



Cambridge IGCSE™

PHYSICAL SCIENCE

0652/22

Paper 2 Multiple Choice (Extended)

October/November 2020

45 minutes

You must answer on the multiple choice answer sheet.

You will need: Multiple choice answer sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

INSTRUCTIONS

- There are **forty** questions on this paper. Answer **all** questions.
- For each question there are four possible answers **A, B, C** and **D**. Choose the **one** you consider correct and record your choice in soft pencil on the multiple choice answer sheet.
- Follow the instructions on the multiple choice answer sheet.
- Write in soft pencil.
- Write your name, centre number and candidate number on the multiple choice answer sheet in the spaces provided unless this has been done for you.
- Do **not** use correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.

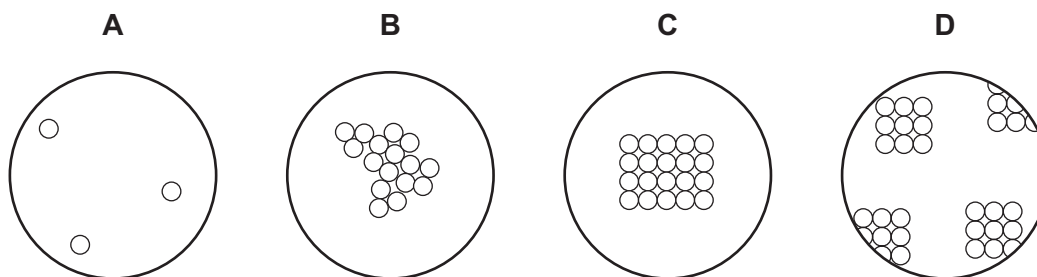
INFORMATION

- The total mark for this paper is 40.
- Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
- Any rough working should be done on this question paper.
- The Periodic Table is printed in the question paper.

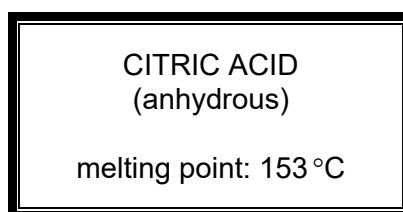
This document has **16** pages. Blank pages are indicated.



1 Which diagram represents the arrangement of particles in a liquid?



2 A bottle of a solid is labelled as shown.



The melting point of a sample from the bottle is measured.

The sample melts over a temperature range from 140 °C to 150 °C.

Which statement explains this observation?

- A The sample contains a mixture of citric acid and other solids.
 - B The sample is too large.
 - C The sample has a pH less than 7.
 - D The sample is too small.
- 3 Which statement describes a compound?
- A It is a mixture of two or more elements.
 - B It is a substance containing two or more elements chemically combined.
 - C It is a substance that can be easily separated by physical means.
 - D It is a substance that cannot be broken down by chemical means.
- 4 Which molecule does **not** contain an atom which shares more than two electrons with one other atom?
- A C_2H_4
 - B CH_3OH
 - C CO_2
 - D N_2

5 Which statement explains why graphite is a good conductor of electricity?

- A It has moving electrons.
- B It has moving ions.
- C It has strong bonds within its layers of atoms.
- D It has weak bonds between its layers of atoms.

6 Potassium nitride is an ionic compound. The charges on its ions are shown.



What is the formula of potassium nitride?

- A KN
- B K_2N
- C K_3N
- D KN_3

7 The formula of aluminium sulfate is $\text{Al}_2(\text{SO}_4)_3$.

Which row shows the number of atoms of each element in aluminium sulfate?

	Al	S	O
A	2	1	4
B	2	1	12
C	2	3	4
D	2	3	12

8 Ethyl ethanoate has the formula $\text{CH}_3\text{CO}_2\text{C}_2\text{H}_5$.

What is the relative molecular mass M_r of this compound?

- A 48
- B 72
- C 88
- D 124

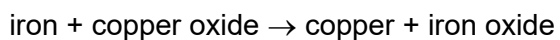
9 Magnesium is added to hydrochloric acid.

The temperature of the mixture increases.

Which statement describes and explains this observation?

- A The reaction is endothermic because the energy needed to make the bonds is greater than the energy released by breaking bonds.
- B The reaction is endothermic because the energy released in making bonds is greater than the energy needed to break bonds
- C The reaction is exothermic because the energy needed to make the bonds is greater than the energy released by breaking bonds
- D The reaction is exothermic because the energy released in making bonds is greater than the energy needed to break bonds.

10 Word equations for two reactions are shown.



Which statement about the two reactions is correct?

- A Carbon and copper oxide have been oxidised.
- B Carbon and iron have been reduced.
- C Zinc oxide and copper oxide have been oxidised.
- D Zinc oxide and copper oxide have been reduced.

11 Wasp stings contain an alkali.

The pH values of some substances are shown.

substance	pH value
saliva	7.4
lime	12.4
salt solution	7.0
vinegar	3.5

Which substance could be used to neutralise a wasp sting?

- A lime
- B saliva
- C salt solution
- D vinegar

12 Four methods of preparing salts are shown.

- 1 adding an excess of an insoluble carbonate to a dilute acid and removing the excess by filtration
- 2 adding an excess of an insoluble metal oxide to a dilute acid and removing the excess by filtration
- 3 precipitation
- 4 titration using an acid and a metal hydroxide

The solubilities of some lead compounds are shown.

compound	solubility
lead carbonate	insoluble
lead hydroxide	insoluble
lead oxide	insoluble
lead nitrate	soluble
lead sulfate	insoluble

Which of the methods could be used to make lead sulfate?

- A** 1 and 3 **B** 1 and 2 **C** 3 only **D** 4 only

13 Elements W, X, Y and Z are all in the same period of the Periodic Table.

Which element has the fewest electrons in its outer shell?

- A** Element W, which has the largest relative atomic mass.
B Element X, which has the largest atomic number.
C Element Y, which has the most metallic character.
D Element Z, which forms an acidic oxide.

14 Chlorine, bromine and iodine are three of the elements in Group VII of the Periodic Table.

They show a trend in reactivity.

Which reaction does **not** take place when a halogen reacts with an aqueous halide ion?

- A** bromine + potassium chloride → chlorine + potassium bromide
B bromine + potassium iodide → iodine + potassium bromide
C chlorine + potassium bromide → bromine + potassium chloride
D chlorine + potassium iodide → iodine + potassium chloride

15 Which statement describes and explains a property of metals?

- A Metals are good electrical conductors as they contain a sea of mobile electrons.
- B Metals are good electrical conductors as they contain a sea of mobile ions.
- C Metals are malleable because metallic bonds are strong.
- D Metals are malleable because metallic bonds are weak.

16 Which of the statements about water are correct?

- 1 Water is used as a solvent.
- 2 Water is used to prevent iron from rusting.
- 3 Water is a compound that contains two parts of oxygen to one part of hydrogen.

- A 1 only B 2 only C 1 and 3 D 2 and 3

17 Nitrogen oxides are produced in a car engine.

Which type of reaction catalytically removes nitrogen oxides from the exhaust fumes?

- A combustion
- B oxidation
- C reduction
- D thermal decomposition

18 What is **not** a characteristic of a homologous series?

- A consecutive members differ by a CH_2 group
- B the same boiling point
- C the same functional group
- D the same general formula

19 One member of the alkane homologous series is butane which is used as a fuel.

What are the products of combustion when butane is burned in excess air?

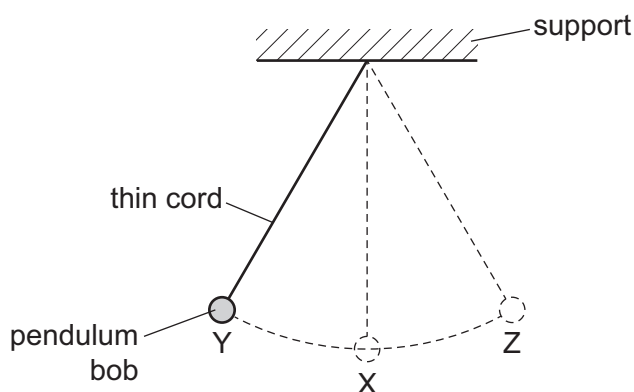
- A carbon and water
- B carbon dioxide and hydrogen
- C carbon dioxide and water
- D carbon monoxide and water

20 Alkenes are identified by reacting them with bromine.

Which type of reaction is this?

- A addition
- B combustion
- C neutralisation
- D polymerisation

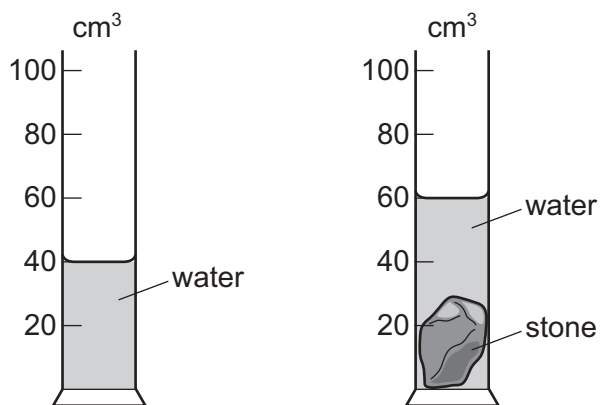
21 A student determines the period of the pendulum shown in the diagram.



Which method gives the most accurate value for the period?

- A Measure the time for ten swings from Y to Z and back to Y, and divide the time by ten.
- B Measure the time taken to swing from Y to X and multiply the time by four.
- C Measure the time taken to swing from Y to Z and multiply the time by two.
- D Measure the time taken to swing from Y to Z and back to Y.

22 A stone of mass 120 g is lowered slowly into a measuring cylinder containing water. The diagrams show the measuring cylinder before and after the stone is lowered into it.

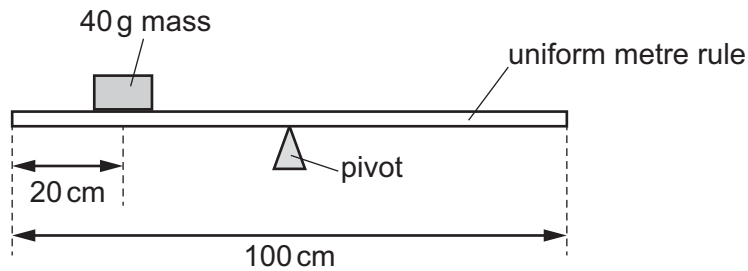


What is the density of the stone?

- A 1.2 g/cm^3
- B 2.0 g/cm^3
- C 3.0 g/cm^3
- D 6.0 g/cm^3

23 A pivot is placed under the centre of a uniform metre rule.

A 40 g mass is placed at the 20 cm mark.



A 50 g mass is placed on the rule to balance it.

Where is the 50 g mass placed?

- A at the 16 cm mark
- B at the 24 cm mark
- C at the 66 cm mark
- D at the 74 cm mark

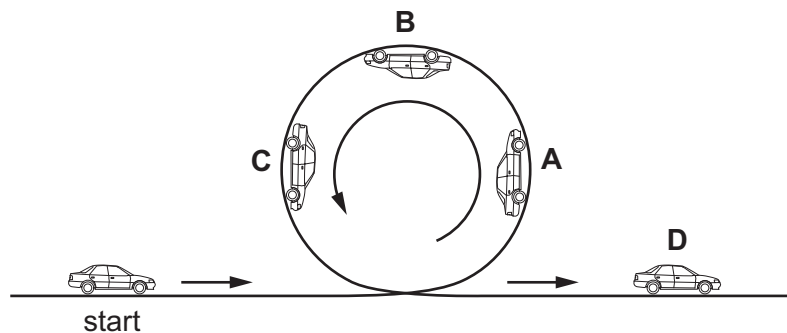
24 A resultant force of 4.0 N acts on an object of mass 2.0 kg. The force does 32 J of work.

What distance does the object move?

- A 8.0 m
- B 16 m
- C 128 m
- D 256 m

25 A toy car without a motor is pushed, then follows the looped track shown.

At which labelled point on the track is the kinetic energy (energy of motion) of the car decreasing and the potential energy (energy of position) increasing?

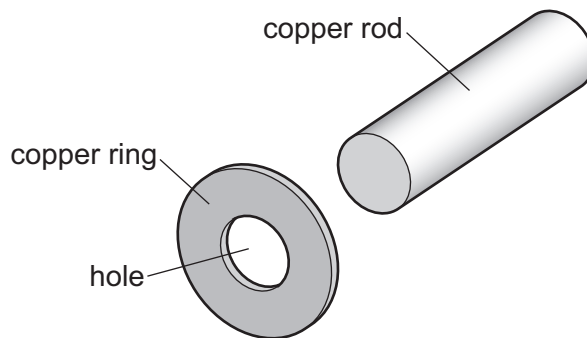


- 26 Two liquid-in-glass thermometers P and Q are both designed to measure temperatures between 0 °C and 100 °C. The lengths of their liquid columns at different temperatures are shown in the table.

temperature / °C	length of liquid column in P / cm	length of liquid column in Q / cm
0	4.0	2.0
50	16.5	9.5
100	29.0	17.0

Which statement about the thermometers is correct?

- A P has a larger range than Q.
 - B P is more sensitive than Q.
 - C Q has a larger range than P.
 - D Q is more sensitive than P.
- 27 The diagram shows a copper ring and a copper rod.



The diameter of the copper rod is too big to fit the rod into the hole in the ring.

What enables the rod to fit into the hole?

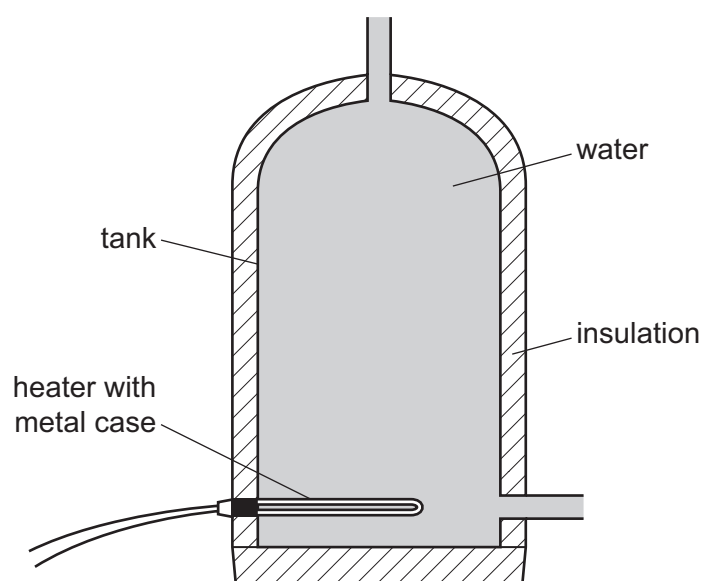
- A cooling the ring and heating the rod
- B cooling the rod and heating the ring
- C heating the rod and keeping the ring at room temperature
- D heating the rod and the ring to the same high temperature

- 28 Which row states the temperatures at which evaporation occurs and at which boiling of water occurs?

	evaporation	boiling
A	at 100 °C only	at 100 °C only
B	at 100 °C only	between 0 °C to 100 °C
C	between 0 °C to 100 °C	at 100 °C only
D	between 0 °C to 100 °C	between 0 °C to 100 °C

- 29 The diagram shows an insulated tank of water fitted with an electric heater that has a metal case.

The water is cold. The heater is not switched on.

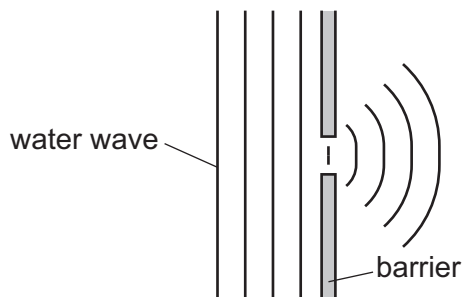


The heater is now switched on.

What are the main methods of transfer of thermal energy through the metal case of the heater, and throughout the water in the tank?

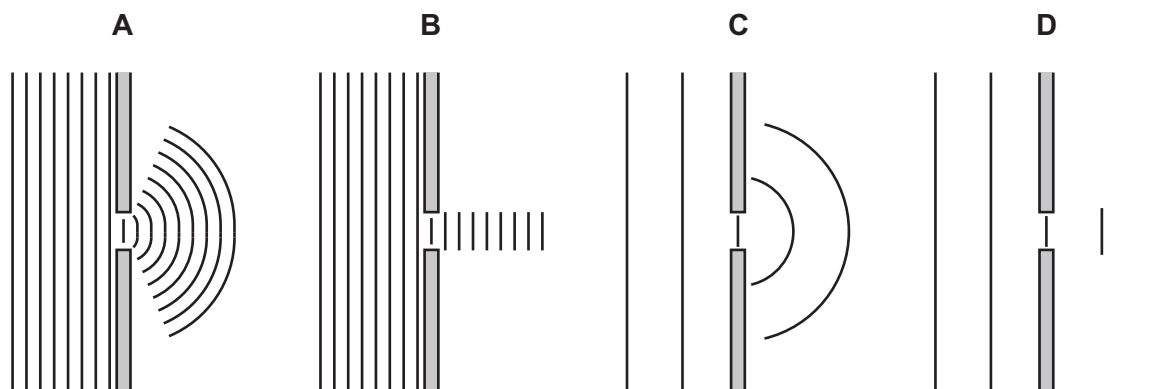
	through the metal case of the heater	throughout the water in the tank
A	conduction	conduction
B	conduction	convection
C	convection	conduction
D	convection	convection

30 The diagram shows a water wave being diffracted.



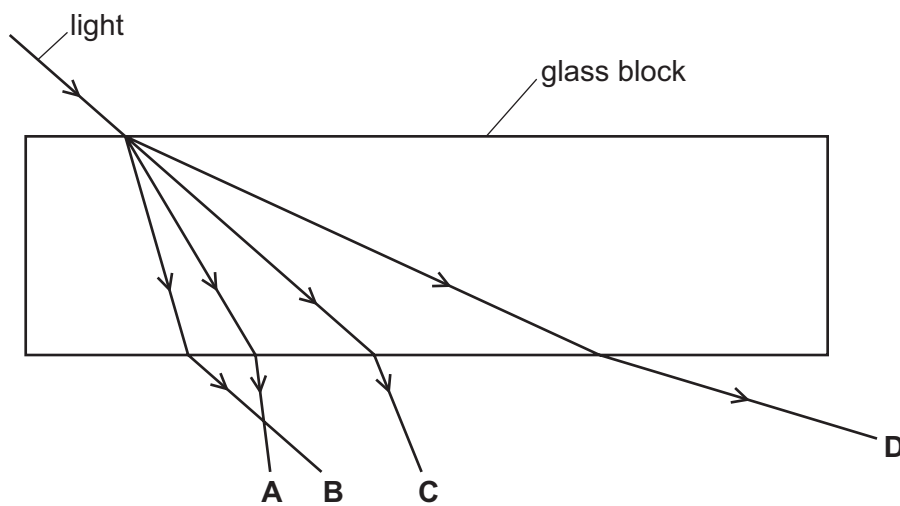
Which diagram shows water waves of half the frequency being diffracted?

(All five diagrams are drawn to the same scale.)



31 The diagram shows light incident on a glass block.

Which labelled arrow shows the path of the light after it has passed through the block?



32 Light from the Sun takes 8.3 minutes to reach the Earth.

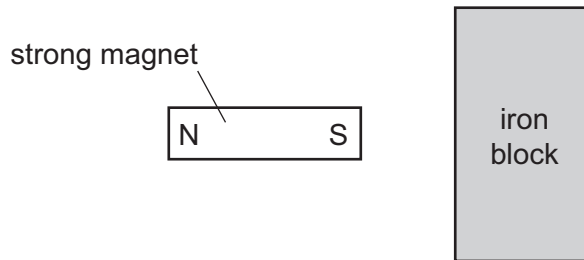
How far apart are the Sun and the Earth?

- A $6.0 \times 10^5 \text{ m}$
- B $3.6 \times 10^7 \text{ m}$
- C $2.5 \times 10^9 \text{ m}$
- D $1.5 \times 10^{11} \text{ m}$

33 What is the approximate range of frequencies of sound that can be heard by the human ear?

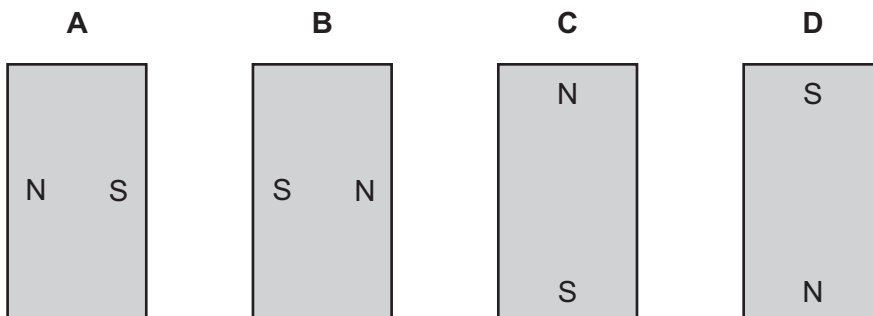
- A 2 Hz to 2000 Hz
- B 2 kHz to 2000 kHz
- C 20 Hz to 20 000 Hz
- D 20 kHz to 20 000 kHz

34 A strong permanent magnet is placed close to an iron block, as shown in the diagram.

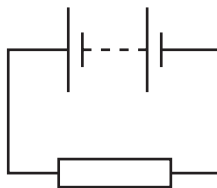


Magnetic poles are induced in the iron block.

What is the arrangement of the induced poles?



35 The diagram shows a resistor connected to a battery.



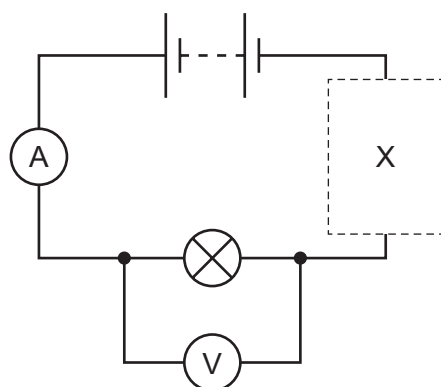
The current in the circuit is 2.0 A.

In 20 s, a total of 120 J of energy is transferred from the battery.

What is the electromotive force (e.m.f.) of the battery?

- A 1.5V
- B 3.0V
- C 6.0V
- D 12V

- 36 The diagram shows a circuit that can be used to investigate how the current in a lamp varies with the potential difference across it.



The current in the lamp needs to be varied.

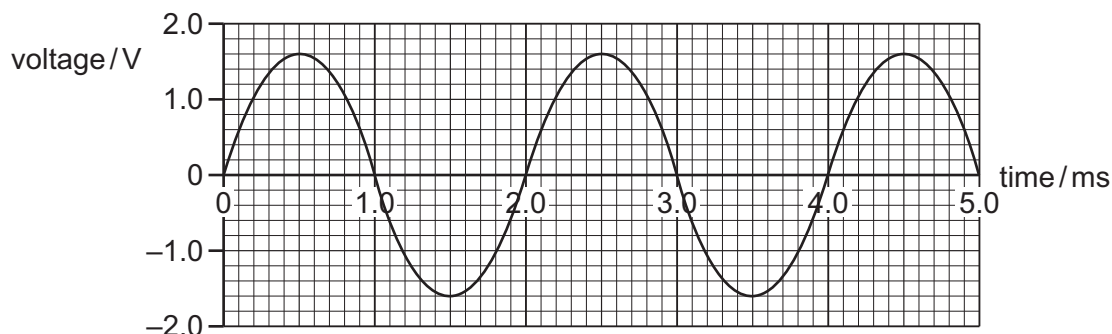
Which component is connected in the circuit at position X?



- 37 Overheating of a cable in an electric circuit is a safety hazard.

How can overheating of the cable be prevented?

- A** Do not switch off the circuit with damp hands.
B Make sure that the current does not become too large.
C Use thicker insulation on the cable.
D Use a thinner cable.
- 38 The graph shows the variation with time of the voltage output of an a.c. generator.



What is the frequency of the a.c. voltage?

- A** 0.50 Hz **B** 1.0 Hz **C** 500 Hz **D** 1000 Hz

39 The emissions from a radioactive source pass through a sheet of lead that is 10 mm thick.

Which type of radiation is emitted and how is it affected by an electric field?

	type of emission	effect of electric field
A	α	deflected from positive to negative
B	α	no deflection
C	γ	deflected from positive to negative
D	γ	no deflection

40 A radioactive nucleus emits a β -particle.

What happens to the nucleus?

- A** Its nucleon number decreases.
- B** Its nucleon number stays the same.
- C** Its proton number decreases.
- D** Its proton number stays the same.

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The Periodic Table of Elements

		Group																																		
I	II	III	IV	V	VI	VII	VIII																													
3 Li lithium 7	4 Be beryllium 9	11 Na sodium 23	12 Mg magnesium 24	19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84															
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	57-71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium —	85 At astatine —	86 Rn radon —	87 Fr francium —	88 Ba barium 137	89-103 actinoids	104 Rf rutherfordium —	105 Db dubnium —	106 Sg seaborgium —	107 Bh bohrium —	108 Hs hassium —	109 Mt meitnerium —	110 Ds darmstadtium —	111 Rg roentgenium —	112 Cn copernicium —	113 Nh nihonium —	114 Fl flerovium —	115 Mc moscovium —	116 Lv livermorium —	117 Ts tennessine —	118 Og oganeson —
57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium —	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175	89 Ac actinium —	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium —	94 Pu plutonium —	95 Am americium —	96 Cm curium —	97 Bk berkelium —	98 Cf californium —	99 Es einsteinium —	100 Fm fermium —	101 Md mendelevium —	102 No nobelium —	103 Lr lawrencium —							

Key
atomic number
atomic symbol
name
relative atomic mass

1
H
hydrogen
1

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium —	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium —	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium —	94 Pu plutonium —	95 Am americium —	96 Cm curium —	97 Bk berkelium —	98 Cf californium —	99 Es einsteinium —	100 Fm fermium —	101 Md mendelevium —	102 No nobelium —	103 Lr lawrencium —

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