Cambridge
O Level

Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

4698038547

COMBINED SCIENCE **5129/21**

Paper 2 **October/November 2015**

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 20.
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 **20** printed pages.

CAMBRIDGE
International Examinations

1 Fig. 1.1 shows a blast furnace for the extraction of iron from iron ore.

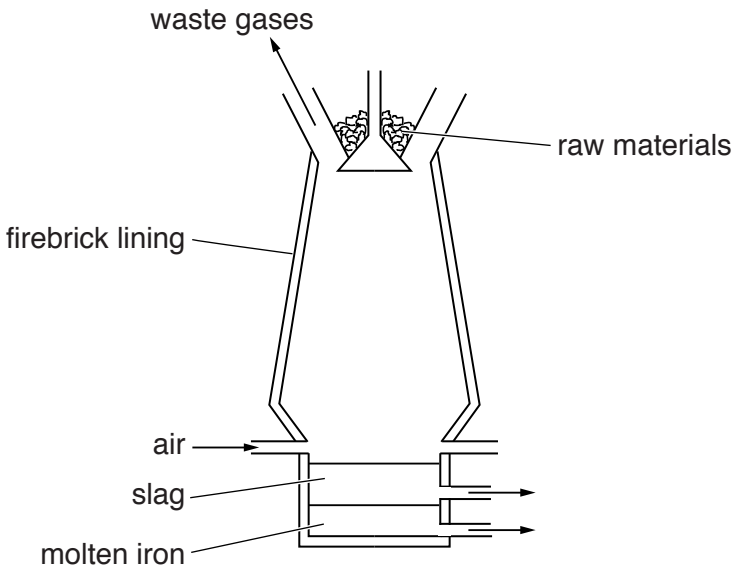

Fig. 1.1

The raw materials added to the top of the furnace are iron ore, coke and limestone.

(a) Name an ore from which iron is extracted. ..... [1]

(b) Iron ore is contaminated by acidic impurities such as silicon dioxide (sand).

Explain how the limestone added to the furnace removes the acidic impurities.

.....

.....

.....

..... [3]

(c) In the extraction of iron, the iron ore is reduced by carbon monoxide.

Balance the equation for the reduction of iron ore.

Fe_2O_3 + ... CO ⟶ ..... Fe + ... CO_2 [1]

(d) Suggest why potassium is not extracted using the same process as iron.

..... [1]

2 Fig. 2.1 shows speed-time graphs for two cars **A** and **B**.

Car **A** starts before car **B**.

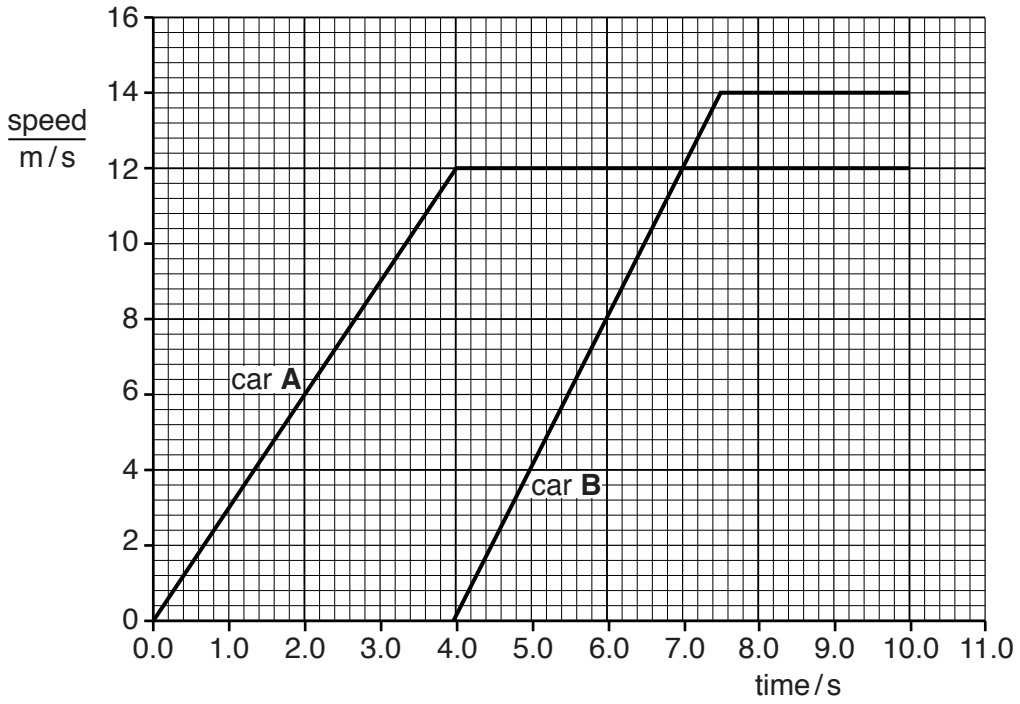

Fig. 2.1

(a) State the time at which the two cars have the same speed.

..... s [1]

(b) Calculate the distance travelled by car **A** between 4.0 s and 8.0 s.

distance = ... m [2]

(c) Explain how the graph shows that, initially, car **A** has a constant acceleration.

.....

..... [1]

(d) A car engine converts chemical energy into heat energy and sound energy.

State two **other** forms of energy into which the chemical energy is converted when the car accelerates up a hill.

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

3 **(a)** Define *excretion*.

.....

.....

.....

..... [2]

(b) Table 3.1 contains the names of three compounds that are excreted.

Table 3.1

name of compound	where compound is produced	organ of excretion
carbon dioxide		
water		
urea		

Complete Table 3.1 by stating where in the body each compound is produced and the organ responsible for its excretion. [6]

4 Ammonium chloride reacts with sodium hydroxide, producing sodium chloride, ammonia and water.

The equation for the reaction is

$$NH_4Cl + NaOH \longrightarrow NaCl + NH_3 + H_2O$$

(a) (i) Calculate the relative molecular mass of

ammonium chloride, ...

sodium hydroxide. ..... [2]

[A_r: N, 14; H, 1; O, 16; Na, 23; Cl, 35.5]

(ii) The relative molecular mass of ammonia is 17.

Complete the following sentences.

34 g of ammonia is produced by ..... g of sodium hydroxide.

0.85 g of ammonia is produced by ..... g of sodium hydroxide.

[2]

(b) State an industrial use of ammonia.

..... [1]

(c) Complete the 'dot and cross' diagram in Fig. 4.1 to show the outer electrons in a molecule of ammonia. [2]

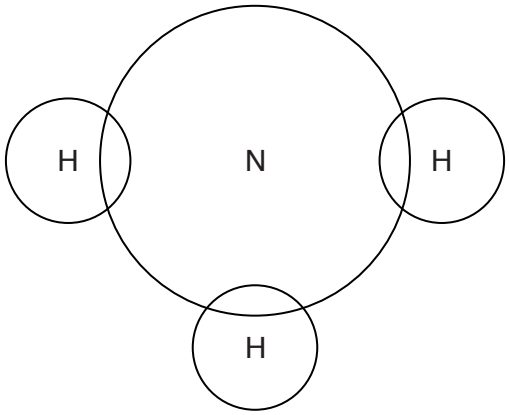

Fig. 4.1

5 Fig. 5.1 shows a mass of 1.5 kg pulled across a surface by a spring.

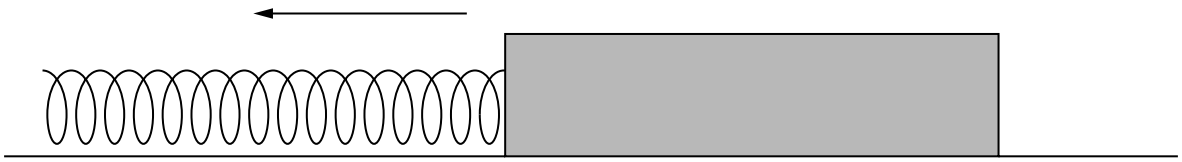

Fig. 5.1

The mass has an acceleration of 1.8 m / s^2.

Calculate the accelerating force exerted on the mass.

force = ... N [2]

6 Ethene is an unsaturated hydrocarbon which undergoes polymerisation to form poly(ethene).

(a) Explain the meaning of the words *unsaturated* and *polymerisation*.

(i) *unsaturated* .....

..... [1]

(ii) *polymerisation* .....

.....

..... [2]

(b) In the space below, draw the structure of poly(ethene).

[2]

7 Fig. 7.1 shows two strips **A** and **B** that are cut from the tissue of the same yam. The length, width and height of each strip are labelled.

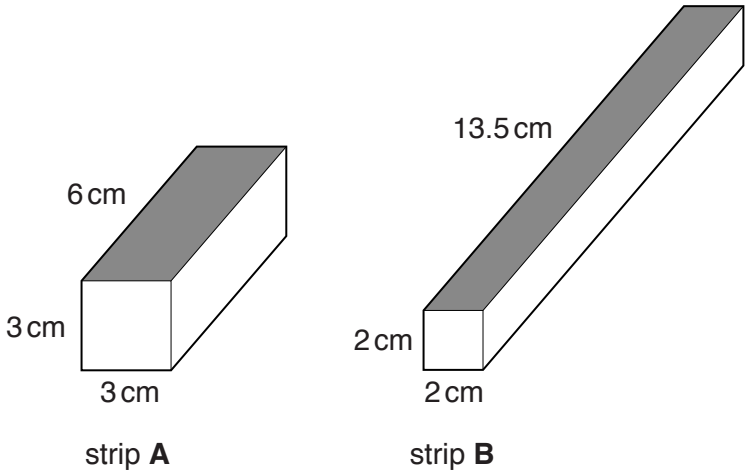

Fig. 7.1

The strips are dried and weighed.

The mass of each strip is 70 g.

(a) Calculate the surface area of the shaded side of each strip.

Write your answers in Table 7.1.

Table 7.1

strip	surface area/cm^2
A	
B	

[1]

(b) Both strips are placed in distilled water.

After fifteen minutes they are taken out of the water, dried and re-weighed.

The results are shown in Table 7.2.

Table 7.2

strip	original mass / g	mass after fifteen minutes in distilled water / g
A	70	80
B	70	92

(i) Explain why the mass of each strip increases.

.....

.....

..... [2]

(ii) Explain why strip **B** gains more mass than strip **A**.

.....

.....

..... [2]

(c) Fig. 7.2 is a drawing of some red blood cells in plasma, as seen using a microscope.

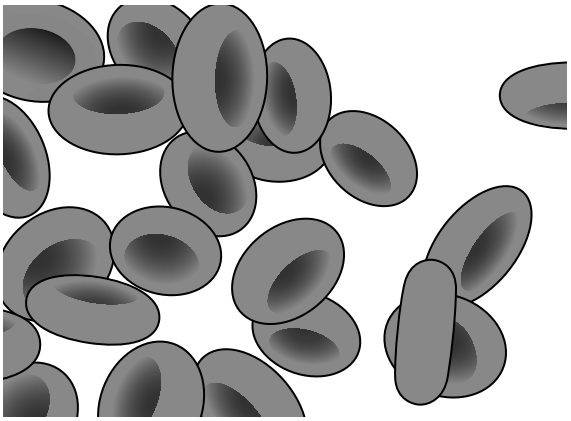

Fig. 7.2

(i) Name the substance that gives these cells their red colour.

..... [1]

(ii) Some red blood cells are placed in distilled water on a microscope slide.

After four minutes, the slide is viewed using the microscope. No cells are visible, but the liquid on the slide is coloured pink.

Describe and explain what happens to the cells during the four-minute period.

.....

.....

.....

.....

..... [2]

[Turn over

8 Complete the following sentences about the separation of mixtures.

Water can be obtained from sea-water by ..... .

A mixture of hydrocarbons is separated by ..... .

A mixture of sand and sea-water is separated by filtration and the solution that passes through the filter paper is called the ..... . The salt in the sea-water is obtained from this solution by the process of ..... .

A mixture of two solids dissolved in water can be separated by ..... .

[5]

9 Complete the following sentences about electrical circuits.

In an electrical circuit, an ..... is used to measure current.

The unit of electric current is ..... .

Electric current is a rate of flow of ..... .

[3]

10 Fig. 10.1 shows a mains plug with its cover removed.

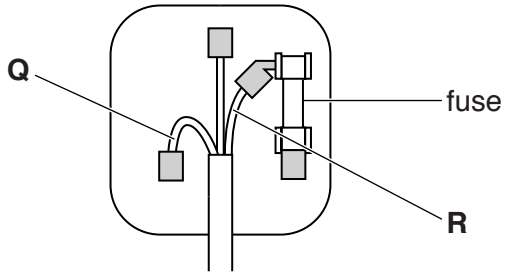

Fig. 10.1

Three wires are shown. Wires **Q** and **R** are labelled.

(a) Complete Table 10.1 to show the name and colour of wires **Q** and **R**.

Table 10.1

wire	name	colour
Q		
R		

[2]

(b) An electrical appliance is double-insulated.

Name the wire that is not required in the mains plug of this appliance.

..... [1]

(c) A kettle transforms 180 000 J of electrical energy in 2 minutes.

Calculate the power of the kettle.

power = ... unit ..... [3]

11 Fig. 11.1 shows the reproductive system of a woman.

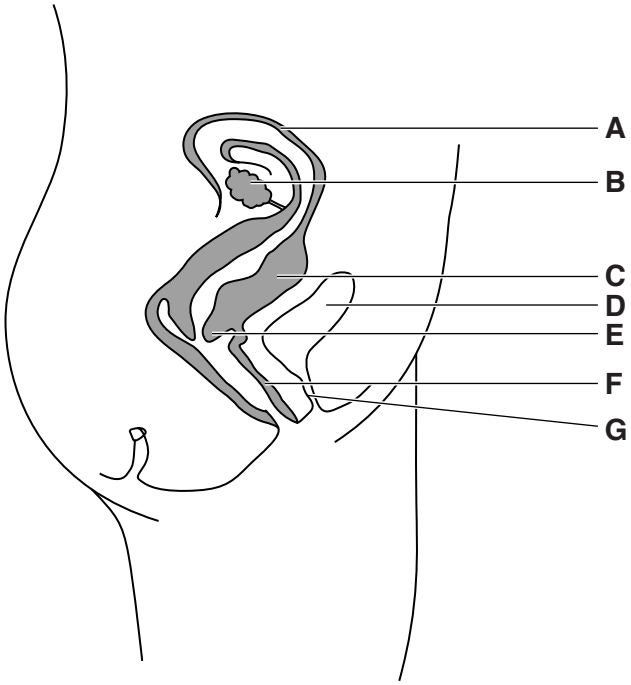

Fig. 11.1

(a) State the letter in Fig. 11.1 which identifies

(i) the cervix, ...

(ii) an ovary, ...

(iii) the vagina. .....

[3]

(b) Describe a function of

(i) the oviduct,

.....

.....

(ii) the uterus.

.....

.....

[2]

(c) (i) The changes that occur during the menstrual cycle are controlled by hormones.

State what is meant by *hormone*.

.....

.....

.....

..... [2]

(ii) State one factor, other than hormones, that can change the length of the menstrual cycle.

.....

..... [1]

12 A student is given three bars that look identical.

One is a permanent magnet, one is made of iron and one is made of copper.

Explain how the student identifies each bar using another permanent magnet.

.....

.....

.....

..... [3]

13 Equal volumes of sulfuric acid are placed in three test-tubes.

A piece of copper or zinc or magnesium is added to each test-tube.

The results are shown in Fig. 13.1.

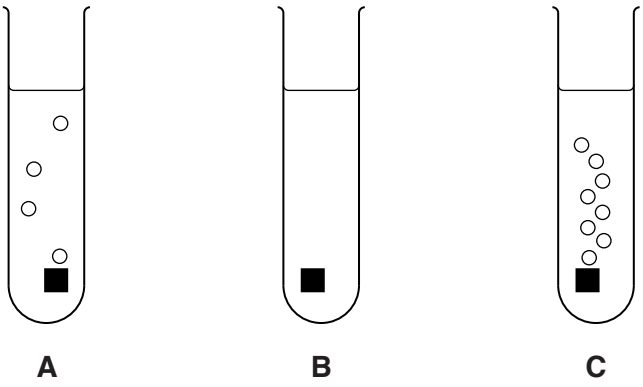

Fig. 13.1

(a) Deduce which test-tube contains

(i) copper, ...

(ii) zinc. .....

[2]

(b) Name the gas produced in the reactions. ..... [1]

(c) **(i)** State a test and the result which shows that sulfuric acid is acidic.

test .....

result .....

[2]

(ii) The formula of sulfuric acid is H_2SO_4.

State the name of each ion in sulfuric acid.

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

14 (a) Fig. 14.1 shows a wire moving downwards between the poles of two magnets.

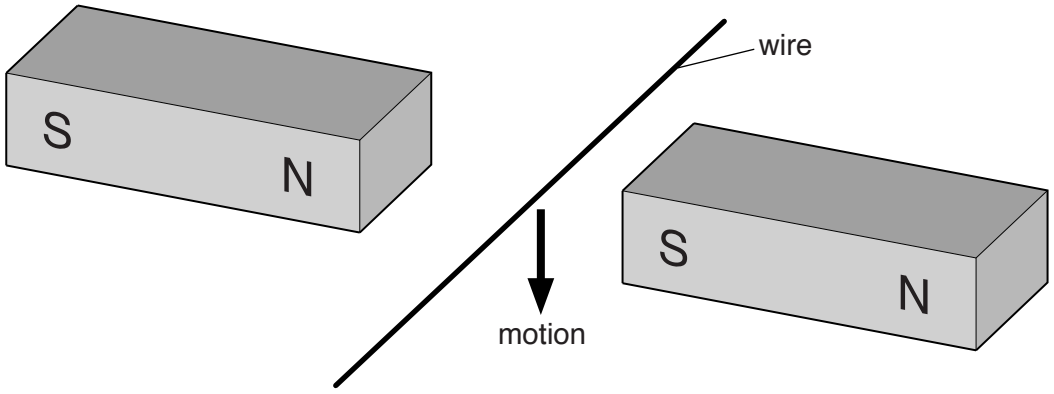

Fig. 14.1

The motion induces an electromotive force (e.m.f.) in the wire.

State how the motion of the wire may be changed

(i) to decrease the size of the induced e.m.f.,

..... [1]

(ii) to reverse the direction of the induced e.m.f.

..... [1]

(b) One application of electromagnetic induction is the transformer.

Explain why, for transformers, the input is an alternating voltage, rather than a direct voltage.

.....

.....

..... [2]

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

anther	**carpel**	**cotyledon**	**fruit**
pericarp	**plumule**	**sepal**	**stomata**
	root	**testa**	

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

Pollen is produced by the ..... of a flower.

When an insect visits a flower it transfers pollen onto the ..... .

After fertilisation, seeds are produced. Each seed contains a food store called the

..... and the plant embryo.

The plant embryo consists of a radical and a ..... .

The food store and the plant embryo are protected by an outer coating called the

..... .

[5]

16 The nucleus of an isotope of phosphorus contains 15 protons and 16 neutrons.

(a) Explain what is meant by *isotopes*.

.....

.....

..... [2]

(b) On Fig. 16.1, complete the electronic structure of this phosphorus atom.

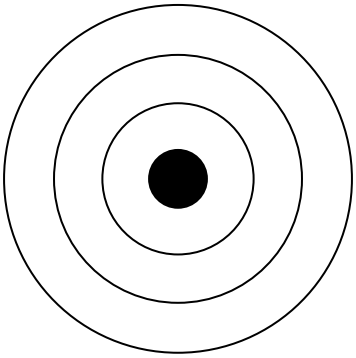

Fig. 16.1

[1]

(c) Phosphorus combines with chlorine to form the compound PCl_3.

Suggest the type of bonding in this compound and give a reason for your answer.

type of bonding .....

reason .....

..... [2]

17 All electromagnetic waves are transverse and travel at 3.0×10^8 m/s in a vacuum.

(a) An X-ray wave has a wavelength of 6.0×10^{-11} m in a vacuum.

Calculate the frequency of this wave.

frequency = ... Hz [2]

(b) (i) Name a component of the electromagnetic spectrum with higher frequencies than X-rays.

..... [1]

(ii) Name a longitudinal wave. ..... [1]

18 Table 18.1 contains descriptions of four different processes.

Table 18.1

description of process	name of process
the breakdown of large food molecules into small soluble molecules	
the release of energy from food in living cells	
the movement of molecules from a region of their higher concentration to a region of their lower concentration	
the fusion of nuclei to form a zygote and the production of genetically dissimilar offspring	

Complete Table 18.1 by naming each process. [4]

19 A nucleus of carbon has 6 protons and 8 neutrons.

(a) Determine the nucleon number. ..... [1]

(b) The nucleus emits a beta-particle.

(i) State the nature of a beta-particle.

..... [1]

(ii) Deduce the change, if any, in the number of protons in the nucleus when a beta-particle is emitted.

..... [1]

(c) An isotope of carbon has a half-life of 5 700 years.

Initially, a sample of the isotope emits 10 000 beta-particles each second.

Calculate the time before the rate of emission is reduced to 1 250 beta-particles each second.

time = ... years [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	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.).