Cambridge Assessment International Education

# Cambridge IGCSE™

**CHEMISTRY** **0620/22**

Paper 2 Multiple Choice (Extended) **May/June 2022**

**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.
- Any rough working should be done on this question paper.
- The Periodic Table is printed in the question paper.



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**[Turn over**

**1** Which two gases will diffuse at the same rate, at the same temperature?

**A** carbon monoxide and carbon dioxide

**B** carbon monoxide and nitrogen

**C** chlorine and fluorine

**D** nitrogen and oxygen

**2** A student measures the time taken for 2.0 g of magnesium to dissolve in 50 $cm^3$ of dilute sulfuric acid.

Which apparatus is essential to complete the experiment?

1 stop-clock

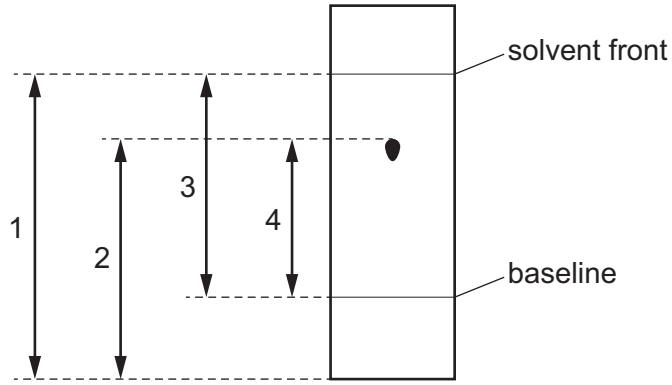
2 measuring cylinder

3 thermometer

4 balance

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

**3** A chromatogram of a single substance T is shown.




Which measurements are used to find the $R_f$ value of T?

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

**4** X and Y are two different elements.

X and Y have the same number of nucleons.

Which statement about X and Y is correct?

**A** They have the same physical properties.

**B** Their atoms have the same number of electrons.

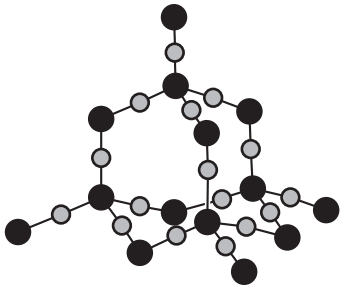
**C** They are in different groups of the Periodic Table.

**D** They have different relative masses.

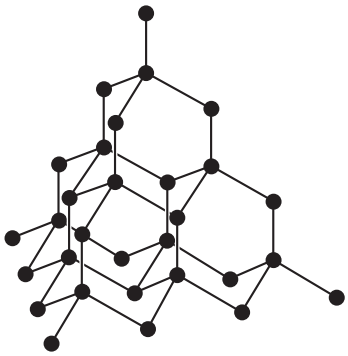
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**5** The diagrams show the structures of three macromolecules P, Q and R.

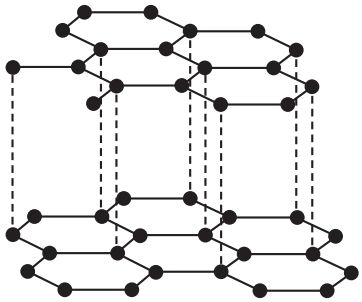
P



Q



R

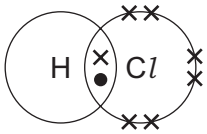


What are P, Q and R?

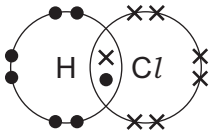
| | P | Q | R |
|---|---|---|---|
| **A** | diamond | silicon(IV) oxide | graphite |
| **B** | graphite | diamond | silicon(IV) oxide |
| **C** | silicon(IV) oxide | diamond | graphite |
| **D** | silicon(IV) oxide | graphite | diamond |

**6** Which dot-and-cross diagram shows the arrangement of outer shell electrons in a molecule of hydrogen chloride?

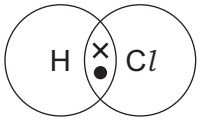
**A**



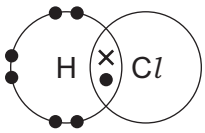

**B**




**C**




**D**




**7** The equation for the reaction between barium chloride and dilute sulfuric acid is shown.

$$BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + 2HCl$$

Which row shows the state symbols for this equation?

| | $BaCl_2$ | $H_2SO_4$ | $BaSO_4$ | $2HCl$ |
|---|---|---|---|---|
| **A** | (aq) | (aq) | (s) | (aq) |
| **B** | (aq) | (l) | (s) | (aq) |
| **C** | (l) | (aq) | (s) | (l) |
| **D** | (aq) | (l) | (aq) | (l) |

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**[Turn over**

**8** Methane and steam react in the presence of a catalyst.

$$CH_4(g) + H_2O(g) \rightarrow CO(g) + 3H_2(g)$$

0.5 mol of methane reacts completely with 0.5 mol of steam.

What is the volume of carbon monoxide and hydrogen produced, measured at room temperature and pressure?

| | volume of CO / $dm^3$ | volume of $H_2$ / $dm^3$ |
|---|---|---|
| **A** | 0.5 | 1.5 |
| **B** | 1.0 | 3.0 |
| **C** | 12.0 | 12.0 |
| **D** | 12.0 | 36.0 |

**9** A compound of element X has the formula $X_2O$ and a relative formula mass of 144.

What is element X?

**A** copper, Cu

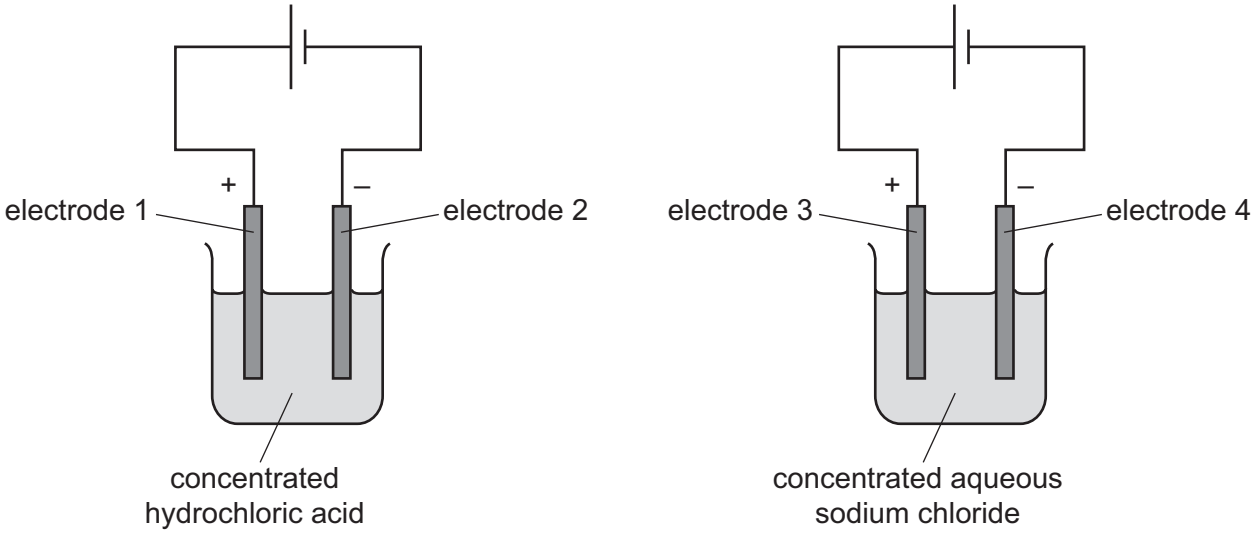
**B** gadolinium, Gd

**C** sulfur, S

**D** tellurium, Te

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**10** The diagram shows the electrolysis of concentrated hydrochloric acid and concentrated aqueous sodium chloride using carbon electrodes.




At which electrodes is hydrogen produced?

**A** electrode 1 only

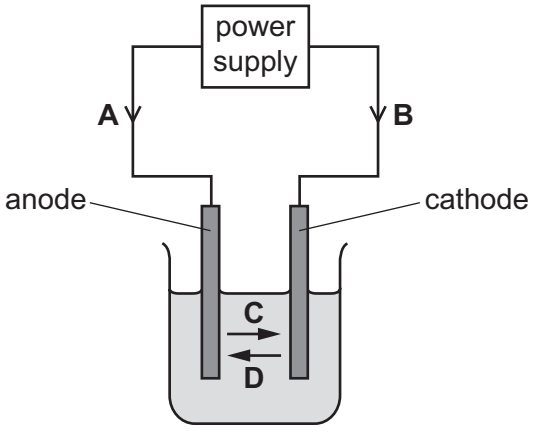
**B** electrodes 1 and 3

**C** electrode 2 only

**D** electrodes 2 and 4

**11** The diagram shows the electrolysis of aqueous copper(II) sulfate using inert electrodes.

Which arrow shows the movement of electrons in the circuit?



**12** Which row identifies a chemical change and a physical change?

| | chemical change | physical change |
|---|---|---|
| **A** | boiling ethanol | burning ethanol |
| **B** | burning ethanol | evaporating ethanol |
| **C** | dissolving ethanol in water | burning ethanol |
| **D** | evaporating ethanol | dissolving ethanol in water |

**13** Which statements explain why increasing the concentration of a reactant increases the rate of reaction?

1 It increases the collision rate of particles.

2 It lowers the activation energy.

3 A greater proportion of the colliding molecules have the required activation energy.

4 There are more particles per unit volume.

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

**14** When the colourless gas $N_2O_4$ is heated, it forms the brown gas $NO_2$.

When the reaction mixture is cooled, the brown colour fades and turns back to colourless.

Which type of reaction is described by these observations?

**A** decomposition

**B** displacement

**C** reduction

**D** reversible

**15** Water is added to anhydrous copper(II) sulfate.

What happens during the reaction?

**A** The copper(II) sulfate turns blue and the solution formed gets colder.

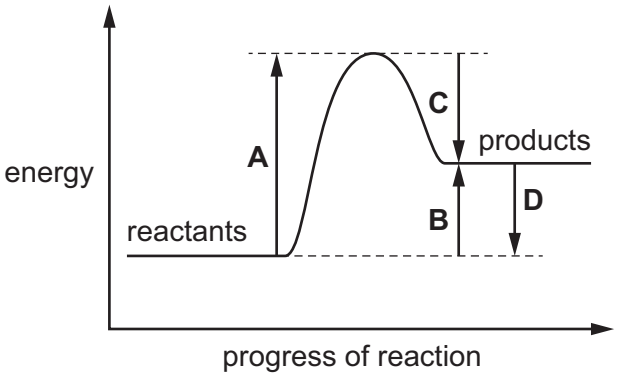
**B** The copper(II) sulfate turns blue and the solution formed gets hotter.

**C** The copper(II) sulfate turns white and the solution formed gets colder.

**D** The copper(II) sulfate turns white and the solution formed gets hotter.

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**16** Which arrow on the energy level diagram shows the overall energy change for an endothermic reaction?




**17** When a hydrogen–oxygen fuel cell is in operation, a different reaction happens at each electrode.

at the hydrogen electrode $H_2 \rightarrow 2H^+ + 2e^-$

at the oxygen electrode $O_2 + 2H_2O + 4e^- \rightarrow 4OH^-$

The electrons that are lost at the hydrogen electrode travel through the external circuit to the oxygen electrode, where they are gained by the oxygen and water.

A hydrogen–oxygen fuel cell is operated for a period of time and four moles of oxygen molecules are consumed.

Which mass of hydrogen is consumed?

**A** 2.0 g **B** 4.0 g **C** 8.0 g **D** 16.0 g

**18** The oxides of two elements, X and Y, are separately dissolved in water and the pH of each solution tested.

| oxide tested | pH of solution |
|---|---|
| X | 1 |
| Y | 13 |

Which information about X and Y is correct?

| | oxide is acidic | oxide is basic | metal | non-metal |
|---|---|---|---|---|
| **A** | X | Y | X | Y |
| **B** | X | Y | Y | X |
| **C** | Y | X | X | Y |
| **D** | Y | X | Y | X |

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**19** An acid is neutralised by adding an excess of an insoluble solid base.

A soluble salt is formed.

How is the pure salt obtained from the reaction mixture?

**A** crystallisation → evaporation → filtration

**B** evaporation → crystallisation → filtration

**C** filtration → crystallisation → evaporation

**D** filtration → evaporation → crystallisation

**20** Substance J takes part in a redox reaction.

In the reaction, J gains electrons.

Which statement is correct?

**A** J is the oxidising agent and it is oxidised in the reaction.

**B** J is the oxidising agent and it is reduced in the reaction.

**C** J is the reducing agent and it is oxidised in the reaction.

**D** J is the reducing agent and it is reduced in the reaction.

**21** Elements in Group IV of the Periodic Table are shown.

carbon

silicon

germanium

tin

lead

What does **not** occur in Group IV as it is descended?

**A** The proton number of the elements increases.

**B** The elements become more metallic.

**C** The elements have more electrons in their outer shell.

**D** The elements have more electron shells.

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**22** Which statement about acids is correct?

**A** Acids are proton acceptors.

**B** Acids transfer electrons to bases in aqueous solution.

**C** Hydrochloric acid reacts with ammonium hydroxide to produce ammonia.

**D** Ethanoic acid partially ionises in aqueous solution.

**23** Which elements have both a high melting point and variable oxidation states?

**A** alkali metals

**B** transition elements

**C** halogens

**D** noble gases

**24** Lithium, sodium and potassium are elements in Group I of the Periodic Table.

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

Which row identifies the **least** dense of these elements in each group?

| | Group I | Group VII |
|---|---|---|
| **A** | lithium | chlorine |
| **B** | lithium | iodine |
| **C** | potassium | chlorine |
| **D** | potassium | iodine |

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**[Turn over**

**25** The reactions of metals P, Q, R and S are shown.

| metal | reaction with water | reaction with hydrochloric acid | reduction of the metal oxide with carbon |
|---|---|---|---|
| P | no reaction | no reaction | reduced |
| Q | slow | vigorous | no reaction |
| R | vigorous | vigorous | no reaction |
| S | very slow | vigorous | reduced |

What is the order of reactivity of the metals?

| | least reactive → | | | most reactive |
|---|---|---|---|---|
| **A** | P | S | Q | R |
| **B** | P | Q | S | R |
| **C** | R | S | Q | P |
| **D** | R | Q | S | P |

**26** The number of protons and the number of neutrons in the atoms of elements X, Y and Z are shown.

| | number of protons | number of neutrons |
|---|---|---|
| X | 6 | 6 |
| Y | 7 | 6 |
| Z | 8 | 10 |

Which statement about the elements is correct?

**A** X and Y are isotopes of the same element.

**B** Z forms an ion with a +2 charge.

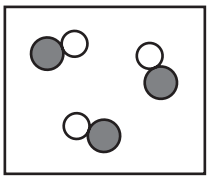
**C** X and Z react together to form an ionic compound.

**D** X, Y and Z are non-metals.

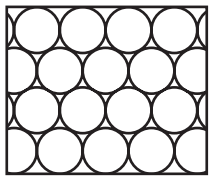
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**27** Which diagram represents the arrangement of atoms in an alloy?

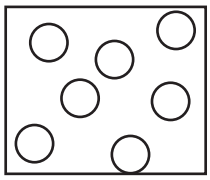
**A**



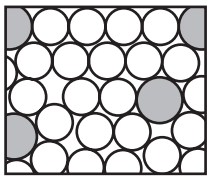
**B**



**C**



**D**



**28** Three metal compounds, J, K and L, are heated using a Bunsen burner.

The results are shown.

J colourless gas produced, which relights a glowing splint

K colourless gas produced, which turns limewater milky

L no reaction

Which row identifies J, K and L?

| | J | K | L |
|---|---|---|---|
| **A** | magnesium carbonate | potassium carbonate | potassium nitrate |
| **B** | magnesium carbonate | potassium nitrate | potassium carbonate |
| **C** | potassium nitrate | magnesium carbonate | potassium carbonate |
| **D** | potassium nitrate | potassium carbonate | magnesium carbonate |

**29** Processes involved in the extraction of zinc are listed.

1 Heat zinc oxide with carbon.

2 Condense zinc vapour.

3 Vaporise the zinc.

4 Roast zinc ore in air.

In which order are the processes carried out?

**A** $1 \rightarrow 2 \rightarrow 3 \rightarrow 4$

**B** $4 \rightarrow 3 \rightarrow 1 \rightarrow 2$

**C** $4 \rightarrow 1 \rightarrow 3 \rightarrow 2$

**D** $1 \rightarrow 4 \rightarrow 3 \rightarrow 2$

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**[Turn over**

**30** Which process uses sacrificial protection to prevent steel from rusting?

**A** galvanising

**B** oiling

**C** copper plating

**D** painting

**31** Fertilisers are used to provide three of the elements needed for plant growth.

Which two compounds would give a fertiliser containing all three of these elements?

**A** $Ca(NO_3)_2$ and $(NH_4)_2SO_4$

**B** $Ca(NO_3)_2$ and $(NH_4)_3PO_4$

**C** $KNO_3$ and $(NH_4)_2SO_4$

**D** $KNO_3$ and $(NH_4)_3PO_4$

**32** Which processes produce carbon dioxide?

1 respiration

2 photosynthesis

3 fermentation

4 combustion of hydrogen

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

**33** Which reaction in the Contact process requires the use of a catalyst?

**A** $S + O_2 \rightarrow SO_2$

**B** $2SO_2 + O_2 \rightarrow 2SO_3$

**C** $SO_3 + H_2SO_4 \rightarrow H_2S_2O_7$

**D** $H_2S_2O_7 + H_2O \rightarrow 2H_2SO_4$

**34** What are the products when limestone (calcium carbonate) is heated strongly?

**A** calcium hydroxide and carbon dioxide

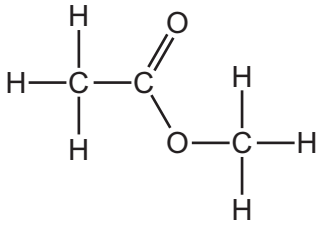
**B** calcium hydroxide and carbon monoxide

**C** calcium oxide and carbon dioxide

**D** calcium oxide and carbon monoxide

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**35** The structure of ester W is shown.



Which row gives the names of ester W and the carboxylic acid and alcohol from which it is made?

| | name of ester W | carboxylic acid | alcohol |
|---|---|---|---|
| **A** | ethyl methanoate | ethanoic acid | methanol |
| **B** | ethyl methanoate | methanoic acid | ethanol |
| **C** | methyl ethanoate | ethanoic acid | methanol |
| **D** | methyl ethanoate | methanoic acid | ethanol |

**36** Ethene reacts with substance X to form ethanol.

What is X?

**A** ethanoic acid

**B** glucose

**C** hydrogen

**D** steam

**37** Alkenes can be produced by cracking large hydrocarbon molecules to form smaller hydrocarbon molecules.

Which equations represent possible reactions when tetradecane, $C_{14}H_{30}$, is cracked?

1 $C_{14}H_{30} \rightarrow C_2H_6 + C_3H_6 + C_4H_8 + C_5H_{10}$

2 $C_{14}H_{30} \rightarrow H_2 + C_2H_4 + C_3H_6 + C_4H_8 + C_5H_{10}$

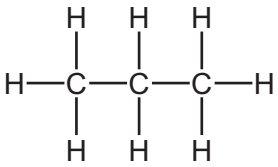
3 $C_{14}H_{30} \rightarrow C_2H_6 + 4C_3H_6$

4 $C_{14}H_{30} \rightarrow C_2H_6 + C_3H_8 + C_9H_{18}$

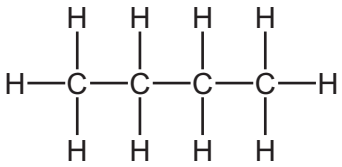
**A** 1 only **B** 1 and 4 **C** 1, 2 and 3 **D** 3 and 4

**38** The structures of some hydrocarbons are shown.

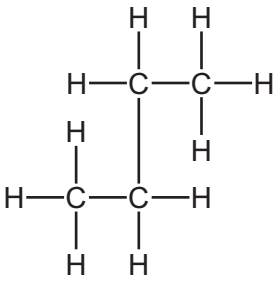
1



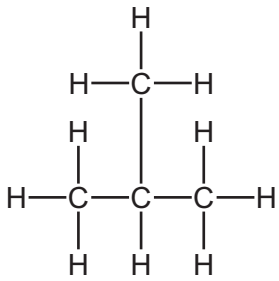
2



3



4



Which statement about the hydrocarbons is correct?

**A** 1 and 2 have a different general formula.

**B** 1 and 4 are in different homologous series.

**C** 2 and 3 are structural isomers.

**D** 3 and 4 have the same empirical formula.

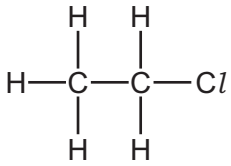
**39** Ethane reacts with chlorine in the presence of ultraviolet light.

Which substances are produced in the reaction?

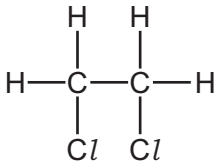
1



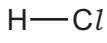
2



3



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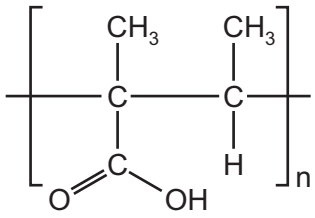


**A** 1, 2 and 3 **B** 1 and 3 only **C** 2, 3 and 4 **D** 2 and 4 only

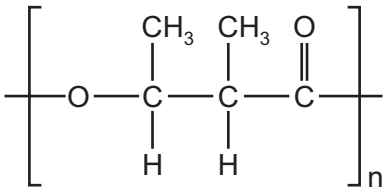
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**40** Which polymer structure has the same linkages as *Terylene*?

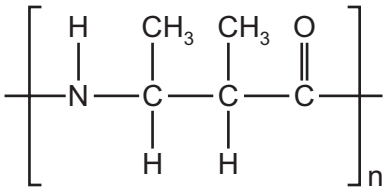
**A**



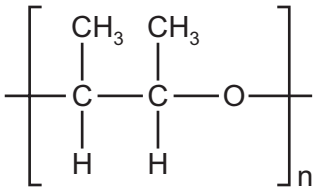
**B**



**C**



**D**



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## The Periodic Table of Elements

| Group | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| I | II | | | | | | | | | | | III | IV | V | VI | VII | VIII |
| | | | | | | | 1 H hydrogen 1 | | | | | | | | | | 2 He helium 4 |
| 3 Li lithium 7 | 4 Be beryllium 9 | | | | | | | | | | | 5 B boron 11 | 6 C carbon 12 | 7 N nitrogen 14 | 8 O oxygen 16 | 9 F fluorine 19 | 10 Ne neon 20 |
| 11 Na sodium 23 | 12 Mg magnesium 24 | | | | | | | | | | | 13 Al aluminium 27 | 14 Si silicon 28 | 15 P phosphorus 31 | 16 S sulfur 32 | 17 Cl chlorine 35.5 | 18 Ar argon 40 |
| 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 | 40 Zr zirconium 91 | 41 Nb niobium 93 | 42 Mo molybdenum 96 | 43 Tc technetium – | 44 Ru ruthenium 101 | 45 Rh rhodium 103 | 46 Pd palladium 106 | 47 Ag silver 108 | 48 Cd cadmium 112 | 49 In indium 115 | 50 Sn tin 119 | 51 Sb antimony 122 | 52 Te tellurium 128 | 53 I iodine 127 | 54 Xe xenon 131 |
| 55 Cs caesium 133 | 56 Ba barium 137 | 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 Ra radium – | 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 – | | 114 Fl flerovium – | | 116 Lv livermorium – | | |

**Key**

atomic number
atomic symbol
name
relative atomic mass

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 $dm^3$ at room temperature and pressure (r.t.p.).