

Centre Number	Candidate Number	Name
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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

COMBINED SCIENCE

0653/03

Paper 3

October/November 2004

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 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 20.

For Examiner's Use	
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Total	

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.

This document consists of **19** printed pages and **1** blank page.



1 (a) Blood contains red cells, white cells and platelets.

(i) Describe how you can recognise red blood cells, apart from their colour, if you are looking at a blood sample using a microscope.

.....
[1]

(ii) What is the function of platelets?

.....[1]

(b) White blood cells can destroy harmful micro-organisms. Fig. 1.1 shows how two different types of white blood cells work together to destroy bacteria in a person's body.

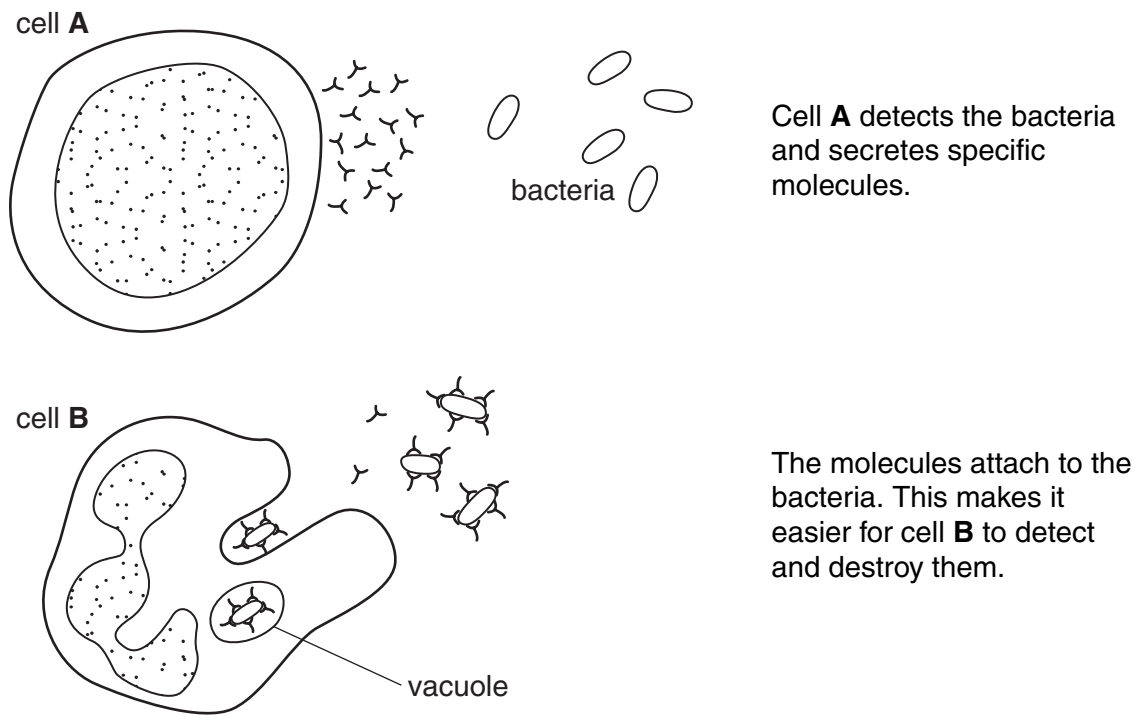


Fig. 1.1

(i) Name

cell A,

cell B,

the molecules secreted by cell A.

[3]

- (ii) The first time that a person is infected by a particular kind of bacterium he may become ill. However, if these bacteria get into the body a second time, the person will probably be immune to this illness.

Explain how the person becomes immune.

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

- (iii) Cell **B** secretes enzymes into the vacuole containing the bacteria. These include proteases.

Suggest how proteases can help to destroy the bacteria.

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

- 2 Fig. 2.1 shows apparatus that a student used to study the rate of reaction when hydrogen peroxide decomposes.

The equation for this reaction is shown below.

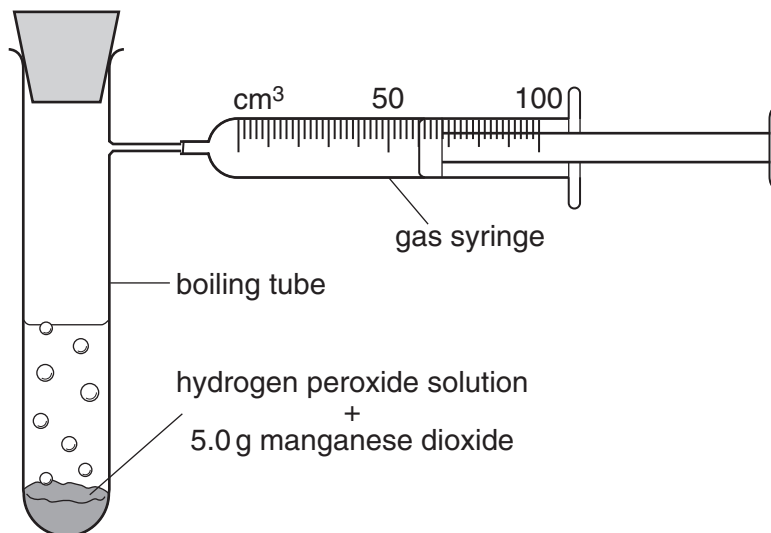
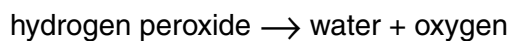


Fig. 2.1

The student added 5.0 g of the insoluble solid manganese dioxide which acted as a catalyst.

- (a) Describe how the student could test the gas produced in this reaction to show that it is oxygen.

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

- (b) When the reaction was complete, the student separated the substances which were left in the boiling tube. Fig. 2.2 shows the result of the separation.

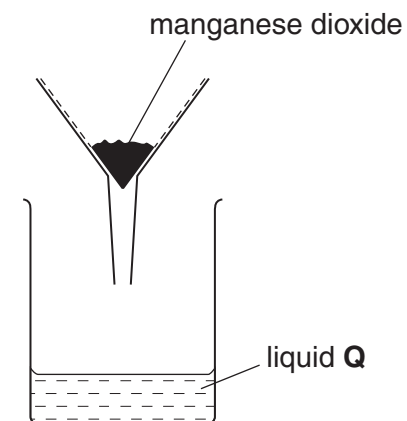


Fig. 2.2

- (i) Name the method of separation shown in Fig. 2.2.
.....[1]
- (ii) Name liquid Q.
.....[1]
- (iii) Predict the mass of dry manganese dioxide which the student obtained and explain your answer.
mass
- explanation
-[2]

- (c) Fig. 2.3 shows the results of three experiments, **A**, **B** and **C**, which the student obtained using the apparatus in Fig. 2.1. In each experiment the mass of manganese dioxide and the volume and concentration of hydrogen peroxide solution were kept constant.

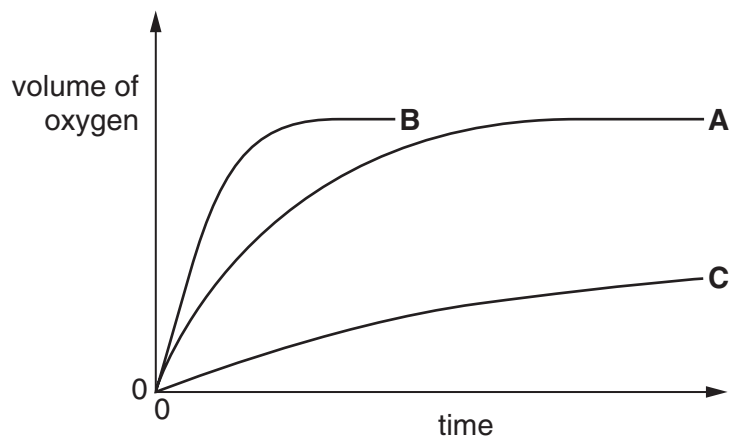


Fig. 2.3

- (i) Explain how the results shown in Fig. 2.3 show that the rate of reaction was the lowest for experiment **C**.

.....
.....[1]

- (ii) Explain which experiment, **A**, **B** or **C**, used manganese dioxide which had the highest surface area.

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

- 3 (a) Fig. 3.1 shows a soft iron ring. Two coils, X and Y, each of 200 turns are wound around the ring. Coil X is connected to a power supply and coil Y is connected to a 12 V lamp.

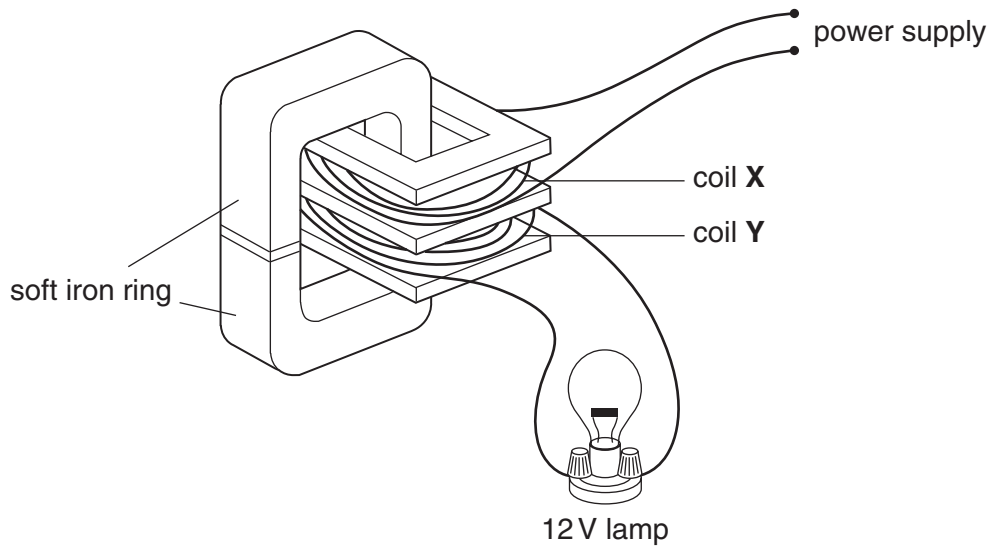


Fig. 3.1

Describe and explain what happens to the lamp when

- (i) the power supply is 12 V a.c.

.....

- (ii) the power supply is 12 V d.c.

.....
[3]

- (b) Electricity is transmitted at a very high voltage and relatively low current. This is because it is cheaper than sending it at a lower voltage and higher current. Explain why it is cheaper.

.....

[1]

(c) Fig. 3.2 shows a bicycle with lights and reflectors.



Fig. 3.2

Fig. 3.3 shows a circuit used to power the two lamps on the bicycle from one battery.

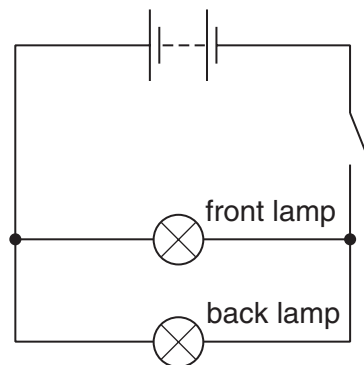


Fig. 3.3

(i) What is the name given to this method of connecting two lamps together?

.....[1]

(ii) If the filament in the back lamp breaks, current can no longer flow through the lamp. Will the front lamp stay alight or go out? Explain your answer.

.....

.....[1]

- (iii) The resistance of each lamp in this circuit is 4 ohms. Calculate the combined resistance of the two lamps. Show your working and state the formula that you use.

formula used

working

.....[2]

- (d) Another method of connecting the lamps is shown in Fig. 3.4.

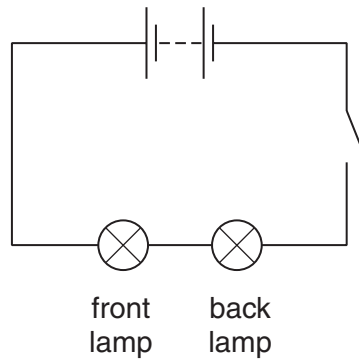


Fig. 3.4

- (i) In this circuit, what happens to the front lamp if the filament in the back lamp breaks?

Explain your answer.

.....[1]

- (ii) State the combined resistance of the two lamps in this circuit.

.....[1]

- (e) The reflectors on bicycles are made of clear red plastic and use the idea of total internal reflection.

Fig. 3.5 shows light hitting part of a reflector.

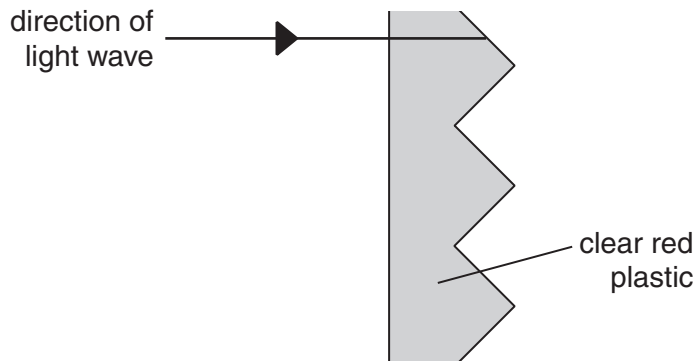


Fig. 3.5

Complete the diagram above to show how light leaves the reflector.

[2]

- 4 Fig. 4.1 shows an insect-pollinated flower.

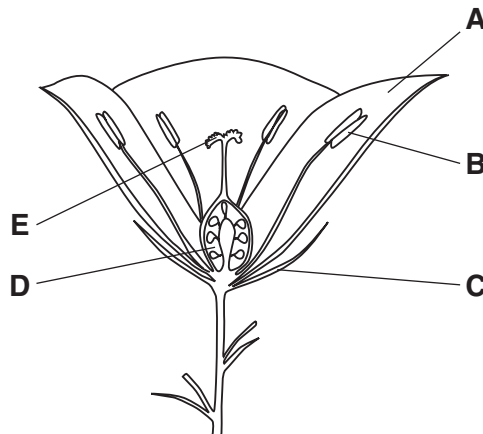


Fig. 4.1

- (a) Give the **letter** of the part of the flower which attracts insects to the flower;
contains the female gametes.

[2]

- (b) Describe how this flower could be pollinated.

.....

[3]

(c) (i) Describe how the stamens of a wind-pollinated flower would differ from the stamens of the flower in Fig. 4.1.

.....
.....[1]

(ii) Wind-pollinated flowers tend to produce much larger quantities of pollen than insect-pollinated flowers.

Suggest a reason for this difference.

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

(d) The type of reproduction which involves flowers is sexual reproduction.

Explain **one** advantage to a plant of sexual reproduction, as compared to asexual reproduction.

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

5 Malachite is a compound of copper found in the Earth's crust. The chemical formula of malachite is $\text{Cu}_2\text{CO}_3(\text{OH})_2$.

(a) (i) State the number of different elements shown in the formula of malachite.

.....[1]

(ii) State the total number of atoms shown in the formula of malachite.

.....[1]

(b) (i) The formulae of four substances are shown below. Underline the formula of the substance that does **not** react with dilute hydrochloric acid to form copper chloride solution.

CuO Cu CuCO_3 $\text{Cu}(\text{OH})_2$ [1]

(ii) Copper chloride solution contains copper ions, Cu^{2+} , and chloride ions, Cl^- .

Explain why the formula of copper chloride is CuCl_2 .

.....
.....[1]

(c) Table 5.1 shows the results obtained by a student who added small pieces of different metals to copper chloride solution.

Table 5.1

metal added	observations
magnesium	<ul style="list-style-type: none"> • magnesium dissolves • brown insoluble solid produced
silver	no reaction
zinc	<ul style="list-style-type: none"> • zinc dissolves • brown insoluble solid produced

Explain why magnesium and zinc reacted but silver did not.

.....
.....[1]

- (d) Fig. 5.1 shows the electrolysis of copper chloride solution. In this process copper forms on one of the electrodes and chlorine is produced at the other.

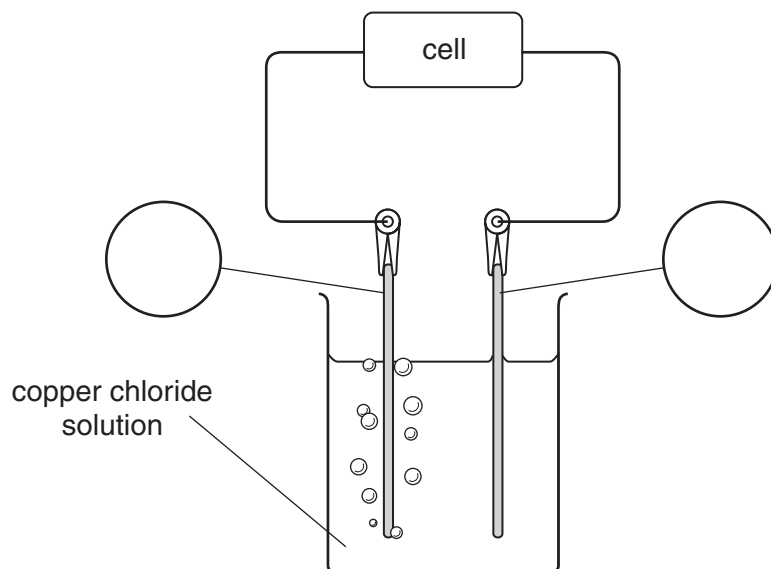


Fig. 5.1

- (i) Show the electrical charges of the electrodes by writing the symbols + and – in the circles and explain your answer.

.....

[2]

- (ii) In this process copper ions, Cu^{2+} , are changed into copper atoms, Cu. Explain the difference, in terms of electrons, between a copper ion and a copper atom.

.....

[2]

- 6 Penguins can swim underwater. When swimming, they can accelerate from 0 m/s to 6 m/s in 1.0 s.

Seals can accelerate from 0 m/s to their maximum speed of 2 m/s in 0.6 s.

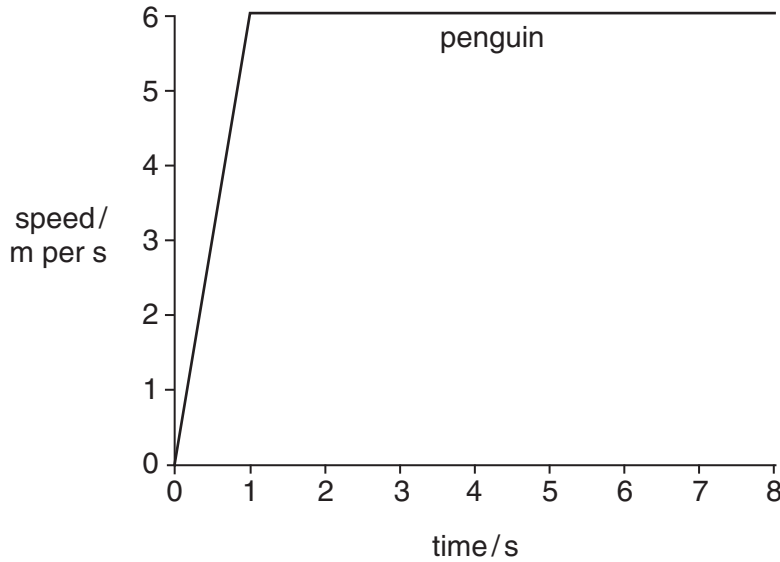
- (a) The acceleration of a penguin is 6 m/s^2 . Calculate the acceleration of a seal. Show your working and state the formula that you use.

formula used

working

.....[2]

- (b) Fig. 6.1 shows the speed-time graph for a penguin starting from rest. On the same axes draw a speed-time graph for a seal starting from rest.



[2]

Fig. 6.1

- (c) A seal starts to chase a penguin. The penguin immediately swims away.

The seal and the penguin are both at rest before the chase starts.

Use your graph to determine how much further the penguin will travel than the seal in the first four seconds of the chase. Show your working.

.....[3]

7 Fig trees grow in tropical rainforests. Fig trees provide food for monkeys and birds such as toucans. These animals may be eaten by eagles.

(a) Construct a food web showing the feeding relationships between these four organisms.

[2]

(b) Fig trees are the producers in this food web.

Describe how plants such as fig trees transfer energy from sunlight into chemical energy.

.....
.....
.....
.....[3]

(c) Food chains rarely have more than four or five links in them.

Explain why this is so.

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

(d) Tropical rainforests in many parts of the world are being destroyed by logging. Give **two** reasons why the conservation of tropical rainforests is important.

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

8 The metallic element potassium and the non-metallic element chlorine react together to form the compound potassium chloride.

(a) Complete Table 8.1 by writing names of substances in the left-hand column, chosen from the list below.

potassium chlorine potassium chloride

Table 8.1

substance	description
	used to kill harmful micro-organisms in water
	reacts with water to form an alkali
	dissolves in water to form an electrolyte

[2]

(b) Fig. 8.1 shows a diagram of a chlorine atom.

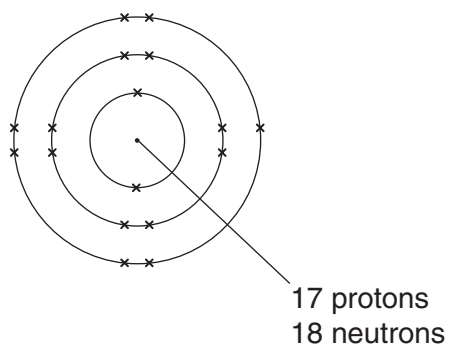


Fig. 8.1

(i) State the number of **complete** electron energy levels shown in the atom in Fig. 8.1.

.....[1]

(ii) Explain why this atom is electrically neutral.

.....

.....[1]

(c) Chlorine joins with hydrogen to make the covalent compound, hydrogen chloride.

(i) Write the balanced symbolic equation for the reaction.

.....[2]

(ii) Draw a diagram of a hydrogen chloride molecule showing how the outer electrons are arranged.

[2]

Question 9 is found on page 18

9 Explain each of the following.

(a) Alpha and beta radiations are affected by electric fields but gamma radiation is not.

.....
.....
.....[1]

(b) Used aerosol cans may explode if they are thrown into a fire.

.....
.....
.....[1]

(c) The heater element in a kettle is placed at the bottom of the kettle but all the water reaches boiling point.

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

(d) A satellite is able to orbit the Earth without falling to its surface.

.....
.....
.....
.....
.....[3]

DATA SHEET
The Periodic Table of the Elements

		Group										
		I	II	III	IV	V	VI	VII	VIII	IX	X	
		1 H Hydrogen 1										4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4											20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12	11 B Boron 5	12 C Carbon 6	13 Al Aluminium 13	14 Si Silicon 14	15 P Phosphorus 15	16 S Sulphur 16	17 Cl Chlorine 17	18 Ar Argon 18			36 Kr Krypton 36
39 K Potassium 19	40 Ca Calcium 20	27 Ga Gallium 31	28 Ge Germanium 32	29 Zn Zinc 30	30 Cu Copper 29	31 Ni Nickel 28	32 Co Cobalt 27	33 Rh Rhodium 45	34 Pd Palladium 46	35 Ag Silver 47	36 Cd Cadmium 48	37 Hg Mercury 80
85 Rb Rubidium 37	88 Sr Strontium 38	70 Ga Gallium 31	73 Ge Germanium 32	74 In Indium 49	75 Sn Tin 50	76 Pb Lead 82	77 Tl Thallium 81	78 Pt Platinum 78	79 Au Gold 79	80 Hg Mercury 80	81 Tl Thallium 81	82 Pb Lead 82
133 Cs Caesium 55	137 Ba Barium 56	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	53 Mn Manganese 25	54 Fe Iron 26	55 Co Cobalt 27	56 Ni Nickel 28	57 Cu Copper 29	58 Zn Zinc 30	59 Ga Gallium 31
139 La Lanthanum 57	178 Hf Hafnium 72	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	94 Mo Molybdenum 42	95 Tc Technetium 43	96 Ru Ruthenium 44	97 Rh Rhodium 45	98 Pd Palladium 46	99 Ag Silver 47	100 Cd Cadmium 48	101 In Indium 49
226 Ra Radium 88	227 Ac Actinium 89	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	187 Os Osmium 76	188 Ir Iridium 77	189 Pt Platinum 78	190 Au Gold 79	191 Hg Mercury 80	192 Tl Thallium 81	193 Pb Lead 82	194 Bi Bismuth 83
227 Fr Francium 87	227 Ac Actinium 89	140 Ce Cerium 58	141 Pr Praseodymium 59	142 Nd Neodymium 60	143 Pm Promethium 61	144 Sm Samarium 62	145 Eu Europium 63	146 Gd Gadolinium 64	147 Tb Terbium 65	148 Dy Dysprosium 66	149 Ho Holmium 67	150 Er Erbium 68
		175 Lu Lutetium 71	176 Yb Ytterbium 70	177 Tm Thulium 69	178 Pm Promethium 61	179 Sm Samarium 62	180 Eu Europium 63	181 Gd Gadolinium 64	182 Tb Terbium 65	183 Dy Dysprosium 66	184 Ho Holmium 67	185 Er Erbium 68
		103 Lr Lawrencium 103	104 No Nobelium 102	105 Md Mendelevium 101	106 Fm Fermium 100	107 Es Einsteinium 99	108 Cf Californium 98	109 Bk Berkelium 97	110 Cm Curium 96	111 Am Americium 95	112 Pu Plutonium 94	113 Np Neptunium 93

*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 dm³ at room temperature and pressure (r.t.p.).