Centre Number	Candidate Number	Name

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CO-ORDINATED SCIENCES **0654/02**

Paper 2

October/November 2004

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 in the spaces provided on the Question Paper.
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.

Answer **all** questions.
The number of marks is given in brackets [ ] at the end of each question or part question.
A copy of the Periodic Table is printed on page 24.

If you have been given a label, look at the details. If any details are incorrect or missing, please fill in your correct details in the space given at the top of this page.

Stick your personal label here, if provided.

For Examiner's Use	
1	
2	
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Total	

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

1 Fig. 1.1 shows some cells in part of a leaf.

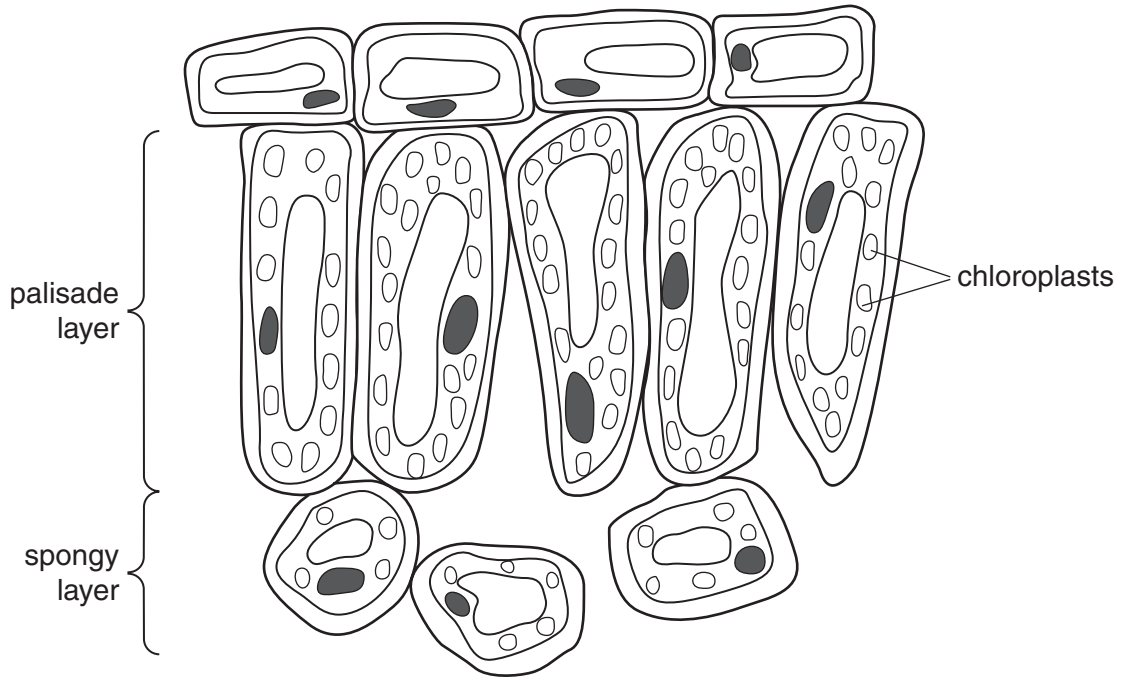


Fig. 1.1

(a) What name is given to a group of similar cells such as the palisade layer in a leaf?

.....[1]

(b) On one of the cells in the diagram, label **one** feature, other than chloroplasts, which is present in plant cells but **not** in animal cells. [1]

(c) Explain how the **structure** of the palisade cells enables them to carry out photosynthesis effectively.

.....

.....

.....[2]

(d) Explain how the **position** of the palisade cells in the leaf enables plenty of light to reach them for photosynthesis.

.....

.....

.....

.....[2]

(e) A green, leafy plant is kept in a closed glass container in a laboratory. A student tests the air inside the container for carbon dioxide. She finds that during the day the concentration of carbon dioxide goes down. During the night the concentration of carbon dioxide goes up.

Complete these sentences to explain why this happened.

The carbon dioxide concentration went down during the day because .....

.....

.....

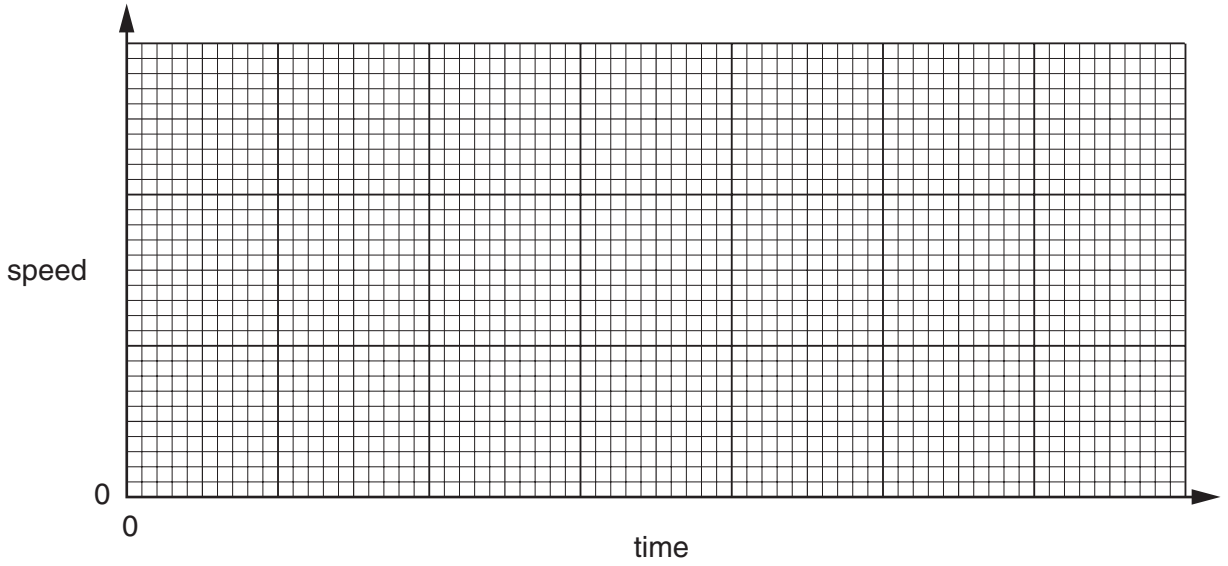
The carbon dioxide concentration went up during the night because .....

.....

.....[3]

2 **(a)** A man drives his car from his home and reaches a slow constant speed. When he reaches the motorway, he accelerates and then travels at a high constant speed. As he leaves the motorway, he decelerates and stops.

(i) On the axes below, sketch a speed-time graph for this journey.



[3]

(ii) Calculate the driver's average speed in kilometres per hour (km/h), if he travels 50 km in 30 minutes.

Show your working and state the formula that you use.

formula used

working

.....km/h [2]

(b) The car has a mass of 1000 kg and is travelling at 20 m/s.

Calculate the kinetic energy of the car.

Show your working and state the formula that you use.

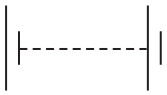
formula used

working

.....J [2]

(c) The car has two headlamps and two rear lamps. All four lamps are connected in parallel with each other across a 12 V battery.

(i) Complete the circuit diagram below to show how the four lamps are connected to the battery. Include one switch in your circuit that will control all four lamps.



[2]

(ii) If the filament in one lamp breaks, the other three stay lit. Explain why this happens. Refer to your circuit diagram if it helps your answer.

.....

.....[1]

(iii) Each headlamp takes a current of 6 A and each rear lamp takes a current of 0.5 A. State the total current taken by all four lamps.

.....A [1]

3 Fig. 3.1 shows a bicycle.

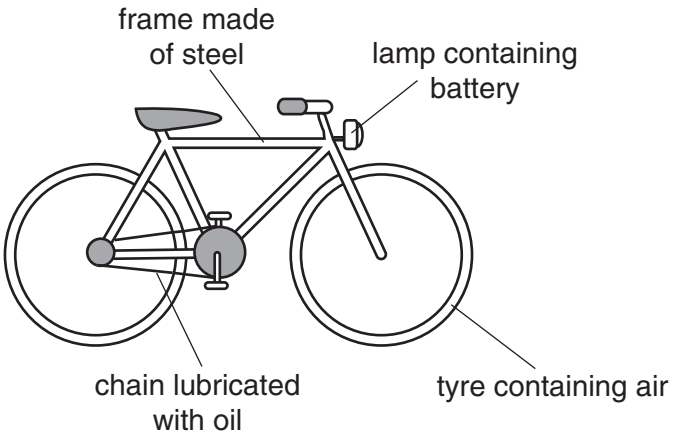


Fig. 3.1

Fig. 3.2 shows diagrams of particles in some of the materials shown in Fig. 3.1.

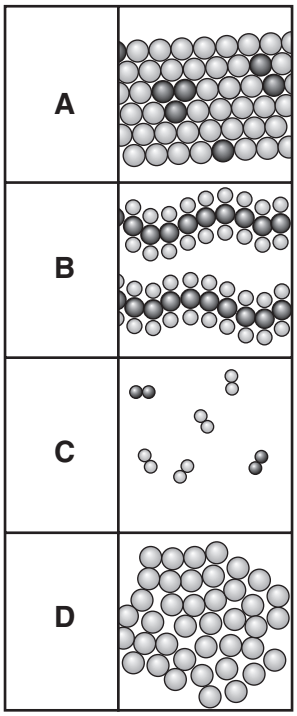


Fig. 3.2

(a) State which diagram, **A**, **B**, **C** or **D** shows the arrangement of atoms in

the air in the tyres, ……..

the steel in the frame, ……..

an example of a giant structure. …….. [3]

(b) The oil used to lubricate the chain contains hydrocarbon molecules.

(i) State the raw material from which this oil is obtained.

.....[1]

(ii) State **one** other important product that is separated from the raw material you have named in **(i)**.

.....[1]

(c) (i) The steel frame of the bicycle is painted to prevent it from rusting.
Explain how painting prevents the frame from rusting.

.....

.....

.....

.....[2]

(ii) The chain is also made of steel. Suggest why the chain does not have to be painted to prevent it from rusting.

.....

.....[1]

(d) The lamp contains a battery which has to be replaced when it runs down. Explain briefly what has happened inside the battery when it has *run down*.

.....

.....

.....[2]

[Turn over

4 Fig. 4.1 is a transverse section through a human eye.

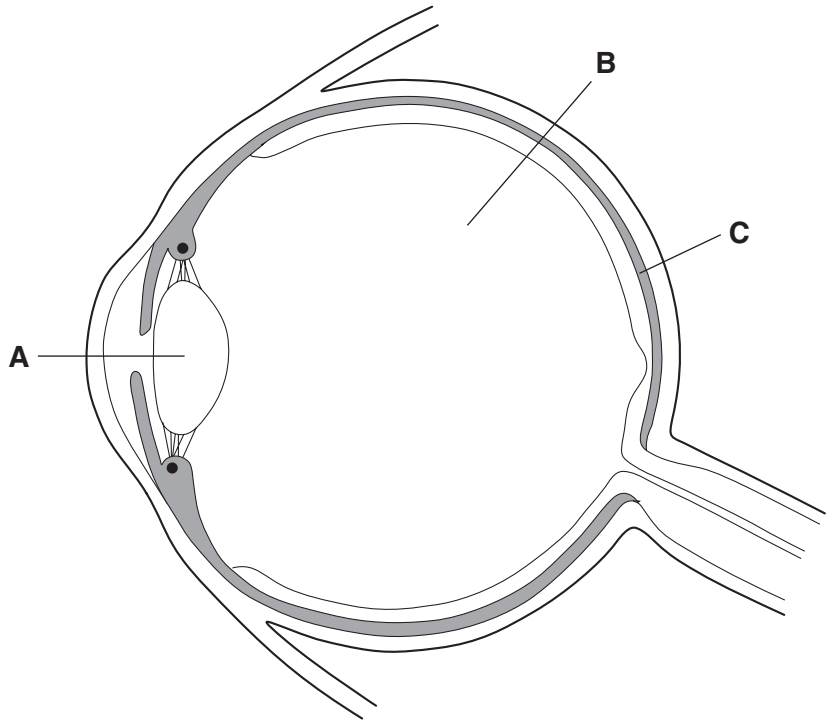


Fig. 4.1

(a) Name each of the parts labelled **A**, **B** and **C**.

A .....

B .....

C ..... [3]

(b) On the diagram, draw label lines to

(i) the area where an image is focused, and label it **F**; [1]

(ii) a part of the eye which prevents too much light from reaching the retina, and label it **P**. [1]

(c) Describe how information from the eye is transmitted to the brain.

.....

.....

.....[2]

(d) The eyes of snakes are not able to see in the dark. However, many snakes hunt for prey, such as small mammals, at night.

Snakes have structures in their heads called pit organs, which can sense infra-red radiation. This helps them to locate their prey even when it is completely dark, because small mammals emit much more infra-red radiation than their surroundings.

(i) State **one** way in which infra-red radiation differs from light.

.....[1]

(ii) Suggest why mammals emit much more infra-red radiation than their surroundings.

.....

.....

.....[2]

5 **(a)** Carbon-14 is an isotope of carbon that emits beta radiation.

(i) What is beta radiation? .....

.....[1]

(ii) Describe how you could show that radiation from a sample of carbon-14 is beta radiation.

.....

.....[2]

(b) Fig. 5.1 shows how the radiation detected from a sample of carbon-14 would change with time.

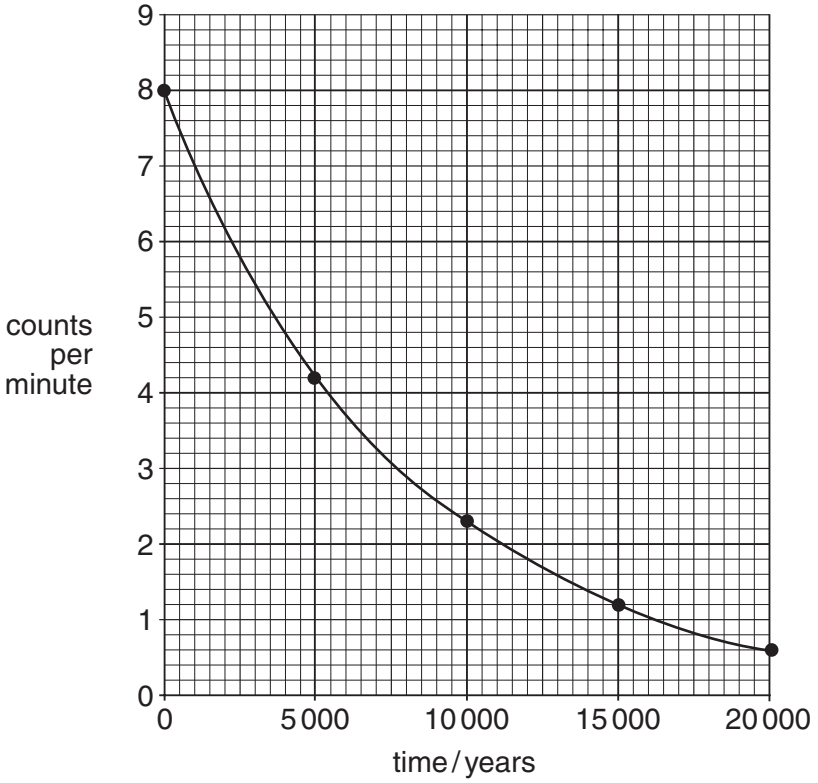


Fig. 5.1

Use the graph to calculate the half-life of carbon-14. Show your working on the graph.

.....years [2]

(c) Explain **one** way in which beta radiation can harm the human body.

.....

.....[2]

6 Table 6.1 shows the proportions of elements in the Earth's crust.

Table 6.1

element	% by mass	element	% by mass
aluminium	7.50	manganese	0.08
barium	0.05	nitrogen	0.03
calcium	3.40	oxygen	49.50
carbon	0.09	phosphorus	0.12
chlorine	0.19	potassium	2.40
chromium	0.03	silicon	25.70
fluorine	0.03	sodium	2.60
hydrogen	0.88	sulphur	0.05
iron	4.70	titanium	0.58
magnesium	1.90	all others	0.15

(a) (i) Complete the table below which refers to the elements in Table 6.1.

description	name of element
most common metal	
most common transition metal	
most common halogen	

[3]

(ii) State the symbol of the most common alkali metal in Table 6.1. .....[1]

(iii) Which **two** non-metallic elements in Table 6.1 form a compound that is the main raw material for making glass?

.....[2]

(b) The most common non-metallic element in the Earth's crust is oxygen. Explain why oxygen in the Earth's crust occurs in solid materials, but in the atmosphere it occurs as a gas.

.....

.....

.....[2]

(c) Many of the elements shown in Table 6.1 may be present in igneous rocks which form following the eruption of a volcano. Some of these elements may eventually form part of the soil.

(i) Describe briefly **one** natural process by which substances originally present in rocks can become part of the soil.

.....

.....

.....

.....[2]

(ii) Explain why the presence in soil of substances originally from rock is important for plants.

.....

.....[1]

(iii) What else needs to be present in soil in order to make it fertile?

.....

.....[2]

7 The male and female gametes of humans are sperms and eggs.

(a) Name the parts of the human reproductive systems in which these gametes are produced.

sperms .....

eggs .....[2]

(b) Sperms are much smaller than eggs. Suggest why it is an advantage for sperms to be small.

.....

.....

.....[2]

(c) State **one** way in which both sperms and eggs are different from all the other cells in a human body.

.....

.....[1]

(d) When a sperm fuses with an egg, a zygote is formed. The zygote divides repeatedly to produce a new organism. This organism has characteristics of both its parents.

Explain how information about these characteristics is carried in the gametes.

.....

.....

.....[2]

8 **(a)** Some of the activities below involve an energy transfer and some do not. Place a tick in the box at the side of those that involve an energy transfer.

A lady pushing a supermarket trolley	☐
A boy riding a bicycle	☐
A bookcase supporting some books	☐
The weight of a car pushing down on the ground	☐
A gas flame heating some water	☐

[2]

(b) When solid ice is heated, energy is transferred to the ice and it starts to melt. Describe what happens to the temperature of the mixture of ice and water while the ice is melting.

.....

.....[2]

(c) Name a device which transfers energy from fuels to electricity in a power station.

.....[1]

(d) Explain what is meant by the term efficiency in terms of energy transfer.

.....

.....[1]

9 Fig. 9.1 shows three athletes.

ice skater skier marathon runner

Fig. 9.1

All three athletes, with their clothing and equipment, have the same mass.

(a) Which athlete exerts the least pressure on the ground? Explain your answer.

.....

.....

.....[2]

(b) The marathon runner stands on both feet.
He weighs 720 N and the area of each shoe in contact with the ground is 180 cm^2.

Calculate the pressure exerted by the marathon runner on the ground using the formula below. Show your working.

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

working

.....N / cm^2 [2]

(c) Explain why the skier has to keep the undersides of her skis very smooth.

.....

.....[1]

(d) Fig. 9.2 shows two ice skaters standing still just before they start skating. The man has a mass of 75 kg and the woman has a mass of 50 kg.

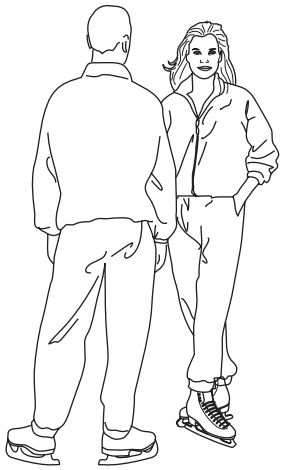


Fig. 9.2

The man and woman push each other and they begin to move apart in opposite directions across the ice.

(i) How does the momentum of the man compare to the momentum of the woman as they move apart? Explain your answer.

.....

.....

.....[2]

(ii) How does the velocity of the man compare to the velocity of the woman as they move apart? Explain your answer.

.....

.....

.....[2]

10 Some acidic waste water is going to be discharged into a river.

A chemist was asked to find out how much of an alkaline solution would be needed to neutralise 2000 dm^3 of this water.

In a laboratory experiment she added a dilute solution of an alkali to 100 cm^3 samples of the waste water. The temperatures of both the waste water and the alkali before mixing were 20°C. In each case she measured the final temperature and pH of the mixture.

Her results are shown in Table 10.1.

Table 10.1

experiment number	volume of acidic waste water /cm^3	volume of alkali /cm^3	temperature of the mixture /°C	pH of the mixture
1	100	300	27	13.7
2	100	250	28	13.2
3	100	200	29	7.0
4	100	150	28	1.0

(a) (i) State and explain how the results show that the reaction was exothermic.

.....

.....[1]

(ii) In one of these experiments not all of the acid was neutralised.
State and explain which experiment this was.

.....

.....

.....[2]

(iii) The chemist concluded that only in experiment **3** was the amount of alkali she added equal to the amount of acid in the sample of waste.

Explain how the chemist was able to reach this conclusion.

.....

.....

.....[2]

(iv) The total volume of the waste water was 2000 dm^3.
Calculate the volume of alkali needed to neutralise this volume of waste water.

.....[1]

(v) Suggest why it is important to add just the correct amount of alkali to the waste water rather than simply adding a large excess.

.....

.....

.....[2]

(b) (i) Rivers are an important source of drinking water in many countries and it is important that they do not become polluted.

Suggest **one** way that rivers can become polluted other than by the discharge from industries.

.....

.....[1]

(ii) Describe briefly how harmful micro-organisms are removed from water before it is supplied to homes.

.....

.....[1]

11 Hog deer (Fig. 11.1) are herbivores which live in regions of Pakistan and India. They eat grass. Hog deer are killed and eaten by tigers.

Fig. 11.1

(a) **(i)** Construct a food chain using the information above.

[1]

(ii) What do the arrows in your food chain represent?

.....[1]

(iii) Name the producer in this food chain.

.....[1]

(b) The stomach of a tiger produces the enzyme protease. However, tigers do not produce amylase.

(i) Describe the function of protease.

.....

.....[2]

(ii) Suggest why tigers do not produce amylase.

.....

.....[2]

(c) Tigers and hog deer are mammals. Give **one** characteristic feature of mammals that is visible in Fig. 11.1.

.....[1]

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

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