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.

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CAMBRIDGE International Examinations

[Turn over

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

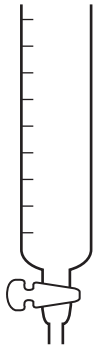
D a substance diffusing through the air

2 A student mixes 25 cm^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.

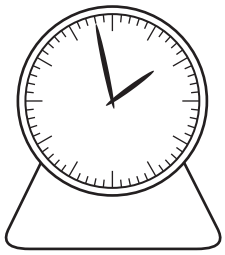
Which piece of apparatus is **not** needed?

A



burette

B



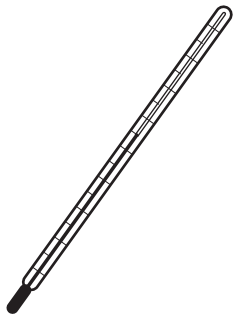
clock

C



pipette

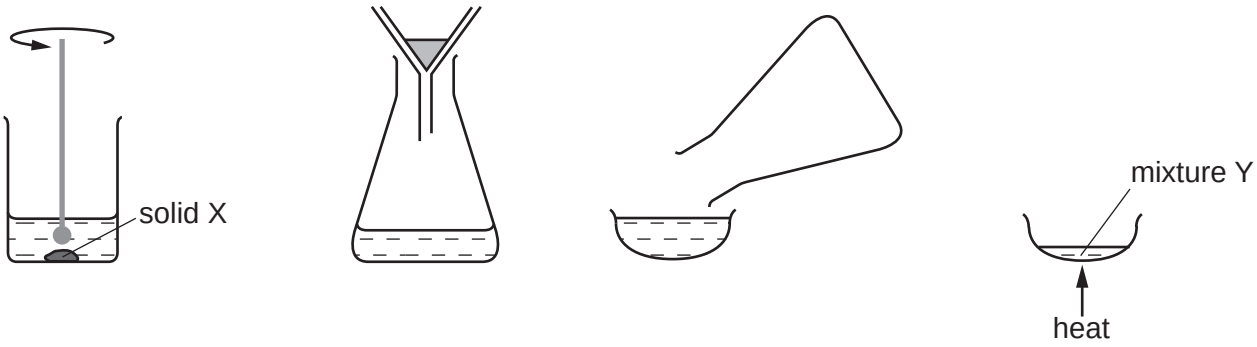
D



thermometer

3 A solid X is purified in five steps.

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



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.

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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.

$$C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(l)$$

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.

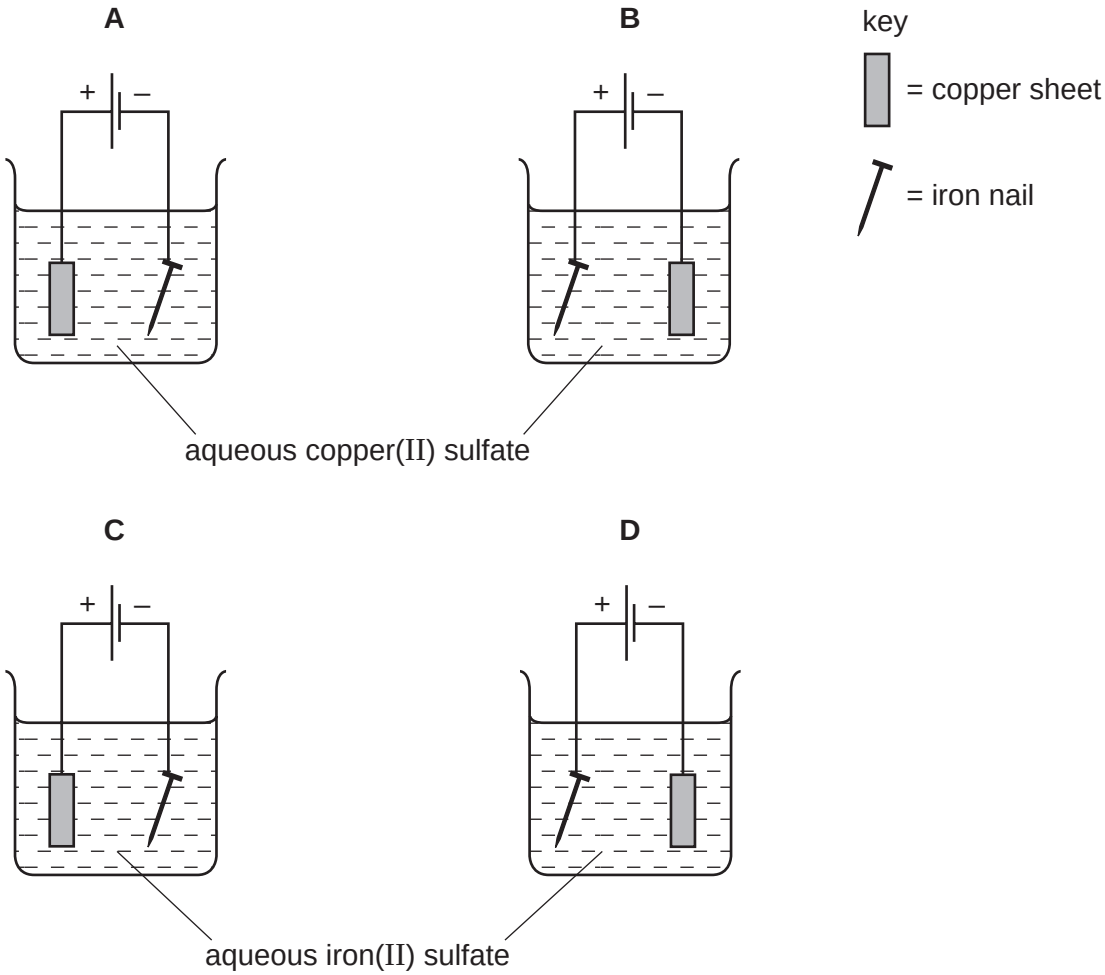
$$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$$

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

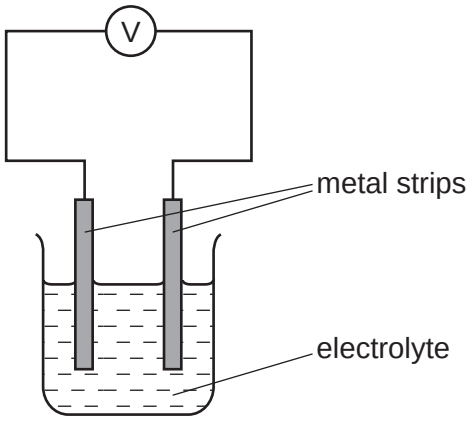
A $12.5\,cm^3$ **B** $25.0\,cm^3$ **C** $50.0\,cm^3$ **D** $100.0\,cm^3$

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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

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[Turn over

12 10 g 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?

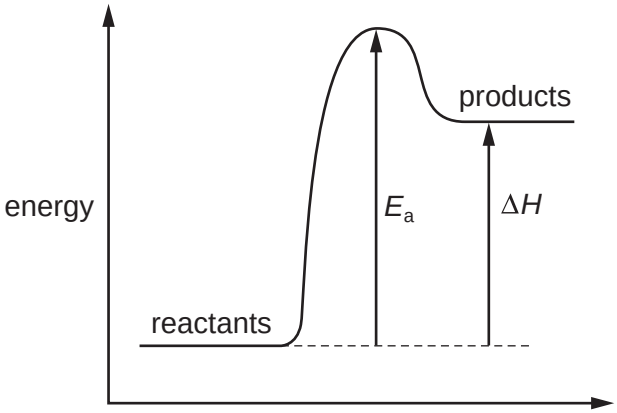
A endothermic

B exothermic

C neutralisation

D reduction

13 The energy level diagram for a reaction is shown.

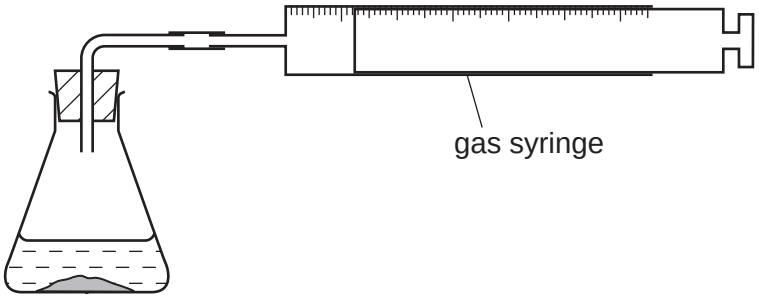


Which row is correct?

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

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

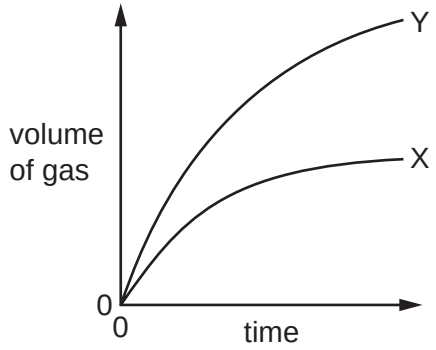


The volume of gas given off is measured at different times and the results plotted on a graph.

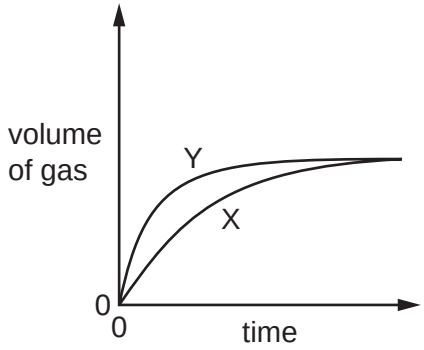
In a second experiment Y, the surface area of the solid is increased but all other factors remain the same.

Which graph shows the results of experiments X and Y?

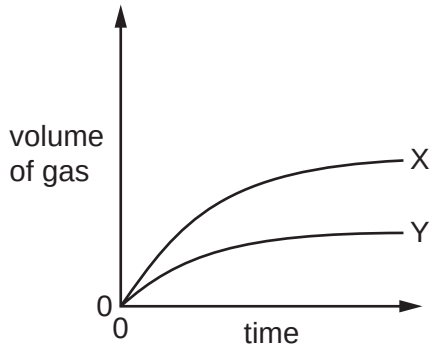
A



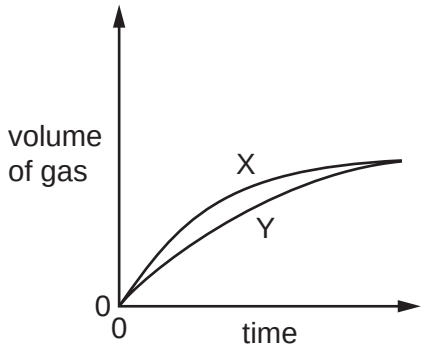
B



C



D



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

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[Turn over

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

$$4HCl(g) + O_2(g) \rightleftharpoons 2H_2O(g) + 2Cl_2(g)$$

Which change increases the yield of chlorine at equilibrium?

A adding more $HCl(g)$

B adding more $H_2O(g)$

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.

$$HCl + H_2O \rightarrow Cl^- + H_3O^+$$

Which statement describes what happens during the reaction?

A The chloride ion is formed by accepting an electron from the water.

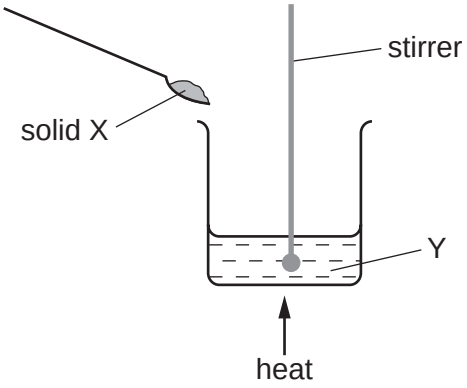
B The hydrogen chloride loses an electron to form the chloride ion.

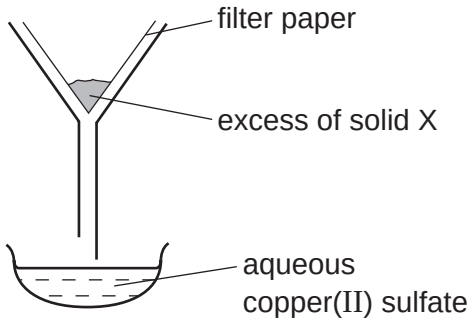
C The water accepts a proton from the hydrogen chloride.

D The water donates a proton to the hydrogen chloride.

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

B $Ag_2O(s) + 2HNO_3(aq) \rightarrow 2AgNO_3(aq) + H_2O(l)$

C $Ag_2CO_3(s) + 2HNO_3(aq) \rightarrow 2AgNO_3(aq) + H_2O(l) + CO_2(g)$

D $2Ag(s) + 2HCl(aq) \rightarrow 2AgCl(s) + H_2(g)$

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22 What is **not** a property of Group I metals?

A They are soft and can be cut with a knife.

B They react when exposed to oxygen in the air.

C They produce an acidic solution when they react with water.

D They react rapidly with water producing hydrogen gas.

23 Compound T is added to dilute hydrochloric acid and warmed gently.

The mixture gives off a gas which turns acidified aqueous potassium manganate(VII) from purple to colourless.

A flame test on compound T gives a lilac flame.

What is compound T?

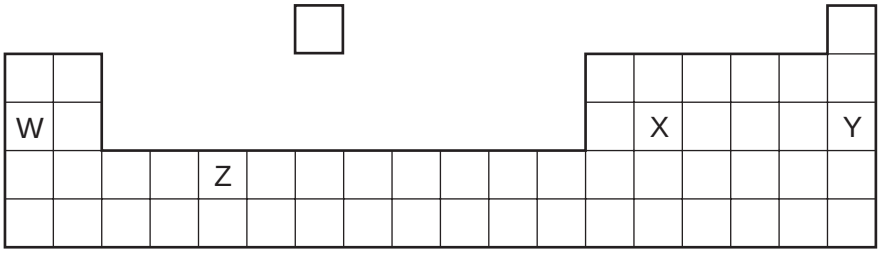
A sodium sulfate

B sodium sulfite

C potassium sulfate

D potassium sulfite

24 Part of the Periodic Table is shown.



Which row correctly describes the properties of elements W, X, Y and Z?

	has variable oxidation states	reacts with cold water	very unreactive	has four outer shell electrons
A	W	Y	Z	X
B	X	W	Y	Z
C	Z	W	Y	X
D	Z	Y	X	W

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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.

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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.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) \qquad \Delta H = -92\,kJ/mol$$

Which change causes an increase in the yield of ammonia?

A decreasing the concentration of nitrogen

B decreasing the pressure

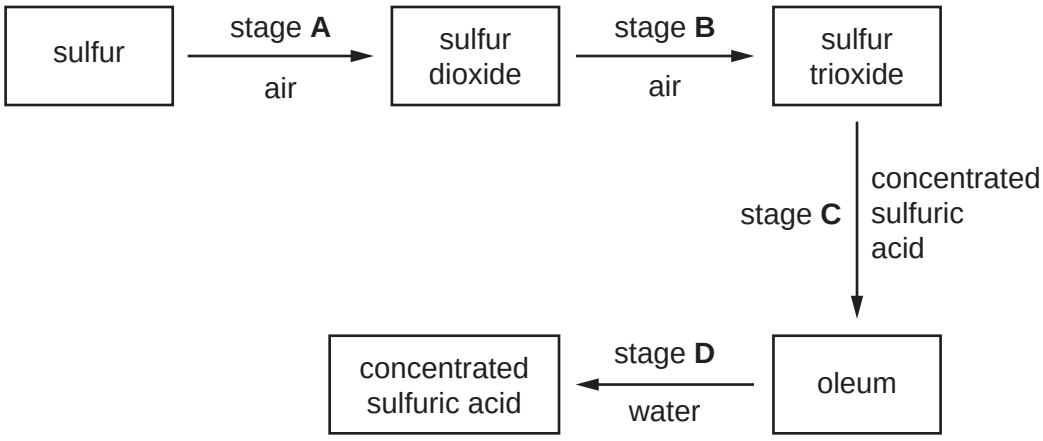
C decreasing the temperature

D using equal amounts of the two reactants

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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

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[Turn over

36 Butane reacts as shown.

$$\text{butane} \xrightarrow[\text{and heat}]{\text{catalyst}} \text{butene} + \text{hydrogen}$$

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

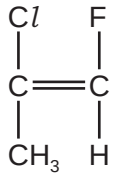
38 Ethanol is manufactured by the catalytic addition of steam to ethene and by fermentation.

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

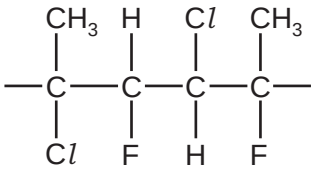
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39 The organic compound shown can be polymerised.

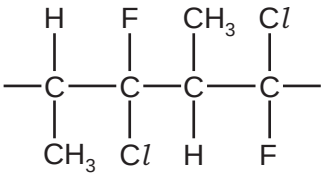


Which diagram represents a section of the polymer?

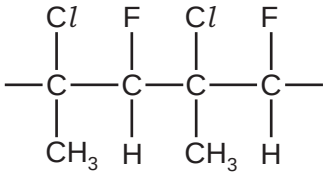
A



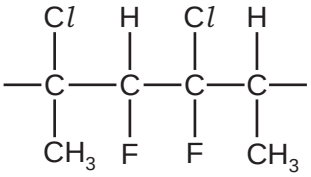
B



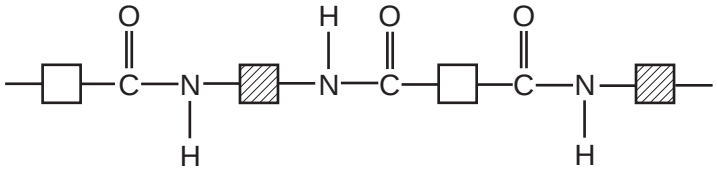
C



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
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9											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 –		114 Fl flerovium –		116 Lv livermorium –		

Key

atomic number
atomic symbol
name
relative atomic mass

lanthanoids	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
actinoids	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 –

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