



# Cambridge O Level

## CHEMISTRY

5070/12

Paper 1 Multiple Choice

October/November 2021

1 hour

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 **20** pages. Any blank pages are indicated.



- 1 In a titration,  $25.0\text{ cm}^3$  of aqueous sodium hydroxide is transferred into a conical flask. A few drops of indicator are added. Dilute hydrochloric acid is then added to the flask until the end-point is reached.

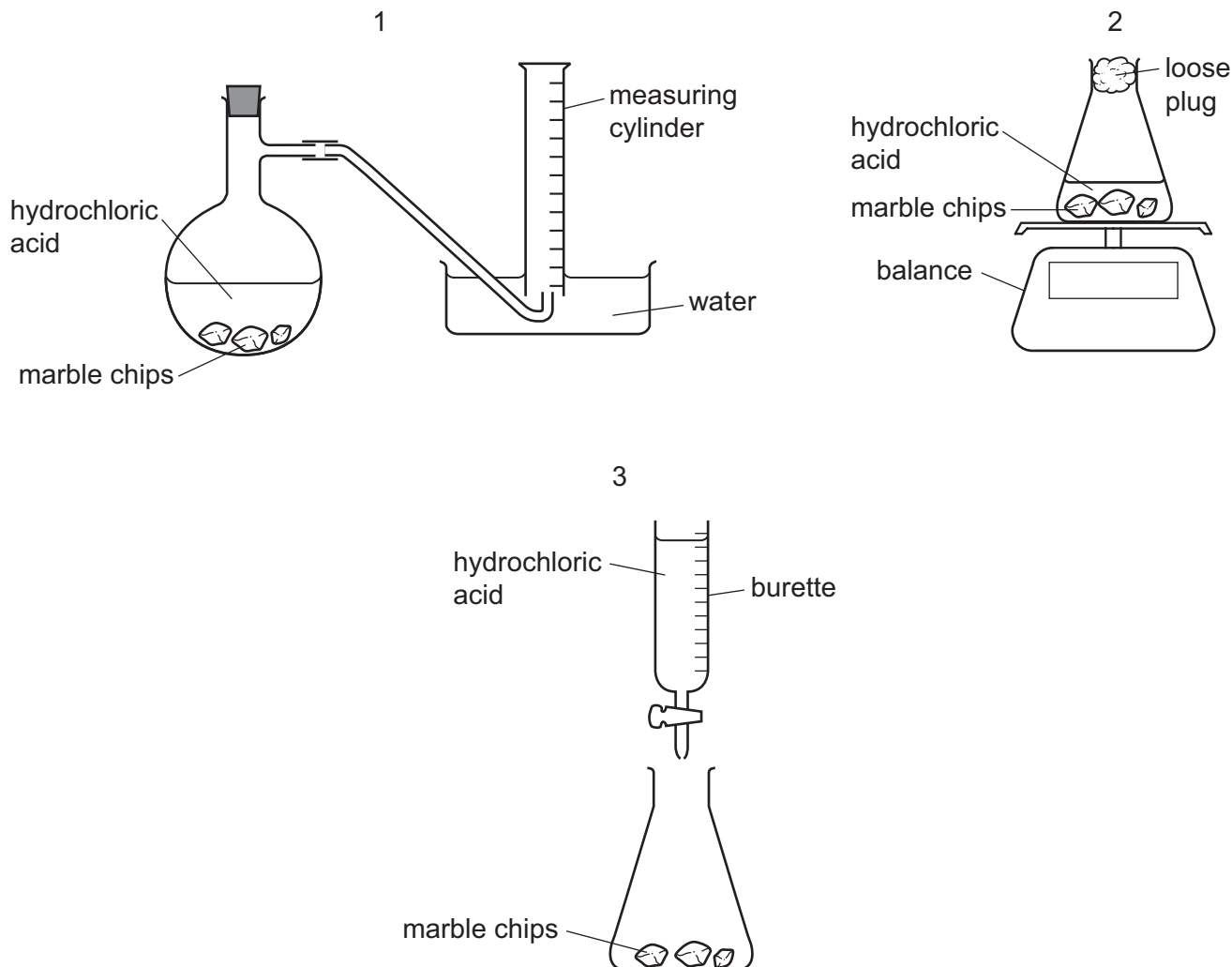
Which pieces of apparatus are used to measure volume in this experiment?

|          | to measure dilute hydrochloric acid | to measure aqueous sodium hydroxide |
|----------|-------------------------------------|-------------------------------------|
| <b>A</b> | burette                             | beaker                              |
| <b>B</b> | burette                             | pipette                             |
| <b>C</b> | pipette                             | pipette                             |
| <b>D</b> | pipette                             | beaker                              |

- 2 A student follows the rate of the reaction between marble chips,  $\text{CaCO}_3$ , and dilute hydrochloric acid.



Which diagrams show apparatus that, with a stopwatch, is suitable for this experiment?



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

- 3 Pure oxygen is needed by many industries.

How is pure oxygen obtained in large amounts for such uses?

- A** by decomposition of calcium carbonate  
**B** by decomposition of hydrogen peroxide  
**C** by filtration of liquid air  
**D** by fractional distillation of liquid air

- 4 An impure sample of compound X has a melting point of 120 °C.

X is purified and its melting point is measured again.

Which row is correct?

|          | method of purifying X | melting point of pure X / °C |
|----------|-----------------------|------------------------------|
| <b>A</b> | crystallisation       | 115                          |
| <b>B</b> | distillation          | 115                          |
| <b>C</b> | crystallisation       | 125                          |
| <b>D</b> | distillation          | 125                          |

- 5 When aqueous sodium hydroxide is added to aqueous compound X, a red-brown precipitate is formed. When dilute nitric acid followed by aqueous barium nitrate is added to aqueous compound X, a white precipitate is formed.

What is X?

- A** chromium(III) sulfate  
**B** chromium(III) chloride  
**C** iron(III) chloride  
**D** iron(III) sulfate
- 6 An aqueous solution of zinc chloride is tested by adding reagents.

Which observation is correct?

|          | reagent added to zinc chloride (aq) | observations                                                  |
|----------|-------------------------------------|---------------------------------------------------------------|
| <b>A</b> | acidified aqueous barium nitrate    | forms a white precipitate                                     |
| <b>B</b> | aqueous ammonia                     | forms a white precipitate, soluble in excess of the reagent   |
| <b>C</b> | aqueous sodium hydroxide            | forms a white precipitate, insoluble in excess of the reagent |
| <b>D</b> | powdered copper                     | forms a grey precipitate                                      |

- 7 A sample of gas is released at a particular point in a laboratory.

A detecting device is placed ten metres from the point where the gas is released. This device detects and records the time when the concentration of the gas is ten molecules in every million molecules of air.

The experiment is carried out with two gases at different temperatures.

In which experiment was the time recorded by the detector **greatest**?

|          | gas             | temperature of laboratory / °C |
|----------|-----------------|--------------------------------|
| <b>A</b> | SF <sub>6</sub> | 20                             |
| <b>B</b> | SF <sub>6</sub> | 40                             |
| <b>C</b> | CO <sub>2</sub> | 20                             |
| <b>D</b> | CO <sub>2</sub> | 40                             |

- 8 The table shows data for some particles.

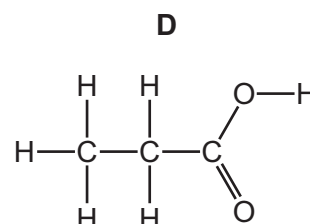
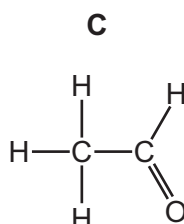
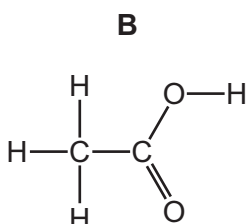
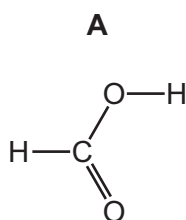
| particle      | proton number | nucleon number | number of protons | number of neutrons | number of electrons |
|---------------|---------------|----------------|-------------------|--------------------|---------------------|
| sodium ion    | 11            | 23             | 11                | W                  | 10                  |
| fluoride ion  | 9             | 19             | 9                 | 10                 | X                   |
| magnesium ion | 12            | 24             | Y                 | 12                 | 10                  |

What are the values of W, X and Y?

|          | W  | X  | Y  |
|----------|----|----|----|
| <b>A</b> | 10 | 10 | 12 |
| <b>B</b> | 11 | 12 | 10 |
| <b>C</b> | 12 | 10 | 12 |
| <b>D</b> | 12 | 10 | 10 |

- 9 A covalent compound P has the empirical formula CH<sub>2</sub>O.

Which structure represents P?



10 Which statement about the structure or bonding of metals is correct?

- A A metal lattice consists of negative ions in a 'sea of electrons'.
- B Electrons in a metal move randomly through the lattice.
- C Metals are malleable because the ions present are mobile.
- D The ions in a metal move when positive and negative electrodes are attached.

11 The relative atomic mass of chlorine is 35.5.

What is the mass of 2.0 mol of chlorine gas?

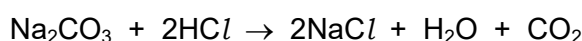
- A 17.75 g      B 35.5 g      C 71 g      D 142 g

12 When gases react, the volume of gaseous reactants may be different from the volume of gaseous products.

For which reaction is the percentage change in the volume of gas largest? (Assume each reaction goes to completion.)

- A  $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{SO}_3(\text{g})$
- B  $\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{g})$
- C  $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$
- D  $2\text{C}_2\text{H}_6(\text{g}) + 7\text{O}_2(\text{g}) \rightarrow 6\text{H}_2\text{O}(\text{g}) + 4\text{CO}_2(\text{g})$

13 Sodium carbonate reacts with dilute hydrochloric acid.



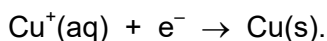
A sample containing 0.0800 mol of sodium carbonate is added to a solution containing 0.100 mol of hydrochloric acid.

Which volume of carbon dioxide is produced, measured at room temperature and pressure?

- A  $0.96 \text{ dm}^3$       B  $1.20 \text{ dm}^3$       C  $1.92 \text{ dm}^3$       D  $2.40 \text{ dm}^3$

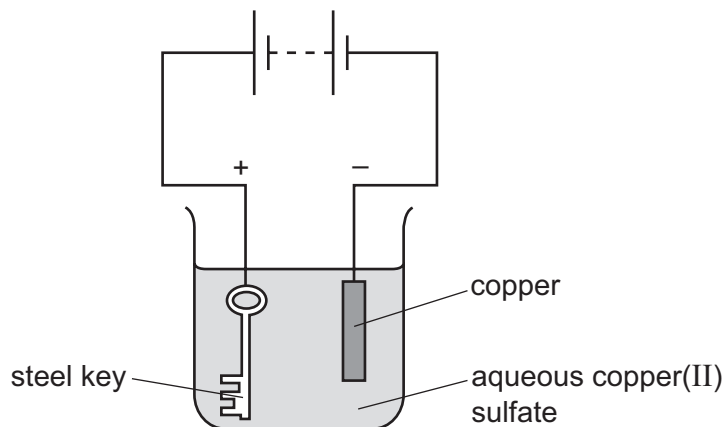
14 Which statement about the electrolysis of solutions is correct?

- A During the electrolysis of concentrated aqueous sodium chloride solution, hydrogen is produced at the cathode.
- B During the electrolysis of dilute sulfuric acid, oxygen is produced at the cathode.
- C When aqueous copper(II) sulfate is electrolysed, the reaction taking place at the cathode is



- D When aqueous copper(II) sulfate is electrolysed using copper electrodes, the mass of the anode at the end of the reaction will be greater than at the beginning.

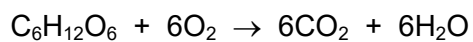
- 15 The apparatus shown is set up to plate a steel key with copper.



The key does not get coated with copper.

Which change needs to be made to plate the key?

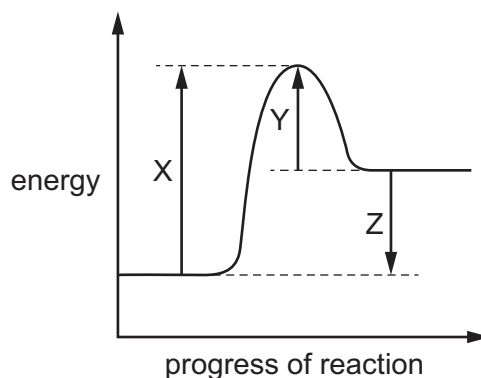
- A Increase the concentration of the aqueous copper(II) sulfate.
  - B Increase the voltage.
  - C Replace the solution with dilute sulfuric acid.
  - D Reverse the electrical connections.
- 16 The equation shows the reaction of glucose with oxygen.



Which statement about this reaction is correct?

- A It can occur in the dark.
- B It is endothermic.
- C It needs chlorophyll as a catalyst.
- D It occurs in plants but not in animals.

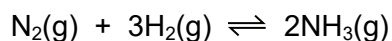
17 The energy profile diagram of a chemical reaction is shown.



Which statement is correct?

- A The reaction is exothermic.
- B X represents the activation energy for the reaction.
- C Y represents  $\Delta H$  for the reaction.
- D Z represents the energy given out as the reaction proceeds.

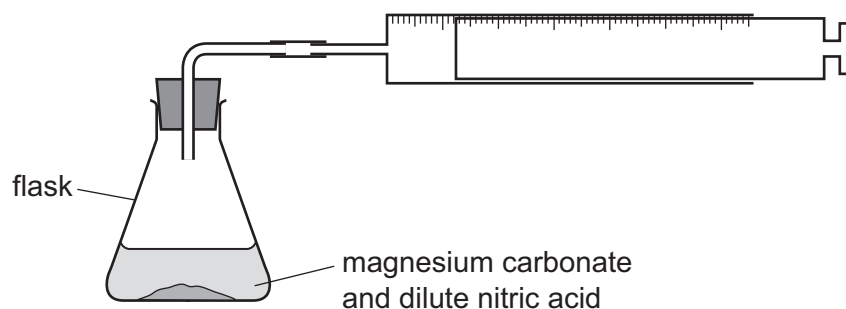
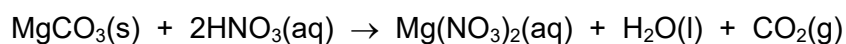
18 The equation shows the reaction for the manufacture of ammonia.



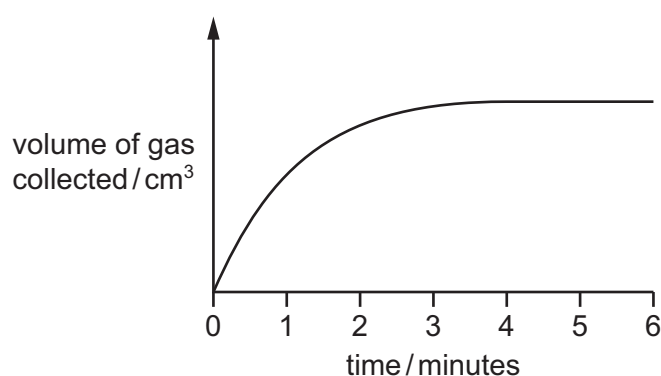
Which change will decrease the activation energy of the reaction?

- A addition of a catalyst
- B decrease in temperature
- C increase in concentration
- D increase in pressure

- 19 The apparatus shows a method of following the rate of the reaction between magnesium carbonate,  $\text{MgCO}_3$ , and dilute nitric acid,  $\text{HNO}_3$ .



The graph shows the volume of gas collected against time.



Three statements are made about the experiment.

- 1 The mass of the flask and its contents decreases as time increases.
- 2 The rate of the reaction decreases as time increases.
- 3 The reaction has finished after four minutes.

Which statements are correct?

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

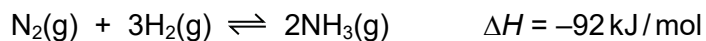
- 20 Aqueous bromine is added to aqueous sodium chloride.

Which statement is correct?

- A** Bromine is oxidised and chloride ions are reduced.  
**B** Bromine is reduced and chloride ions are oxidised.  
**C** Neither oxidation nor reduction takes place.  
**D** Sodium ions are oxidised.

- 21** Which statement is correct for all reversible reactions that have reached dynamic equilibrium?
- A** Introduction of a catalyst changes the position of the equilibrium.
  - B** The number of moles of products equals the number of moles of reactants.
  - C** The rate of the forward reaction equals the rate of the reverse reaction.
  - D** When the reaction reaches the position of equilibrium the reaction stops.
- 22** Which statement about acids and bases is correct?
- A** A  $0.1 \text{ mol/dm}^3$  solution of ethanoic acid has a higher pH than a  $0.1 \text{ mol/dm}^3$  solution of hydrochloric acid.
  - B** All bases dissolve in water to produce  $\text{OH}^-$  ions.
  - C** Bases react with nitrates to produce ammonia.
  - D** Oxides of metals are always acidic in character.
- 23** Which compound can be formed by precipitation?
- A**  $\text{NaCl}$                       **B**  $\text{K}_2\text{SO}_4$                       **C**  $\text{Ca}(\text{NO}_3)_2$                       **D**  $\text{PbSO}_4$
- 24** Which methods could be used to make a pure sample of copper(II) sulfate?
- 1 acid + metal carbonate
  - 2 acid + metal oxide
  - 3 acid + metal
  - 4 precipitation
- A** 1 and 2 only    **B** 1 and 3 only    **C** 1, 2 and 3    **D** 1, 2 and 4

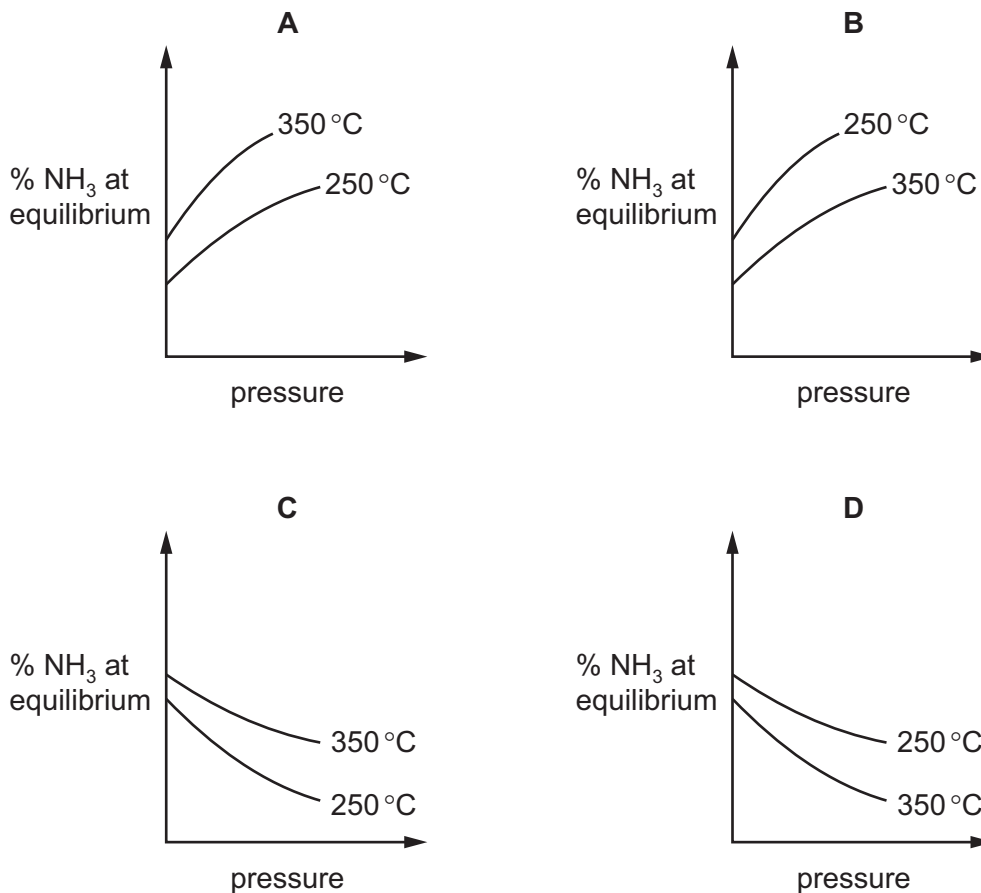
**25** Ammonia is made by a reversible reaction.



A chemist investigates how the percentage of ammonia at equilibrium changes with pressure.

The experiment is carried out both at 250 °C and at 350 °C.

Which graph shows the chemist's results?



**26** Which statement about sulfur dioxide, SO<sub>2</sub>, is correct?

- A** It is dissolved in water to make sulfuric acid for car batteries.
- B** It is the final product of the Contact process.
- C** It is used as a food preservative.
- D** It turns aqueous potassium iodide brown.



**31** The table gives properties of four metals, P, Q, R and S.

|   | method of extraction      | reaction with water       | reaction with acid |
|---|---------------------------|---------------------------|--------------------|
| P | electrolysis only         | no reaction               | reacts slowly      |
| Q | heating oxide with carbon | reacts slowly with steam  | reacts slowly      |
| R | electrolysis only         | reacts rapidly with steam | reacts rapidly     |
| S | heating oxide with carbon | no reaction               | no reaction        |

Which statement is correct?

- A** P is the least reactive.
- B** Q would displace R from a solution of its salt.
- C** R could be zinc.
- D** S could be copper.

**32** Which statements about extracting metals from their ores are correct?

- 1 Aluminium is extracted by the electrolysis of aluminium oxide dissolved in cryolite.
- 2 Silver is difficult to extract from its ores because of its low reactivity.
- 3 Iron is extracted from haematite by reduction in the blast furnace.

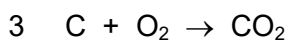
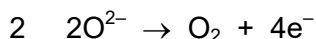
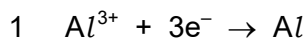
- A** 1 and 2 only    **B** 1 and 3 only    **C** 2 and 3 only    **D** 1, 2 and 3

**33** Which statements about the corrosion of iron are correct?

- 1 Corrosion can be prevented by coating the iron with zinc.
- 2 Corrosion only occurs in the presence of both air and water.
- 3 Rust is an alloy of iron and oxygen.
- 4 Sacrificial protection occurs when iron is connected to a less reactive metal.

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

**34** In the extraction of aluminium from aluminium oxide, the following three reactions take place.



Which reactions take place at the positive electrode?

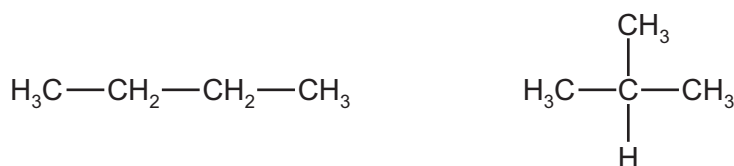
- A** 1 only      **B** 2 only      **C** 1 and 3      **D** 2 and 3

**35** Which statements are correct?

- 1 Chlorination is used to remove unpleasant tastes from drinking water.
- 2 Desalination can be achieved using distillation.
- 3 The presence of phosphates in water and soil encourages plant growth.

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

**36** Two isomers are shown.



Which statements about these isomers are correct?

- 1 They have the same empirical formula.
- 2 They have different molecular formulae.
- 3 They are members of the same homologous series.

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

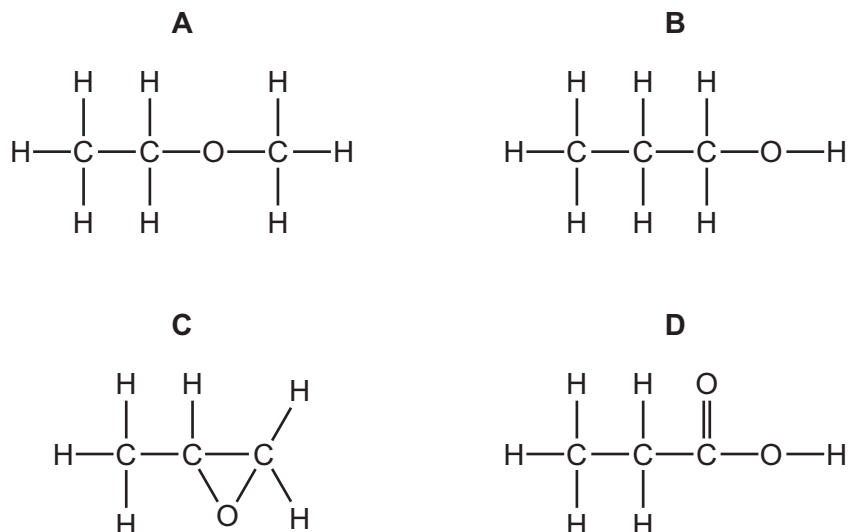
**37** A hydrocarbon compound Q has molecular formula  $\text{C}_x\text{H}_y$ .

Q reacts with hydrogen to form a single product with molecular formula  $\text{C}_x\text{H}_{y+2}$ .

Which statement about Q is correct?

- A** Q does not burn in air.
- B** Q is a saturated hydrocarbon.
- C** Q reacts with bromine to form a single product with molecular formula  $\text{C}_x\text{H}_{y-1}\text{Br}$ .
- D** Q reacts with steam to form a single product with molecular formula  $\text{C}_x\text{H}_{y+2}\text{O}$ .

38 Which structural formula represents an alcohol?



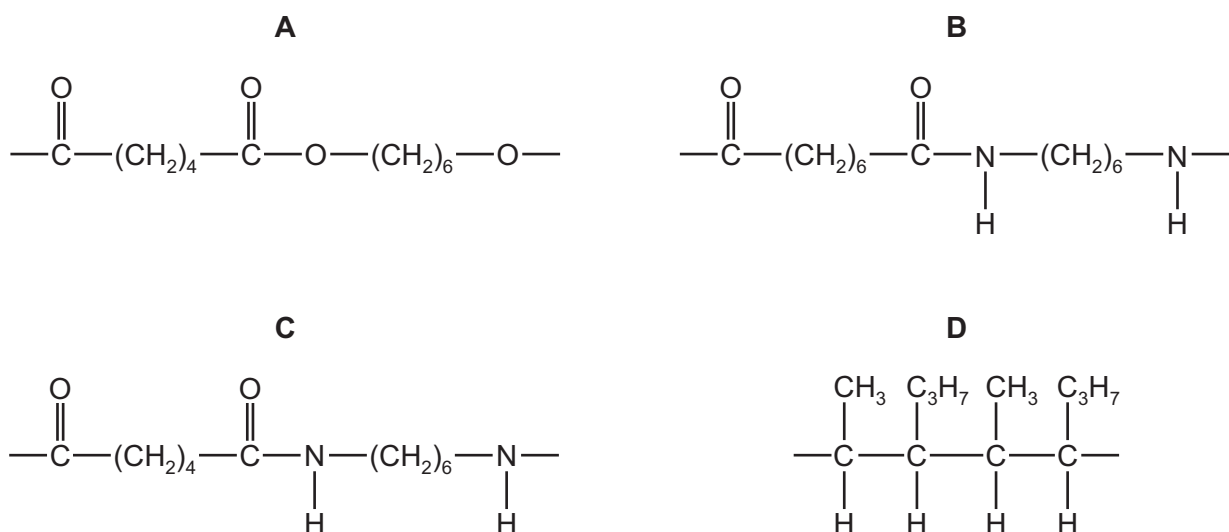
39 Which statement about carboxylic acids is correct?

- A** They are prepared by the oxidation of alkanes.
- B** They decolourise bromine water.
- C** They react with alcohols to form esters.
- D** They react with carbonates to form a salt, hydrogen and water.

40 P is a polymer that:

- has six carbon atoms in each of the monomers from which it is formed
- is **not** a polyester
- is formed using condensation polymerisation.

What is the partial structure of P?



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