UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CHEMISTRY **5070/01**

Paper 1 Multiple Choice

October/November 2004

1 hour

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, highlighters, 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.

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.
You may use a calculator.

IB04 11_5070_01/2RP

UNIVERSITY of CAMBRIDGE
International Examinations

1 A pale green solution **X** gives a green precipitate with excess aqueous sodium hydroxide.

An alkaline gas is only given off when the mixture is warmed with powdered aluminium.

Which ions does **X** contain?

A ammonium and copper(II)

B ammonium and iron(III)

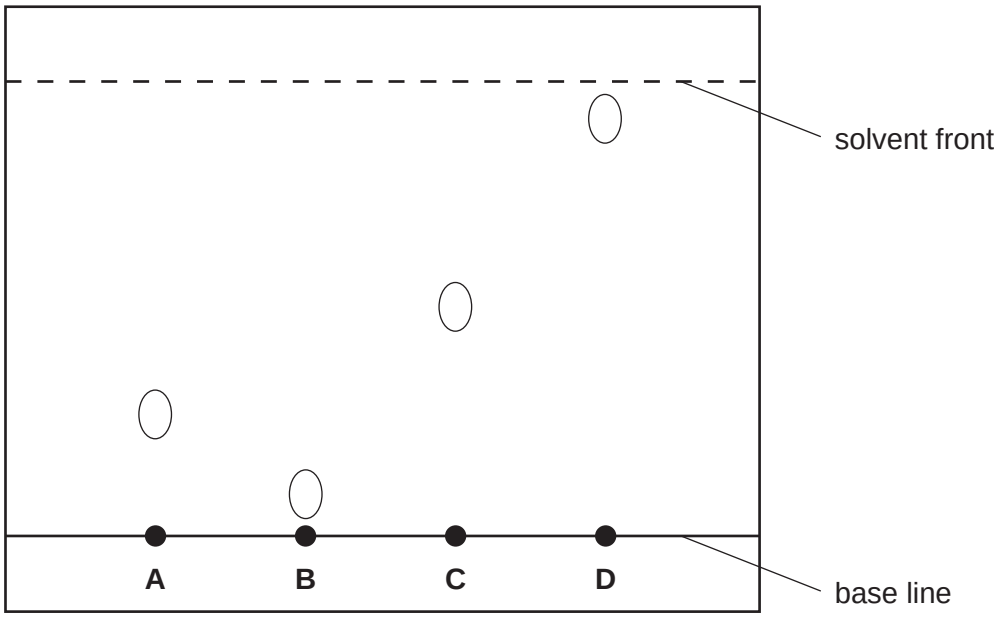
C copper(II) and nitrate

D iron(II) and nitrate

2 The diagram shows the chromatogram of four different sugars using the same solvent.

Glucose has an R_f value of 0.5.

Which sugar is glucose?



3 A liquid boils at a temperature of 100 °C.

Which other property of the liquid proves that it is pure water?

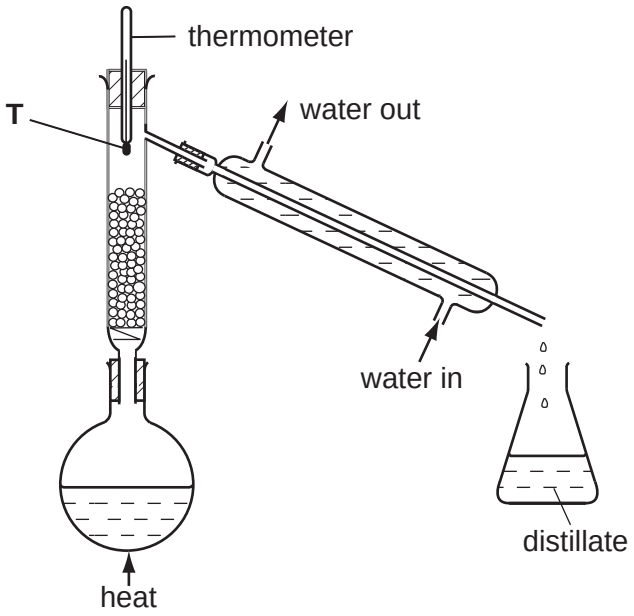
A It does not leave a residue when boiled.

B It freezes at 0 °C.

C It is neither acidic nor alkaline.

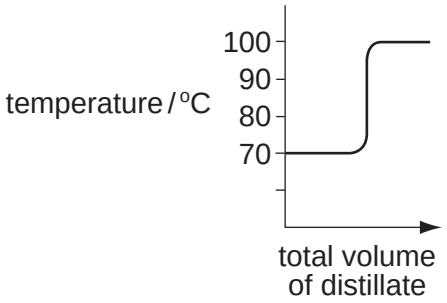
D It turns white anhydrous copper(II) sulphate blue.

4 The diagram shows apparatus used to separate hexane (boiling point, 70 °C) and heptane (boiling point, 98 °C).



Which graph would be obtained if the temperature at point **T** was plotted against the total volume of distillate collected?

A



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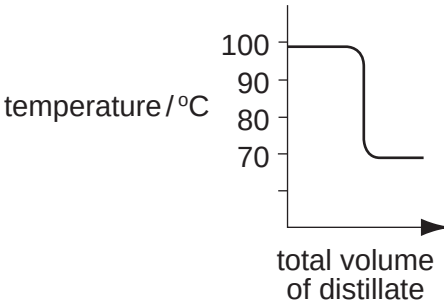

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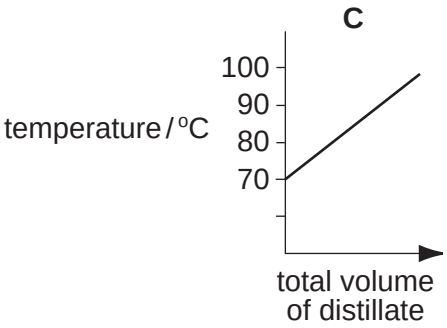
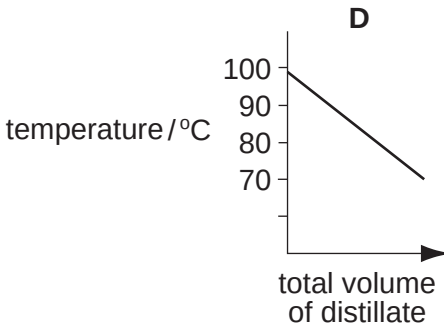
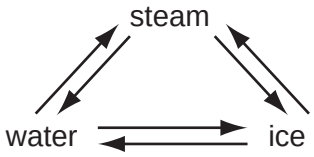


D



[Turn over

5 In which conversion do H_2O molecules lose speed?



A ice → water

B ice → steam

C steam → ice

D water → steam

6 Two particles **X** and **Y** have the composition shown in the table.

particle	number of electrons	number of neutrons	number of protons
X	10	8	8
Y	18	18	17

The particles **X** and **Y** are

A metal atoms.

B non-metal atoms.

C negative ions.

D positive ions.

7 What is the nucleon number of the isotope of uranium, $^{235}_{92}U$?

A 92 **B** 143 **C** 235 **D** 327

8 Which of the following is a compound?

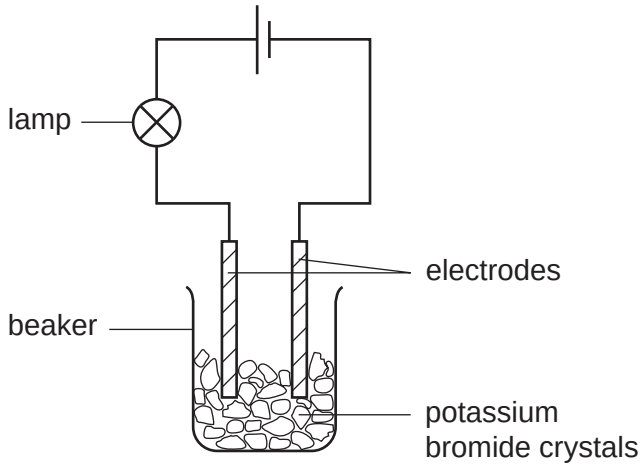
A air

B carbon

C oxygen

D steam

9 The experiment shown is used to test potassium bromide crystals.



The lamp does not light.

Distilled water is then added to the beaker and the lamp lights.

Which statement explains these results?

A Electrons are free to move in the solution when potassium bromide dissolves.

B Metal ions are free to move when potassium bromide melts.

C Metal ions are free to move when potassium reacts with water.

D Oppositely charged ions are free to move in the solution when potassium bromide dissolves.

10 Which compound has both ionic and covalent bonds?

A ammonium chloride

B carbon dioxide

C ethyl ethanoate

D sodium chloride

11 'Cracking' of hydrocarbons breaks them into smaller molecules.

Which example of 'cracking' would produce the largest volume of products from one mole of hydrocarbon? Assume that all measurements are made at the same temperature and pressure.

A $C_6H_{14}(g) \rightarrow 3C_2H_4(g) + H_2(g)$

B $C_8H_{18}(g) \rightarrow 2C_3H_8(g) + C_2H_2(g)$

C $C_{10}H_{22}(g) \rightarrow C_8H_{18}(g) + C_2H_4(g)$

D $C_{12}H_{26}(g) \rightarrow C_8H_{18}(g) + 2C_2H_4(g)$

[Turn over

12 When 20 cm^3 of a gaseous alkene burns in an excess of oxygen, 60 cm^3 of carbon dioxide are formed. Both volumes are measured at r.t.p.

What is the formula of the alkene?

A C_3H_6

B C_3H_8

C C_6H_{12}

D C_6H_{14}

13 'Meta-fuel', $C_8H_{16}O_4$, is a fuel used in camping stoves.

What is the equation for its complete combustion?

A $C_8H_{16}O_4 + 2O_2 \rightarrow 8C + 8H_2O$

B $C_8H_{16}O_4 + 5O_2 \rightarrow 8CO + 8H_2O$

C $C_8H_{16}O_4 + 10O_2 \rightarrow 8CO_2 + 8H_2O$

D $C_8H_{16}O_4 + 8O_2 \rightarrow 4CO_2 + 4CO + 8H_2O$

14 Dilute sulphuric acid is electrolysed using inert electrodes.

Which equation represents the reaction at the anode (+ve)?

A $O_2^{2-} \rightarrow O_2 + 2e^-$

B $2H^+ + 2e^- \rightarrow H_2$

C $4OH^- \rightarrow O_2 + 2H_2O + 4e^-$

D $SO_4^{2-} \rightarrow O_2 + SO_2 + 2e^-$

15 What are the products when concentrated aqueous lithium chloride is electrolysed?

	at the anode (positive)	at the cathode (negative)
A	chlorine	hydrogen
B	chlorine	lithium
C	oxygen	hydrogen
D	oxygen	lithium

16 A solid deposit of element **R** is formed at the cathode(-ve) when an aqueous solution containing ions of **R** is electrolysed.

Which statement about element **R** must be correct?

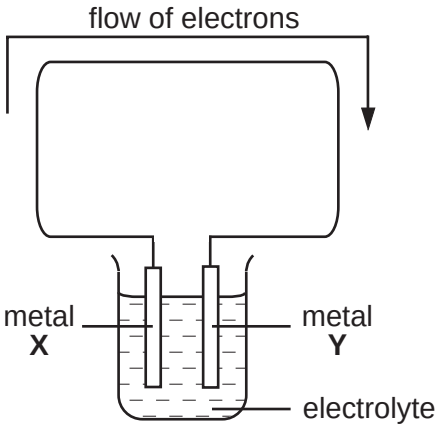
A **R** forms negative ions.

B **R** ions gain electrons at the cathode.

C **R** ions lose electrons at the cathode.

D **R** is above hydrogen in the reactivity series.

17 Apparatus was set up as shown.



For which pair of metals would electrons flow in the direction shown?

	metal **X**	metal **Y**
A	copper	zinc
B	iron	aluminium
C	iron	magnesium
D	zinc	silver

[Turn over

18 The table shows the energy released by the complete combustion of some compounds used as fuels.

compound	formula	M_r	ΔH in kJ / mol
methane	CH_4	16	–880
ethanol	C_2H_5OH	46	–1380
propane	C_3H_8	44	–2200
heptane	C_7H_{16}	100	–4800

Which fuel produces the most energy when 1 g of the compound is completely burned?

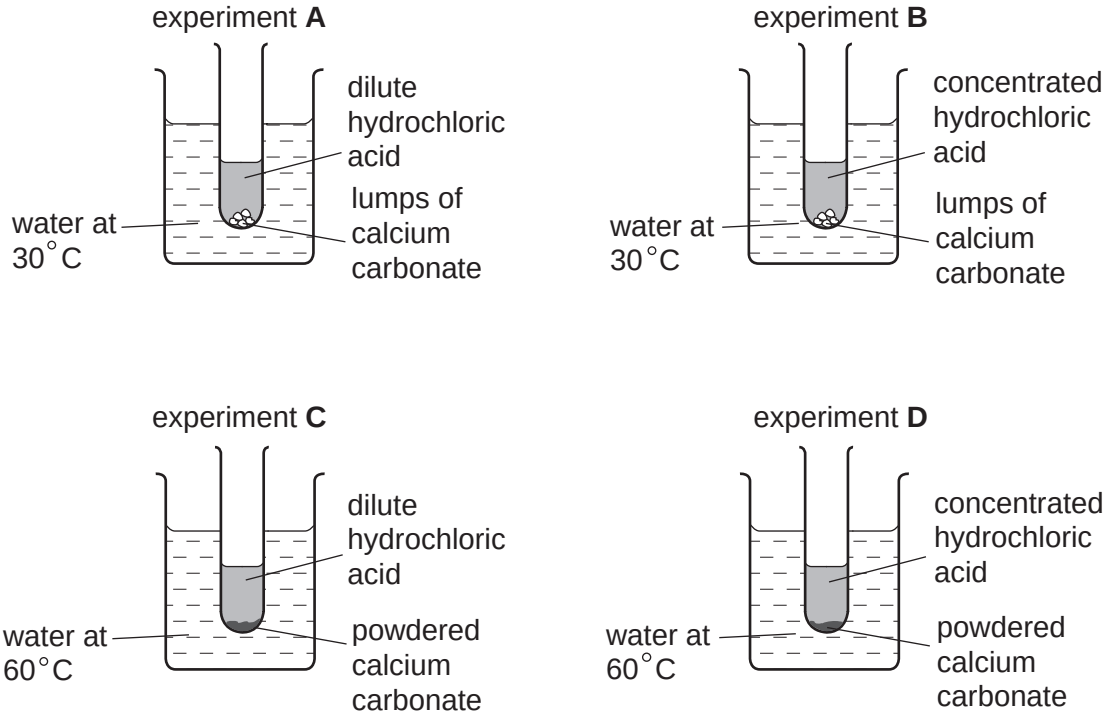
A ethanol

B heptane

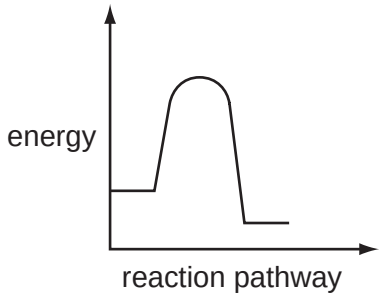
C methane

D propane

19 Which reaction is the fastest?

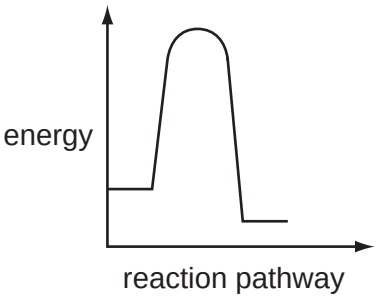


20 The diagram shows the reaction pathway for a reaction without a catalyst.



Which diagram shows the pathway resulting from the addition of a catalyst to the reaction?

A



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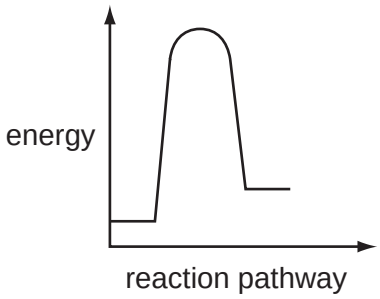

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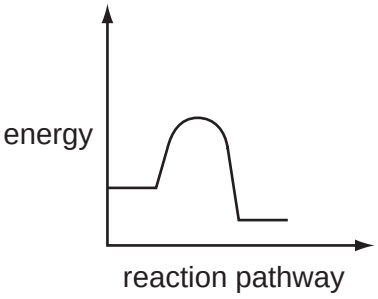
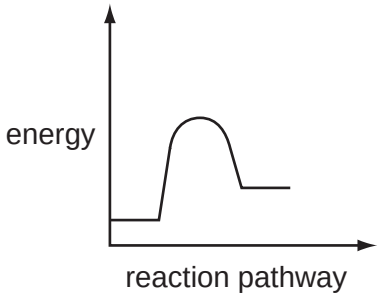


D



21 Nitrogen reacts with oxygen.

$$N_2(g) + O_2(g) \rightleftharpoons 2NO(g) \qquad \Delta H = +170\,kJ\,/\,mol$$

At equilibrium, which statement is true?

A The concentration of nitrogen present will change with time.

B The forward and backward reaction are taking place at the same rate.

C The forward reaction releases heat energy.

D There are more molecules on the left hand side of the equation than on the right.

[Turn over

22 Which series of changes includes both oxidation and reduction?

A $C \rightarrow CO \rightarrow CO_2$

B $PbO_2 \rightarrow PbO \rightarrow Pb$

C $N_2 \rightarrow NH_3 \rightarrow NO$

D $C_2H_2 \rightarrow C_2H_4 \rightarrow C_2H_6$

23 The table gives information about three indicators.

indicator	colour at pH 1	pH at which colour changes	colour at pH 12
thymol blue	red	3	yellow
congo red	blue	5	red
phenolphthalein	colourless	10	red

Which colours would be obtained when each indicator was added separately to pure water?

	thymol blue	congo red	phenolphthalein
A	red	blue	red
B	yellow	blue	colourless
C	yellow	blue	red
D	yellow	red	colourless

24 Which reactants could be used safely to prepare potassium chloride?

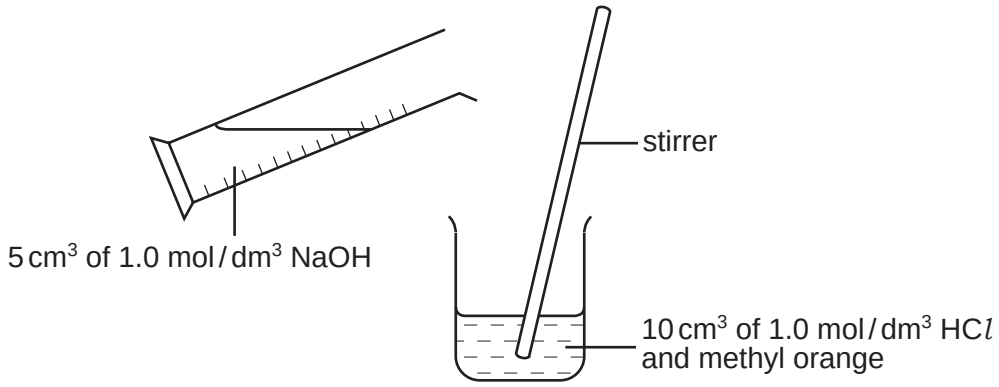
A aqueous potassium hydroxide and dilute hydrochloric acid

B aqueous potassium sulphate and aqueous sodium chloride

C potassium and aqueous sodium chloride

D potassium and dilute hydrochloric acid

25 In an experiment 5 cm^3 of 1.0 mol / dm^3 sodium hydroxide are gradually added to 10 cm^3 of 1.0 mol / dm^3 hydrochloric acid containing methyl orange.



Which change occurs in the mixture?

A The concentration of the H^+ ions increases.

B The methyl orange changes colour.

C More water molecules are formed.

D A precipitate is formed.

26 X and Y are diatomic elements. X is less reactive than Y.

What are elements X and Y?

	X	Y
A	bromine	iodine
B	iodine	bromine
C	potassium	sodium
D	sodium	potassium

27 Element **Z** has the following properties.

- It has a high melting point.
- Its presence can lower the activation energy for a reaction.

What type of element is **Z**?

A a halogen

B an alkali metal

C a noble gas

D a transition metal

[Turn over

28 All ammonium salts on heating with sodium hydroxide produce ammonia gas.

From which ammonium salt can the greatest mass of ammonia be obtained?

A 0.5 mol $(NH_4)_3PO_4$

B 0.5 mol $(NH_4)_2SO_4$

C 1.0 mol NH_4Cl

D 1.0 mol NH_4NO_3

29 The position of metal **M** in the reactivity series is shown.

K, Na, **M**, Al, Zn, Fe, Pb, Cu, Ag

Which method will be used to extract **M** from its ore?

A electrolysis of its molten oxide

B electrolysis of its aqueous sulphate

C reduction of its oxide by heating with hydrogen

D reduction of its oxide by heating with coke

30 Two elements are in the same group of the Periodic Table.

Which property will be the same for both elements?

A the charge on their ions

B their electronic structure

C their melting point

D their reactivity with water or acids

31 How does the mass of a sample of copper(II) oxide change when it is heated in hydrogen and in oxygen?

	mass after heating in hydrogen	mass after heating in oxygen
A	decreases	decreases
B	decreases	unchanged
C	unchanged	decreases
D	unchanged	unchanged

32 From which reaction is a gas produced?

A adding calcium to water

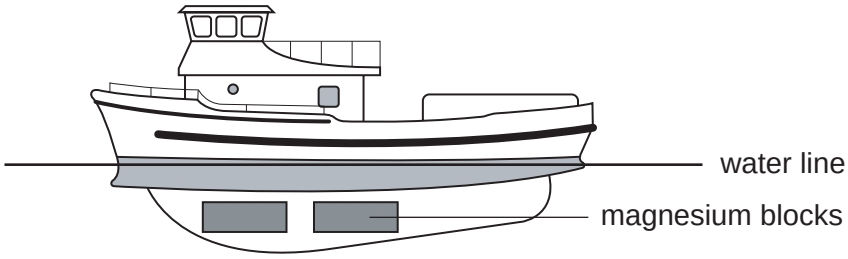
B adding dilute hydrochloric acid to silver

C adding dilute sulphuric acid to copper

D electrolysing aqueous copper(II) sulphate, using copper electrodes

33 The diagram shows a boat made from iron.

Some magnesium blocks are attached to the iron below the water line.



Why does the magnesium stop the iron from rusting?

A Magnesium reacts in preference to the iron.

B Magnesium reacts to form a protective coating of magnesium oxide on the iron.

C The magnesium forms an alloy with the iron.

D The magnesium stops oxygen in the water from getting to the iron.

34 A catalytic converter in a car exhaust system changes pollutants into less harmful products.

Which change does **not** occur in a catalytic converter?

A carbon dioxide $\rightarrow$ carbon

B carbon monoxide $\rightarrow$ carbon dioxide

C nitrogen oxides $\rightarrow$ nitrogen

D unburned hydrocarbons $\rightarrow$ carbon dioxide and water

35 The equation shows a reaction in the Contact process.

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g) \qquad \Delta H = -98 \text{ kJ/mol}$$

Which change would move the position of equilibrium to the left?

A adding more O_2

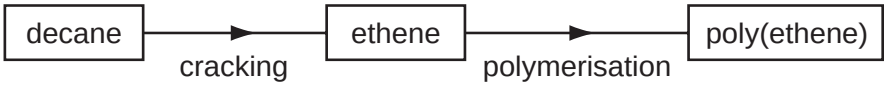
B increasing the pressure

C increasing the temperature

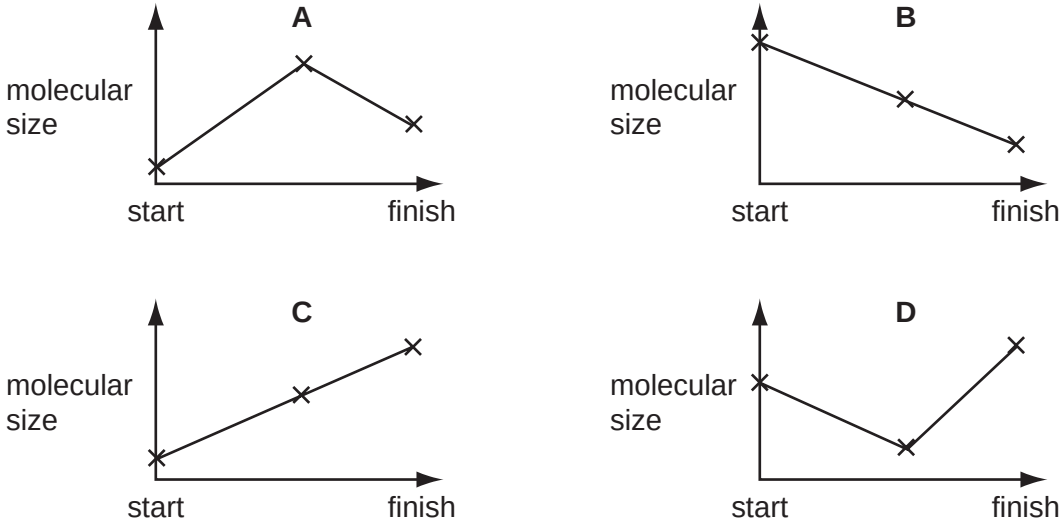
D removing SO_3 from the reacting mixture

[Turn over

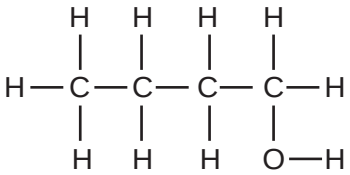
36 Poly(ethene) can be manufactured by the process below.



Which diagram shows the change in molecular size during this process?

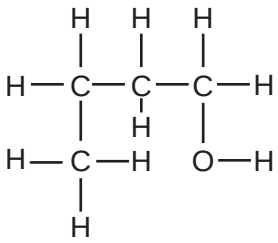


37 Compound **Q** has the structure shown.



Which structure is an isomer of **Q**?

A



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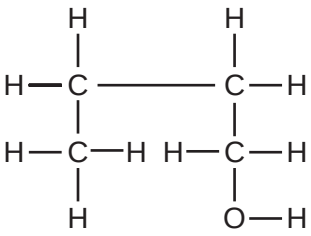

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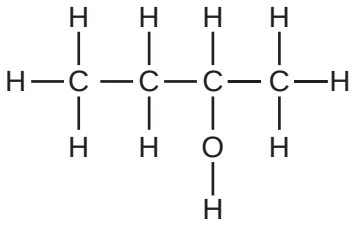

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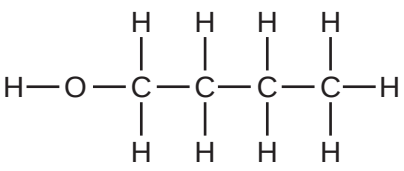

38 Compound **X** has the molecular formula C_2H_6O.

- **X** can be made by a fermentation process.
- **X** can be oxidised to **Y**.
- **X** can react with **Y** to form **Z** and water.

To which homologous series do **X**, **Y** and **Z** belong?

	X	Y	Z
A	alcohols	carboxylic acids	esters
B	alcohols	esters	carboxylic acids
C	carboxylic acids	alcohols	esters
D	carboxylic acids	esters	alcohols

39 The list shows reactions in which ethanol is either a reactant or a product.

1	combustion of ethanol
2	conversion of ethene to ethanol
3	fermentation of glucose
4	oxidation of ethanol to ethanoic acid

In which reactions is water also either a reactant or a product?

A 1, 3 and 4 only

B 2, 3 and 4 only

C 1, 2 and 4 only

D 3 only

40 A vegetable oil is polyunsaturated.

Which statement about this vegetable oil is correct?

A It has double bonds between carbon and hydrogen atoms.

B It reacts with hydrogen to form a solid compound.

C It reacts with steam to form margarine.

D It turns aqueous bromine from colourless to brown.

DATA SHEET
The Periodic Table of the Elements

	Group																	
	I	II									III	IV	V	VI	VII	0
																4 He Helium 2
						1 H Hydrogen 1					11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
	7 Li Lithium 3	9 Be Beryllium 4									27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
	23 Na Sodium 11	24 Mg Magnesium 12									70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
	39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	112 Cd Cadmium 48	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
	85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
	133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
	226 Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89															

*58-71 Lanthanoid series	140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
90-103 Actinoid series	232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103

Key: a = relative atomic mass; X = atomic symbol; b = proton (atomic) number

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