



# Cambridge IGCSE™

**CHEMISTRY**

**0620/22**

Paper 2 Multiple Choice (Extended)

**October/November 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.

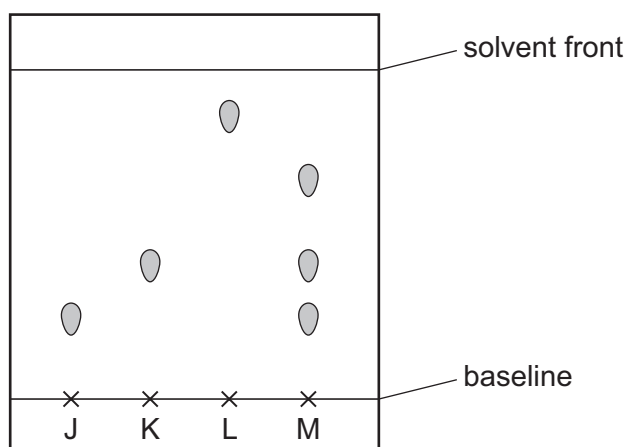
This document has **16** pages.



- 1 The rate of diffusion of three gases, ammonia, carbon dioxide and methane, is measured.

What is the order of the rate of diffusion of the gases from slowest to fastest?

- A**  $\text{CO}_2 \rightarrow \text{NH}_3 \rightarrow \text{CH}_4$
- B**  $\text{CO}_2 \rightarrow \text{CH}_4 \rightarrow \text{NH}_3$
- C**  $\text{CH}_4 \rightarrow \text{NH}_3 \rightarrow \text{CO}_2$
- D**  $\text{NH}_3 \rightarrow \text{CH}_4 \rightarrow \text{CO}_2$
- 2 Which description of Brownian motion is correct?
- A** random movement of particles due to bombardment by larger particles
- B** random movement of particles due to bombardment by smaller particles
- C** random movement of particles from a high concentration to a low concentration
- D** random movement of particles from a low concentration to a high concentration
- 3 The chromatogram obtained using four substances, J, K, L and M, is shown.



Which statement about M is correct?

- A** It is a mixture of J and K only.
- B** It is a pure substance.
- C** It is a mixture of J, K and L.
- D** It is a mixture of J, K and an unknown substance.

4 Which statements about isotopes of the same element are correct?

- 1 They are atoms which have the same chemical properties because they have the same number of electrons in their outer shell.
- 2 They are atoms which have the same number of electrons and neutrons but different numbers of protons.
- 3 They are atoms which have the same number of electrons and protons but different numbers of neutrons.

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

5 Which statement about solid magnesium oxide is correct?

- A** It is a giant structure made up of magnesium and oxygen atoms bonded covalently.
- B** It is an electrical conductor with mobile magnesium ions and oxygen ions.
- C** Magnesium loses electrons and these electrons move freely through a lattice.
- D** Oxygen ions and magnesium ions are attracted to each other in a giant lattice.

6 Which molecule contains only three shared pairs of electrons?

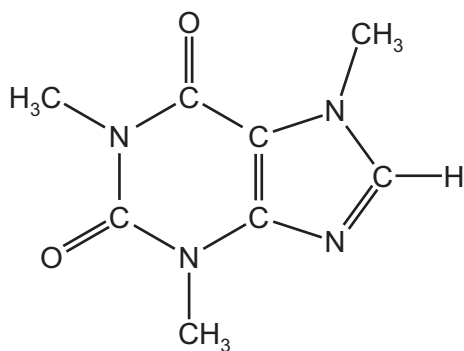
**A** CH<sub>3</sub>OH      **B** Cl<sub>2</sub>      **C** H<sub>2</sub>O      **D** N<sub>2</sub>

7 Which particles are present in the structure of metals?

- 1 positive ions
- 2 negative ions
- 3 shared pairs of electrons
- 4 mobile electrons

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

- 8 Caffeine is a stimulant found in coffee.

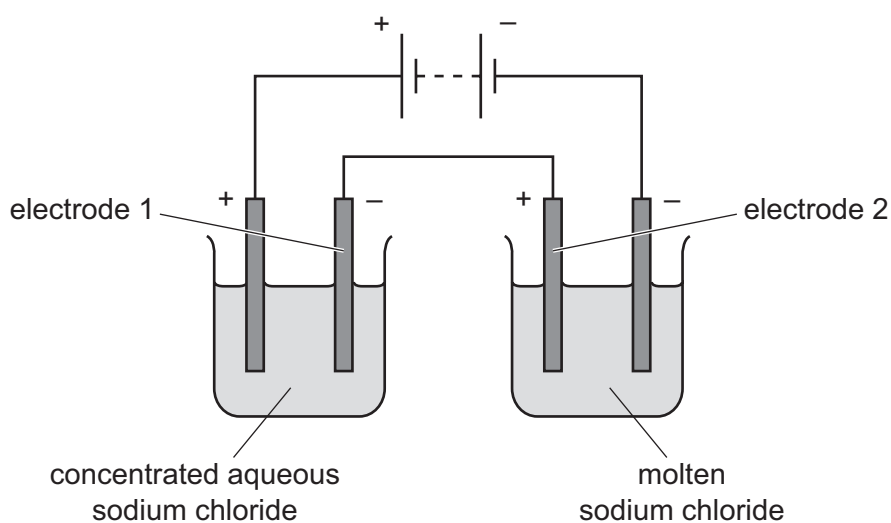


caffeine

Which formula represents caffeine?

- A**  $C_7H_{10}N_4O_2$     **B**  $C_8H_{10}N_3O_2$     **C**  $C_8H_{10}N_4O_2$     **D**  $C_8H_{11}N_4O_2$
- 9 Which sample does **not** contain a number of atoms equal to the Avogadro constant?
- A** 14 g of nitrogen,  $N_2$   
**B** 6 g of water,  $H_2O$   
**C** 4 g of helium, He  
**D** 28 g of carbon monoxide, CO

10 The electrolysis of concentrated aqueous sodium chloride and molten sodium chloride is shown.



What are the products at electrodes 1 and 2?

|          | electrode 1 | electrode 2 |
|----------|-------------|-------------|
| <b>A</b> | chlorine    | chlorine    |
| <b>B</b> | hydrogen    | chlorine    |
| <b>C</b> | hydrogen    | sodium      |
| <b>D</b> | sodium      | sodium      |

11 When an acid is added to an alkali, the temperature of the reaction mixture rises.

Which words describe this reaction?

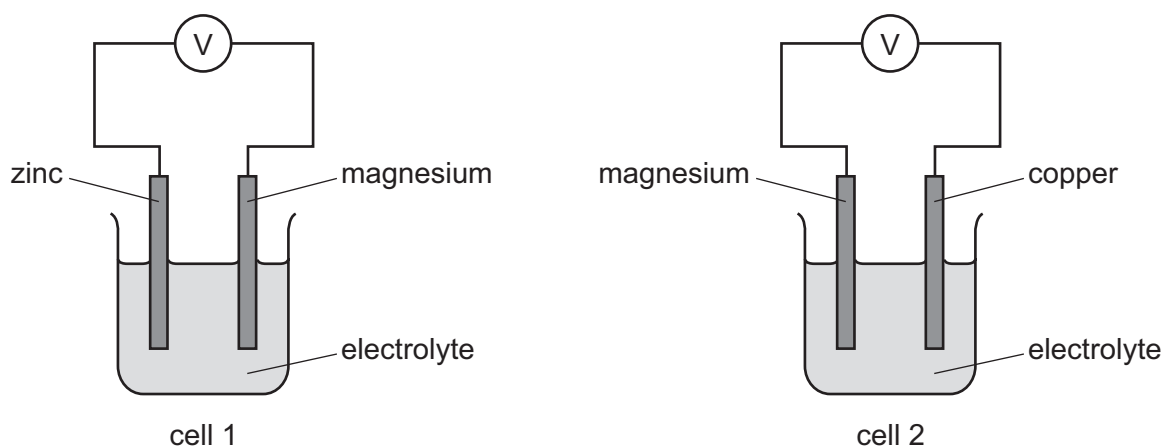
- A** decomposition and endothermic
- B** decomposition and exothermic
- C** neutralisation and endothermic
- D** neutralisation and exothermic

12 Some properties of four fuels are shown.

Which fuel is a gas at room temperature and makes two products when it burns in a plentiful supply of air?

|          | fuel     | formula                         | melting point /°C | boiling point /°C |
|----------|----------|---------------------------------|-------------------|-------------------|
| <b>A</b> | hydrogen | H <sub>2</sub>                  | -259              | -253              |
| <b>B</b> | methane  | CH <sub>4</sub>                 | -182              | -164              |
| <b>C</b> | octane   | C <sub>8</sub> H <sub>18</sub>  | -57               | 126               |
| <b>D</b> | wax      | C <sub>31</sub> H <sub>64</sub> | 60                | 400               |

13 The electrical energy, or voltage, of two simple cells is measured.



- statement 1 The voltage of cell 1 is greater than cell 2.  
 statement 2 Zinc is more reactive than copper.  
 statement 3 Magnesium is oxidised in both cells.  
 statement 4 Magnesium atoms lose electrons to form magnesium ions.

Which option is correct?

- A** All the statements are correct.  
**B** Only statements 1 and 3 are correct.  
**C** Statement 2 is correct and explains statement 1.  
**D** Statement 4 is correct and explains statement 3.

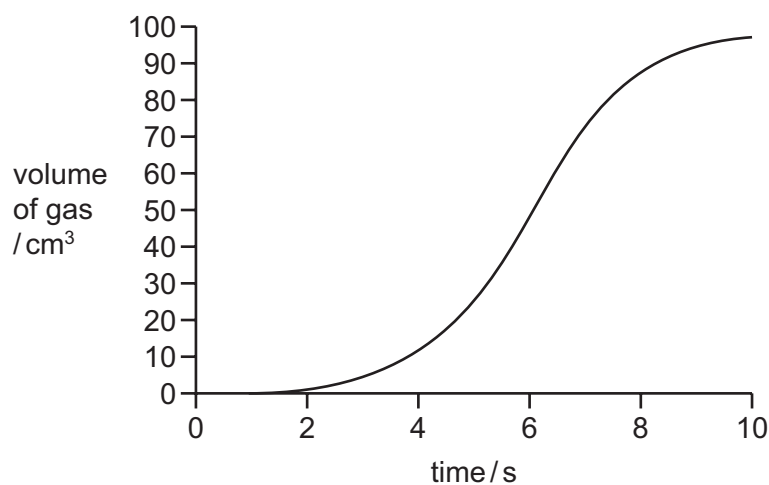
14 Dilute aqueous sodium chloride is electrolysed using carbon electrodes.

What is the product at the anode?

- A carbon dioxide
- B hydrogen
- C oxygen
- D sodium

15 The volume of gas given off in a chemical reaction is measured over time.

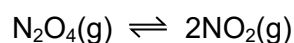
The results are shown.



At which time is the rate of reaction greatest?

- A 0 s
- B 4 s
- C 6 s
- D 10 s

16 Dinitrogen tetroxide,  $\text{N}_2\text{O}_4$ , is converted into nitrogen dioxide,  $\text{NO}_2$ , in a reversible reaction.



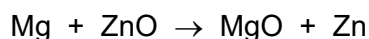
The forward reaction is endothermic.

Which conditions give the highest equilibrium yield of nitrogen dioxide?

|   | pressure / atmospheres | temperature |
|---|------------------------|-------------|
| A | 2                      | high        |
| B | 2                      | low         |
| C | 50                     | high        |
| D | 50                     | low         |

17 When magnesium is heated with zinc oxide a reaction occurs.

The equation is shown.



Which substance is oxidised?

- A magnesium
- B magnesium oxide
- C zinc
- D zinc oxide

18 X and Y are oxides of two different elements.

- X reacts with water to produce aqueous solution Z.
- Z turns universal indicator paper blue.
- An aqueous solution of Y reacts with sodium carbonate to produce carbon dioxide gas.

Which statement is correct?

- A X and Y are both the oxides of metals.
- B X and Y are both the oxides of non-metals.
- C X is the oxide of a metal and Y is the oxide of a non-metal.
- D X is the oxide of a non-metal and Y is the oxide of a metal.

19 Ethanoic acid reacts with water to produce an acidic solution.

Which row describes the roles of ethanoic acid and water in this reaction?

|          | ethanoic acid       | water               |
|----------|---------------------|---------------------|
| <b>A</b> | accepts a proton    | donates a proton    |
| <b>B</b> | accepts an electron | donates an electron |
| <b>C</b> | donates a proton    | accepts a proton    |
| <b>D</b> | donates an electron | accepts an electron |



20 Copper(II) sulfate is a soluble salt.

Calcium sulfate is an insoluble salt.

Which row shows suitable reactants for preparing a pure sample of the named salt?

|          | salt               | reactants  |
|----------|--------------------|--|
| <b>A</b> | calcium sulfate    | calcium carbonate + dilute sulfuric acid               |
| <b>B</b> | calcium sulfate    | aqueous calcium chloride and aqueous sodium sulfate    |
| <b>C</b> | copper(II) sulfate | copper + dilute sulfuric acid                          |
| <b>D</b> | copper(II) sulfate | aqueous copper(II) chloride and aqueous sodium sulfate |

21 Strontium displaces magnesium from molten magnesium chloride.

Bromine displaces iodine from aqueous potassium iodide.

Which row describes the change in reactivity down both Group II and Group VII of the Periodic Table?

|          | reactivity down the group |           |
|----------|---------------------------|-----------|
|          | Group II                  | Group VII |
| <b>A</b> | decreases                 | decreases |
| <b>B</b> | decreases                 | increases |
| <b>C</b> | increases                 | decreases |
| <b>D</b> | increases                 | increases |

22 Elements J and K are in the same period in the Periodic Table.

J reacts with acids to produce a salt and hydrogen.

K reacts with sodium to form an ionic compound.

Which statement about J and K is correct?

- A** An atom of J has more electrons than an atom of K.
- B** J and K are both metals.
- C** J and K are both non-metals.
- D** J is to the left of K in the Periodic Table.

23 Part of the Periodic Table is shown.

Which element has a high density, a high melting point and forms a brown oxide?

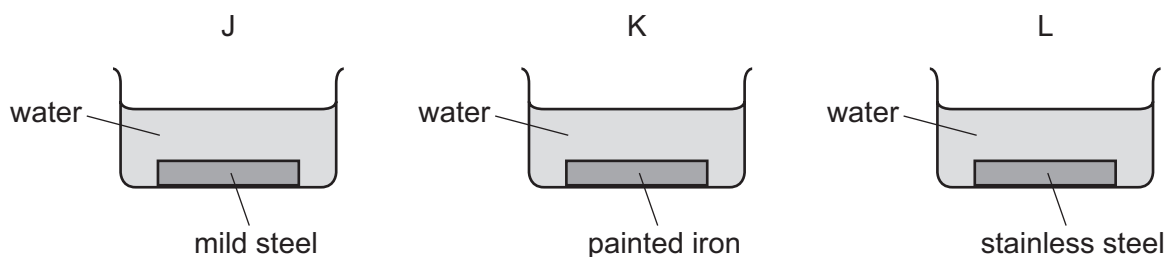
24 The reactions of four metals, W, X, Y and Z, are listed.

- Metal W displaces metal X from the oxide of metal X.
- Metal Y has a greater tendency to form positive ions than metal W.
- Aqueous ions of metal Z are reduced by metal X.

What is the order of reactivity of the metals?

|          | least reactive | → |   | most reactive |
|----------|----------------|---|---|---------------|
| <b>A</b> | Y              | W | X | Z             |
| <b>B</b> | Y              | X | W | Z             |
| <b>C</b> | Z              | W | X | Y             |
| <b>D</b> | Z              | X | W | Y             |

25 Three experiments, J, K and L, are set up to investigate rusting.



In which experiments does rusting occur?

|          | J | K | L |
|----------|---|---|---|
| <b>A</b> | x | ✓ | ✓ |
| <b>B</b> | x | ✓ | x |
| <b>C</b> | ✓ | x | x |
| <b>D</b> | ✓ | x | ✓ |

key  
 ✓ = yes  
 x = no

26 Silver is below copper in the reactivity series.

Which row describes the reactions of silver?

|          | reaction with steam            | reaction with dilute hydrochloric acid |
|----------|--------------------------------|--|
| <b>A</b> | no reaction                    | no reaction                            |
| <b>B</b> | no reaction                    | reacts to produce hydrogen gas         |
| <b>C</b> | reacts to produce hydrogen gas | no reaction                            |
| <b>D</b> | reacts to produce hydrogen gas | reacts to produce hydrogen gas         |

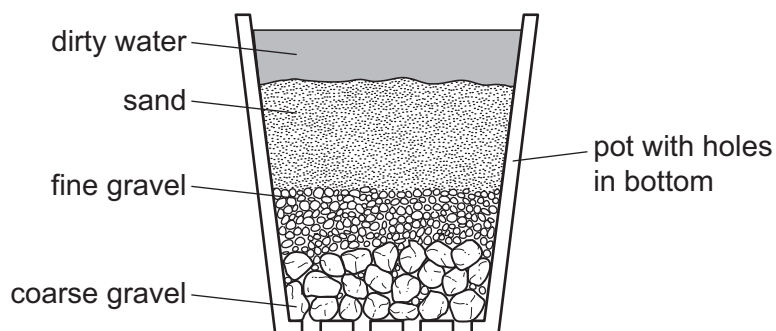
27 Iron is galvanised by coating it in zinc.

Brass is made by mixing copper with zinc.

Which row gives the reasons for each of these uses of zinc?

|          | reason for galvanising iron | reason for making brass |
|----------|-----------------------------|-------------------------|
| <b>A</b> | prevents corrosion          | produces a softer metal |
| <b>B</b> | prevents corrosion          | produces a harder metal |
| <b>C</b> | produces a harder metal     | produces a softer metal |
| <b>D</b> | produces a harder metal     | produces a harder metal |

28 The diagram shows a stage in the purification of dirty water.



Which process does this apparatus show?

- A** chlorination
- B** condensation
- C** distillation
- D** filtration

29 Which substance in polluted air damages stonework and kills trees?

- A carbon dioxide
- B carbon monoxide
- C lead compounds
- D sulfur dioxide

30 Ammonium nitrate,  $\text{NH}_4\text{NO}_3$ , is a fertiliser and is added to fields to help crops grow.

Slaked lime,  $\text{Ca}(\text{OH})_2$ , is an alkali and is added to fields to reduce the acidity of the soil.

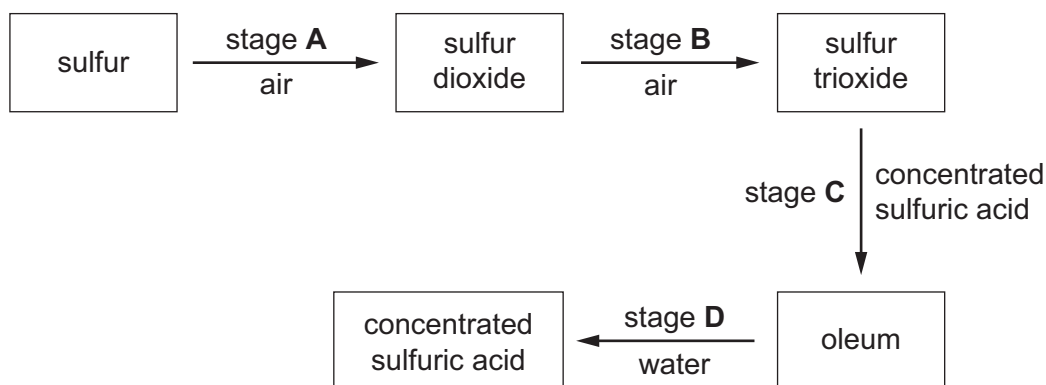
Ammonium nitrate and slaked lime should not be added to a field at the same time because they react with each other to form a gas, Z.

What is Z?

- A ammonia
- B hydrogen
- C nitrogen
- D oxygen

31 The scheme shows four stages in the conversion of sulfur to sulfuric acid.

In which stage is a catalyst used?



32 Which element has an oxide that is used as a food preservative?

- A helium
- B hydrogen
- C iron
- D sulfur

33 Which substance gives off carbon dioxide on heating?

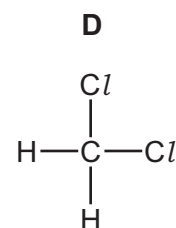
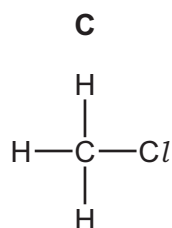
- A lime
- B limestone
- C limewater
- D slaked lime

34 Which compound has the most  $-\text{CH}_2-$  groups in one molecule?

- A butane
- B butanoic acid
- C butan-1-ol
- D but-1-ene

35 Methane reacts with chlorine in the presence of ultraviolet light.

Which substance is **not** produced in this reaction?



36 Ethene reacts with both hydrogen and steam.

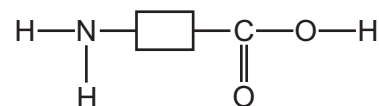
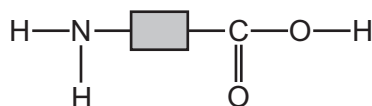
Which row about these reactions is correct?

|          | reactant with ethene | type of reaction | catalyst used   |
|----------|----------------------|------------------|-----------------|
| <b>A</b> | hydrogen             | substitution     | phosphoric acid |
| <b>B</b> | hydrogen             | addition         | nickel          |
| <b>C</b> | steam                | substitution     | phosphoric acid |
| <b>D</b> | steam                | addition         | nickel          |

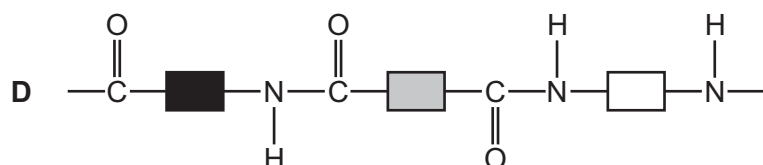
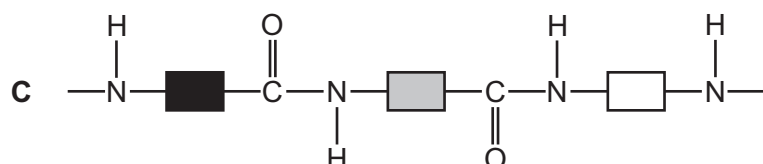
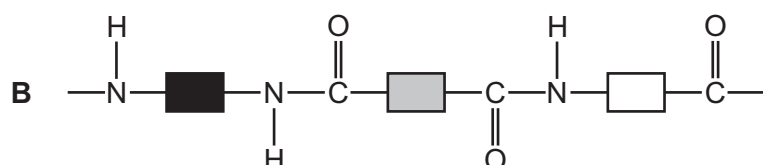
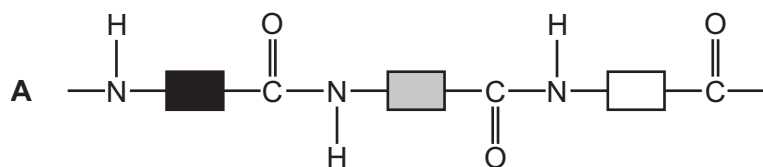
37 Which type of reaction occurs when ethanol is converted to ethanoic acid?

- A combustion
- B decomposition
- C neutralisation
- D oxidation

38 Hydrolysis of polymer P produces the three compounds shown.



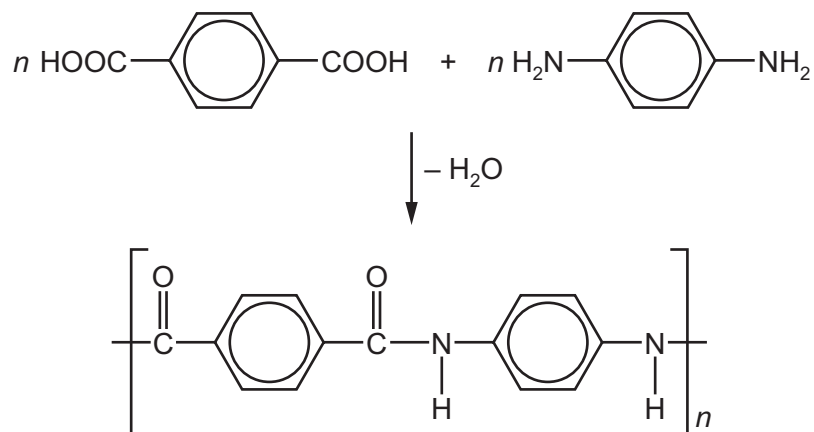
What is the structure of polymer P?



39 Which statement about unsaturated hydrocarbons is correct?

- A  $\text{CH}_3\text{CH}_2\text{CH}=\text{CHCH}_3$  is an unsaturated hydrocarbon.
- B Ethene has more hydrogen atoms per molecule than ethane.
- C Unsaturated hydrocarbons have double bonds between carbon and hydrogen atoms.
- D Unsaturated hydrocarbons turn aqueous bromine from colourless to brown.

40 The equation shows the formation of a polymer called *Kevlar*.



Which row describes *Kevlar*?

|          | how the polymer is formed   | type of polymer |
|----------|-----------------------------|-----------------|
| <b>A</b> | addition polymerisation     | polyamide       |
| <b>B</b> | addition polymerisation     | polyester       |
| <b>C</b> | condensation polymerisation | polyamide       |
| <b>D</b> | condensation polymerisation | polyester       |

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The Periodic Table of Elements

|                                   |                                    | Group  |  |                                    |                                     |                                    |                                     |                                     |                                       |                                      |                                      |                                    |                                      |                                    |                                     |                                  |                                     |
|-----------------------------------|------------------------------------|--|--|------------------------------------|-------------------------------------|------------------------------------|-------------------------------------|-------------------------------------|---------------------------------------|--------------------------------------|--------------------------------------|------------------------------------|--------------------------------------|------------------------------------|-------------------------------------|----------------------------------|-------------------------------------|
| I                                 | II                                 |  |  |                                    |                                     |                                    |                                     |                                     |                                       |                                      |                                      | III                                | IV                                   | V                                  | VI                                  | VII                              | VIII                                |
| 3<br><b>Li</b><br>lithium<br>7    | 4<br><b>Be</b><br>beryllium<br>9   | <div style="border: 1px solid black; padding: 5px; text-align: center;"> <b>Key</b><br/>                     atomic number<br/>                     atomic symbol<br/>                     name<br/>                     relative atomic mass                 </div> |  |                                    |                                     |                                    |                                     |                                     |                                       |                                      |                                      | 5<br><b>B</b><br>boron<br>11       | 6<br><b>C</b><br>carbon<br>12        | 7<br><b>N</b><br>nitrogen<br>14    | 8<br><b>O</b><br>oxygen<br>16       | 9<br><b>F</b><br>fluorine<br>19  | 10<br><b>Ne</b><br>neon<br>20       |
| 11<br><b>Na</b><br>sodium<br>23   | 12<br><b>Mg</b><br>magnesium<br>24 |  |  |                                    |                                     |                                    |                                     |                                     |                                       |                                      |                                      | 1<br><b>H</b><br>hydrogen<br>1     | 13<br><b>Al</b><br>aluminium<br>27   | 14<br><b>Si</b><br>silicon<br>28   | 15<br><b>P</b><br>phosphorus<br>31  | 16<br><b>S</b><br>sulfur<br>32   | 17<br><b>Cl</b><br>chlorine<br>35.5 |
| 19<br><b>K</b><br>potassium<br>39 | 20<br><b>Ca</b><br>calcium<br>40   | 21<br><b>Sc</b><br>scandium<br>45  | 22<br><b>Ti</b><br>titanium<br>48      | 23<br><b>V</b><br>vanadium<br>51   | 24<br><b>Cr</b><br>chromium<br>52   | 25<br><b>Mn</b><br>manganese<br>55 | 26<br><b>Fe</b><br>iron<br>56       | 27<br><b>Co</b><br>cobalt<br>59     | 28<br><b>Ni</b><br>nickel<br>59       | 29<br><b>Cu</b><br>copper<br>64      | 30<br><b>Zn</b><br>zinc<br>65        | 31<br><b>Ga</b><br>gallium<br>70   | 32<br><b>Ge</b><br>germanium<br>73   | 33<br><b>As</b><br>arsenic<br>75   | 34<br><b>Se</b><br>selenium<br>79   | 35<br><b>Br</b><br>bromine<br>80 | 36<br><b>Kr</b><br>krypton<br>84    |
| 37<br><b>Rb</b><br>rubidium<br>85 | 38<br><b>Sr</b><br>strontium<br>88 | 39<br><b>Y</b><br>yttrium<br>89  | 40<br><b>Zr</b><br>zirconium<br>91     | 41<br><b>Nb</b><br>niobium<br>93   | 42<br><b>Mo</b><br>molybdenum<br>96 | 43<br><b>Tc</b><br>technetium<br>— | 44<br><b>Ru</b><br>ruthenium<br>101 | 45<br><b>Rh</b><br>rhodium<br>103   | 46<br><b>Pd</b><br>palladium<br>106   | 47<br><b>Ag</b><br>silver<br>108     | 48<br><b>Cd</b><br>cadmium<br>112    | 49<br><b>In</b><br>indium<br>115   | 50<br><b>Sn</b><br>tin<br>119        | 51<br><b>Sb</b><br>antimony<br>122 | 52<br><b>Te</b><br>tellurium<br>128 | 53<br><b>I</b><br>iodine<br>127  | 54<br><b>Xe</b><br>xenon<br>131     |
| 55<br><b>Cs</b><br>caesium<br>133 | 56<br><b>Ba</b><br>barium<br>137   | 57–71<br>lanthanoids   | 72<br><b>Hf</b><br>hafnium<br>178      | 73<br><b>Ta</b><br>tantalum<br>181 | 74<br><b>W</b><br>tungsten<br>184   | 75<br><b>Re</b><br>rhenium<br>186  | 76<br><b>Os</b><br>osmium<br>190    | 77<br><b>Ir</b><br>iridium<br>192   | 78<br><b>Pt</b><br>platinum<br>195    | 79<br><b>Au</b><br>gold<br>197       | 80<br><b>Hg</b><br>mercury<br>201    | 81<br><b>Tl</b><br>thallium<br>204 | 82<br><b>Pb</b><br>lead<br>207       | 83<br><b>Bi</b><br>bismuth<br>209  | 84<br><b>Po</b><br>polonium<br>—    | 85<br><b>At</b><br>astatine<br>— | 86<br><b>Rn</b><br>radon<br>—       |
| 87<br><b>Fr</b><br>francium<br>—  | 88<br><b>Ra</b><br>radium<br>—     | 89–103<br>actinoids  | 104<br><b>Rf</b><br>rutherfordium<br>— | 105<br><b>Db</b><br>dubnium<br>—   | 106<br><b>Sg</b><br>seaborgium<br>— | 107<br><b>Bh</b><br>bohrium<br>—   | 108<br><b>Hs</b><br>hassium<br>—    | 109<br><b>Mt</b><br>meitnerium<br>— | 110<br><b>Ds</b><br>darmstadtium<br>— | 111<br><b>Rg</b><br>roentgenium<br>— | 112<br><b>Cn</b><br>copernicium<br>— | 114<br><b>Fl</b><br>flerovium<br>— | 116<br><b>Lv</b><br>livermorium<br>— | —                                  | —                                   | —                                | —                                   |

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

The volume of one mole of any gas is 24 dm<sup>3</sup> at room temperature and pressure (r.t.p.).