Cambridge Assessment International Education

# Cambridge IGCSE®

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|---|---|---|---|---|---|---|---|---|---|
| CANDIDATE NAME | | | | | | | | | |
| CENTRE NUMBER | | | | | | CANDIDATE NUMBER | | | |

**CHEMISTRY** **0620/02**

Paper 2 Multiple Choice (Extended) **For examination from 2020**

SPECIMEN PAPER

**45 minutes**

Additional materials: Multiple choice answer sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

**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.

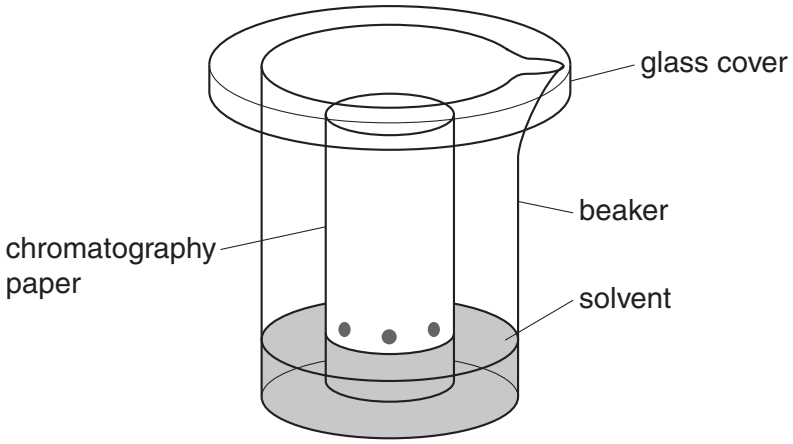
There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate answer sheet.

**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 18.
Electronic calculators may be used.

This document consists of **18** printed pages.

**1** Amino acids are colourless and can be separated and identified by chromatography.




What additional apparatus is required to identify the amino acids present in a mixture?

**A** a locating agent

**B** a ruler

**C** a ruler and a locating agent

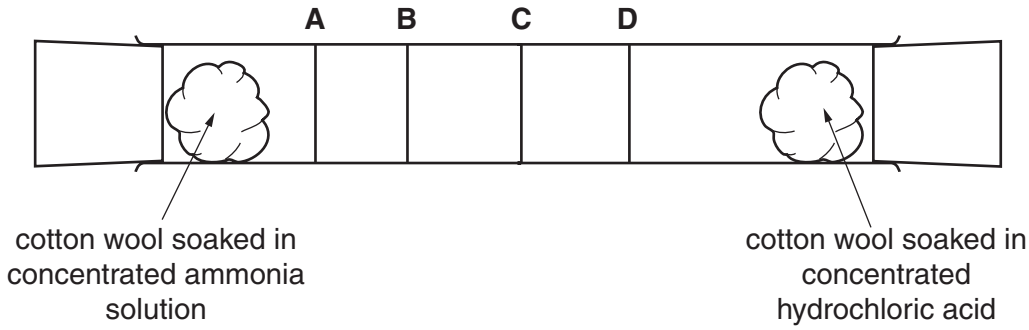
**D** neither a ruler or a locating agent

**2** The diagram shows the diffusion of hydrogen chloride and ammonia in a glass tube.

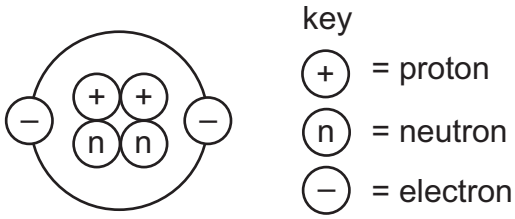
The gases are given off by the solutions at each end of the tube.

When hydrogen chloride and ammonia mix they produce a white solid, ammonium chloride.

Which line shows where the white solid is formed?

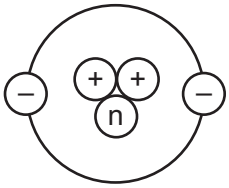


**3** The diagram shows the structure of an atom.

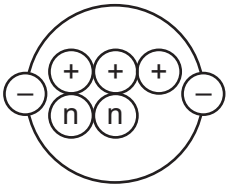



Which diagram shows the structure of an isotope of this atom?

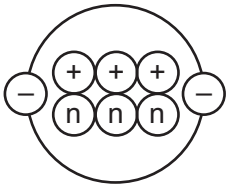
**A**



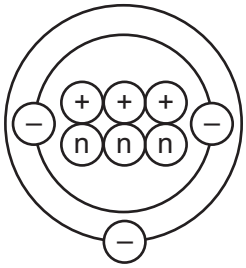
**B**



**C**



**D**



**4** The table shows the structure of different atoms and ions.

| particle | proton number | nucleon number | number of protons | number of neutrons | number of electrons |
|---|---|---|---|---|---|
| Mg | 12 | 24 | 12 | W | 12 |
| $Mg^{2+}$ | X | 24 | 12 | 12 | 10 |
| F | 9 | 19 | 9 | Y | 9 |
| $F^-$ | 9 | 19 | 9 | 10 | Z |

What are the values of W, X, Y and Z?

| | W | X | Y | Z |
|---|---|---|---|---|
| **A** | 10 | 10 | 9 | 9 |
| **B** | 10 | 12 | 10 | 9 |
| **C** | 12 | 10 | 9 | 10 |
| **D** | 12 | 12 | 10 | 10 |





**[Turn over**

**5** Iron is a metal. The structure of iron is described as a lattice of positive ions in a sea of electrons.

Which of the following statements about iron are correct?

1 iron conducts electricity because the electrons are free to move

2 iron has a high melting point due to the strong covalent bonds

3 iron is an alloy

4 iron is malleable because the layers of atoms can slide over one another

**A** 1 only

**B** 1 and 3

**C** 1 and 4

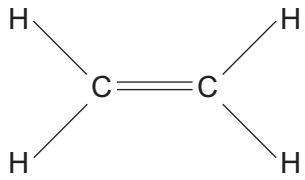
**D** 2, 3 and 4

**6** Which two elements react together to form an ionic compound?

| element | electronic structure |
|---|---|
| R | 2,4 |
| T | 2,8 |
| X | 2,8,1 |
| Z | 2,8,7 |

**A** R and T **B** T and X **C** X and Z **D** Z and R

**7** Ethene is an unsaturated hydrocarbon.




Which description of the bonding in ethene is correct?

**A** All atoms in the molecule have a share of eight electrons.

**B** Each carbon atom shares two of its electrons with hydrogen atoms and two of its electrons with a carbon atom.

**C** Each carbon atom shares two of its electrons with hydrogen atoms and one of its electrons with a carbon atom.

**D** The two carbon atoms share a total of six electrons with other atoms.

**8** What is the relative molecular mass, $M_r$, of butanol?

**A** 15 **B** 37 **C** 74 **D** 148

**9** The chemical formulae of two substances, W and X, are given.

W $NaAlSi_3O_8$

X $CaAl_2Si_2O_8$

Which statements are correct?

1 W and X contain the same amount of oxygen.

2 W contains three times as much silicon as X.

3 X contains twice as much aluminium as W.

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

**10** What is the concentration of a solution containing 1.0 g of sodium hydroxide in 250 $cm^3$ of solution?

**A** 0.025 mol / $dm^3$

**B** 0.10 mol / $dm^3$

**C** 0.25 mol / $dm^3$

**D** 1.0 mol / $dm^3$

**11** Four students prepared hydrated copper(II) sulfate by adding an excess of dilute sulfuric acid to copper(II) oxide.

Each student used a different mass of copper(II) oxide.

$$\underset{M_r = 80}{CuO} \xrightarrow{\text{dilute sulfuric acid}} \underset{M_r = 250}{CuSO_4.5H_2O}$$

After the copper(II) sulfate had crystallised the students dried and weighed the crystals.

Which student produced the highest percentage yield of hydrated copper(II) sulfate?

| | mass of copper(II) oxide used / g | mass of crystals produced / g |
|---|---|---|
| **A** | 4.0 | 11.5 |
| **B** | 8.0 | 23.5 |
| **C** | 12.0 | 35.0 |
| **D** | 16.0 | 46.5 |





**[Turn over**

**12** 20 $cm^3$ of ethyne, $C_2H_2$, are reacted with 500 $cm^3$ of oxygen.

The equation for the reaction is

$$2C_2H_2(g) + 5O_2(g) \rightarrow 4CO_2(g) + 2H_2O(l)$$

What is the total volume of gas remaining at the end of the reaction?

(all volumes are measured at room temperature and pressure)

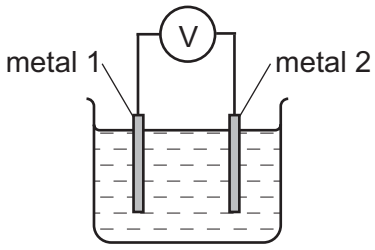
**A** 400 $cm^3$

**B** 450 $cm^3$

**C** 490 $cm^3$

**D** 520 $cm^3$

**13** Different metals were tested using the apparatus shown.




Which pair of metals would produce the largest voltage?

**A** copper and silver

**B** magnesium and silver

**C** magnesium and zinc

**D** zinc and copper

**14** Three electrolysis cells are set up. Each cell has inert electrodes.

The electrolytes are listed below.

| | |
|---|---|
| cell 1 | aqueous sodium chloride |
| cell 2 | dilute sulfuric acid |
| cell 3 | molten lead(II) bromide |

In which of these cells is a gas formed at **both** electrodes?

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

**15** The statements refer to the electrolysis of concentrated copper(II) chloride solution.

1 Electrons are transferred from the cathode to the copper(II) ions.

2 Electrons move around the circuit from the cathode to the anode.

3 Chloride ions are attracted to the anode.

4 Hydroxide ions transfer electrons to the cathode.

Which statements about the electrolysis of concentrated copper(II) chloride are correct?

**A** 1 and 3

**B** 1 and 4

**C** 2 and 3

**D** 2 and 4

**16** Water can be used to produce hydrogen gas.

$$2H_2O \rightarrow 2H_2 + O_2$$

Which row describes bond breaking in the reactant?

| | | |
|---|---|---|
| **A** | endothermic | heat absorbed |
| **B** | endothermic | heat released |
| **C** | exothermic | heat absorbed |
| **D** | exothermic | heat released |

**17** Dinitrogen tetroxide, $N_2O_4$, breaks down into nitrogen dioxide, $NO_2$.

$$N_2O_4(g) \rightleftharpoons 2NO_2(g)$$

The reaction is reversible and endothermic.

Which conditions will give the largest yield of nitrogen dioxide, $NO_2$?

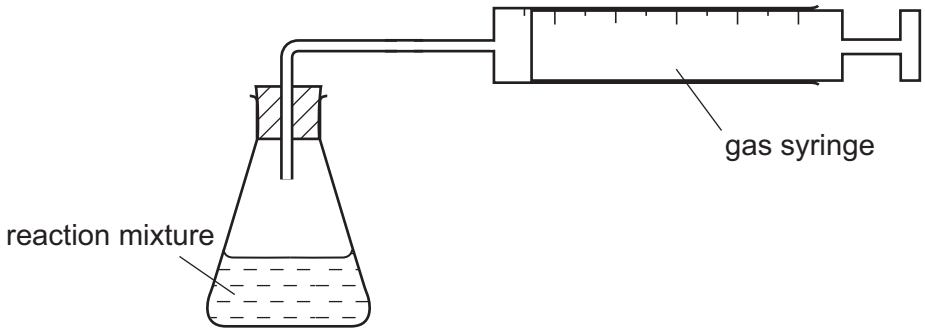
| | temperature | pressure |
|---|---|---|
| **A** | high | high |
| **B** | high | low |
| **C** | low | high |
| **D** | low | low |





**[Turn over**

**18** The apparatus shown can be used to measure the rate of some chemical reactions.




For which two reactions would this apparatus be suitable?

reaction 1 $AgNO_3(aq) + HCl(aq) \rightarrow AgCl(s) + HNO_3(aq)$

reaction 2 $2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$

reaction 3 $MgO(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2O(l)$

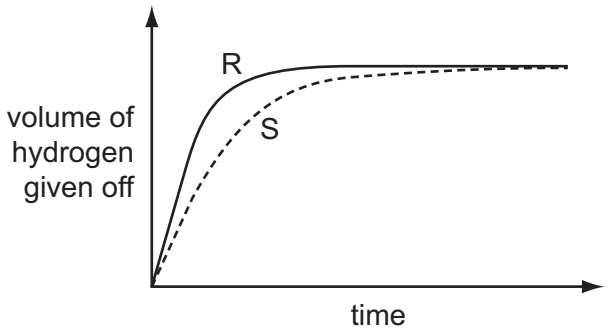
reaction 4 $ZnCO_3(s) + 2HCl(aq) \rightarrow ZnCl_2(aq) + CO_2(g) + H_2O(l)$

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

**19** A student investigates the rate of reaction between magnesium and excess sulfuric acid.

The volume of hydrogen given off in the reaction is measured over time.

The graph shows the results of two experiments, R and S.




Which change in conditions would cause the difference between R and S?

**A** A catalyst is added in S.

**B** The acid is more concentrated in R than in S.

**C** The magnesium is less finely powdered in R than in S.

**D** The temperature in R is lower than in S.

**20** Which of these reactions shows only reduction?

**A** $Cu^{2+} + 2e^- \rightarrow Cu$

**B** $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

**C** $HCl + NaOH \rightarrow NaCl + H_2O$

**D** $Mg + ZnSO_4 \rightarrow Zn + MgSO_4$

**21** The red colour in some pottery glazes may be formed as a result of the reactions shown.

$$CuCO_3 \xrightarrow{\text{heat}} CuO + CO_2$$

$$CuO + SnO \longrightarrow Cu + SnO_2$$

These equations show that .....1..... is oxidised and .....2..... is reduced.

Which substances correctly complete gaps 1 and 2 in the above sentence?

| | 1 | 2 |
|---|---|---|
| **A** | $CO_2$ | $SnO_2$ |
| **B** | $CuCO_3$ | CuO |
| **C** | CuO | SnO |
| **D** | SnO | CuO |

**22** Acids are compounds which donate protons (hydrogen ions).

$$NH_3(aq) + H_2O(l) \rightarrow NH_4^+(aq) + OH^-(aq)$$

Which compound in this equation is behaving as an acid?

**A** ammonia

**B** ammonium hydroxide

**C** none of them

**D** water





**[Turn over**

**23** The reactions of four different oxides W, X, Y and Z are shown.

W reacts with hydrochloric acid but not sodium hydroxide.

X reacts with both hydrochloric acid and sodium hydroxide.

Y does not react with either hydrochloric acid or sodium hydroxide.

Z reacts with sodium hydroxide but not hydrochloric acid.

Which row shows the correct types of oxide?

| | acidic | basic | amphoteric | neutral |
|---|---|---|---|---|
| **A** | W | Z | X | Y |
| **B** | X | Y | W | Z |
| **C** | Z | X | Y | W |
| **D** | Z | W | X | Y |

**24** A solution contains barium ions and silver ions and one type of anion.

What could the anion be?

**A** chloride only

**B** nitrate only

**C** sulfate only

**D** chloride or nitrate or sulfate

**25** A mixture containing two anions was tested and the results are shown below.

| test | result |
|---|---|
| dilute nitric acid added | effervescence of a gas which turned limewater milky |
| dilute nitric acid added, followed by aqueous silver nitrate | yellow precipitate formed |

Which anions were present?

**A** carbonate and chloride

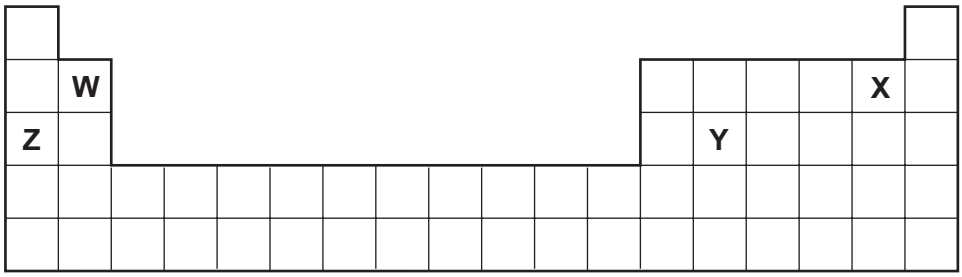
**B** carbonate and iodide

**C** sulfate and chloride

**D** sulfate and iodide

**26** Part of the Periodic Table is shown.

The letters are not the chemical symbols of the elements.




Which statement about the elements is **not** correct.

**A** W has two electrons in the outermost shell.

**B** Y is in Group IV of the Periodic Table.

**C** X and Y bond covalently to form a molecule $XY_4$.

**D** Z has more metallic character than Y.

**27** Astatine is an element in Group VII of the Periodic Table. It has only ever been produced in very small amounts.

What are the likely properties of astatine?

| | colour | state | reaction with aqueous potassium iodide |
|---|---|---|---|
| **A** | black | solid | no reaction |
| **B** | dark brown | gas | brown colour |
| **C** | green | solid | no reaction |
| **D** | yellow | liquid | brown colour |





**[Turn over**

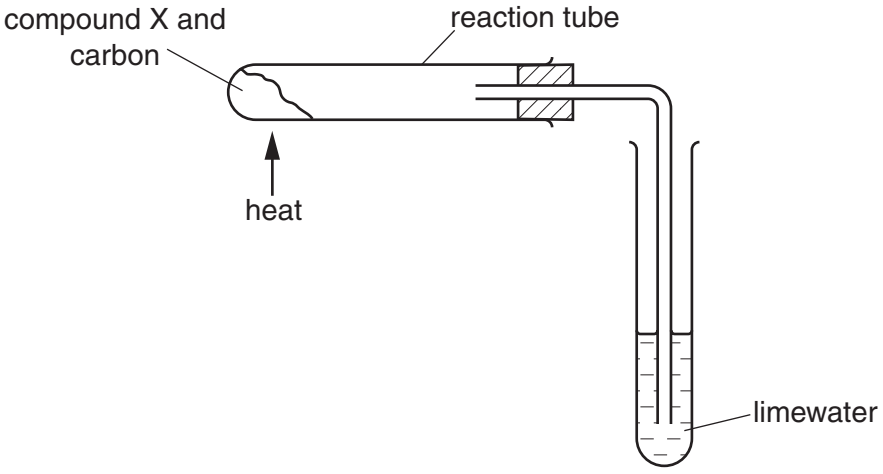
**28** The table shows the results of adding three metals, P, Q and R, to dilute hydrochloric acid and to water.

| metal | dilute hydrochloric acid | water |
|---|---|---|
| P | hydrogen produced | hydrogen produced |
| Q | no reaction | no reaction |
| R | hydrogen produced | no reaction |

What is the order of reactivity of the metals?

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

**29** Compound X is heated with carbon using the apparatus shown.




A brown solid is formed in the reaction tube and the limewater turns cloudy.

What is compound X?

**A** calcium oxide

**B** copper(II) oxide

**C** magnesium oxide

**D** sodium oxide

**30** Zinc is extracted from zinc blende. Zinc blende is an ore of zinc and consists mainly of zinc sulfide.

One of the steps in the process involves zinc sulfide reacting with oxygen from the air.

What is the equation for this reaction?

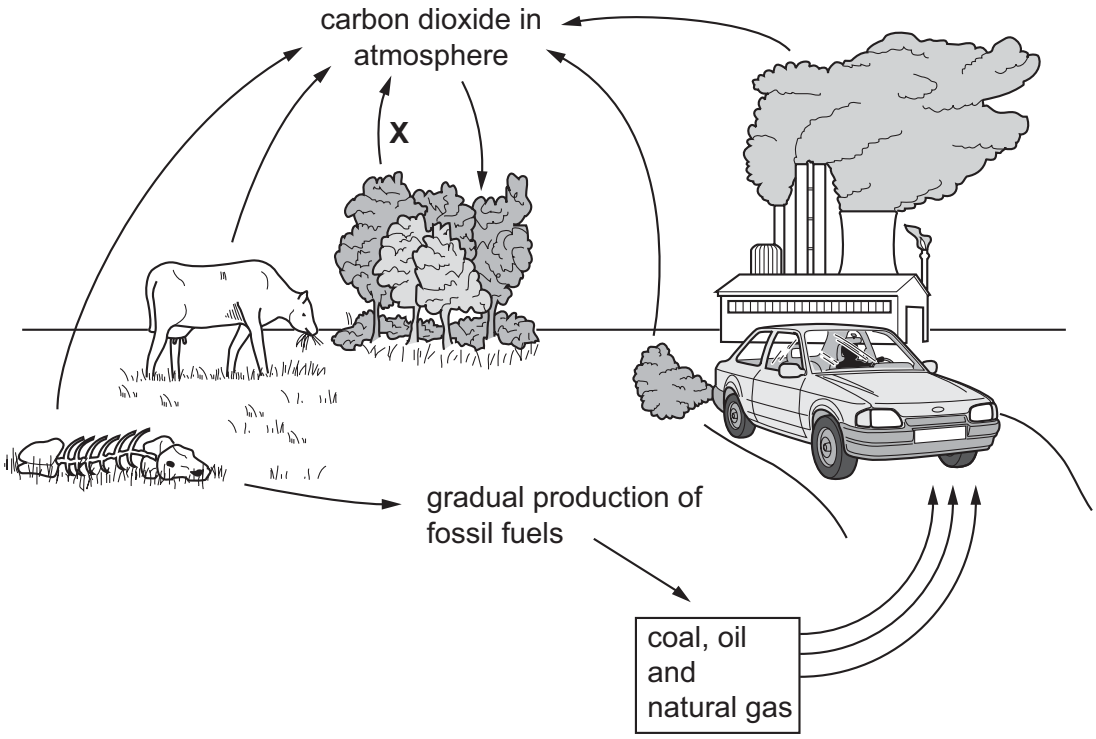
**A** $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$

**B** $2ZnS + O_2 \rightarrow 2Zn + SO_2$

**C** $2ZnS + O_2 \rightarrow 2ZnO + S$

**D** $ZnS + 2O_2 \rightarrow ZnSO_4$

**31** The diagram shows the carbon cycle.




Which process is shown by the arrow marked X?

**A** combustion

**B** photosynthesis

**C** respiration

**D** transpiration

**32** A catalytic converter removes harmful gases from motor car exhausts.

Which reaction does **not** take place in a catalytic converter?

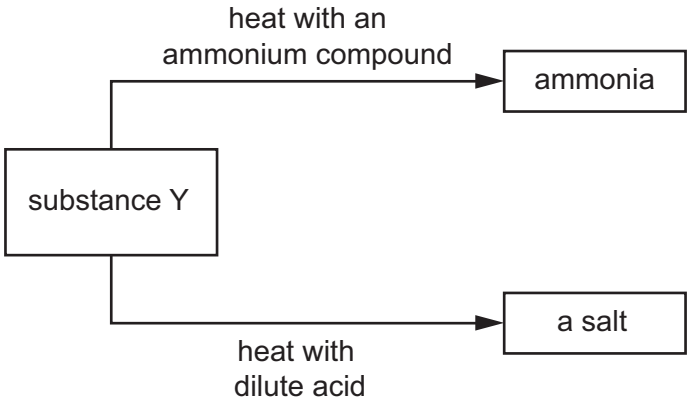
**A** $2CO + O_2 \rightarrow 2CO_2$

**B** $N_2 + 2CO_2 \rightarrow 2NO + 2CO$

**C** $2NO_2 \rightarrow N_2 + 2O_2$

**D** $2NO_2 + 4CO \rightarrow N_2 + 4CO_2$

**33** The diagram shows some reactions of substance Y.




Which type of substance is Y?

**A** an alcohol

**B** a base

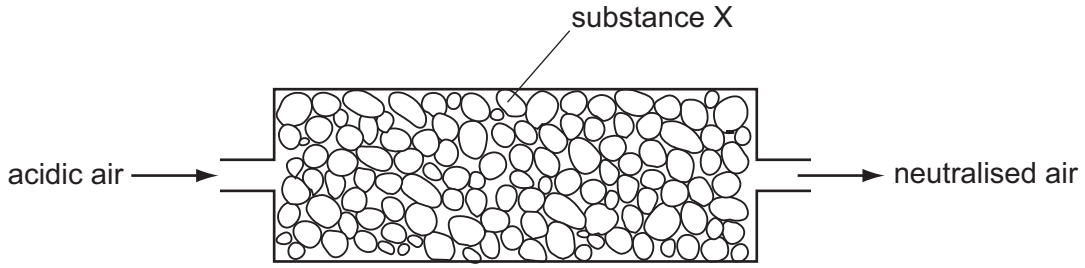
**C** a catalyst

**D** a metal

**34** Which row shows the conditions for the manufacture of sulfuric acid?

| | pressure / atm | temperature / °C | catalyst |
|---|---|---|---|
| **A** | 2 | 450 | vanadium(V) oxide |
| **B** | 2 | 250 | iron |
| **C** | 200 | 450 | iron |
| **D** | 200 | 250 | vanadium(V) oxide |

**35** Air containing an acidic impurity was neutralised by passing it through a column containing substance X.




What is substance X?

**A** calcium oxide

**B** sand

**C** sodium chloride

**D** concentrated sulfuric acid

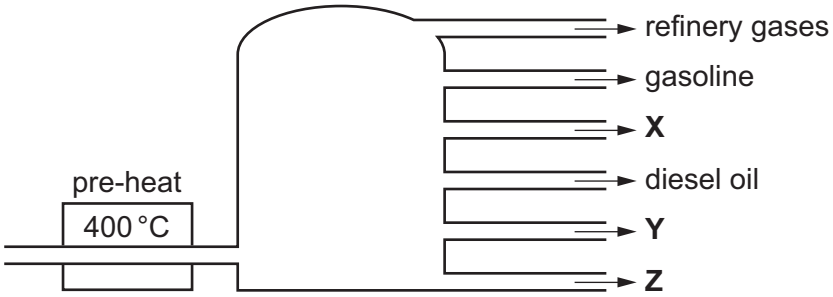




**[Turn over**

**36** In an oil refinery, petroleum is separated into useful fractions.

The diagram shows some of these fractions.




What are fractions X, Y and Z?

| | X | Y | Z |
|---|---|---|---|
| **A** | fuel oil | bitumen | paraffin (kerosene) |
| **B** | fuel oil | paraffin (kerosene) | bitumen |
| **C** | paraffin (kerosene) | bitumen | fuel oil |
| **D** | paraffin (kerosene) | fuel oil | bitumen |

**37** Which reaction does **not** take place in the dark?

**A** $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

**B** $CH_4 + Cl_2 \rightarrow CH_3Cl + HCl$

**C** $C_2H_4 + H_2O \rightarrow C_2H_5OH$

**D** $C_2H_4 + H_2 \rightarrow C_2H_6$

**38** Ethane and ethene are both hydrocarbons.

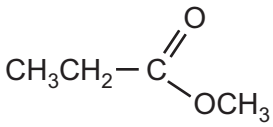
Ethane reacts with chlorine and ethene reacts with bromine.

Which row describes the type of reaction that ethane and ethene undergo?

| | ethane | ethene |
|---|---|---|
| **A** | addition | addition |
| **B** | addition | substitution |
| **C** | substitution | substitution |
| **D** | substitution | addition |

**39** Esters are made by reacting an alcohol with a carboxylic acid.

Which acid and alcohol react together to form the following ester?



**A** propanoic acid and ethanol

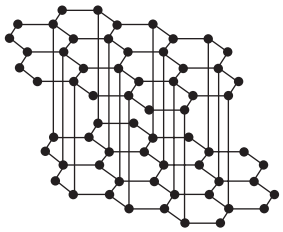
**B** propanoic acid and methanol

**C** ethanoic acid and ethanol

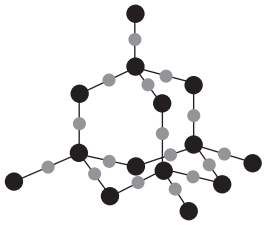
**D** ethanoic acid and methanol

**40** Which structure represents a polymer?

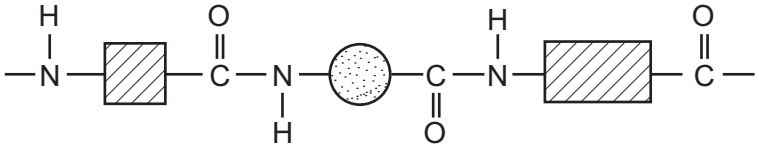
**A**



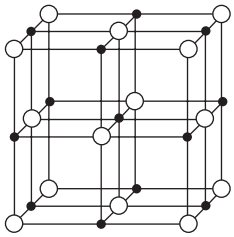
**B**



**C**



**D**



| Group | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| I | II | | | | | | | | | | III | IV | V | VI | VII | VIII |
| | | | | | | | | | | | | | | | | 2 He helium 4 |
| | | | | | | 1 H hydrogen 1 | | | | | 5 B boron 11 | 6 C carbon 12 | 7 N nitrogen 14 | 8 O oxygen 16 | 9 F fluorine 19 | 10 Ne neon 20 |
| 3 Li lithium 7 | 4 Be beryllium 9 | | | | | | | | | | 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 |
| 11 Na sodium 23 | 12 Mg magnesium 24 | | | | | | | | | | 31 Ga gallium 70 | 32 Ge germanium 73 | 33 As arsenic 75 | 34 Se selenium 79 | 35 Br bromine 80 | 36 Kr krypton 84 |
| 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 | 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 |
| 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 | |
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**Key**

atomic number
**atomic symbol**
name
relative atomic mass

The volume of one mole of any gas is 24 $dm^3$ at room temperature and pressure (r.t.p.)