Cambridge
O Level

Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

COMBINED SCIENCE **5129/22**

Paper 2 **October/November 2014**

2 hours 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 an HB pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
A copy of the Periodic Table is printed on page 24.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

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.

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

CAMBRIDGE International Examinations

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1 Use the words from the list to complete the sentences below.

aerobic **anaerobic** **carbon dioxide** **energy**

glucose **kidney** **lactic acid** **lung**

minerals **muscle** **oxygen** **water**

Each word may be used once, more than once or not at all.

Respiration is the release of ..... from food substances in living cells.

One type of respiration requires the presence of oxygen and is called ..... respiration.

It produces the chemicals ..... and ..... .

A different type of respiration takes place when oxygen is absent. It produces

..... and takes place in ..... cells during exercise.

[6]

2 Copper(II) carbonate decomposes when it is heated.

The equation for the reaction is

$$CuCO_3 \longrightarrow CuO + CO_2$$

Four students each have a test-tube containing some copper(II) carbonate which they weigh.

The test-tubes are heated and the carbon dioxide given off is collected in gas syringes. Each student then weighs their test-tube again to find the mass of carbon dioxide lost.

The mass and the volume of carbon dioxide lost from each test-tube are shown in Table 2.1.

Table 2.1

mass of carbon dioxide /g	volume of carbon dioxide /cm^3
0.77	420
0.55	300
0.33	180
0.11	60

(a) On Fig. 2.2, plot a graph of these results. Draw a best-fit straight line.

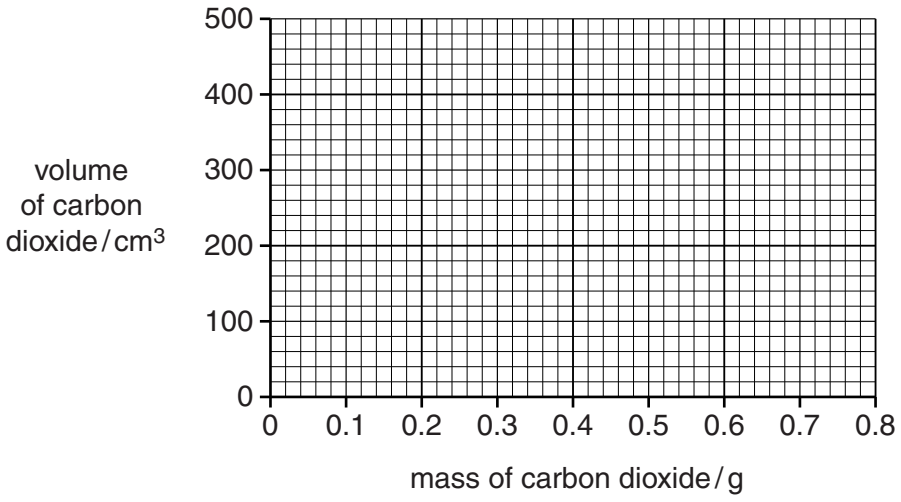


Fig. 2.2

[2]

(b) (i) Use Fig. 2.2 to find the volume of 0.44 g of carbon dioxide. ..... [1]

(ii) Use your answer to **(b)(i)** to calculate the volume of 44 g of carbon dioxide.

volume of carbon dioxide = ... cm^3 [1]

(c) State a test to show that the gas given off is carbon dioxide.

test .....

.....

result .....[2]

3 A small ball falls into a swimming pool and through the water.

The speed of the ball changes with time as shown in Fig. 3.1.

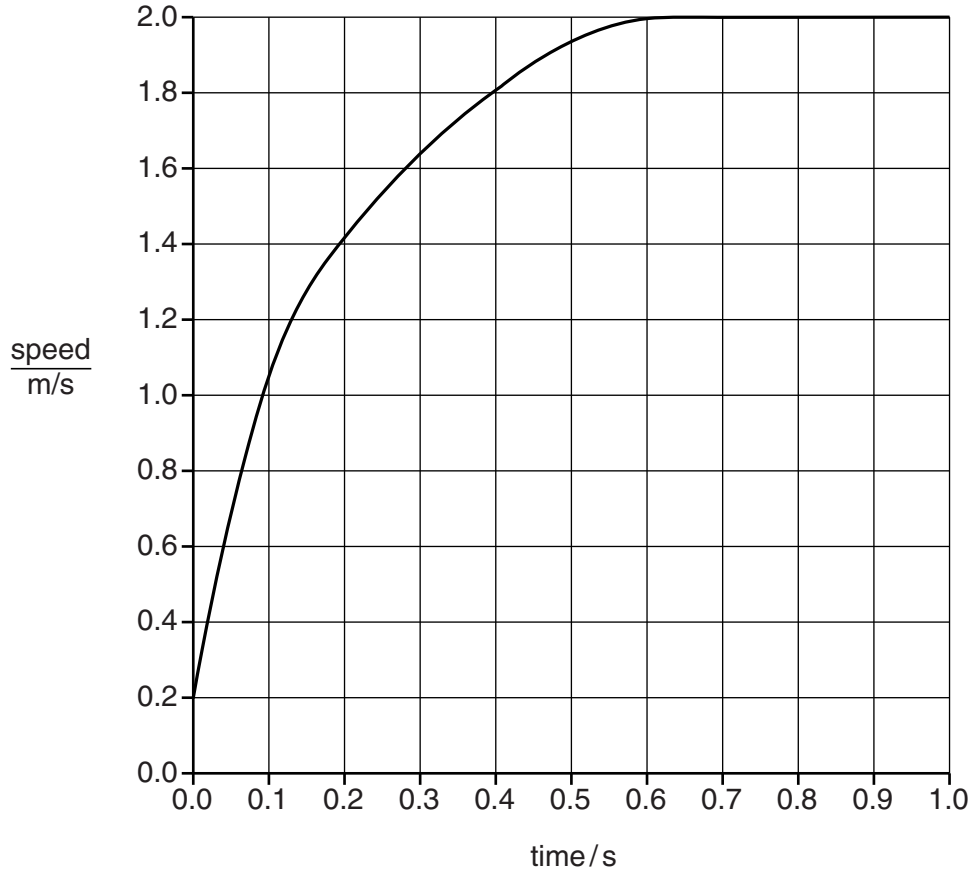


Fig. 3.1

(a) Use Fig. 3.1 to

(i) explain how it is known that the acceleration of the ball is not constant for the first 0.6 s,

.....

.....[1]

(ii) determine the value of the ball's acceleration at 0.8 s,

acceleration = ... m/s^2 [1]

(iii) calculate the distance fallen by the ball between time 0.6 s and time 1.0 s.

distance = ... m [3]

(b) The ball has a mass of 0.030 kg.

(i) Calculate the accelerating force needed to give the ball an acceleration of 8.0 m/s^2.

force = ... N [2]

(ii) The volume of the ball is 8.0×10^{-6} m^3.

Calculate the density of the ball.

density = ... unit .....[3]

4 The liver carries out many functions in the body.

Two substances which are carried to the liver by the blood are amino acids and glucose.

(a) Name one substance produced in the liver when excess amino acids are metabolised and one when excess glucose is metabolised.

one substance produced from excess amino acids .....

one substance produced from excess glucose .....
[2]

(b) Name two different substances which are broken down in the liver.

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

5 Table 5.1 gives information about three elements in Group VII of the Periodic Table.

Table 5.1

element	state	colour	proton number
chlorine	gas	pale green	17
bromine	liquid	red	35
iodine	solid	dark purple	53

(a) State the name given to the elements in Group VII of the Periodic Table.

.....[1]

(b) Another element in Group VII has the proton number 85.

Predict the state and the colour of this element.

state .....

colour ..... [2]

(c) State why, in terms of electrons, these elements are placed in Group VII.

.....[1]

(d) An aqueous solution of bromine is used to test for a homologous series of hydrocarbons.

State the name of this homologous series. .....[1]

6 A student measures the length of a spring when different loads are hung from it. Some of the results are shown in Table 6.1.

Table 6.1

load / N	length / cm	extension / cm
0.00	12.0	0.0
0.10	13.2	
0.20		
0.30	15.6	
0.40	16.8	

(a) Complete Table 6.1. [2]

(b) The spring and a wooden cube are now used to keep a metre rule horizontal, as shown in Fig. 6.1.

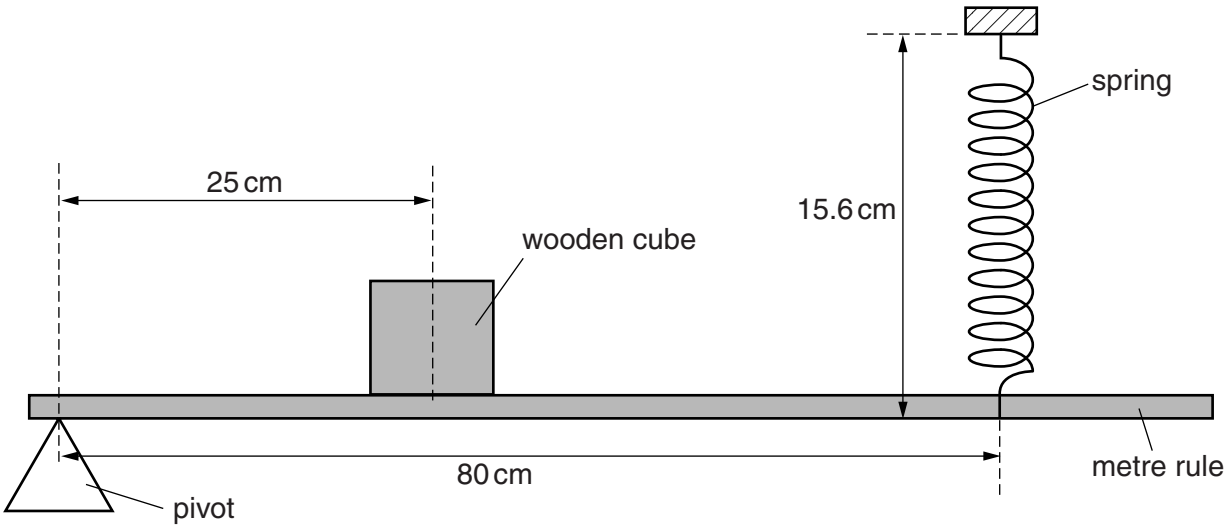


Fig. 6.1

The length of the spring in Fig. 6.1 is 15.6 cm. The metre rule has negligible mass.

The centre of the wooden cube is 25 cm from the pivot.

The spring is fixed to the rule at a distance of 80 cm from the pivot.

Calculate the weight of the wooden cube.

weight = ... N [2]

7 Fig. 7.1 shows a piece of tissue cut from a plant called a yam. It has a mass of 30.0 g and a volume of 27 cm^3.

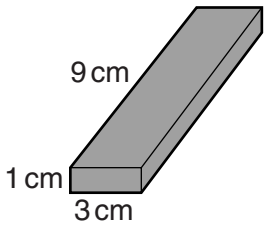


Fig. 7.1

The piece is suspended in a sugar solution. Sugar molecules are very large compared to water molecules.

Every 0.5 hours the piece is removed from the solution, dried and weighed. The piece is then replaced in the sugar solution.

The mass of the piece decreases to 22.1 g over the first three hours. There is no further change in mass after this time.

(a) (i) State the name of the process that causes the loss in mass.

.....[1]

(ii) Explain why the mass of the piece decreases during the first three hours.

.....

.....

.....

.....

.....[3]

(iii) Suggest a reason why the mass of the piece stayed the same after three hours.

.....

.....

.....[1]

Fig. 7.2 shows a second piece of tissue, cut from the same yam as the first piece.

The second piece of tissue also has a mass of 30.0 g.

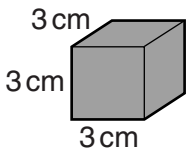


Fig. 7.2

(b) Calculate the volume of the second piece of yam.

volume = ... cm^3 [1]

(c) The second piece is suspended in a sugar solution of the same concentration as used for the first piece.

The mass of the second piece reduces to 22.1 g in seven hours.

(i) Suggest why both pieces lose the same mass.

.....

.....[1]

(ii) Suggest why the second piece takes longer than the first piece to reach 22.1 g.

.....

.....

.....[1]

8 The atomic structures of some atoms and ions are given in Table 8.1.

Table 8.1

	number of protons	number of neutrons	electronic structure
^{27}Al	13		2,8,3
^{23}Na	11	12	
^{40}Ar		22	2,8,8
$^{39}K^{+}$	19		2,8,8
$^{32}S^{2-}$	16	16	

(a) Complete Table 8.1. [5]

(b) (i) Sodium and sulfur combine to form sodium sulfide.

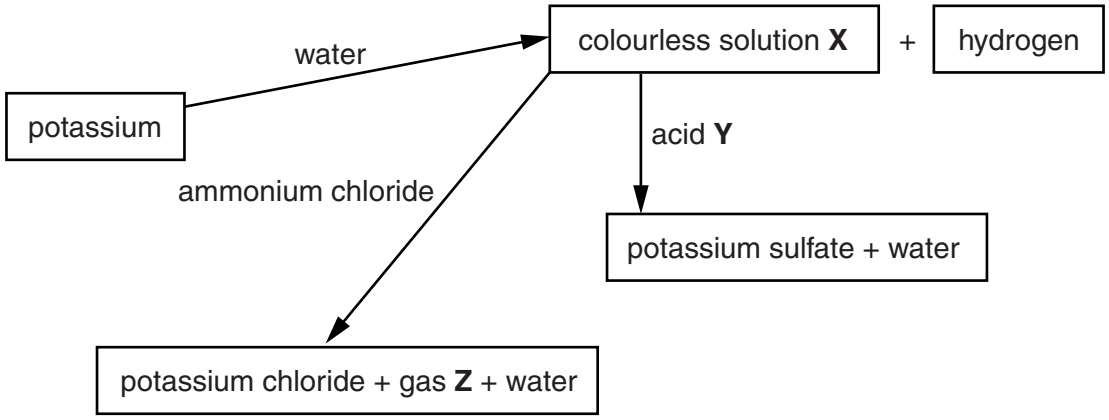
Deduce the formula of sodium sulfide.

.....[1]

(ii) State the type of bonding in sodium sulfide.

.....[1]

9 Study the following reaction scheme.



(a) Identify **X**, **Y** and **Z**.

colourless solution **X** .....

acid **Y** .....

gas **Z** ..... [3]

(b) State the type of reaction that occurs when acid **Y** reacts with colourless solution **X**.

.....[1]

(c) State one industrial use of hydrogen.

.....[1]

10 Alpha-particles, beta-particles and gamma-rays are three types of emission from radioactive sources.

(a) State the type of emission that

(i) cannot pass through thin cardboard, ...

(ii) is the least ionising radiation. .....

[2]

(b) A radioactive source emits beta-particles.

Table 10.1 gives some information about how the number of beta-particles emitted each second changes with time.

Table 10.1

time / hours	number of particles emitted each second
0.0	400
6.0	200
12.0	
	25

Complete Table 10.1. [2]

11 Fig. 11.1 shows two plane mirrors **A** and **B**.

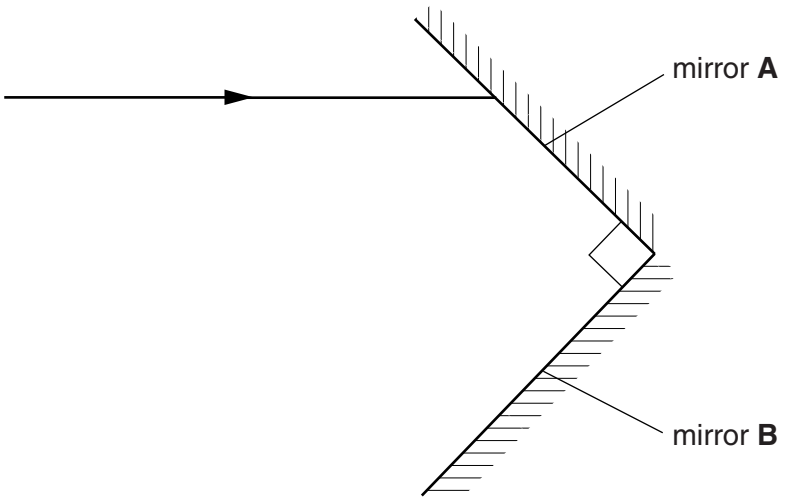


Fig. 11.1

The angle between the two mirrors is 90°.
A ray of light is incident at an angle of 45° on mirror **A**.

(a) On Fig. 11.1, draw a normal where the ray is incident on mirror **A**. [1]

(b) Complete Fig. 11.1 to show the ray being reflected from mirror **A** and then from mirror **B**. [2]

12 **(a)** Define what is meant by a *drug*.

.....

.....

.....

.....[2]

(b) Heroin use may lead to ill health in a person.

State three harmful effects on the body of heroin use.

1. .....

2. .....

3. .....

[3]

13 Petroleum is a mixture of hydrocarbons which may be separated into useful substances.

(a) **(i)** State the name of the process used to separate petroleum.

.....[1]

(ii) State the name of the substance obtained from petroleum that is used for

road building, ...

fuel for oil stoves. .....

[2]

(b) Hexane is a hydrocarbon present in petroleum.

(i) State the homologous series to which hexane belongs.

.....[1]

(ii) Balance the equation for the incomplete combustion of hexane.

$2C_6H_{14}$ + ... O_2 ⟶ ..... CO + ... H_2O [1]

14 A series circuit containing a fixed resistor **R** and a variable resistor is shown in Fig. 14.1.

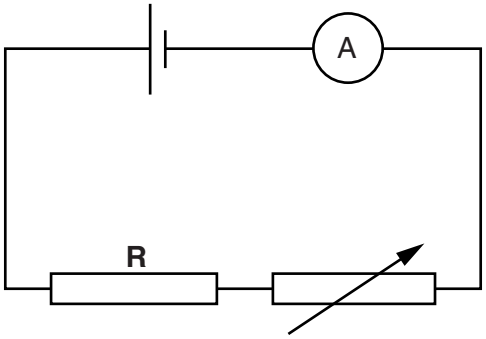


Fig. 14.1

(a) On Fig. 14.1, draw the symbol for a voltmeter connected so as to measure the potential difference across the variable resistor. [2]

(b) The variable resistor has a resistance of 2.0 Ω when the potential difference across it is 0.6 V.

Calculate the current that occurs in the ammeter.

current = ... A [2]

(c) The resistance of the variable resistor is increased.

State the change, if any, to

(i) the ammeter reading, ...

(ii) the potential difference across resistor **R**, ...

(iii) the potential difference across the variable resistor. .....

[3]

15 Fig. 15.1 shows a section through a human heart.

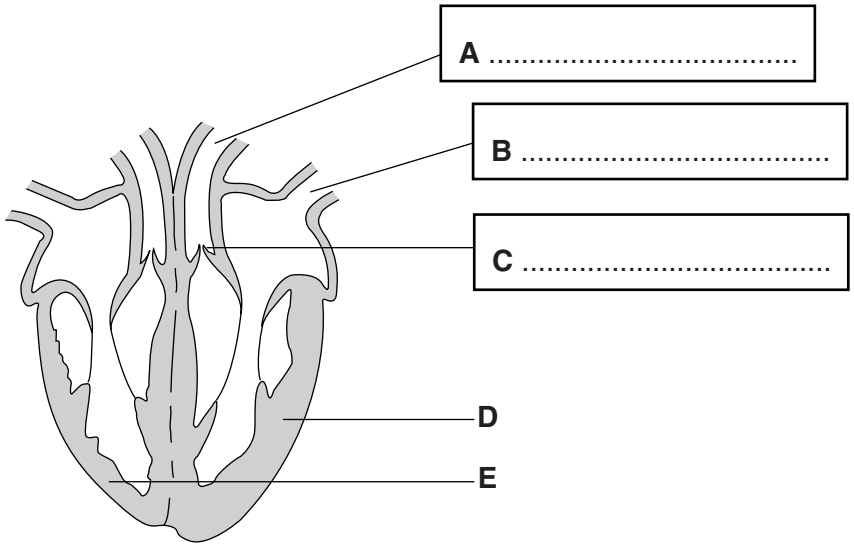


Fig. 15.1

(a) (i) On Fig. 15.1, complete the labels **A**, **B** and **C**. [3]

(ii) Explain why tissue **D** is thicker than tissue **E**.

.....

.....[1]

(b) (i) State the blood component that is responsible for clot formation.

..... [1]

(ii) Briefly explain how this component causes the blood to form a clot.

.....

.....

.....

.....[2]

(c) Coronary heart disease is caused by a blockage of coronary arteries.

State three changes in lifestyle that may reduce the risk of developing coronary heart disease.

1. .....

2. .....

3. .....

[3]

16 The following is a list of gases.

argon carbon monoxide carbon dioxide helium

hydrogen nitrogen oxygen sulfur dioxide

Complete the following sentences using the gases from the list.

Each gas may be used once, more than once or not at all.

(a) The gas that relights a glowing splint is ..... . [1]

(b) The most abundant gas in the air is ..... . [1]

(c) The unreactive gas used in filling balloons is ..... . [1]

(d) The gas that acts as a reducing agent in the extraction of iron from iron ore is ..... . [1]

(e) A gas that dissolves in water to give an acidic solution is ..... . [1]

17 A magnet is pushed towards a coil, as shown in Fig. 17.1.

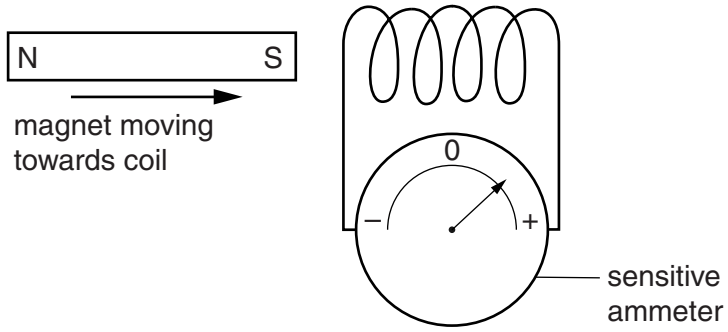


Fig. 17.1

The coil is connected to a sensitive ammeter which shows a positive reading as the magnet is pushed towards the coil.

(a) The magnet in Fig. 17.1 is now pushed more quickly towards the coil.

State the change that is seen in the ammeter reading.

.....[1]

(b) State two changes that will each cause the current in the ammeter to reverse in direction.

1. .....

2. .....
[2]

18 A can, filled with cold water, is left in bright sunlight in order to heat the water.
The outer surface of the can is painted black.

(a) Suggest why the can is painted black.

.....

.....[1]

(b) The temperature of the water rises.

State what happens to

(i) the volume of the water, ...

(ii) the density of the water. ..... [2]

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DATA SHEET
The Periodic Table of the Elements

Group I	Group II						Group III	Group IV	Group V	Group VI	Group VII	Group 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	209 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86
223 Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 †															

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	147 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	231 Pa Protactinium 91	238 U Uranium 92	237 Np Neptunium 93	244 Pu Plutonium 94	243 Am Americium 95	247 Cm Curium 96	247 Bk Berkelium 97	251 Cf Californium 98	252 Es Einsteinium 99	257 Fm Fermium 100	258 Md Mendelevium 101	259 No Nobelium 102	260 Lr Lawrencium 103

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

Key: a X b — a = relative atomic mass; X = atomic symbol; b = atomic (proton) number

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