Cambridge O Level

Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

5511873191

COMBINED SCIENCE **5129/21**

Paper 2 **May/June 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.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.
A copy of the Periodic Table is printed on page 20.

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 **19** printed pages and **1** blank page.

CAMBRIDGE International Examinations

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

osmosis photosynthesis respiration

stamens stomata transpiration

wilted yellow

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

Water enters root hairs of a plant by the process of ..... .

Water vapour passes out of the leaves through pores called ..... .

Loss of water vapour from leaves is called ..... .

When more water is lost from leaves than is replaced by roots, a plant becomes

..... .

[4]

2 Magnesium burns in carbon dioxide forming carbon and magnesium oxide.

The equation for the reaction is

$$2Mg + CO_2 \longrightarrow 2MgO + C$$

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

carbon dioxide, ...

magnesium oxide. .....

(A_r: Mg, 24; C, 12; O, 16) [2]

(ii) Use your answers in part **(i)** and the equation to complete the following sentence.

24 g of magnesium reacts with ..... g of carbon dioxide and produces ..... g of magnesium oxide. [2]

(b) Suggest why magnesium cannot be obtained from magnesium oxide by heating with carbon.

.....

.....[1]

(c) State the type of reaction that the carbon dioxide has undergone.

.....[1]

3 A circuit diagram containing two lamps **P** and **Q** is shown in Fig. 3.1.

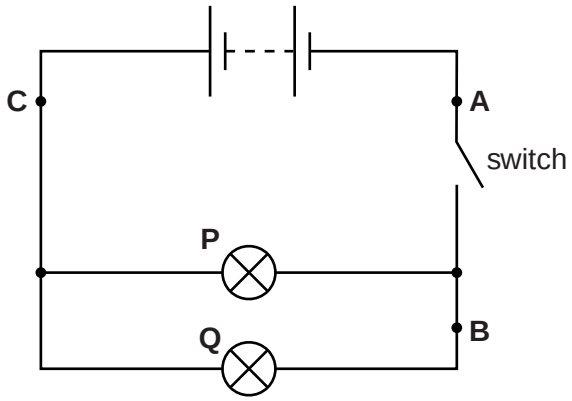

Fig. 3.1

The switch is now closed.

When the switch is closed, the current in lamp **P** is 0.3 A and the potential difference across it is 6 V.

(a) Calculate the resistance of lamp **P**.

resistance = ... unit ..... [3]

(b) The current in lamp **Q** is 0.2 A.

Determine the current in the circuit at

(i) point **A**, ... A

(ii) point **B**, ... A

(iii) point **C**. ..... A

[3]

4 Fig. 4.1 is a photomicrograph of blood when seen through a light microscope.

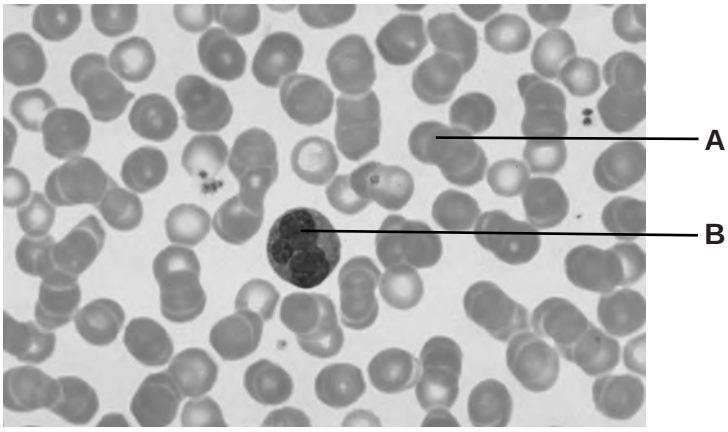

Fig. 4.1

Blood contains plasma, platelets, red blood cells and white blood cells.

(a) In Table 4.1, name components **A** and **B**.

Table 4.1

	name of blood component
A	
B	

[1]

(b) State one function for each of the following components.

platelets .....

.....

red blood cells .....

.....

white blood cells .....

.....

[3]

(c) Plasma transports platelets, red blood cells and white blood cells as well as other substances.

State three of these **other** substances.

1. .....

2. .....

3. .....

[3]

5 The electronic structure of a magnesium **atom** is shown in Fig. 5.1.

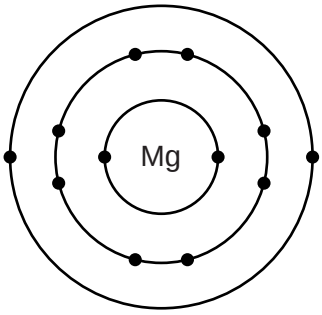

Fig. 5.1

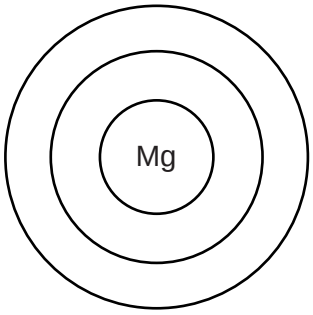

Fig. 5.2

(a) **(i)** Complete Fig. 5.2 to show the electronic structure of the magnesium **ion**. [1]

(ii) State the charge on the magnesium ion. ..... [1]

(b) The nucleon number of an isotope of magnesium atom is 25.

Calculate the number of neutrons in a nucleus of this isotope.

.....[1]

(c) Magnesium reacts with nitric acid to produce magnesium nitrate.

(i) Complete the equation for the reaction.

$$Mg + \text{.....} HNO_3 \longrightarrow Mg(NO_3)_2 + H_2$$ [1]

(ii) Suggest two other substances that react with nitric acid to produce magnesium nitrate.

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

6 A boy on a diving board is shown in Fig. 6.1.

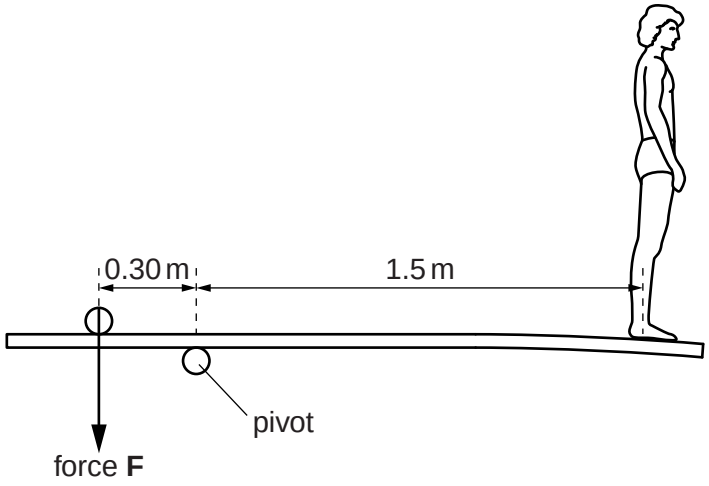

Fig. 6.1

The boy weighs 500 N and stands 1.5 m from the pivot.

The clockwise moment of the boy's weight about the pivot is equal to the anti-clockwise moment of force **F** about the pivot.

(a) Force **F** is 0.30 m from the pivot.

Calculate force **F**.

force **F** = ... N [2]

(b) The boy steps off the end of the diving board and falls vertically.

(i) Calculate the work done by the force of gravity on the boy as he falls through 1.2 m.

work done = ... unit ..... [3]

(ii) State the type of energy lost by the boy as he falls.

.....[1]

Please turn over for Question 7

7 **(a)** **(i)** Define *diffusion*.

.....

.....

.....

.....[2]

(ii) Name two substances that diffuse across the wall of the alveolus.

1. .....

2. .....

[2]

(b) Fig. 7.1 shows a section through a group of alveoli in a lung.
Part of the wall of an alveolus and the capillary next to it has been magnified.

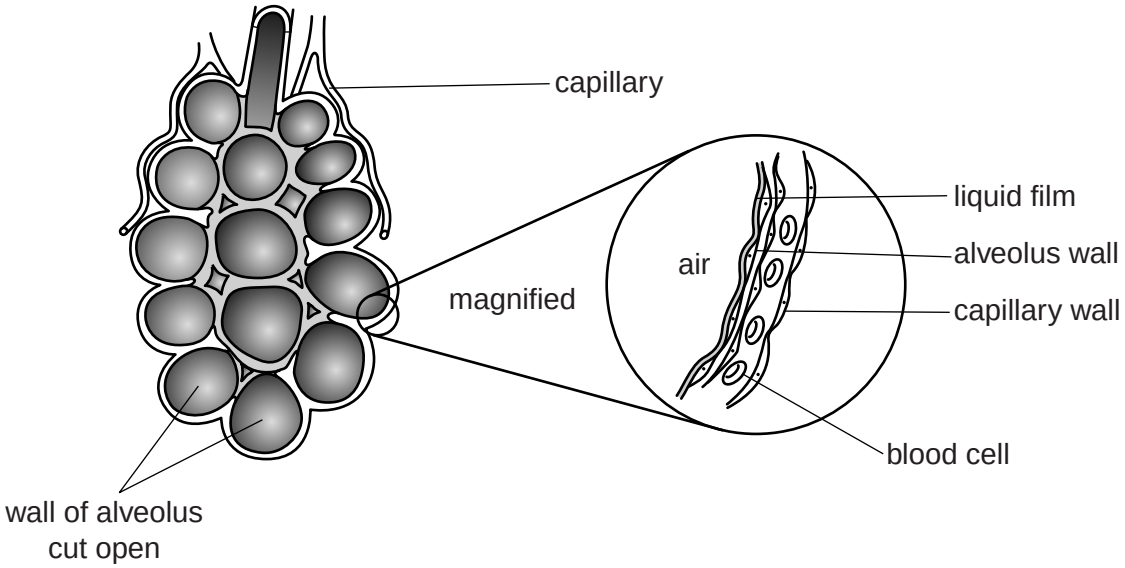

Fig. 7.1

Irritation of the cells of the alveoli produces a thicker liquid film.

(i) Suggest one cause of irritation

.....

.....[1]

(ii) State and explain how a thicker liquid film affects the rate of diffusion across the wall of the alveolus.

.....

.....

.....

.....[2]

(iii) Coughing helps to remove the thicker layer of liquid. Repeated coughing over many years may damage the walls of the alveoli.

Fig. 7.2 shows a group of damaged alveoli.

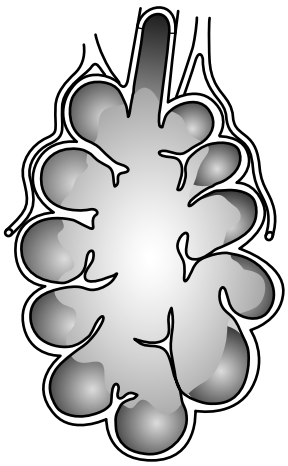

Fig. 7.2

State and explain how this damage will affect diffusion across the walls of the alveoli.

.....

.....

.....

.....[2]

[Turn over

8 Octane is a hydrocarbon obtained by fractional distillation of petroleum.

It is decomposed to ethene, propene and substance **X** by heating in the presence of a catalyst.

The equation for the reaction is

$$C_8H_{18} \longrightarrow C_2H_4 + C_3H_6 + \mathbf{X}$$

(a) **(i)** State the name of the process for the decomposition of octane.

.....[1]

(ii) Deduce the formula of **X**. .....[1]

(iii) Name the homologous series to which **X** belongs. .....[1]

(b) State what you see when aqueous bromine is added to

octane, ...

.....

ethene. .....

.....[2]

(c) Complete the diagram to show the bonds in a molecule of ethene.

[1]

(d) State the name of the compound formed when ethene reacts with steam.

.....[1]

9 Fig. 9.1 shows a liquid-in-glass thermometer.

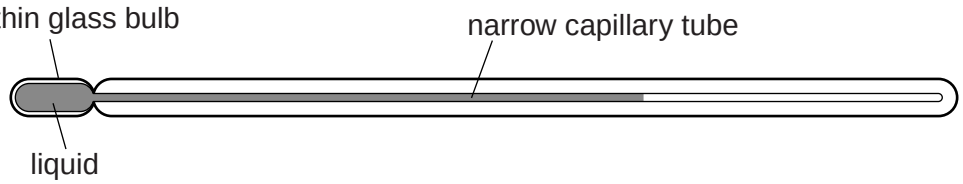

Fig. 9.1

(a) Which physical property of the liquid changes with temperature?

..... [1]

(b) The capillary tube of a clinical liquid-in-glass thermometer is narrower than the capillary tube of a normal laboratory liquid-in-glass thermometer.

Explain why a narrower capillary tube makes a clinical thermometer more sensitive.

.....

.....[1]

(c) **(i)** State the temperature of pure boiling water. .....°C [1]

(ii) Explain why a clinical thermometer is **not** used to measure the temperature of boiling water.

.....

.....[1]

10 A balloon on an insulating thread is rubbed with a duster. This removes some electrons from the balloon.

(a) State the sign of the charge now on the balloon. ..... [1]

(b) The balloon is free to move. A second balloon with the same charge is brought near to the first balloon.

State what happens to the first balloon.

.....[1]

11 Fig. 11.1 shows a section through a flower.

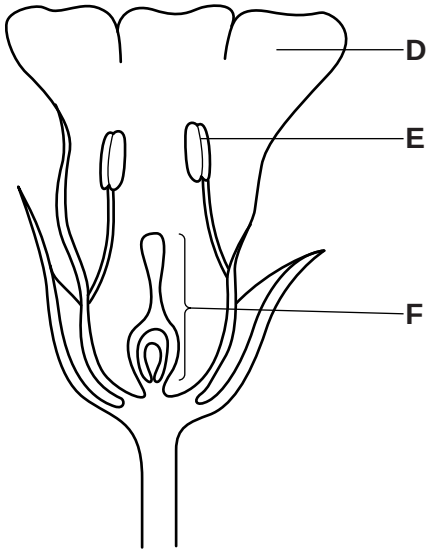

Fig. 11.1

(a) (i) In Table 11.1, name the parts of the flower **D**, **E** and **F**.

Table 11.1

	name of flower part
D	
E	
F	

[3]

(ii) State one function of the

anther, ...

.....

sepal. .....

.....

[2]

(b) Flowers produce seeds.

(i) State **two** conditions for a seed to germinate.

1. .....

2. .....
[2]

(ii) During germination, the enzyme amylase becomes active in the seed.

State and explain why amylase is necessary during germination.

.....

.....

.....

.....

.....

.....[3]

12 Some properties of five substances are shown in Table 12.1. The letter given for each substance is **not** the chemical symbol of that substance.

Table 12.1

substance	conducts electricity when solid	conducts electricity when melted	melting point / °C	soluble in water
V	no	no	119	no
W	no	no	–78	yes
X	no	yes	857	yes
Y	yes	yes	1083	no
Z	yes	yes	63	reacts with water

Use the letters in Table 12.1 to answer the following questions.

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

(a) The substance that is not a solid at room temperature is .....[1]

(b) (i) The substance that is a Group 1 metal is .....[1]

(ii) Give a reason for your choice in part **(i)**.

.....

.....[1]

(c) (i) The substance that is an ionic compound is .....[1]

(ii) Give **two** reasons for your choice in part **(i)**.

1. .....

.....

2. .....

.....
[2]

13 A metal ring and a wooden rod are shown in Fig. 13.1.

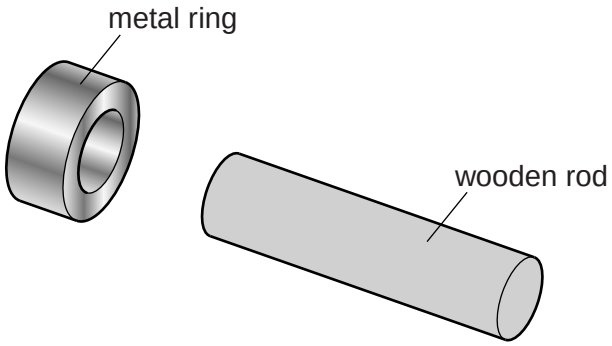

Fig. 13.1

The hole in the metal ring is too small for the wooden rod to fit inside it.

When the metal ring is heated, the wooden rod now fits inside it.

The wooden rod is pushed into the hole in the hot metal ring and the metal ring is cooled. The wooden rod cannot be removed.

(a) Explain why

(i) the wooden rod will fit inside the metal ring when the ring is heated,

.....[1]

(ii) the wooden rod cannot be removed when the metal ring cools.

.....[1]

(b) When the hot metal ring is placed on one end of the wooden rod, as shown in Fig. 13.2, the other end of the rod remains cool.

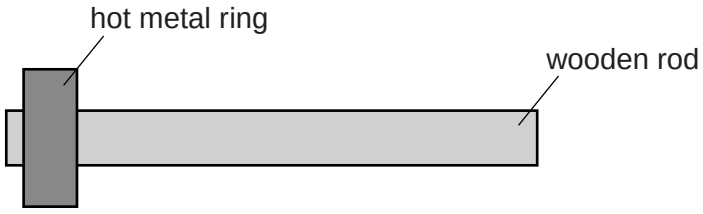

Fig. 13.2

Explain why the other end of the rod remains cool.

.....

.....[1]

(c) Name the method of heat transfer which

(i) involves changes in fluid density, ...

(ii) can transfer energy through a vacuum. .....[2]

14 Fig. 14.1 shows the apparatus used to pass 100 cm^3 of air over an excess of heated copper.

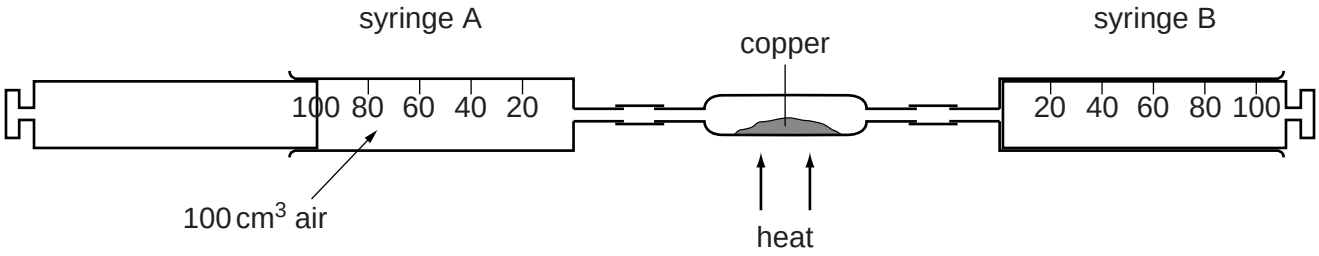

Fig. 14.1

The air is passed over the heated copper several times until there is no further change in the volume of gas. The apparatus is then left to cool to room temperature.

(a) State the name of the gas that

(i) makes up most of the air in the syringe, ...[1]

(ii) is removed by the copper. .....[1]

(b) State the final volume of gas in the syringe at the end of the experiment.

final volume ..... cm^3 [1]

(c) **(i)** State the name of a pollutant produced by the combustion of fossil fuels.

.....[1]

(ii) Explain how this pollutant is produced during the combustion of fossil fuels.

.....

.....[1]

15 Some of the components of the electromagnetic spectrum are shown in Fig. 15.1.

radiowaves	**A**	infra-red	visible light	ultraviolet	**B**	gamma-rays

Fig. 15.1

(a) Name components **A** and **B**.

A .....

B .....

[2]

(b) Name

(i) the part of an atom that emits gamma-rays,

.....[1]

(ii) the surface colour that is the best absorber of infra-red radiation.

.....[1]

(c) Some light has a frequency of 4.0×10^{14} Hz and a wavelength of 5.0×10^{-7} m in glass.

Calculate the speed of this light in glass.

speed = ... m/s [2]

16 Many rain forests are being cut down. This causes undesirable effects on the local ecosystem.

Complete the following sentences about the destruction of the rain forests.

Cutting down trees reduces the amount of water vapour and ..... gas in the atmosphere and increases the amount of ..... gas in the atmosphere.

The number and variety of animals decrease as a result of a loss of ..... and shelter.

The loss of trees causes ..... to be washed away more quickly.

[4]

17 Complete the following sentences about the Periodic Table.

The Periodic Table is a list of elements arranged in order of ..... number.

The ..... elements are on the left-hand side of the table and the

..... elements are on the right-hand side of the table.

The vertical columns are called ..... and the horizontal rows are

called ..... .

[4]

18 A car has a mass of 800 kg.

The accelerating force on the car is 2000 N.

(a) Calculate the acceleration of the car.

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

(b) The car's initial speed is zero. After some time, the constant accelerating force decreases gradually.

On Fig. 18.1 draw a line to show how the speed of the car changes with time for the constant and for the decreasing accelerating force. [1]

Fig. 18.1

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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.).