



**Cambridge International Examinations**  
Cambridge International General Certificate of Secondary Education

**CHEMISTRY**

**0620/22**

Paper 2 Multiple Choice (Extended)

**February/March 2016**

**45 Minutes**

Additional Materials:      Multiple Choice Answer Sheet  
   Soft clean eraser  
   Soft pencil (type B or HB is recommended)

\* 6 4 9 2 0 1 1 2 2 1 \*

**READ THESE INSTRUCTIONS FIRST**

Write in soft pencil.  
Do not use staples, paper clips, glue or correction fluid.  
Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.  
**DO NOT WRITE IN ANY BARCODES.**

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 separate Answer Sheet.

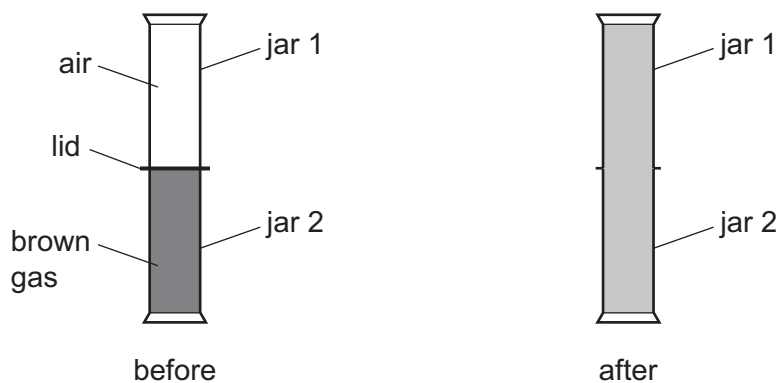
**Read the instructions on the Answer Sheet very carefully.**

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.  
Any rough working should be done in this booklet.  
A copy of the Periodic Table is printed on page 16.  
Electronic calculators may be used.

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **15** printed pages and **1** blank page.

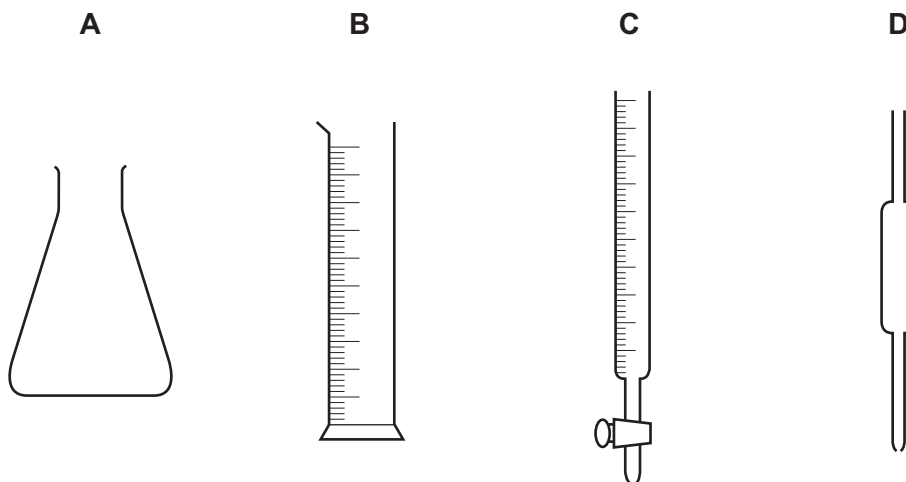
- 1 Two gas jars are set up as shown.



The lid is removed and the gas jars are left to stand. After some time the contents of both gas jars are brown.

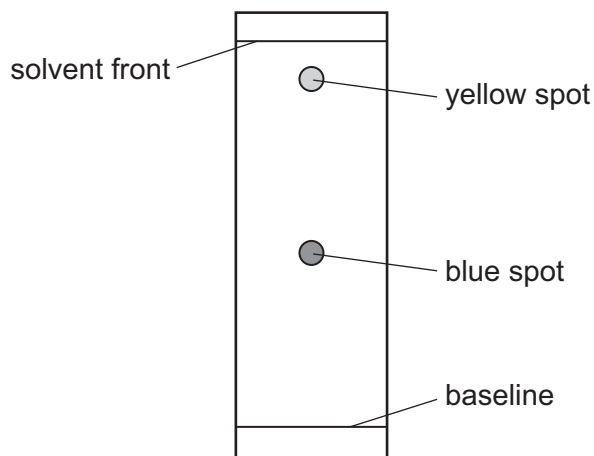
Which process causes this to happen?

- A condensation
  - B diffusion
  - C evaporation
  - D filtration
- 2 Which piece of apparatus is used to measure variable quantities of liquid in a titration?



- 3 A sample of a green food colouring was separated into its component colours using paper chromatography.

The results obtained are shown.



What is the  $R_f$  value of the blue spot?

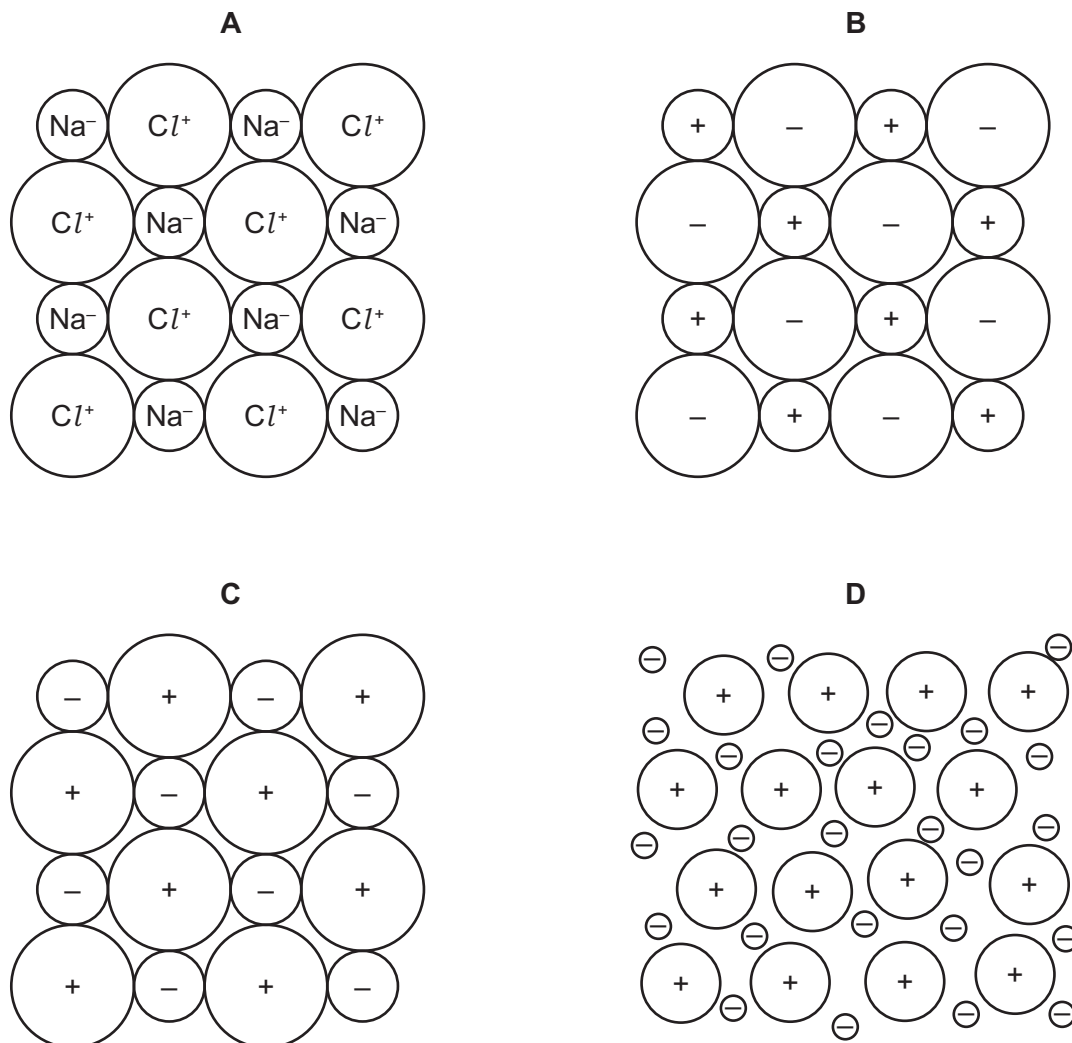
- A** 0.45                      **B** 0.90                      **C** 1.10                      **D** 2.20
- 4 In which row are the substances correctly classified?

|          | element | compound | mixture |
|----------|---------|----------|---------|
| <b>A</b> | brass   | sulfur   | water   |
| <b>B</b> | sulfur  | brass    | water   |
| <b>C</b> | sulfur  | water    | brass   |
| <b>D</b> | water   | sulfur   | brass   |

- 5 Which molecule contains only single covalent bonds?

- A**  $Cl_2$                       **B**  $CO_2$                       **C**  $N_2$                       **D**  $O_2$

6 Which structure represents the sodium chloride lattice?



7 X and Y are isotopes of the same element.

Which statement is correct?

- A** X and Y have atoms with different numbers of electron shells.
- B** X and Y have atoms with the same nucleon number.
- C** X and Y have atoms with the same number of outer shell electrons.
- D** X and Y have different chemical properties.

8 Which quantities of chemicals will react exactly with no reactants left over?

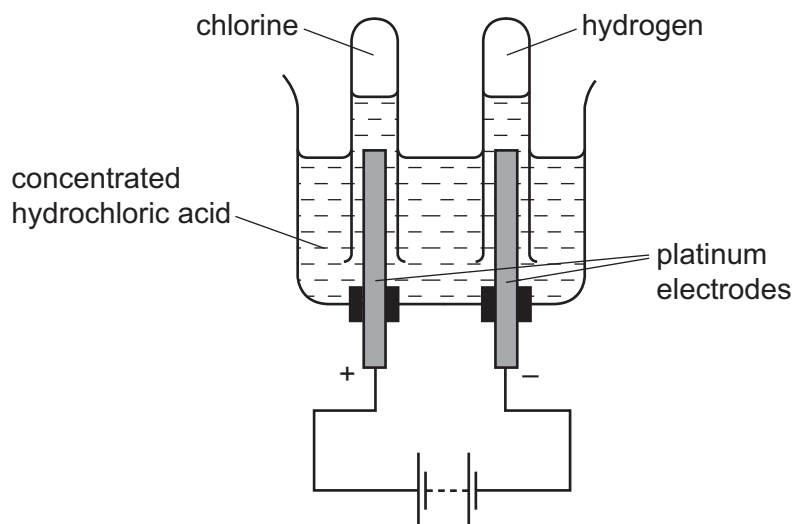
- A** 12 g of carbon and 12 g of oxygen
- B** 12 g of carbon and 48 g of oxygen
- C** 12 g of magnesium and 16 g of oxygen
- D** 24 g of magnesium and 16 g of oxygen

- 9 Magnesium nitride is formed when magnesium burns in air. Magnesium nitride is an ionic compound.

What is the formula of magnesium nitride?

- A  $MgN_2$       B  $Mg_2N_2$       C  $Mg_2N_3$       D  $Mg_3N_2$

- 10 The electrolysis of concentrated hydrochloric acid is shown.



Which statement describes what happens to the electrons during the electrolysis?

- A They are added to chloride ions.  
 B They are added to hydrogen ions.  
 C They move through the circuit from positive to negative.  
 D They move through the solution from negative to positive.
- 11 Which reaction does **not** occur in the extraction of aluminium?
- A  $Al^{3+} + 3e^{-} \rightarrow Al$   
 B  $2Al_2O_3 + 3C \rightarrow 4Al + 3CO_2$   
 C  $2O^{2-} \rightarrow O_2 + 4e^{-}$   
 D  $C + O_2 \rightarrow CO_2$

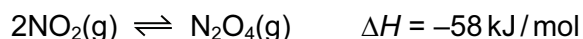
- 12 Which substance could **not** be used as a fuel to heat water in a boiler?

- A ethanol  
 B hydrogen  
 C methane  
 D oxygen

13 Which row describes an endothermic reaction?

|          | energy needed to break bonds/kJ | energy released by forming bonds/kJ | temperature |
|----------|---------------------------------|-------------------------------------|-------------|
| <b>A</b> | 400                             | 200                                 | decreases   |
| <b>B</b> | 400                             | 800                                 | decreases   |
| <b>C</b> | 600                             | 200                                 | increases   |
| <b>D</b> | 600                             | 800                                 | increases   |

14 A reversible reaction is shown.



Which statement about an equilibrium mixture of  $\text{NO}_2$  and  $\text{N}_2\text{O}_4$  is correct?

- A** If the pressure is decreased the amount of  $\text{N}_2\text{O}_4$  increases.
- B** If the temperature is increased the amount of  $\text{N}_2\text{O}_4$  increases.
- C** The rates of formation and decomposition of  $\text{N}_2\text{O}_4$  are not the same.
- D** The decomposition of  $\text{N}_2\text{O}_4$  is an endothermic reaction.

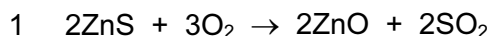
15 Which statement about catalysts in chemical reactions is **not** correct?

- A** Catalysts are not used up in the reaction.
- B** Catalysts increase the energy of the reacting particles.
- C** Catalysts increase the rate of the reaction.
- D** Catalysts lower the activation energy.

16 Zinc is extracted from zinc blende by roasting it in air to form zinc oxide.

The zinc oxide is then heated with carbon to form zinc.

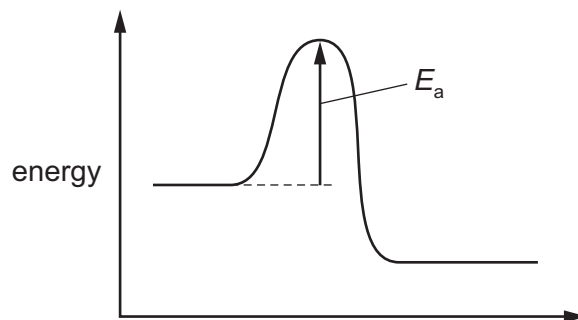
The equations for the reactions are shown.



Which statement about reactions 1 and 2 is **not** correct?

- A** In reaction 1 the oxidation state of sulfur increases and it is oxidised.
- B** In reaction 1 the oxidation state of zinc increases and it is oxidised.
- C** In reaction 2 the carbon acts as a reducing agent and it is oxidised.
- D** In reaction 2 the oxidation state of zinc decreases and it is reduced.

17 The diagram shows an energy level diagram for a reaction.



The diagram shows that the reaction is .....1..... .

Increasing the temperature increases the rate of reaction. A reason for this is that the .....2..... .

Which words correctly complete gaps 1 and 2?

|          | 1           | 2                           |
|----------|-------------|-----------------------------|
| <b>A</b> | endothermic | activation energy decreases |
| <b>B</b> | endothermic | collision rate increases    |
| <b>C</b> | exothermic  | activation energy decreases |
| <b>D</b> | exothermic  | collision rate increases    |

18 Concentrated hydrochloric acid is a *strong acid*.

What is meant by the terms 'strong' and 'acid'?

|          | strong                             | acid            |
|----------|------------------------------------|-----------------|
| <b>A</b> | contains a low proportion of water | accepts protons |
| <b>B</b> | contains a low proportion of water | donates protons |
| <b>C</b> | fully ionised                      | accepts protons |
| <b>D</b> | fully ionised                      | donates protons |

19 Which oxide is amphoteric?

- A** aluminium oxide
- B** calcium oxide
- C** carbon monoxide
- D** sodium oxide

20 A salt is made by adding an excess of an insoluble metal oxide to an acid.

How is the excess metal oxide removed from the mixture?

- A chromatography
- B crystallisation
- C distillation
- D filtration

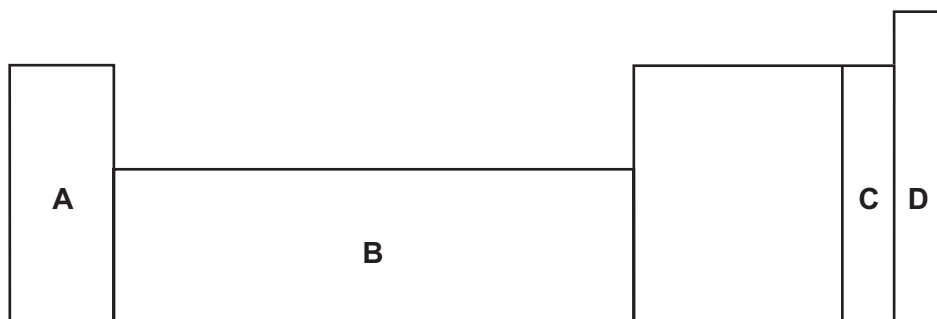
21 A substance is heated with aluminium foil in aqueous sodium hydroxide. A gas is produced which turns damp, red litmus paper blue.

Which anion is present in the substance?

- A carbonate
- B iodide
- C nitrate
- D sulfate

22 An element does not conduct electricity and exists as diatomic molecules.

Where in the Periodic Table is the element found?



23 In the Periodic Table, how does the metallic character of the elements vary from left to right across a period?

- A It decreases.
- B It increases.
- C It increases then decreases.
- D It stays the same.



24 The elements in a group of the Periodic Table show the following trends.

- 1 The element with the lowest proton number has the lowest reactivity.
- 2 All the elements in the group form basic oxides.
- 3 The density of the elements increases down the group.
- 4 The melting point of the elements decreases down the group.

In which group are the elements found?

- A** I                      **B** IV                      **C** VI                      **D** VII

25 Brass is an alloy of two metals.

Which row gives a correct use for the two metals from which brass is made?

|          | metal 1                      | metal 2                    |
|----------|------------------------------|----------------------------|
| <b>A</b> | used for electrical wiring   | used for galvanising steel |
| <b>B</b> | used for galvanising steel   | used for making aircraft   |
| <b>C</b> | used for making aircraft     | used for making cutlery    |
| <b>D</b> | used for making cooking pans | used for electrical wiring |

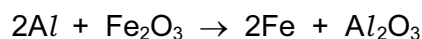
26 Iron is extracted from hematite in the blast furnace.

The hematite contains silicon(IV) oxide (sand) as an impurity.

What reacts with this impurity to remove it?

- A** calcium oxide  
**B** carbon  
**C** carbon dioxide  
**D** slag

27 The reaction below is called the 'thermite reaction'.



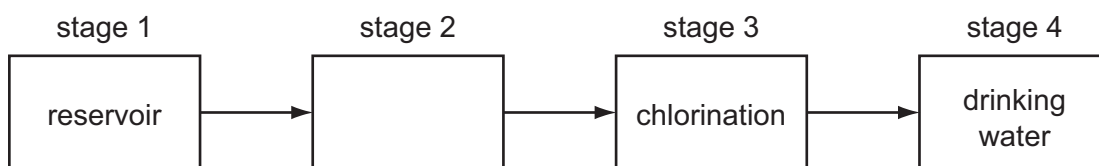
Which pair of substances reacts in a similar way?

- A** Fe and MgO  
**B** Fe and ZnO  
**C** Mg and CuO  
**D** Zn and  $Al_2O_3$

- 28 One method of preventing the rusting of iron is to keep oxygen away from the surface of the metal.

Which way of rust prevention does **not** use this method?

- A coating the iron with grease
  - B connecting the iron to a more reactive metal
  - C covering the iron with plastic
  - D painting the iron
- 29 The diagram shows how water is treated to make it suitable for drinking.



What happens in stage 2?

- A condensation
  - B distillation
  - C evaporation
  - D filtration
- 30 Nitrogen monoxide is produced in a car engine when petrol is burnt.
- The gases from the car engine are passed through a catalytic converter.
- In the catalytic converter the nitrogen monoxide reacts with carbon monoxide to form nitrogen and carbon dioxide.
- Which statement is **not** correct?
- A Carbon monoxide is oxidised in the catalytic converter.
  - B Carbon monoxide is produced by the complete combustion of petrol.
  - C Nitrogen monoxide is formed by the reaction of nitrogen and oxygen.
  - D Nitrogen monoxide is reduced in the catalytic converter.
- 31 Which pollutant gas can be produced as a result of incomplete combustion of octane,  $C_8H_{18}$ ?
- A carbon
  - B carbon dioxide
  - C carbon monoxide
  - D methane

32 Fertilisers are used to provide three elements needed to increase the yield of crops.

Which two compounds would provide all three of these elements?

- A ammonium nitrate and calcium phosphate
- B ammonium nitrate and potassium sulfate
- C potassium nitrate and calcium phosphate
- D potassium nitrate and potassium sulfate

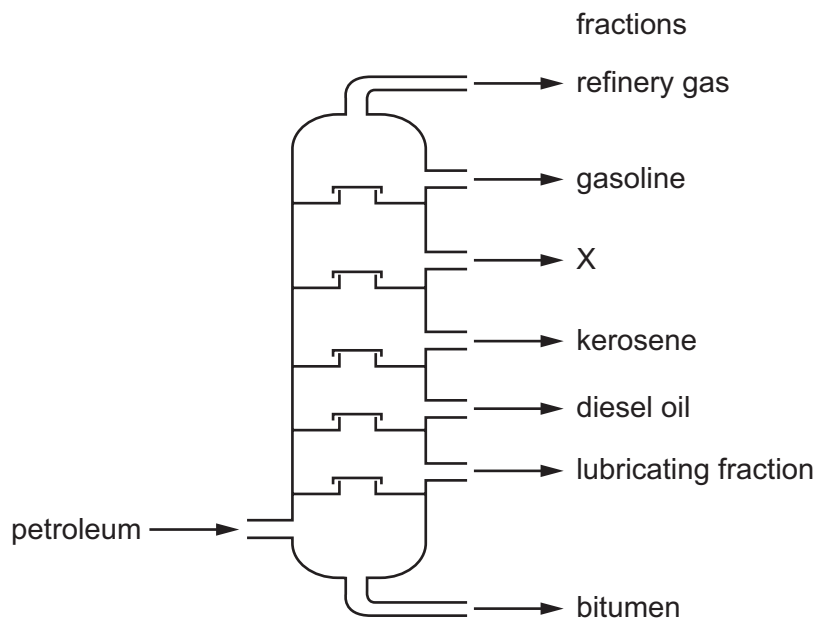
33 What is a property of concentrated sulfuric acid but **not** of dilute sulfuric acid?

- A It is a dehydrating agent.
- B It neutralises alkalis.
- C It produces a white precipitate with barium nitrate.
- D It reacts with metals to give a salt and hydrogen.

34 Why does a farmer put lime (calcium oxide) on the soil?

- A to act as a fertiliser
- B to kill pests
- C to make the soil less acidic
- D to make the soil less alkaline

35 What is the name of fraction X?



- A alcohol
- B fuel oil
- C naphtha
- D paraffin

36 Which compounds are alkanes?

| compound | W           | X           | Y           | Z           |
|----------|-------------|-------------|-------------|-------------|
| formula  | $C_4H_{10}$ | $C_5H_{10}$ | $C_6H_{12}$ | $C_6H_{14}$ |

- A W and X
- B W and Z
- C X and Y
- D Y and Z

37 The statements below are about the alcohol homologous series.

The alcohols have the same .....1..... formula.

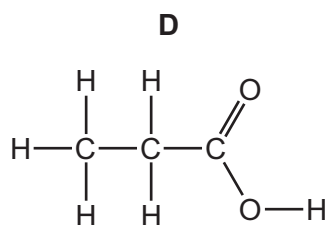
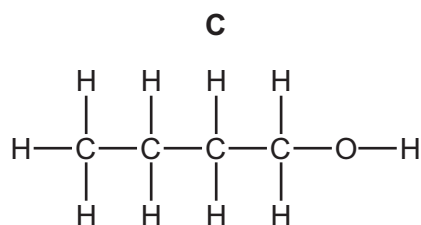
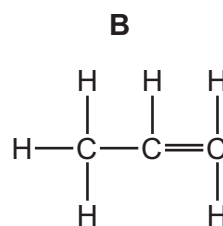
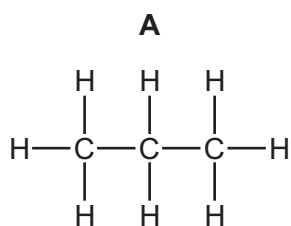
The alcohols have .....2..... chemical properties because they have the same .....3..... .

The melting points of the alcohols .....4..... as the number of carbon atoms increases.

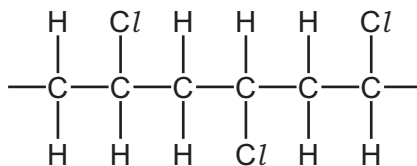
Which words correctly complete gaps 1–4?

|          | 1         | 2         | 3                    | 4        |
|----------|-----------|-----------|----------------------|----------|
| <b>A</b> | general   | different | functional group     | decrease |
| <b>B</b> | general   | similar   | electronic structure | increase |
| <b>C</b> | general   | similar   | functional group     | increase |
| <b>D</b> | molecular | similar   | functional group     | increase |

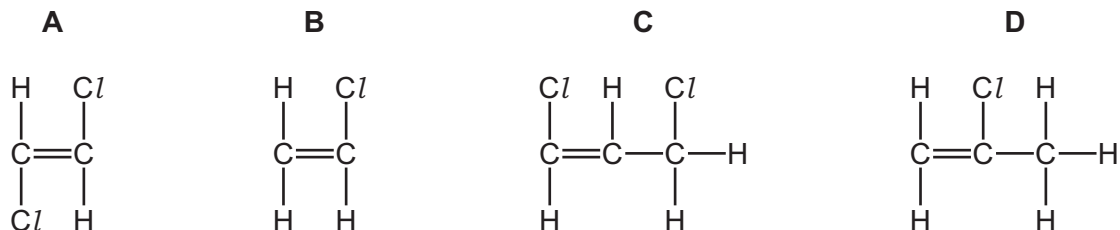
38 Which structure represents a compound that dissolves in water to form an acidic solution?



39 The partial structure of an addition polymer is shown.



What is the structure of the monomer used to make this polymer?



40 Which statement about polymers is correct?

- A Addition polymers are all biodegradable.
- B Condensation polymers can all be hydrolysed to give amino acids.
- C Condensation polymers only exist in nature.
- D Forming addition polymers produces only one product.

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The Periodic Table of Elements

|                                   |                                    | Group  |  |                                    |                                     |                                    |                                     |                                     |                                       |                                      |                                      |                                    |                                      |                                     |                                     |                                      |                                      |
|-----------------------------------|------------------------------------|--|--|------------------------------------|-------------------------------------|------------------------------------|-------------------------------------|-------------------------------------|---------------------------------------|--------------------------------------|--------------------------------------|------------------------------------|--------------------------------------|-------------------------------------|-------------------------------------|--------------------------------------|--------------------------------------|
| I                                 | II                                 | III  | IV                                     | V                                  | VI                                  | VII                                | VIII                                |                                     |                                       |                                      |                                      |                                    | VIII                                 |                                     |                                     |                                      |                                      |
| 3<br><b>Li</b><br>lithium<br>7    | 4<br><b>Be</b><br>beryllium<br>9   | 1<br><b>H</b><br>hydrogen<br>1   | 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       |                                       |                                      |                                      |                                    |                                      | 2<br><b>He</b><br>helium<br>4       |                                     |                                      |                                      |
| 11<br><b>Na</b><br>sodium<br>23   | 12<br><b>Mg</b><br>magnesium<br>24 | <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> |  |                                    |                                     |                                    |                                     |                                     |                                       |                                      |                                      |                                    |                                      |                                     |                                     |                                      |                                      |
| 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>— | 117<br><b>Ts</b><br>tennessine<br>— | 118<br><b>Og</b><br>oganesson<br>—  | 119<br><b>Uue</b><br>unbinilium<br>— | 120<br><b>Uuo</b><br>ununoctium<br>— |

|                                     |                                   |  |                                     |                                    |                                    |                                    |                                      |                                   |                                      |                                     |                                  |                                      |                                     |                                     |
|-------------------------------------|-----------------------------------|--|-------------------------------------|------------------------------------|------------------------------------|------------------------------------|--------------------------------------|-----------------------------------|--------------------------------------|-------------------------------------|----------------------------------|--------------------------------------|-------------------------------------|-------------------------------------|
| 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  |
| 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>— |

lanthanoids

actinoids

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