UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

7983516015

COMBINED SCIENCE **0653/21**

Paper 2 (Core) **May/June 2010**

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.
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.

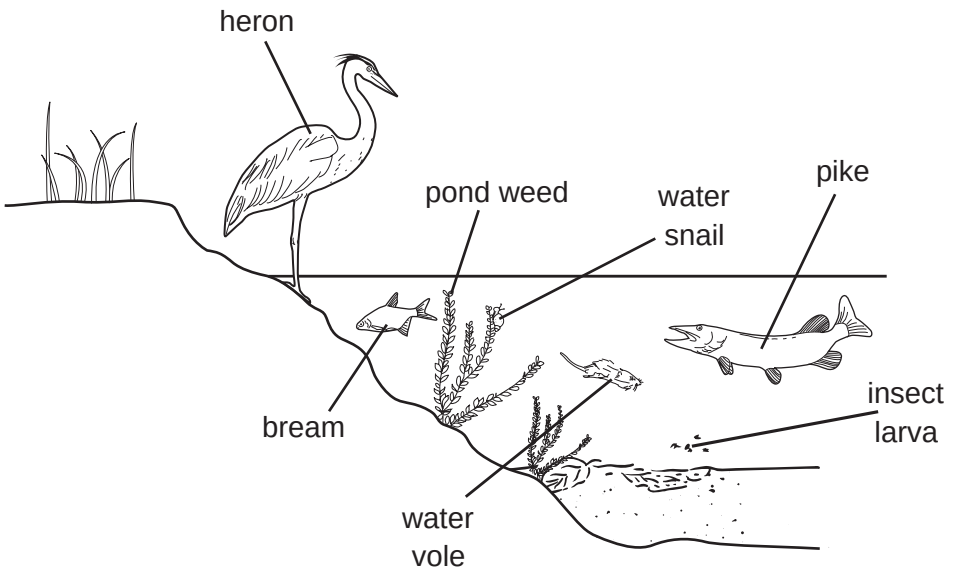
At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total	

This document consists of **22** printed pages and **2** blank pages.

1 Fig. 1.1 shows some of the animals and plants that live in or close to a pond.

For Examiner's Use



not to scale

Fig. 1.1

(a) Choose the correct term from the list below for each of the following descriptions.

community	**decomposer**	**ecosystem**
habitat	**photosynthesis**	**population**

all the animals and plants that live in and around the pond .....

all the water voles living in and around the pond .....

all the living things, and their environment, interacting with each other

..... [3]

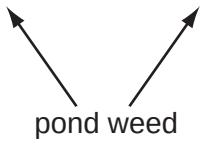
For Examiner's Use

(b) The pond weed is a producer.

Water snails and water voles are primary consumers.

The heron and pike are secondary consumers.

Complete the diagram of a food web that includes only these five organisms.



[3]

(c) The pond is at the bottom of a sloping field which was ploughed.

During very heavy rain, a lot of soil from the field was washed into the pond.

It made the water cloudy and stopped the light from reaching the leaves of the water plants, so that the plants died.

After a while, the fish and other animals also died.

Give **two** reasons why the fish and other animals died.

1 .....

.....

2 .....

..... [2]

(d) Fig. 1.2 shows a cell from the pond weed.

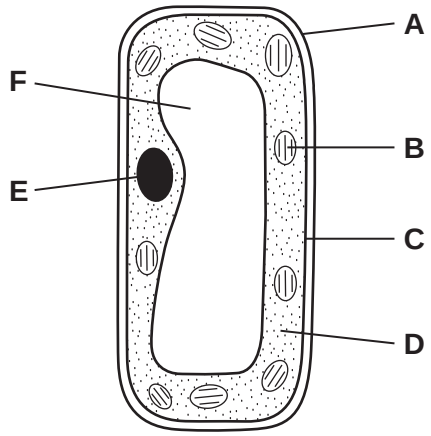


Fig. 1.2

(i) Give the letter of the part of the cell that

controls what enters and leaves the cell, ...

is the place where photosynthesis happens, ...

contains DNA. ..... [3]

(ii) Describe **two** ways in which a cell from the heron would look different from the cell in Fig. 1.2.

1 .....

.....

2 .....

..... [2]

For Examiner's Use

2 **(a)** Alpha, beta and gamma are three types of radiation emitted during radioactive decay.

Name a suitable detector for these three types of radiation.

..... [1]

(b) State **two** hazards to the human body from exposure to radiation.

1 .....

2 ..... [2]

(c) **(i)** Complete the table to compare alpha, beta and gamma radiations.

Tick **one** box in each of the two rows in the table.

	alpha	**beta**	**gamma**
most penetrating			
most ionising			

[2]

(ii) State which type of radiation

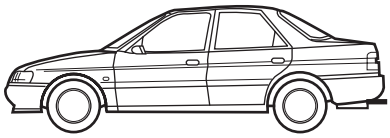
consists of particles with the greatest mass, ...

consists of electromagnetic waves. ..... [2]

For Examiner's Use

3 Aluminium, iron and sodium are metallic elements. Aluminium and iron are widely used, but no useful objects can be made out of metallic sodium.

aluminium alloys are used in aircraft



iron is used to make steel for cars

(a) (i) State **one** property of a metallic element which is different from a non-metallic element.

.....

..... [1]

(ii) Use your knowledge of the metals in Group I of the Periodic Table to state **one** reason, other than cost, why no useful objects can be made out of metallic sodium.

.....

..... [1]

(b) Aluminium and iron are mainly found as their oxides in rocks.

(i) In order to obtain metallic iron, iron oxide is heated strongly in a furnace with carbon monoxide.

One reaction which occurs in the furnace has the symbolic chemical equation shown below.

$$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$$

Explain whether or not this equation is balanced.

.....

.....

..... [2]

(ii) State the formula of the compound which has been reduced in the equation in **(i)**.

Explain your answer.

formula .....

explanation .....

..... [2]

For Examiner's Use

(c) Aluminium is produced by electrolysis in which the electrolyte contains molten aluminium oxide.

Aluminium oxide is a compound of a metal with a non-metal.

(i) Name the type of chemical bonding found in aluminium oxide.

..... [1]

(ii) State the meaning of the term *electrolyte*.

.....

..... [1]

(iii) State the type of energy which must be supplied to decompose molten aluminium oxide.

..... [1]

(iv) Name **one** other metal which is produced industrially by electrolysis.

..... [1]

For Examiner's Use

4 Fig. 4.1 shows part of the human nervous system.

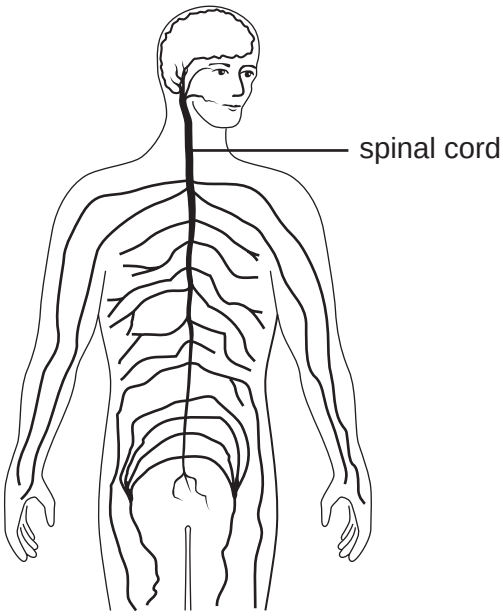


Fig. 4.1

(a) The spinal cord is part of the central nervous system.

(i) On Fig. 4.1, label and name **one** other part of the central nervous system. [1]

(ii) Complete the sentences below.

When a receptor receives a stimulus, signals pass along ..... to the central nervous system. They then pass to ..... which respond to the stimulus. [2]

(b) Messages can also be passed from one part of the body to another in the form of hormones.

Name the type of gland that produces hormones. ..... [1]

(c) A hormone secreted by the pancreas helps to keep blood sugar levels constant.

(i) On Fig. 4.1, write the letter **P** to show the position of the pancreas in the body. [1]

(ii) Name the hormone that reduces the blood sugar level if it gets too high.

..... [1]

(iii) Which body organ removes extra glucose from the blood when the blood sugar level gets too high?

..... [1]

(iv) Suggest why it is harmful to the body if the blood sugar level falls very low.

For Examiner's Use

.....

.....

..... [2]

For Examiner's Use

5 Fig. 5.1 shows two dolphins communicating with each other using sound waves.

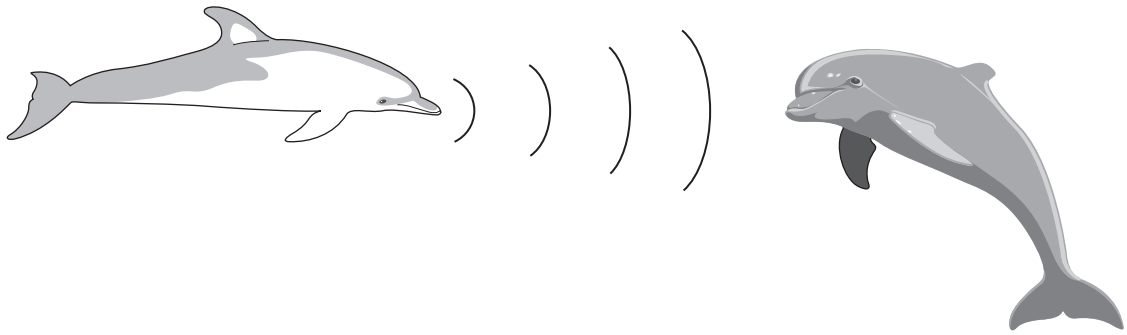


Fig. 5.1

(a) How does a sound wave travel through water?

.....

..... [1]

(b) Sound travels at different speeds through different substances.

substance	speed of sound (m/s)
air	340
steel	5200
water	1500

(i) Does sound travel fastest in a solid, a liquid or a gas?

..... [1]

(ii) It takes 0.5 seconds for the sound wave to travel from one dolphin to the other.

Calculate the distance between the two dolphins.

State the formula that you use and show your working.

formula

working

..... m [2]

For Examiner's Use

(c) A student is measuring the density of water.

(i) Name a piece of apparatus he could use to measure the volume of the water.

..... [1]

(ii) Name the piece of apparatus he could use to measure the mass of the water.

..... [1]

(iii) Complete the formula that he would use to calculate the density.

density = ... [1]

For Examiner's Use

6 Fig. 6.1 shows samples of three of the elements in Group VII (Group 7) of the Periodic Table.

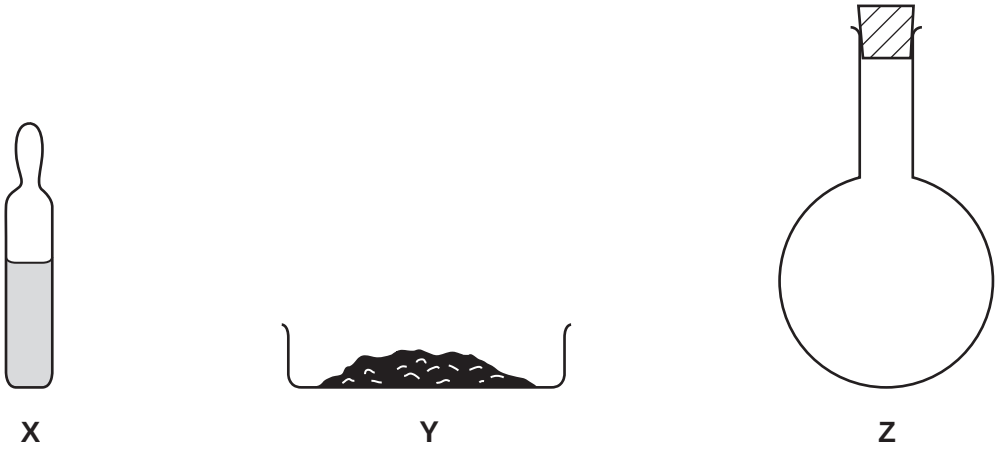


Fig. 6.1

(a) The elements in Fig. 6.1 are at the same temperature. One element is a solid, one is a liquid and one is a gas.

(i) State which element, **X**, **Y** or **Z**, has the highest melting point.

..... [1]

(ii) Suggest the names of the elements, **X**, **Y** and **Z**.

X .....

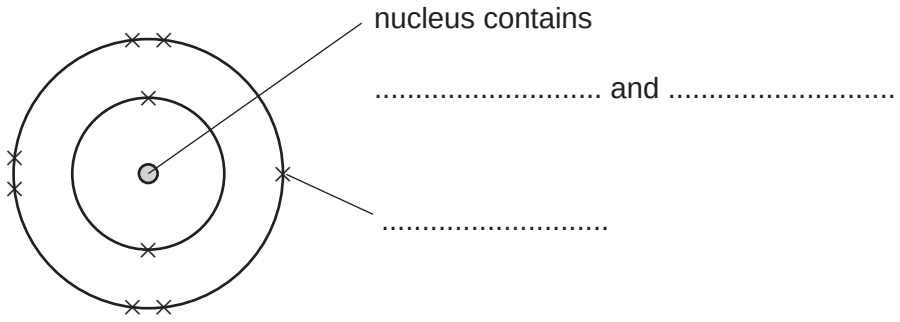
Y .....

Z ..... [2]

(b) An atom of fluorine has a proton (atomic) number of 9 and a nucleon (mass) number of 19.

(i) A diagram of this fluorine atom is shown in Fig. 6.2.

Complete the labelling of the diagram by writing the words **electrons**, **neutrons** and **protons** in the spaces.



[1]

Fig. 6.2

For Examiner's Use

(ii) State the number of neutrons in the fluorine atom in Fig. 6.2.

..... [1]

(iii) Explain why the nucleus of an atom has almost the same mass as the whole atom.

.....

..... [1]

(c) Many people use solutions which contain chlorine to clean some parts of their homes.

Suggest **one** advantage of using a solution containing chlorine rather than water alone when cleaning homes.

.....

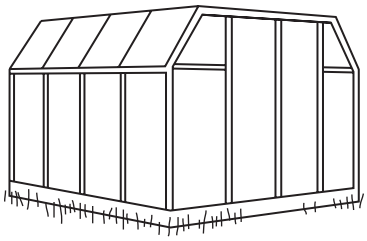
.....

..... [2]

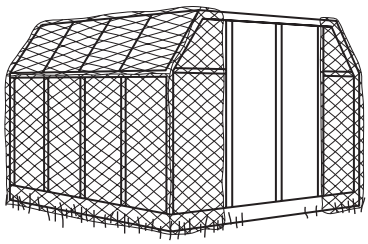
For Examiner's Use

7 An investigation was carried out in Tamil Nadu, India, into the best conditions for growing tomatoes.

The tomato plants were grown in unheated glasshouses or outside. Netting was used to provide shade in one of the glasshouses.



glasshouse **A**
no shade



glasshouse **B**
all four side walls shaded

outside
no shade

Table 7.1 shows the mean temperature, and the mass of tomatoes produced, in the two glasshouses and outside.

Table 7.1

	mean temperature / ºC	**mass of tomatoes produced per plant / g**
glasshouse **A**	38	1020
glasshouse **B**	36	2310
outside	34	1380

(a) Which temperature gave the greatest mass of tomatoes?

.....ºC [1]

(b) Use your knowledge of convection to explain why the air inside the glasshouses stayed warmer than the air outside.

.....

.....

..... [2]

For Examiner's Use

(c) Tomatoes are a fruit, produced from the fertilised flowers of tomato plants.

Bees are most active in temperatures between 35 ºC and 36 ºC.

Suggest why the mass of tomatoes produced was greater in glasshouse **B** than in glasshouse **A**.

.....

.....

..... [2]

(d) Suggest **two** factors, other than temperature, that could account for the lower mass of tomatoes produced outside than in glasshouse **B**.

1 .....

2 ..... [2]

For Examiner's Use

8 (a) (i) The air is a mixture of gases.

Complete Table 8.1 to show the percentages of the two main gases in the air.

Table 8.1

name of gas	percentage in the air
oxygen	
nitrogen	

[2]

(ii) Name **one** other gas which is found in unpolluted air.

..... [1]

(b) Sulfur dioxide is a gas which causes air pollution.

Sulfur dioxide enters the air when volcanoes erupt.

(i) Write the chemical formula of sulfur dioxide.

..... [1]

(ii) Describe **one** environmental problem which can occur when large amounts of sulfur dioxide are released into the air.

.....

.....

..... [2]

(c) When gasoline burns, the two main gases which are formed are carbon dioxide and water vapour. Both of these compounds are made of non-metallic elements bonded together.

For Examiner's Use

(i) Name the type of chemical bonding in molecules of carbon dioxide and water.

..... [1]

(ii) The displayed (graphical) formula of a water molecule is shown below.

H — O — H

Draw the displayed formula of a carbon dioxide molecule.

[2]

For Examiner's Use

9 **(a)** A rider on his bicycle roll down a constant slope onto level ground. The rider uses the brakes to stop the bicycle. Fig. 9.1 shows the motion of the bicycle.

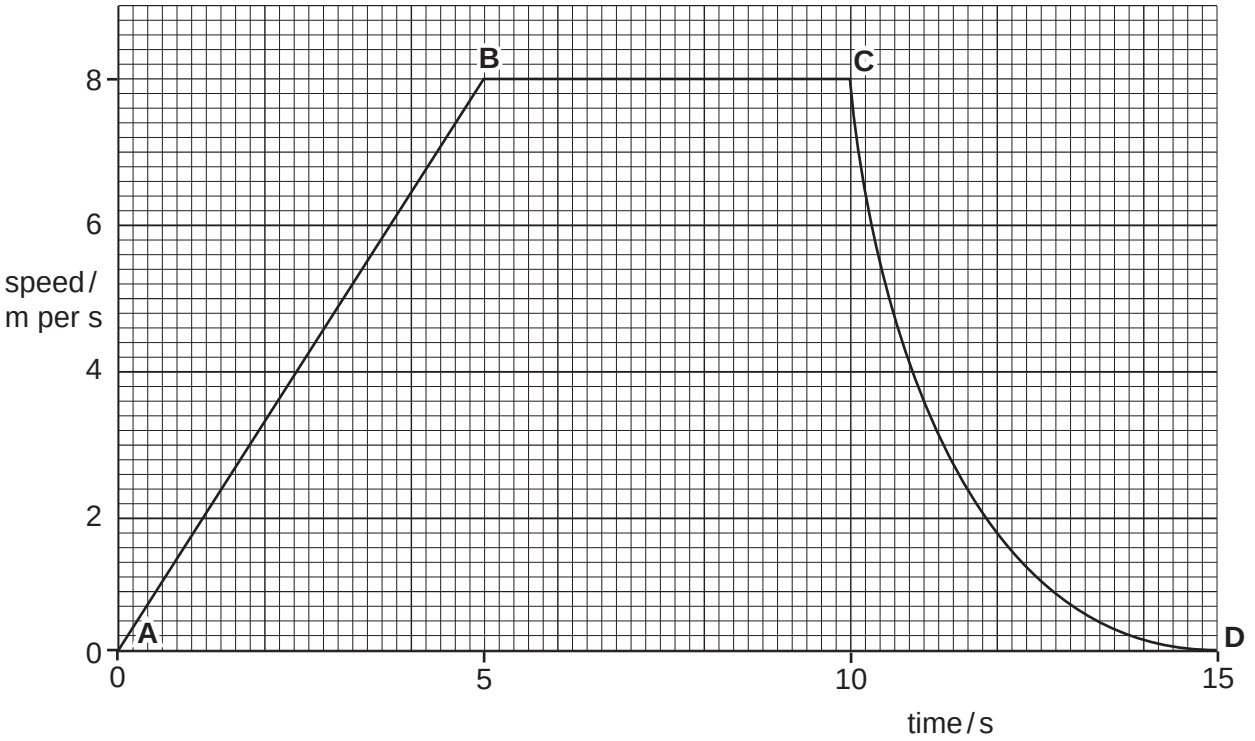


Fig. 9.1

(i) Over which section of the graph was the speed of the bicycle constant?

..... [1]

(ii) How long did it take the bicycle to stop after the brakes were used?

..... s [1]

For Examiner's Use

(b) As the bicycle moves along a level road, the brakes are suddenly applied. The bicycle comes to a stop after 10 m.

When the brakes are applied, the average frictional force stopping the bicycle is 250 N.

Work is done and energy is transferred.

(i) Calculate the work done as the bicycle slows down to a stop.

State the formula that you use and show your working.

formula

working

..... J [2]

(ii) Identify the energy transfer which takes place.

from ..... energy to ..... energy [2]

For Examiner's Use

(c) Fig. 9.2 shows a bicycle with two lamps at the front.

Fig. 9.2

Fig. 9.3 shows the circuit used to power the two lamps.

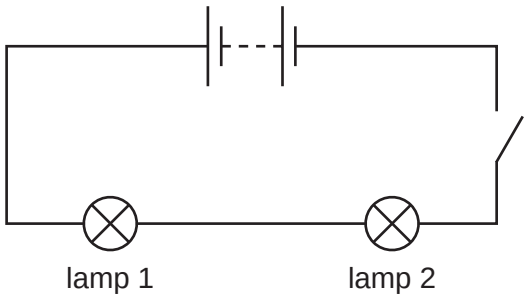


Fig. 9.3

(i) What name is given to this type of circuit?

..... [1]

(ii) The resistance of each lamp in the circuit is 4 Ω.

State the combined resistance of the two lamps.

..... Ω [1]

For Examiner's Use

(d) Fig. 9.4 shows a metal nut on the bicycle wheel which is difficult to unscrew.

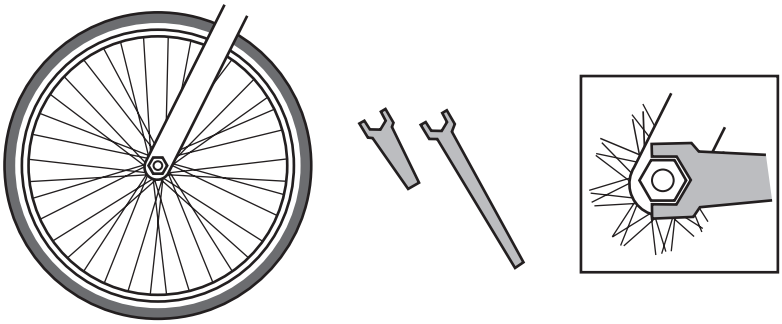


Fig. 9.4

Explain why a long spanner is better than a short spanner to unscrew the nut.

.....

.....

..... [2]

BLANK PAGE

BLANK PAGE

DATA SHEET
The Periodic Table of the Elements

Group																	
I	II									III	IV	V	VI	VII	0
															4 He Helium 2
					1 H Hydrogen 1										
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	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 = 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.).