



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE
NAME

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NUMBER

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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.

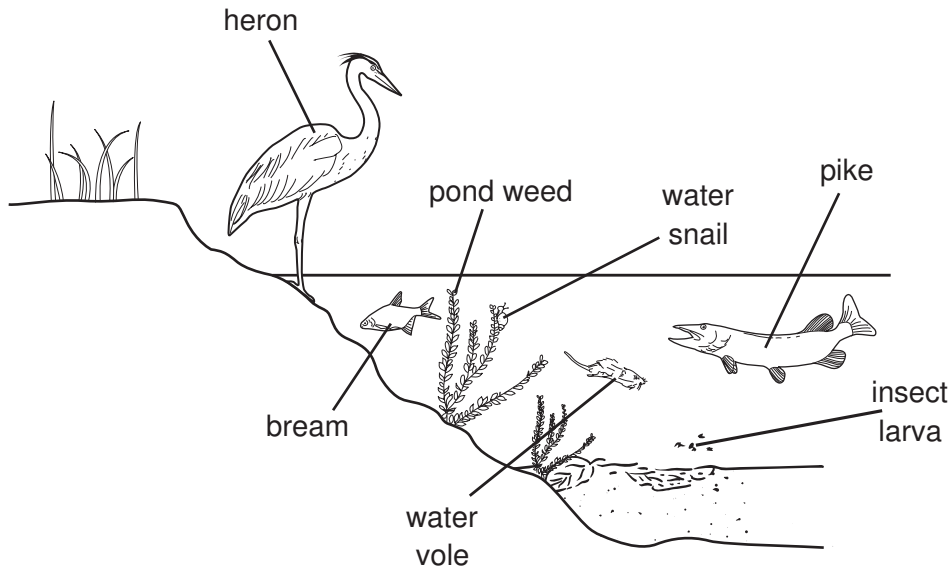
| For Examiner's Use | |
|--------------------|--|
| 1 | |
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| 8 | |
| 9 | |
| Total | |

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.

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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

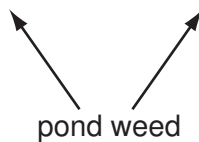
..... [3]

(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.

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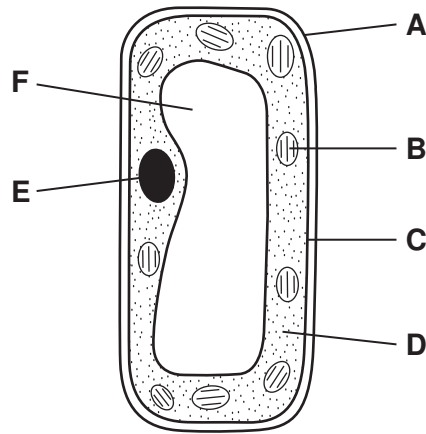


Fig. 1.2

- (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]

- 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

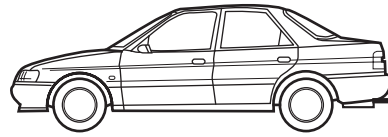
consists of particles with the greatest mass,

consists of electromagnetic waves. [2]

- 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]

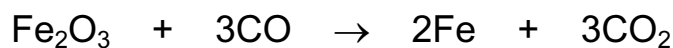
- (ii) Use your knowledge of the metals in Group I of the Periodic Table to state **one** reason, other than cost, why no useful objects can be made out of metallic sodium.

.....
..... [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.



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]

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

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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]

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

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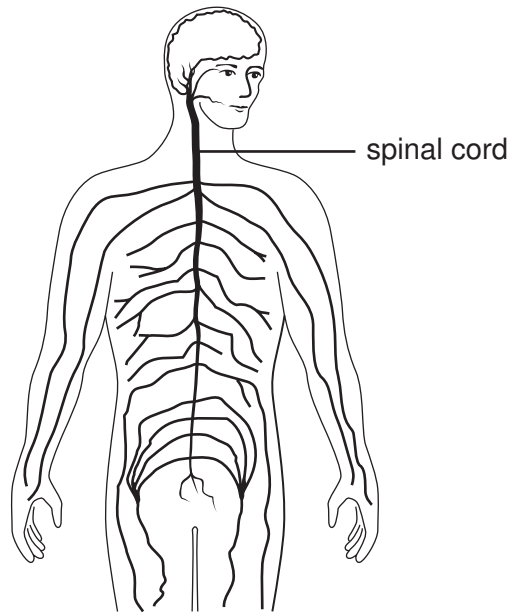


Fig. 4.1

(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.

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

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



Fig. 5.1

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(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]

(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]

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

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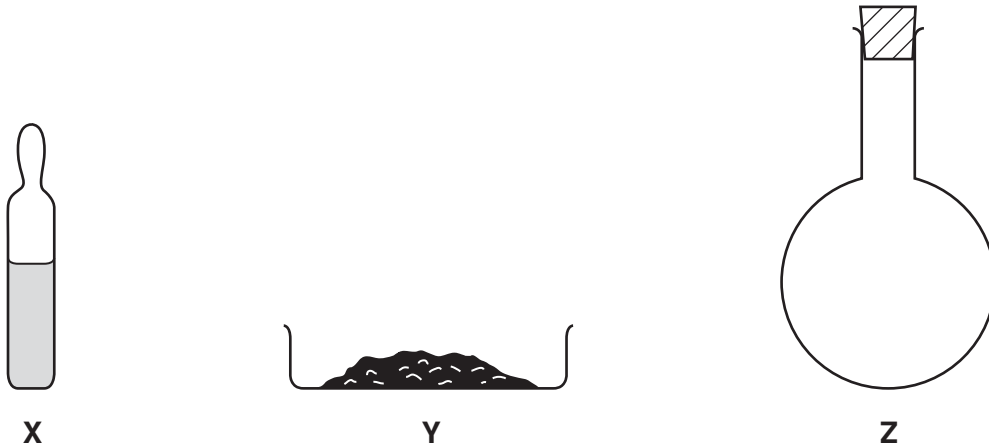


Fig. 6.1

(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.

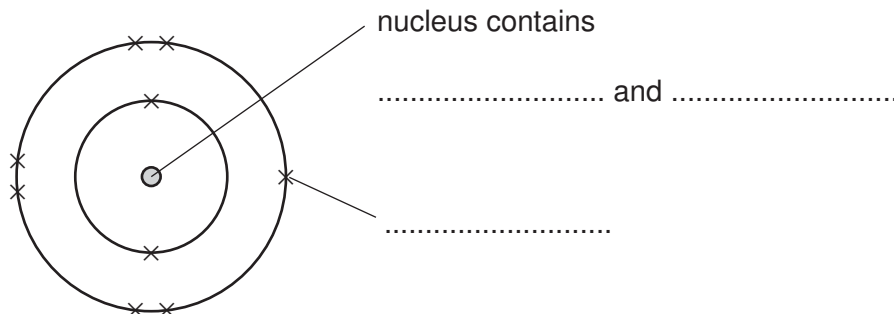


Fig. 6.2

[1]

(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]

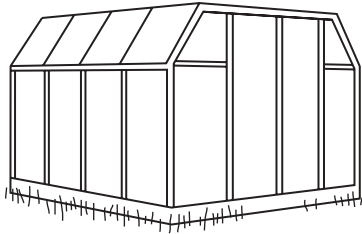
(c) Many people use solutions which contain chlorine to clean some parts of their homes.

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

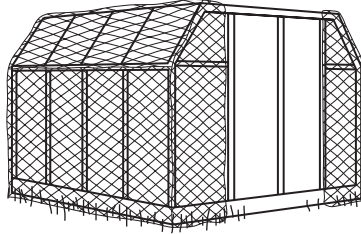
.....
.....
..... [2]

- 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 / °C | 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?

..... °C [1]

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

.....

 [2]

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

Bees are most active in temperatures between 35°C and 36°C.

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]

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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.

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(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.



Draw the displayed formula of a carbon dioxide molecule.

[2]

- 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.

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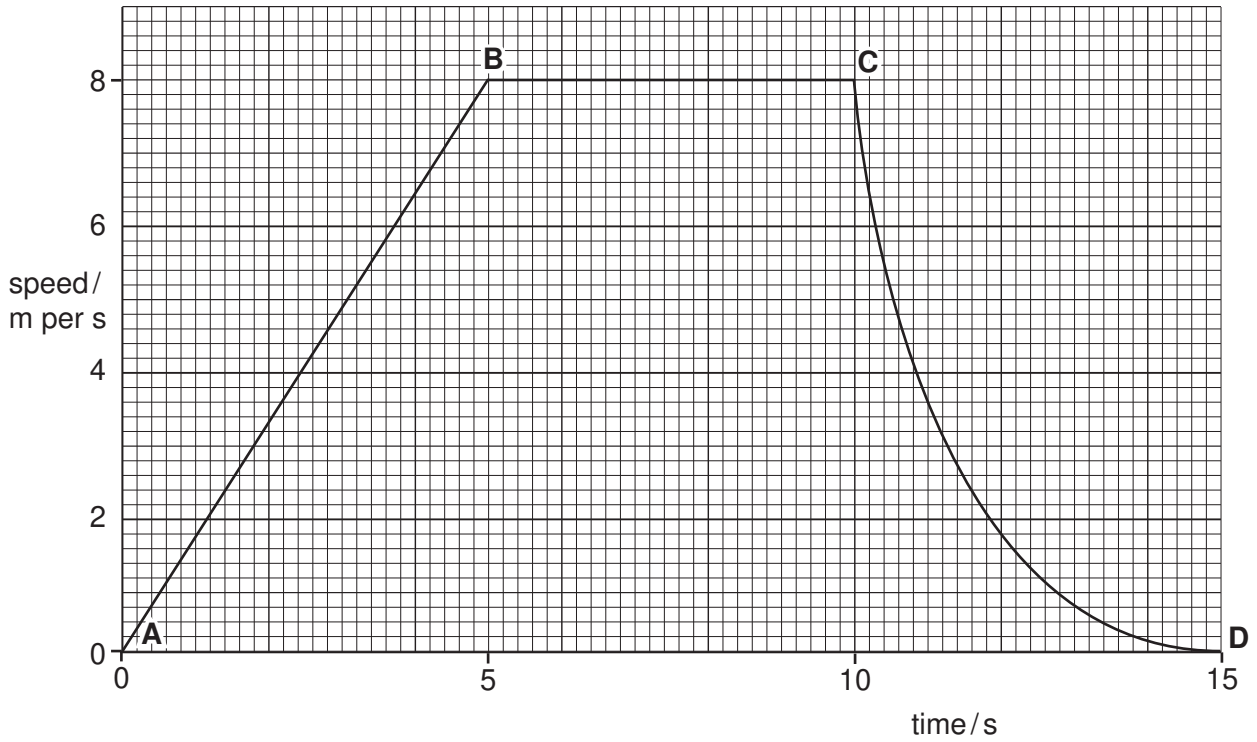


Fig. 9.1

- (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]

(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]

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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.

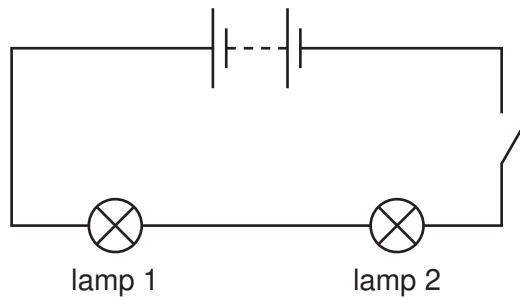


Fig. 9.3

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

..... [1]

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

State the combined resistance of the two lamps.

..... Ω [1]

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

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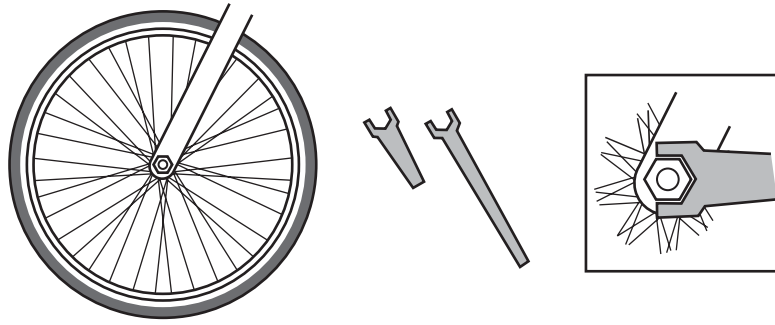


Fig. 9.4

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

.....

.....

..... [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 | 9 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Li Lithium | Be Beryllium | B Boron | C Carbon | N Nitrogen | O Oxygen | F Fluorine | Ne Neon | Na Sodium | Mg Magnesium | Al Aluminium | Si Silicon | P Phosphorus | S Sulfur | Cl Chlorine | Ar Argon | K Potassium | Ca Calcium | Sc Scandium | Ti Titanium | V Vanadium | Cr Chromium | Mn Manganese | Fe Iron | Co Cobalt | Ni Nickel | Cu Copper | Zn Zinc | Ga Gallium | Ge Germanium | As Arsenic | Se Selenium | Br Bromine | Kr Krypton | | | | | | | | | | | | | | | |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | | | | | |
| Na Sodium | Mg Magnesium | Al Aluminium | Si Silicon | P Phosphorus | S Sulfur | Cl Chlorine | Ar Argon | K Potassium | Ca Calcium | Sc Scandium | Ti Titanium | V Vanadium | Cr Chromium | Mn Manganese | Fe Iron | Co Cobalt | Ni Nickel | Cu Copper | Zn Zinc | Ga Gallium | Ge Germanium | As Arsenic | Se Selenium | Br Bromine | Kr Krypton | Rb Rubidium | Sr Strontium | Y Yttrium | Zr Zirconium | Nb Niobium | Mo Molybdenum | Tc Technetium | Ru Ruthenium | Rh Rhodium | Pd Palladium | Ag Silver | Cd Cadmium | In Indium | Sn Tin | Sb Antimony | Te Tellurium | I Iodine | Xe Xenon | | | | | |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | | | |
| Rb Rubidium | Sr Strontium | Y Yttrium | Zr Zirconium | Nb Niobium | Mo Molybdenum | Tc Technetium | Ru Ruthenium | Rh Rhodium | Pd Palladium | Ag Silver | Cd Cadmium | In Indium | Sn Tin | Sb Antimony | Te Tellurium | I Iodine | Xe Xenon | Cs Caesium | Ba Barium | La Lanthanum | Ce Cerium | Pr Praseodymium | Nd Neodymium | Pm Promethium | Sm Samarium | Eu Europium | Gd Gadolinium | Tb Terbium | Dy Dysprosium | Ho Holmium | Er Erbium | Tm Thulium | Yb Ytterbium | Lu Lutetium | Rn Radon | | | | | | | | | | | | | |
| 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 |
| Fr Francium | Ra Radium | Ac Actinium | Th Thorium | Pa Protactinium | U Uranium | Np Neptunium | Pu Plutonium | Am Americium | Cm Curium | Bk Berkelium | Cf Californium | Es Einsteinium | Fm Fermium | Md Mendelevium | No Nobelium | Lr Lawrencium | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fr Francium | Ra Radium | Ac Actinium | Th Thorium | Pa Protactinium | U Uranium | Np Neptunium | Pu Plutonium | Am Americium | Cm Curium | Bk Berkelium | Cf Californium | Es Einsteinium | Fm Fermium | Md Mendelevium | No Nobelium | Lr Lawrencium | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

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

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

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

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