



Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CHEMISTRY

0620/23

Paper 2 Multiple Choice (Extended)

October/November 2016

45 minutes

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

* 0 8 3 8 0 6 5 7 4 9 *

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 **16** printed pages.

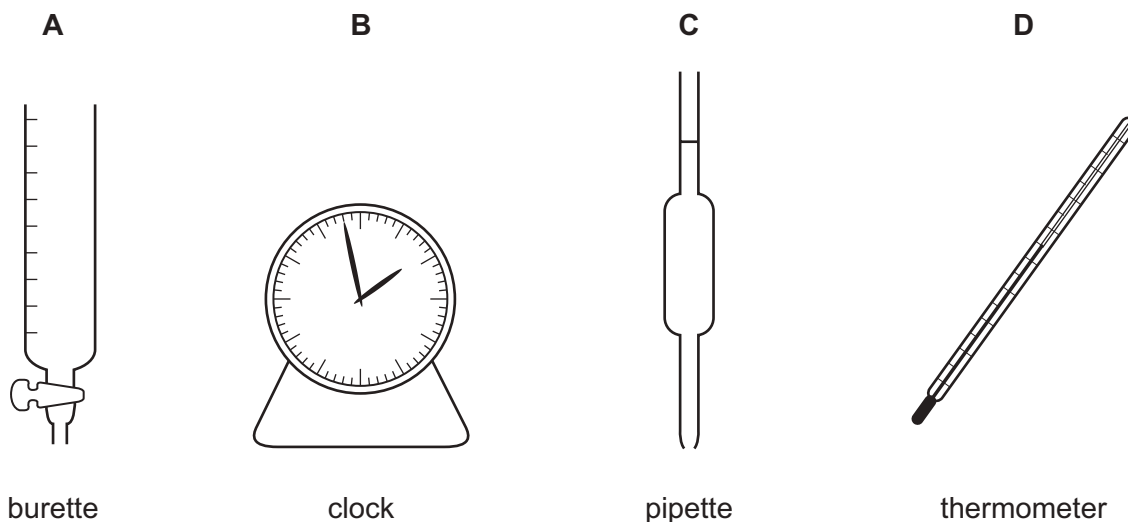
- 1 'Particles moving **very slowly** from an area of higher concentration to an area of lower concentration.'

Which process is being described?

- A a liquid being frozen
 - B a solid melting
 - C a substance diffusing through a liquid
 - D a substance diffusing through the air
- 2 A student mixes 25cm^3 samples of dilute hydrochloric acid with different volumes of aqueous sodium hydroxide.

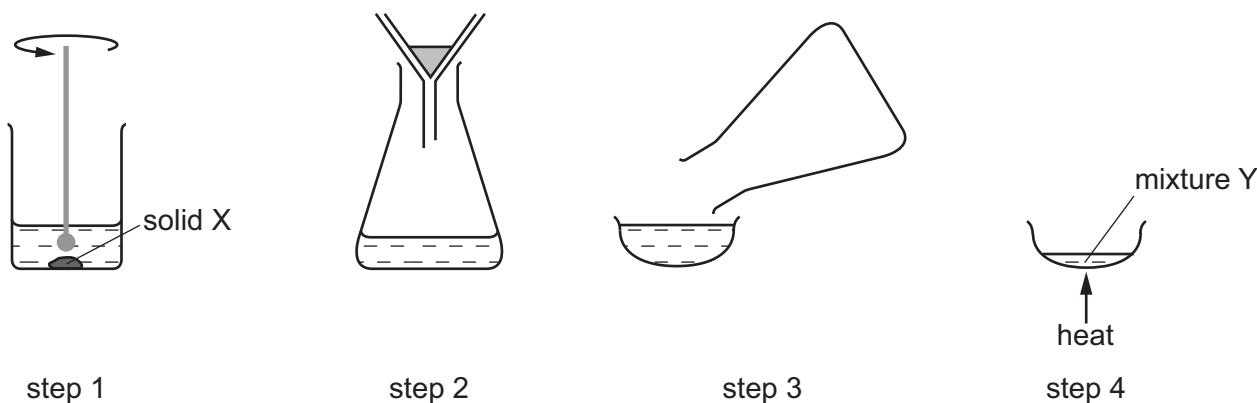
In each case, the student measures the change in temperature to test if the reaction is exothermic.

Which piece of apparatus is **not** needed?



3 A solid X is purified in five steps.

The first four steps of the purification are shown in the diagram.



step 1

step 2

step 3

step 4

In **step 5**, how is a pure sample of solid X obtained from mixture Y?

- A dissolving
- B distillation
- C evaporating
- D filtering

4 An atom has three electron shells. There are three electrons in the outer shell.

How many protons and how many neutrons are in this atom?

| | protons | neutrons |
|----------|---------|----------|
| A | 13 | 14 |
| B | 13 | 27 |
| C | 14 | 13 |
| D | 21 | 24 |

5 Ethanol is a liquid at room temperature and boils at 78 °C.

Sodium chloride is a solid at room temperature.

Which statement about the bonding in ethanol and sodium chloride is **not** correct?

- A Each ethanol molecule is held together by weak covalent bonds.
- B The ethanol molecules are held together by weak attractive forces.
- C The sodium ions and chloride ions are held together by strong attractive forces.
- D The sodium ions and chloride ions are held together in a giant lattice.

- 6 The molecules N_2 , C_2H_4 , CO_2 and CH_3OH all have covalent bonds.

These bonds consist of shared pairs of electrons.

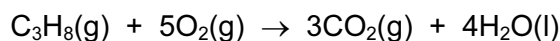
Which row gives the total number of shared pairs of electrons in the molecules shown?

| | molecule | total number of shared pairs of electrons |
|----------|------------------------|---|
| A | N_2 | 2 |
| B | C_2H_4 | 6 |
| C | CO_2 | 2 |
| D | CH_3OH | 4 |

- 7 Metals are malleable.

Which statement explains why metals are malleable?

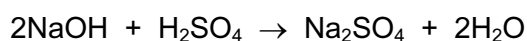
- A** Metallic bonding is very strong.
B Metals are good conductors of electricity.
C Positive metal ions are arranged in a regular lattice structure.
D The layers of positive metal ions can slide over each other.
- 8 The equation shows the complete combustion of propane.



Which statement is correct?

- A** 10 cm^3 of propane cannot burn if less than 50 cm^3 of oxygen is present.
B 10 cm^3 of propane would produce 40 cm^3 of liquid water.
C 100 cm^3 of oxygen would be sufficient to react completely with 20 cm^3 of propane.
D This reaction would result in an increase in the volume of gas.
- 9 Sodium hydroxide reacts with sulfuric acid.

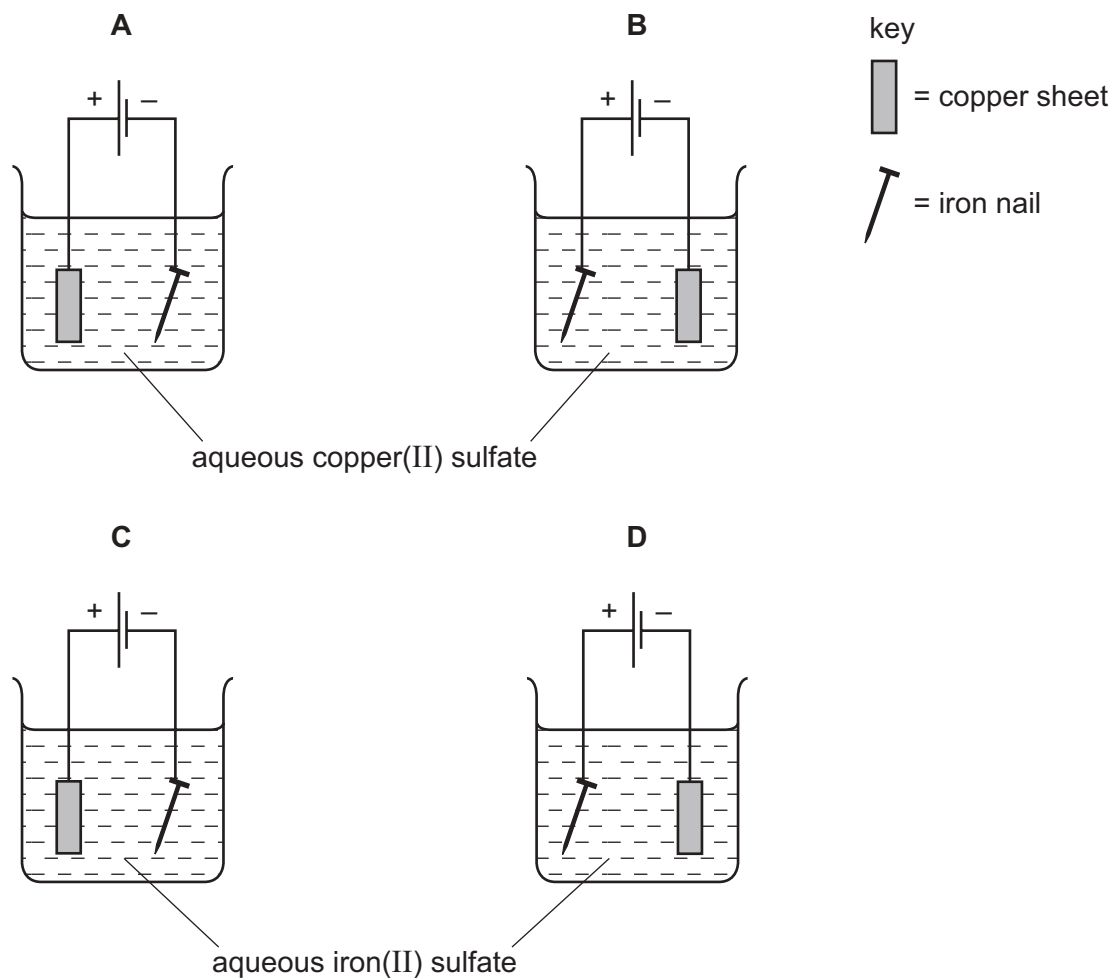
The equation for the reaction is shown.



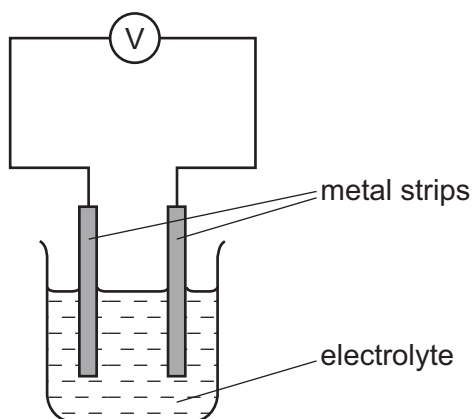
Which volume of 0.4 mol/dm^3 sodium hydroxide reacts with 50.0 cm^3 of 0.1 mol/dm^3 sulfuric acid?

- A** 12.5 cm^3 **B** 25.0 cm^3 **C** 50.0 cm^3 **D** 100.0 cm^3

10 Which apparatus could be used to electroplate an iron nail with copper?



11 The diagram shows two different metal strips dipped into an electrolyte.



Which pair of metals produces the highest voltage?

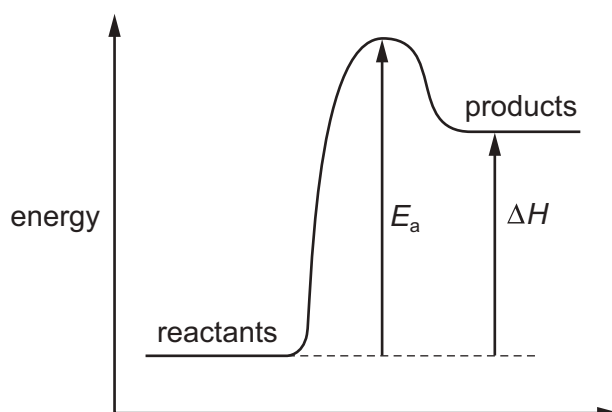
- A copper and iron
- B copper and magnesium
- C copper and zinc
- D magnesium and iron

- 12 10g of ammonium nitrate are added to water at 25°C and the mixture stirred. The ammonium nitrate dissolves and, after one minute, the temperature of the solution is 10°C.

Which word describes this change?

- A endothermic
- B exothermic
- C neutralisation
- D reduction

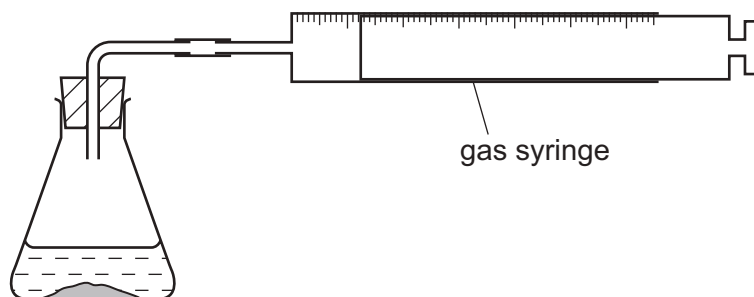
- 13 The energy level diagram for a reaction is shown.



Which row is correct?

| | sign of ΔH | overall energy change | sign of E_a |
|----------|--------------------|-----------------------|---------------|
| A | – | exothermic | – |
| B | + | endothermic | + |
| C | + | endothermic | – |
| D | + | exothermic | + |

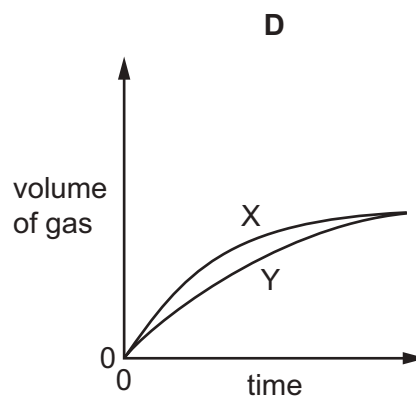
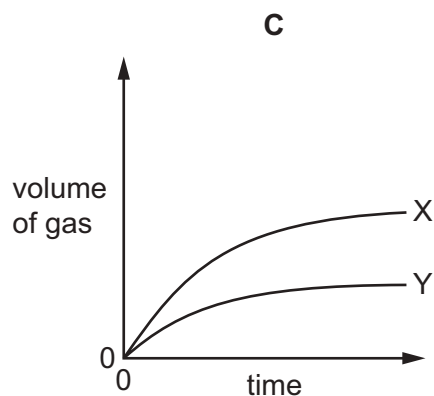
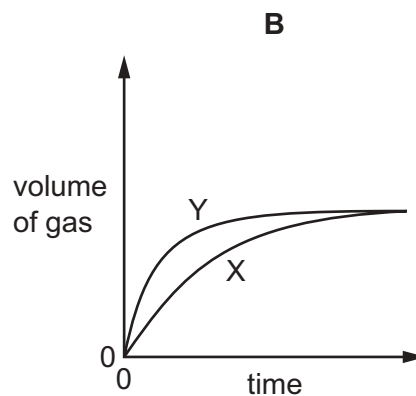
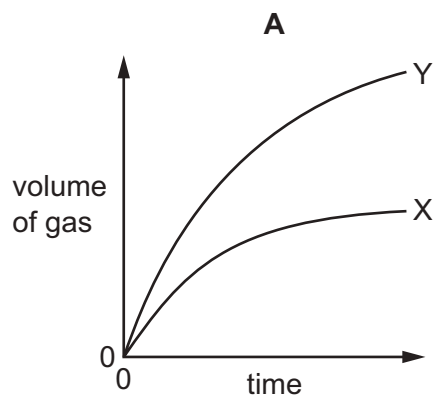
14 An experiment X is carried out between a solid and a solution using the apparatus shown.



The volume of gas given off is measured at different times and the results plotted on a graph.

In a second experiment Y, the surface area of the solid is increased but all other factors remain the same.

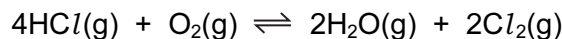
Which graph shows the results of experiments X and Y?



15 Which change in conditions increases the energy of the particles in a reaction?

- A addition of a catalyst
- B increase in concentration
- C increase in surface area
- D increase in temperature

- 16 Chlorine can be manufactured by the following reaction. The reaction is exothermic.



Which change increases the yield of chlorine at equilibrium?

- A adding more $\text{HCl}(\text{g})$
 - B adding more $\text{H}_2\text{O}(\text{g})$
 - C decreasing the pressure
 - D increasing the temperature
- 17 Which change represents an oxidation reaction?
- A chlorine changes to chlorate(I) ions
 - B chlorine changes to chloride ions
 - C copper(II) ions change to copper
 - D potassium manganate(VII) ions change to potassium manganate(VI) ions

- 18 Germanium oxide is a white powder.

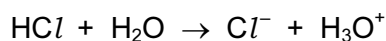
Germanium oxide reacts with concentrated hydrochloric acid.

Germanium oxide reacts with concentrated aqueous sodium hydroxide.

Germanium oxide does not dissolve when added to water.

Which type of oxide is germanium oxide?

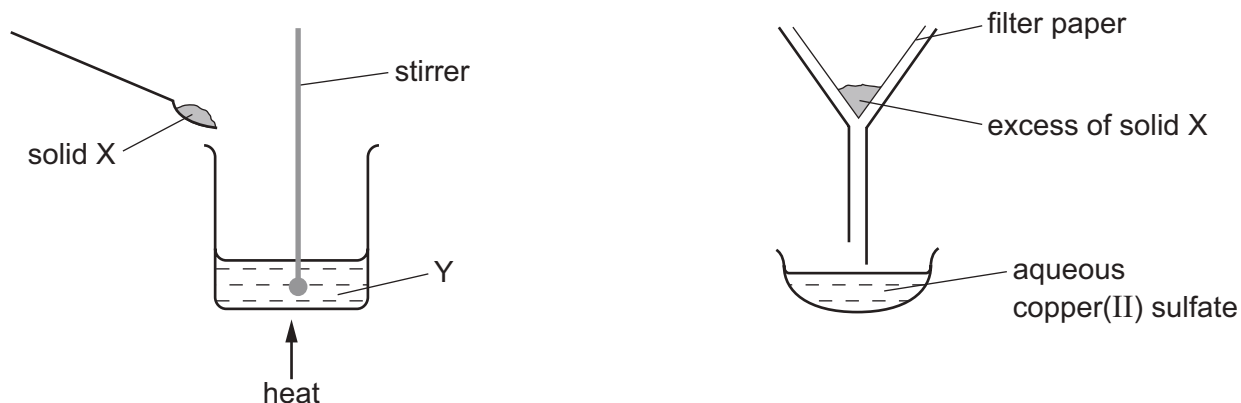
- A acidic
 - B amphoteric
 - C basic
 - D neutral
- 19 Hydrogen chloride gas reacts with water to produce an acidic solution. The equation for the reaction is shown.



Which statement describes what happens during the reaction?

- A The chloride ion is formed by accepting an electron from the water.
- B The hydrogen chloride loses an electron to form the chloride ion.
- C The water accepts a proton from the hydrogen chloride.
- D The water donates a proton to the hydrogen chloride.

20 The apparatus shown is used to prepare aqueous copper(II) sulfate.



What are X and Y?

| | X | Y |
|----------|---------------------|-----------------------------|
| A | copper | aqueous iron(II) sulfate |
| B | copper(II) chloride | sulfuric acid |
| C | copper(II) oxide | sulfuric acid |
| D | sulfur | aqueous copper(II) chloride |

21 Information about some silver compounds is shown in the table.

| compound | formula | solubility in water |
|------------------|--------------------------|---------------------|
| silver carbonate | Ag_2CO_3 | insoluble |
| silver chloride | AgCl | insoluble |
| silver nitrate | AgNO_3 | soluble |
| silver oxide | Ag_2O | insoluble |

Which equation shows a reaction which **cannot** be used to make a silver salt?

- A** $\text{AgNO}_3(\text{aq}) + \text{HCl}(\text{aq}) \rightarrow \text{AgCl}(\text{s}) + \text{HNO}_3(\text{aq})$
- B** $\text{Ag}_2\text{O}(\text{s}) + 2\text{HNO}_3(\text{aq}) \rightarrow 2\text{AgNO}_3(\text{aq}) + \text{H}_2\text{O}(\text{l})$
- C** $\text{Ag}_2\text{CO}_3(\text{s}) + 2\text{HNO}_3(\text{aq}) \rightarrow 2\text{AgNO}_3(\text{aq}) + \text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g})$
- D** $2\text{Ag}(\text{s}) + 2\text{HCl}(\text{aq}) \rightarrow 2\text{AgCl}(\text{s}) + \text{H}_2(\text{g})$

25 Basic oxides and oxygen are used to convert iron into steel.

Which statement is **not** correct?

- A Carbon is converted into carbon dioxide.
- B Silicon is converted into silicon(IV) oxide.
- C The basic oxides react with acidic impurities to form slag.
- D The oxygen reacts with the iron to produce hematite.

26 The results of two experiments are given.

- 1 Cobalt displaces manganese from an aqueous solution of a manganese salt.
- 2 Manganese displaces silver from an aqueous solution of a silver salt.

Three more experiments are carried out.

- 3 Cobalt is added to an aqueous solution of a silver salt.
- 4 Manganese is added to an aqueous solution of a cobalt salt.
- 5 Silver is added to an aqueous solution of a cobalt salt.

In which experiments does a reaction take place?

- A 3 only B 3 and 4 C 4 and 5 D 5 only

27 Cryolite, Na_3AlF_6 , is added to aluminium oxide in the electrolytic extraction of aluminium.

What is the reason for this?

- A to decrease the melting point of the electrolyte
- B to protect the anodes
- C to produce more aluminium
- D to stop the aluminium reacting with air

28 Different forms of steel contain different proportions of carbon.

Steel P contains a high proportion of carbon.

Steel Q contains a low proportion of carbon.

Which statement is correct?

- A P is stronger and more brittle than Q.
- B P is stronger and less brittle than Q.
- C P is less strong and more brittle than Q.
- D P is less strong and less brittle than Q.

29 Air is a mixture of gases.

Which gas is present in the largest amount?

- A argon
- B carbon dioxide
- C nitrogen
- D oxygen

30 Which information about carbon dioxide and methane is correct?

| | | carbon dioxide | methane |
|----------|-----------------------------------|----------------|---------|
| A | formed when vegetation decomposes | ✓ | ✗ |
| B | greenhouse gas | ✓ | ✓ |
| C | present in unpolluted air | ✗ | ✗ |
| D | produced during respiration | ✗ | ✓ |

key
 ✓ = true
 ✗ = false

31 A metal, X, is used to make oil pipelines.

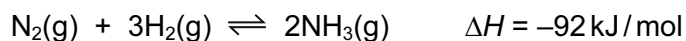
X corrodes in air and water.

X can be protected from corrosion by attaching blocks of element Y.

Which statement is correct?

- A This process is known as galvanising.
- B Y forms positive ions more readily than X.
- C Y is an unreactive metal.
- D Y is an unreactive non-metal.

32 The Haber process for the manufacture of ammonia occurs at 450 °C and 250 atmospheres. The nitrogen and hydrogen are supplied in a 1:3 ratio by volume. The reaction is exothermic.

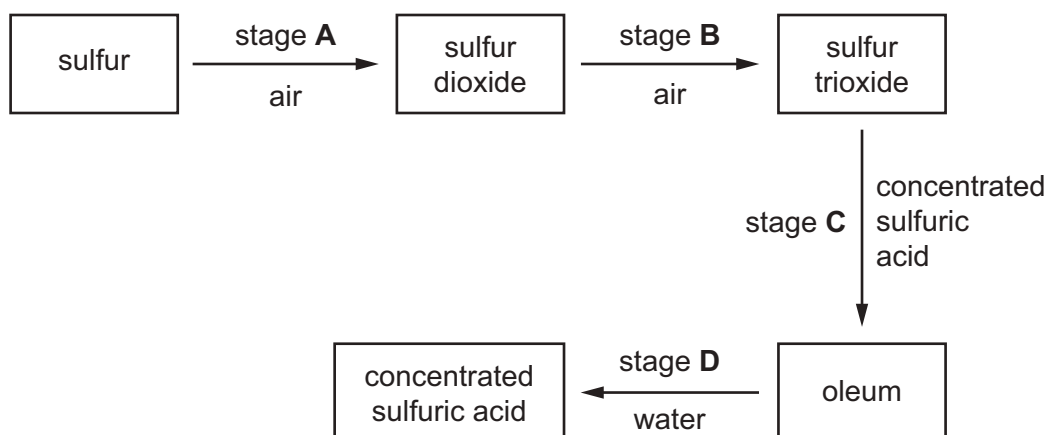


Which change causes an increase in the yield of ammonia?

- A decreasing the concentration of nitrogen
- B decreasing the pressure
- C decreasing the temperature
- D using equal amounts of the two reactants

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

In which stage is a catalyst used?



34 Slaked lime is used to neutralise an acidic soil.

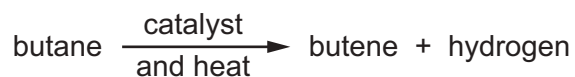
How does the pH of the soil change?

| | from | to |
|----------|------|----|
| A | 6 | 7 |
| B | 7 | 8 |
| C | 8 | 7 |
| D | 8 | 6 |

35 Which list shows the fractions obtained from distilling petroleum, in order of increasing boiling point?

- A** bitumen → diesel oil → fuel oil → lubricating oil
- B** diesel oil → gasoline → naphtha → kerosene
- C** gasoline → naphtha → kerosene → diesel oil
- D** kerosene → lubricating oil → naphtha → refinery gas

36 Butane reacts as shown.



What is this type of reaction?

- A combustion
- B cracking
- C polymerisation
- D reduction

37 Substance Z has the following characteristics.

- 1 It burns in an excess of oxygen to form carbon dioxide and water.
- 2 It is oxidised by air to form a liquid smelling of vinegar.
- 3 It reacts with carboxylic acids to form esters.

What is substance Z?

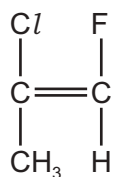
- A ethane
- B ethanoic acid
- C ethanol
- D ethyl ethanoate

38 Ethanol is manufactured by the catalytic addition of steam to ethene and by fermentation.

Which row shows an advantage and a disadvantage of using the catalytic addition of steam to ethene compared to fermentation?

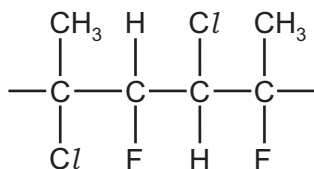
| | advantage | disadvantage |
|----------|--------------------------|------------------------------|
| A | fast | the product is impure |
| B | fast | uses non-renewable materials |
| C | the product is pure | slow |
| D | uses renewable materials | slow |

39 The organic compound shown can be polymerised.

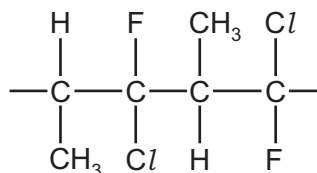


Which diagram represents a section of the polymer?

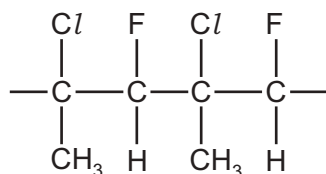
A



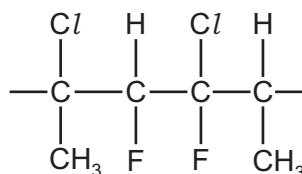
B



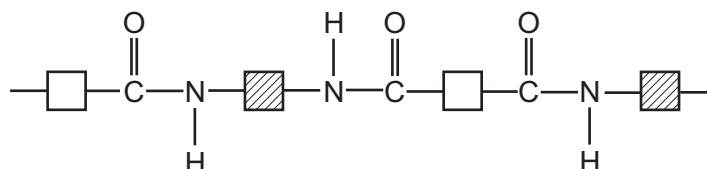
C



D



40 The partial structure of a polymer is shown.



Which type of polymer is represented?

- A** a carbohydrate
- B** a polyamide
- C** a polyester
- D** an addition polymer

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The Periodic Table of Elements

| Group | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-----------------------------------|------------------------------------|--|--|------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|---------------------------------------|--------------------------------------|--------------------------------------|-----------------------------------|------------------------------------|------------------------------------|--------------------------------------|-------------------------------------|------------------------------------|-----------------------------------|----------------------------------|----------------------------------|------------------------------------|------------------------------------|-----------------------------------|-----------------------------------|----------------------------------|-----------------------------------|------------------------------------|--------------------------------|-----------------------------------|------------------------------------|--------------------------------|-----------------------------------|----------------------------------|----------------------------------|-------------------------------|
| I | II | III | | | | | | | | | | IV | V | VI | VII | VIII | | | | | | | | | | | | | | | | | | | |
| 3 Li lithium 7 | 4 Be beryllium 9 | <div style="border: 1px solid black; padding: 5px; text-align: center;"> Key atomic number name atomic symbol relative atomic mass </div> | | | | | | | | | | 5 B boron 11 | 6 C carbon 12 | 7 N nitrogen 14 | 8 O oxygen 16 | 9 F fluorine 19 | 10 Ne neon 20 | | | | | | | | | | | | | | | | | | |
| 11 Na sodium 23 | 12 Mg magnesium 24 | 13 Al aluminium 27 | 14 Si silicon 28 | 15 P phosphorus 31 | 16 S sulfur 32 | 17 Cl chlorine 35.5 | 18 Ar argon 40 | 19 K potassium 39 | 20 Ca calcium 40 | 21 Sc scandium 45 | 22 Ti titanium 48 | 23 V vanadium 51 | 24 Cr chromium 52 | 25 Mn manganese 55 | 26 Fe iron 56 | 27 Co cobalt 59 | 28 Ni nickel 59 | 29 Cu copper 64 | 30 Zn zinc 65 | 31 Ga gallium 70 | 32 Ge germanium 73 | 33 As arsenic 75 | 34 Se selenium 79 | 35 Br bromine 80 | 36 Kr krypton 84 | | | | | | | | | | |
| 37 Rb rubidium 85 | 38 Sr strontium 88 | 39 Y yttrium 89 | 40 Zr zirconium 91 | 41 Nb niobium 93 | 42 Mo molybdenum 96 | 43 Tc technetium — | 44 Ru ruthenium 101 | 45 Rh rhodium 103 | 46 Pd palladium 106 | 47 Ag silver 108 | 48 Cd cadmium 112 | 49 In indium 115 | 50 Sn tin 119 | 51 Sb antimony 122 | 52 Te tellurium 128 | 53 I iodine 127 | 54 Xe xenon 131 | 55 Cs caesium 133 | 56 Ba barium 137 | 57–71 lanthanoids | 72 Hf hafnium 178 | 73 Ta tantalum 181 | 74 W tungsten 184 | 75 Re rhenium 186 | 76 Os osmium 190 | 77 Ir iridium 192 | 78 Pt platinum 195 | 79 Au gold 197 | 80 Hg mercury 201 | 81 Tl thallium 204 | 82 Pb lead 207 | 83 Bi bismuth 209 | 84 Po polonium — | 85 At astatine — | 86 Rn radon — |
| 87 Fr francium — | 88 Ra radium — | 89–103 actinoids | 104 Rf rutherfordium — | 105 Db dubnium — | 106 Sg seaborgium — | 107 Bh bohrium — | 108 Hs hassium — | 109 Mt meitnerium — | 110 Ds darmstadtium — | 111 Rg roentgenium — | 112 Cn copernicium — | 113 Nh nihonium — | 114 Fl flerovium — | 115 Mc moscovium — | 116 Lv livermorium — | 117 Ts tennessine — | 118 Og oganesson — | | | | | | | | | | | | | | | | | | |

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

lanthanoids

actinoids

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.)