Ω [2]

(ii) Calculate the quantity of charge which flows through the wire in one minute.

State the formula that you use and show your working.

formula used

working

..... C [2]

For Examiner's Use

2 Fig. 2.1 shows a small gas burner which can be used to heat water or food contained in a metal cooking pot. The fuel used in this burner is the hydrocarbon butane, C_4H_{10}.

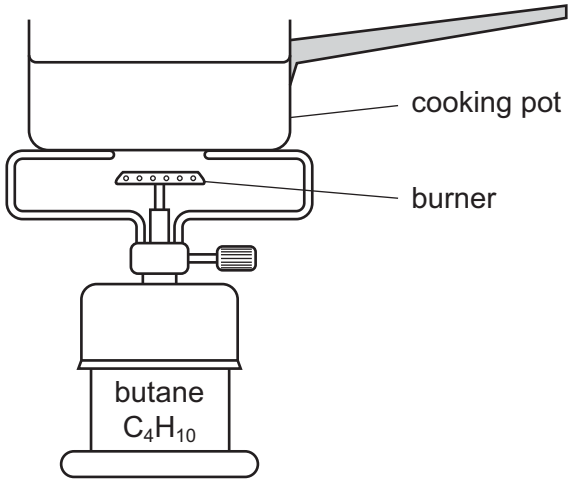


Fig. 2.1

(a) (i) Butane is obtained from crude oil (petroleum). Name the process which is used to separate butane from the other hydrocarbons in crude oil.

..... [1]

(ii) State **one** important use, other than as fuels, of hydrocarbons obtained from crude oil.

..... [1]

(iii) Butane is normally a gas at room temperature. In the type of burner shown in Fig. 2.1, butane has been condensed into a liquid.

Suggest what must be done to gaseous butane to turn it into a liquid.

.....

..... [1]

(b) Name the **two** compounds which are formed when butane is completely burnt.

..... [2]

For Examiner's Use

3 Dairy cattle are kept to produce milk. The milk is produced and stored in the cow's udder.

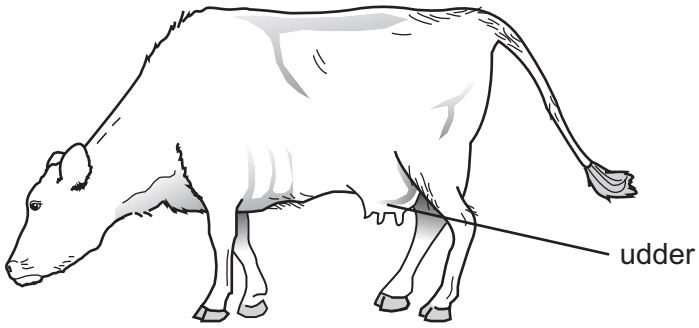


Fig. 3.1

(a) State two features of a dairy cow that are visible in Fig. 3.1 and show it is a mammal.

1. .....

2. ..... [2]

(b) Milk contains a lot of protein, fat and calcium.

Outline the function of each of these substances in the human diet.

(i) protein .....

..... [1]

(ii) fat .....

..... [1]

(iii) calcium .....

..... [1]

For Examiner's Use

(c) Some cows have horns, while others do not. The gene that determines whether there are horns or not has two alleles. Allele **A** does not produce horns. Allele **a** does produce horns. Heterozygous cows do not have horns.

(i) What is the phenotype of a heterozygous cow?

..... [1]

(ii) A heterozygous bull was bred with a heterozygous cow.

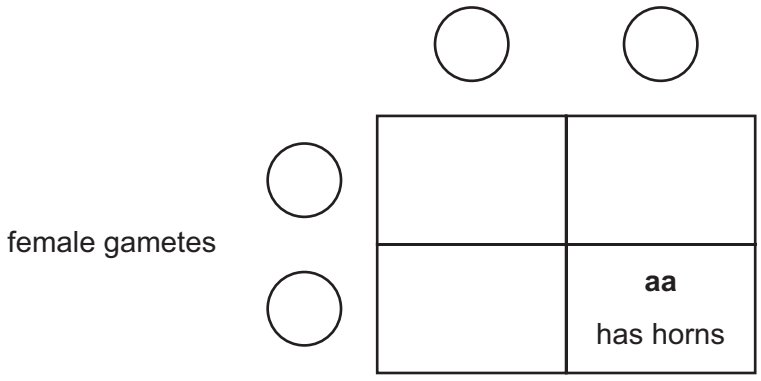
Complete the genetic diagram to show the chances of her calf having horns.

parents bull with no horns cow with no horns

Aa .....

gametes ◯ and ◯ ◯ and ◯

offspring male gametes



chance of the calf having horns is ..... [4]

For Examiner's Use

4 **(a)** Iodine-123 and iodine-131 are radioactive isotopes of iodine that are used to treat patients in medicine. Iodine-123 emits gamma radiation and has a half-life of 13.6 hours. Iodine-131 emits both beta and gamma radiation and has a half-life of 8 days.

(i) What is the meaning of the term *half-life*?

.....

[1]

(ii) State and explain two reasons why it would be safer for a patient to use iodine-123 rather than iodine-131.

1. .....

.....

2. .....

.....

[3]

(b) There are people working near the radioactive source.

(i) How might these workers be harmed by radiation from this radioactive source?

.....

[1]

(ii) Give **one** way in which these workers could be protected from the radiation emitted.

.....

.....

.....

[1]

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Please turn over for question 5

For Examiner's Use

5 **(a)** What is meant by a *period* in the Periodic Table?

.....

..... [1]

(b) Table 5.1 shows the numbers of protons, neutrons and electrons in four atoms, **P**, **Q**, **R** and **S**.

Table 5.1

atom	protons	neutrons	electrons
P	17	18	18
Q	11	12	10
R	17	18	17
S	16	16	16

(i) Explain which atom, **P**, **Q**, **R** or **S**, is an **ion** with a positive charge.

.....

.....

..... [2]

(ii) Explain which atom, **P**, **Q**, **R** or **S**, is a **neutral atom** with nucleon (mass) number of 35.

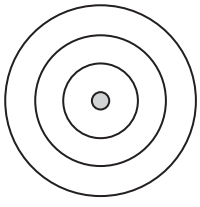
.....

.....

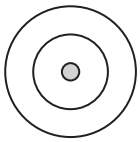
..... [2]

(iii) An element is in Group 3 of the Periodic Table.

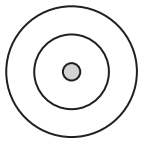
State and explain which **one** of the diagrams below shows an atom of this element.



atom 1



atom 2



atom 3

.....

.....

..... [2]

For Examiner's Use

(c) The diagram in Fig. 5.1 shows how ions are arranged in the compound sodium chloride.

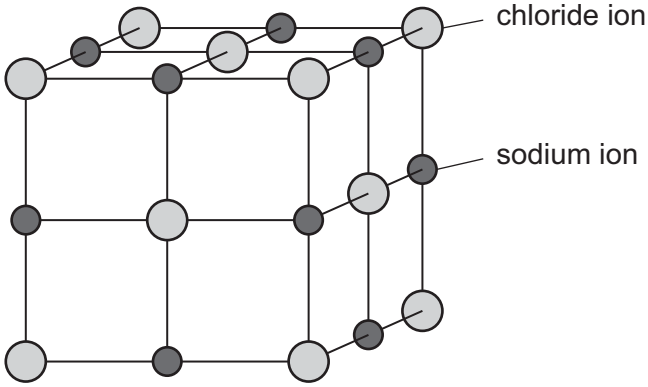


Fig. 5.1

(i) What name is given to the type of structure in sodium chloride?

..... [1]

(ii) Describe briefly how chlorine gas could be made from sodium chloride crystals.

.....

.....

..... [2]

For Examiner's Use

6 Fig. 6.1 shows the structure of an insect-pollinated flower.

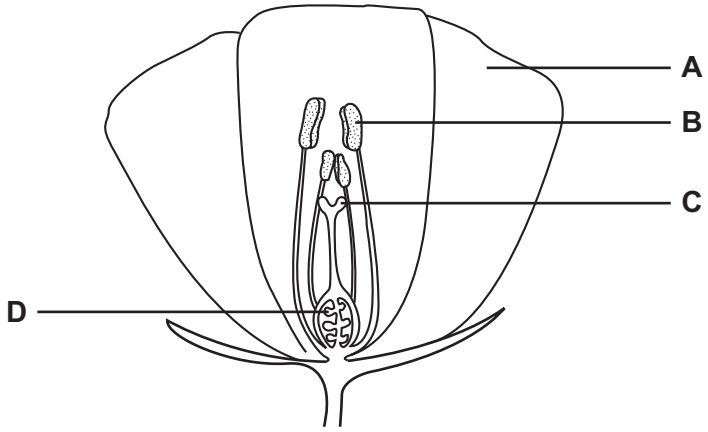


Fig. 6.1

(a) Outline the functions of the parts of the flower labelled **A**, **B** and **C**.

A .....

B .....

C ..... [3]

(b) The flower shown in Fig. 6.1 is pollinated with pollen that came from another flower on the same plant.

Is this an example of asexual reproduction or sexual reproduction?

Explain your answer.

type of reproduction .....

explanation .....

..... [1]

(c) After pollination, structure **D** is fertilised.

What will structure **D** develop into after it has been fertilised?

..... [1]

(d) The ovary of a flower develops into a fruit after fertilisation. Fruits help to disperse the seeds inside them.

Draw a fruit that is dispersed by animals.

Label the fruit to explain how it is adapted for animal dispersal.

[3]

(e) A student carried out an experiment to find out what conditions some lettuce seeds needed in order to germinate.

Table 6.1 shows his results.

Table 6.1

set of seeds	air present	soil present	water present	light present	did seeds germinate?
A	yes	yes	yes	yes	yes
B	no	yes	yes	yes	no
C	yes	no	yes	yes	yes
D	yes	yes	no	yes	no
E	yes	yes	yes	no	no

(i) Which conditions did the lettuce seeds need for germination?

..... [2]

(ii) State **one** factor that the student should have kept constant in his experiment.

..... [1]

For Examiner's Use

7 The arrows in Fig. 7.1 show the horizontal forces acting on a car moving forwards. In each case the length of the arrow indicates the size of the force.

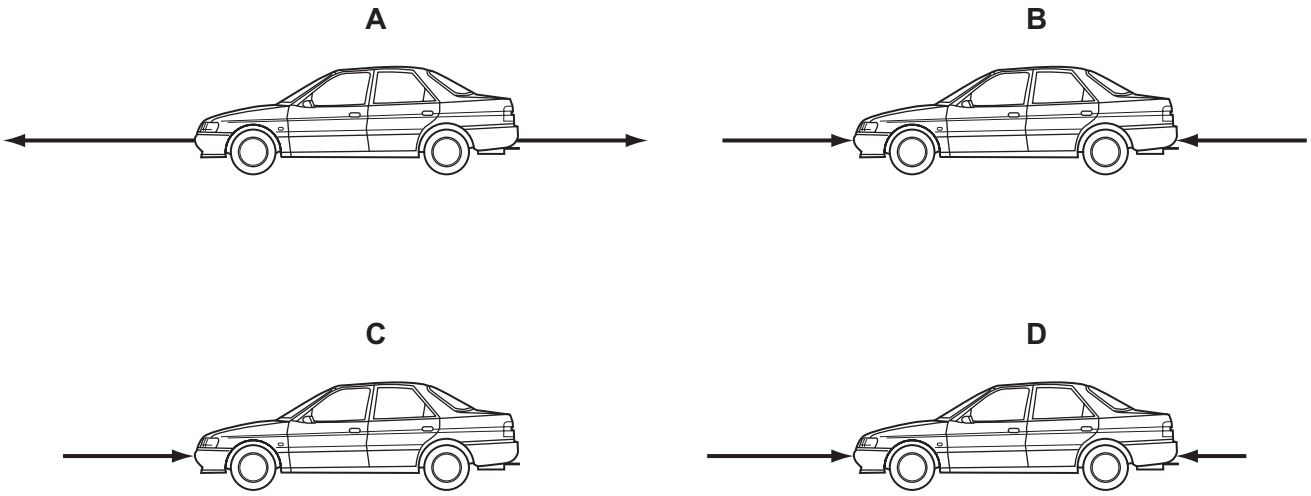


Fig. 7.1

(a) Which diagram or diagrams show a car which is

(i) slowing down, ... [1]

(ii) accelerating, ... [1]

(iii) travelling at constant speed? ..... [1]

(b) (i) A car of mass 1000 kg travels 320 m in 20 s.

Show that the speed of the car is 16 m / s.

State the formula that you use and show your working.

formula used

working

[1]

For Examiner's Use

(ii) Calculate the kinetic energy of the car.

State the formula that you use and show your working.

formula used

working

..... J [2]

(c) A car headlamp has a power rating of 60 W.

(i) Calculate the current passing through the headlamp when the voltage across it is 12 V.

State the formula that you use and show your working.

formula used

working

..... A [2]

(ii) State how many joules of energy will be converted every second in the headlamp.

..... J [1]

8 A student added four substances, **A**, **B**, **C** and **D**, to four separate beakers each with 25 cm^3 of dilute sulphuric acid as shown in Fig. 8.1.

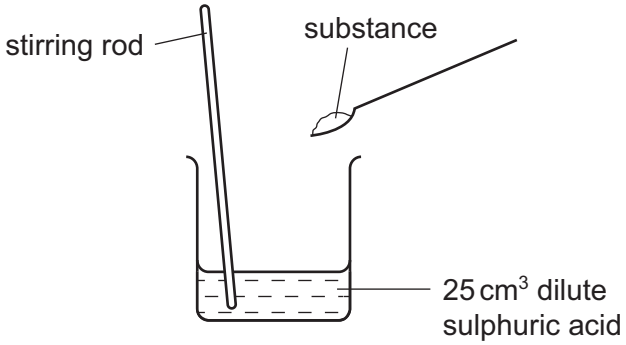


Fig. 8.1

The observations which the student made are shown in Table 8.1.

Table 8.1

substance	observations	pH of the mixture after any reaction is complete
A	• gas given off which turns limewater milky • colourless solution formed	2
B	• gas given off which turns limewater milky • blue solution formed	3
C	• gas given off which burns with a squeaky pop when ignited • colourless solution formed	3
D	• no gas given off • blue solution formed	4

(a) (i) State and explain in which experiment the greatest amount of acid was neutralised.

.....

.....

..... [2]

For Examiner's Use

(ii) Explain which **one** of the substances, **A**, **B**, **C** or **D**, could have been magnesium carbonate.

.....

..... [2]

(iii) Explain which **one** of the substances, **A**, **B**, **C** or **D**, could have been copper(II) oxide.

.....

..... [2]

(b) Sulphuric acid occurs in acid rain which forms when rain falls through polluted air.

Explain how the burning of a fossil fuel, such as coal, can lead to the formation of acid rain.

.....

.....

..... [2]

(c) Dilute sulphuric acid is a solution of hydrogen ions and sulphate ions in water.

Describe a chemical test which would show that sulphuric acid contains sulphate ions.

.....

.....

..... [2]

For Examiner's Use

9 Fig. 9.1 shows three cells in a leaf.

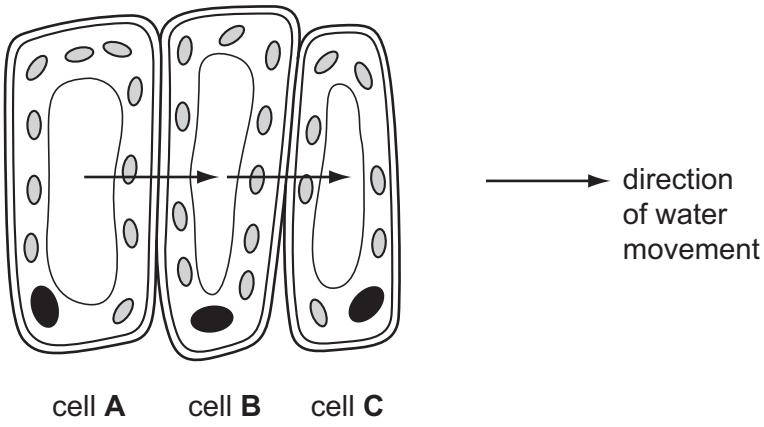


Fig. 9.1

(a) Name the tissue in which these cells are found.

..... [1]

(b) Describe **one** feature, shown in Fig. 9.1, which indicates that these cells are adapted for photosynthesis.

.....

.....

..... [2]

(c) The arrows in Fig. 9.1 show the direction in which water is moving between these cells.

(i) Name the process by which the water is moving.

..... [1]

(ii) Which cell, **A**, **B** or **C**, must have the highest concentration of solutes in its cell sap?

Explain your answer.

.....

.....

..... [2]

For Examiner's Use

(d) Complete the sentences to explain how water is absorbed by a plant and transported to its leaves. Use some of the words listed below.

guard cells **leaf epidermis** **leaves** **phloem** **respiration**

root hairs **stem** **transpiration** **xylem**

Water enters a plant through its ..... . The water moves through the cells towards the centre of the root. It enters the ..... vessels, which are empty tubes leading up through the root and stem and into the leaves. The water is pulled up because ..... is happening in the leaves. [3]

(e) Outline two ways in which the tissues in a leaf are supported.

1. .....

.....

2. .....

..... [2]

(f) The leaf cells shown in Fig. 9.1 contain starch, which has been made by photosynthesis. An animal eats the leaf.

(i) Name the enzyme in the animal's digestive system that digests starch.

..... [1]

(ii) Name the substance that is produced when starch is digested.

..... [1]

[Turn over

For Examiner's Use

10 Some children are swimming in a swimming pool.

(a) When they are under the water, they can still hear sounds from the surface.

Suggest how sound travels through water.

.....

..... [2]

(b) The children make some small waves on the surface of the water.

Are these waves longitudinal or transverse?

Explain your answer using a labelled diagram.

.....

..... [2]

(c) When the children leave the pool, the water on their bodies evaporates.

Explain how this evaporation takes place in terms of particles.

.....

.....

..... [2]

(d) There is a lamp at the bottom of the pool. Fig. 10.1 shows a ray of light from the lamp travelling up to the surface.

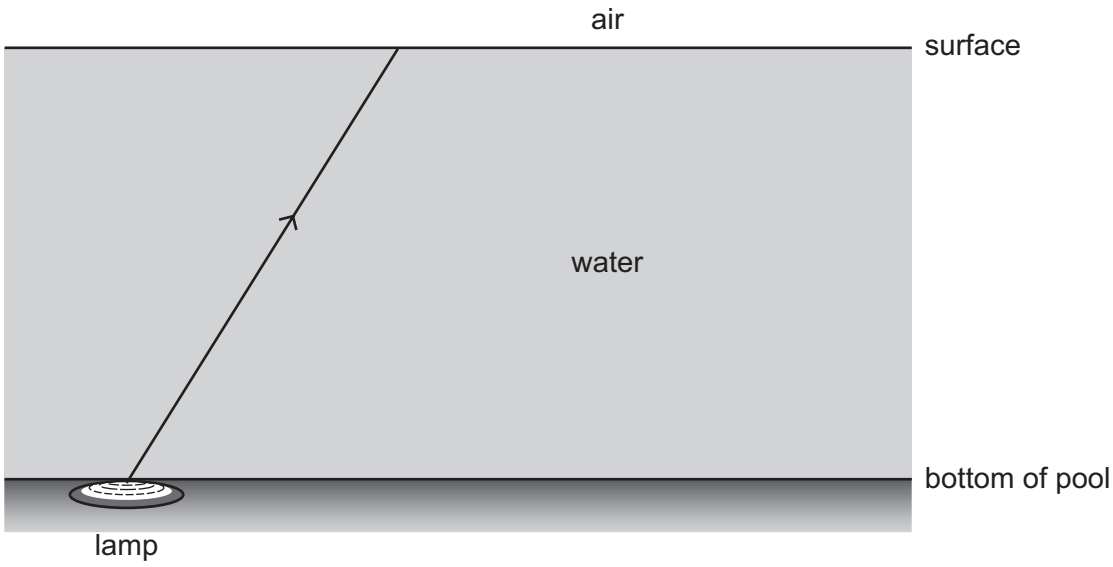


Fig. 10.1

(i) The ray of light passes through the surface of the water and up into the air.

On the diagram, draw the path of the ray as it leaves the water and goes through the air. [2]

(ii) State the name of the process in **(i)**.

..... [1]

For Examiner's Use

11 (a) Cellulose is a compound found in plants.
Plants obtain the carbon atoms they need to make cellulose from carbon dioxide which is taken in through their leaves.

Name the other elements which are present in cellulose.

.....

[2]

(b) Amino acids are compounds found in all living organisms. The chemical formula of a typical amino acid is $C_2H_5O_2N$.

(i) Explain why the nitrogen atoms needed by the plant to make amino acids cannot be obtained directly from the nitrogen molecules in the air.

.....

.....

[1]

(ii) Describe briefly how protein molecules are formed from amino acid molecules.

.....

.....

[1]

(c) Many of the nutrients that plants need for growth are obtained from the soil. Some of these nutrients are salts released when rocks are broken down by weathering followed by erosion.

Describe **one** way in which rocks are weathered by physical processes.

.....

.....

.....

[2]

For Examiner's Use

(d) When water flows over certain types of rock, compounds enter the water making it hard.

(i) Name a metallic element whose ions cause hardness in water.

..... [1]

(ii) A student carries out experiments into removing hardness from water. He measures hardness by finding the volume of soap solution which must be added to equal volumes of water in order to form a permanent lather.

His experiments and results are shown in Table 11.1.

Table 11.1

experiment	details of experiment	soap volume needed for permanent lather /cm^3
1	control (no water treatment)	12.0
2	0.5 g of sodium carbonate dissolved in the water	4.0
3	5.0 g of sodium chloride dissolved in the water	12.0
4	1.0 g of sodium carbonate dissolved in the water	0.5

Explain which of the student's experiments was the most successful in removing hardness.

.....

.....

.....

..... [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** Sulphur 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 †															

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

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

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.).