

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CHEMISTRY

5070/01

Paper 1 Multiple Choice

May/June 2005

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.

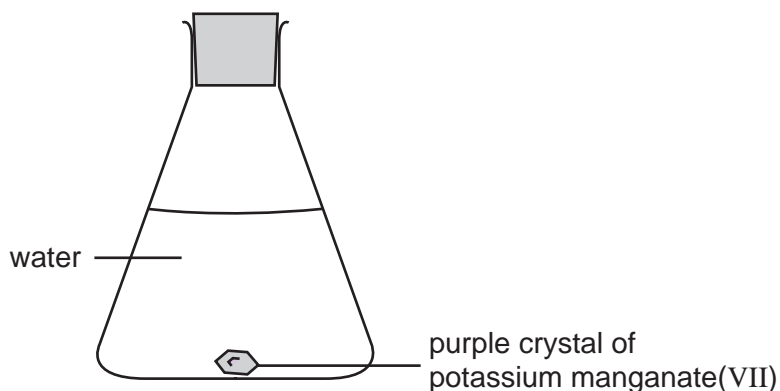
Any rough working should be done in this booklet.

A copy of the Periodic Table is printed on page 20.

This document consists of **17** printed pages and **3** blank pages.



- 1 The experiment is set up as shown and left until there is no further change.



What is observed?

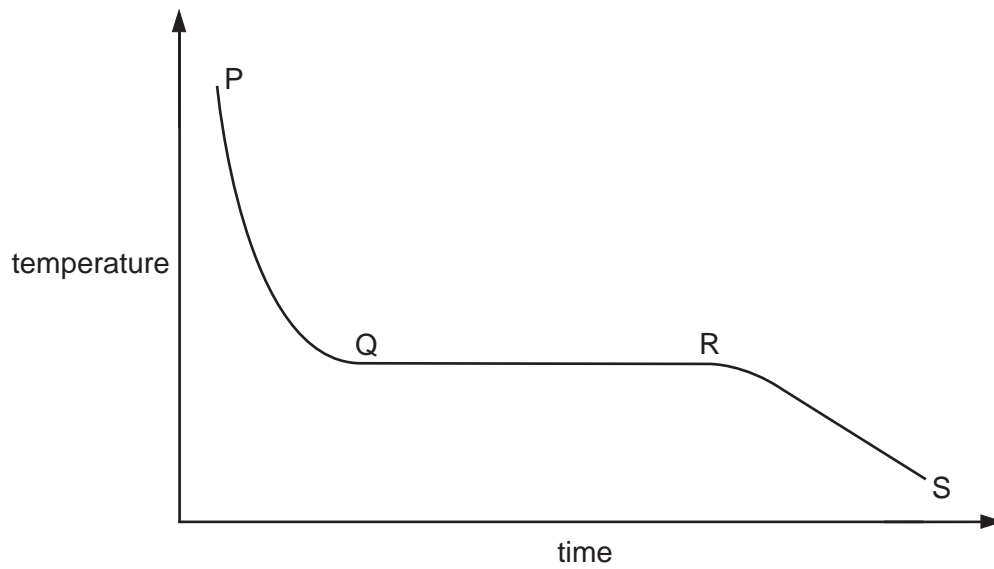
- A** a colourless layer below a purple layer
B a colourless liquid with the purple crystal unchanged
C a purple layer below a colourless layer
D a uniformly purple solution
- 2 A student adds aqueous sodium hydroxide or aqueous ammonia to aqueous solutions of four different metal compounds.

Which solution contains Zn^{2+} ions?

solution	add a few drops of NaOH(aq)	add excess NaOH(aq)	add a few drops of $NH_3(aq)$	add excess $NH_3(aq)$
A	ppt	ppt dissolves	ppt	ppt dissolves
B	ppt	ppt dissolves	ppt	ppt
C	ppt	ppt	no ppt	no ppt
D	no ppt	no ppt	no ppt	no ppt

- 3 A sample of a pure compound is heated until it is completely molten and the compound is then allowed to cool until it is completely solid again.

The graph shows how the temperature of the compound changes with time.

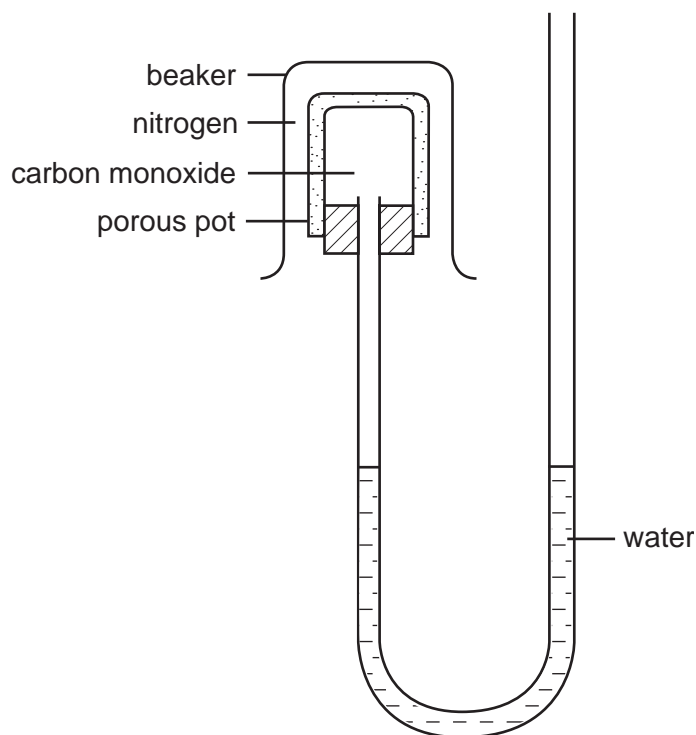


When are liquid and solid both present?

- A P to Q and R to S
- B P to Q
- C Q to R
- D R to S

- 4 A beaker of nitrogen is inverted over a porous pot containing carbon monoxide as shown.

The water level does not change.



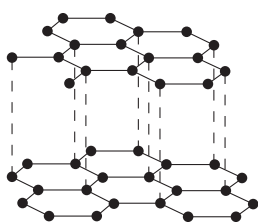
What is the reason for this?

- A Both gases are diatomic.
 - B Nitrogen is an unreactive gas.
 - C The gas particles are too large to pass through the porous pot.
 - D The two gases have the same relative molecular mass.
- 5 Which statement about all the noble gases is correct?
- A The number of protons in the atoms equals the number of neutrons.
 - B Their atoms each have a stable arrangement of electrons.
 - C Their atoms each have eight electrons in their outer shell.
 - D They exist as molecules containing two atoms.
- 6 A substance **Q** conducts electricity both when solid and molten.

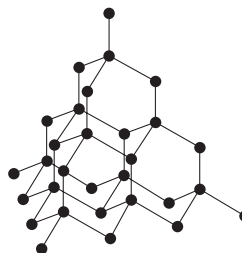
What is **Q**?

- A an alloy
- B a hydrocarbon
- C a metal oxide
- D a salt

7 The diagrams show the structures of two forms of carbon.



S



T

Which set of data is correct for these two structures?

	conducts electricity	very hard material	can be used as lubricant
A	T	T	S
B	S	T	S
C	S	S	T
D	T	S	T

8 Substance **X** has a melting point higher than 500 °C. It is insoluble both in water and in organic solvents. It conducts electricity when both solid and molten.

What is **X**?

- A** copper
- B** mercury
- C** poly(ethene)
- D** sodium chloride

9 How many moles per dm³ of gaseous carbon dioxide are there if 4.4 g occupies 500 cm³?

- A** 0.1 mol/dm³ **B** 0.2 mol/dm³ **C** 2.2 mol/dm³ **D** 8.8 mol/dm³

10 Which reactions take place during the electrolysis of aqueous copper(II) sulphate with copper electrodes?

	reaction at positive electrode	reaction at negative electrode
A	$\text{Cu}^{2+} + 2\text{e}^{-} \rightarrow \text{Cu}$	$\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}^{-}$
B	$4\text{OH}^{-} \rightarrow 2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}^{-}$	$\text{Cu}^{2+} + 2\text{e}^{-} \rightarrow \text{Cu}$
C	$\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}^{-}$	$2\text{H}^{+} + 2\text{e}^{-} \rightarrow \text{H}_2$
D	$\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}^{-}$	$\text{Cu}^{2+} + 2\text{e}^{-} \rightarrow \text{Cu}$

11 The heat-reflecting shields of some space rockets are gold-plated, using electrolysis.

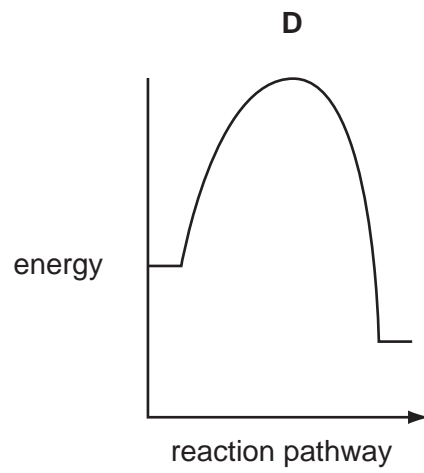
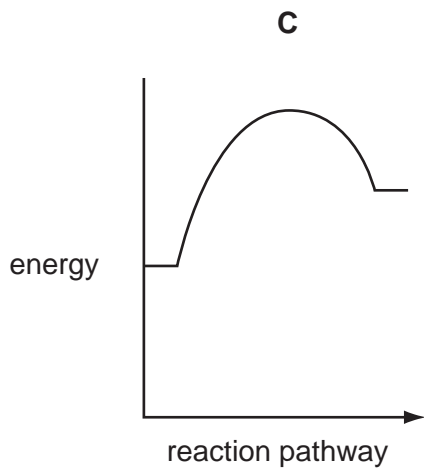
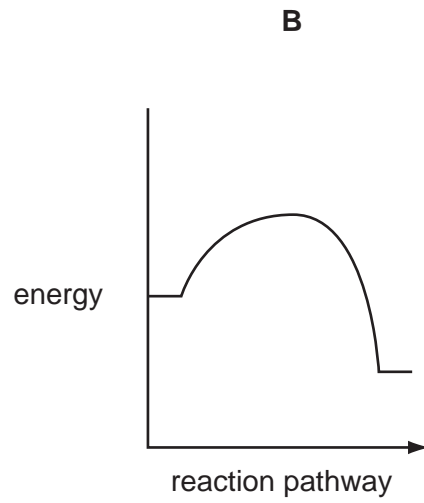
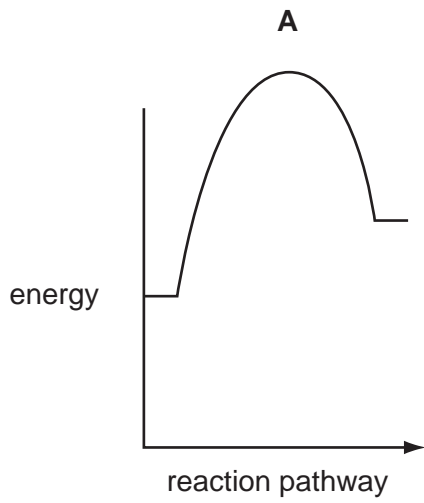
Which electrodes and electrolyte would be used to gold-plate the heat shield?

	negative electrode	positive electrode	electrolyte
A	carbon	heat shield	gold compound
B	gold	heat shield	copper compound
C	heat shield	carbon	copper compound
D	heat shield	gold	gold compound

12 The reaction $\text{C}_2\text{H}_4 + 3\text{O}_2 \rightarrow 2\text{CO}_2 + 2\text{H}_2\text{O}$ is exothermic because

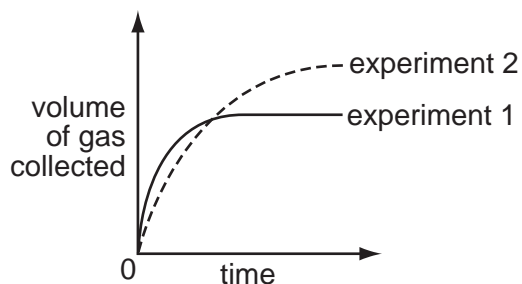
- A** more bonds are broken than are formed.
- B** more bonds are formed than are broken.
- C** the energy needed to break the bonds is greater than that released on forming new bonds.
- D** the energy needed to break the bonds is less than that released on forming new bonds.

13 Which reaction profile shows the fastest exothermic reaction?

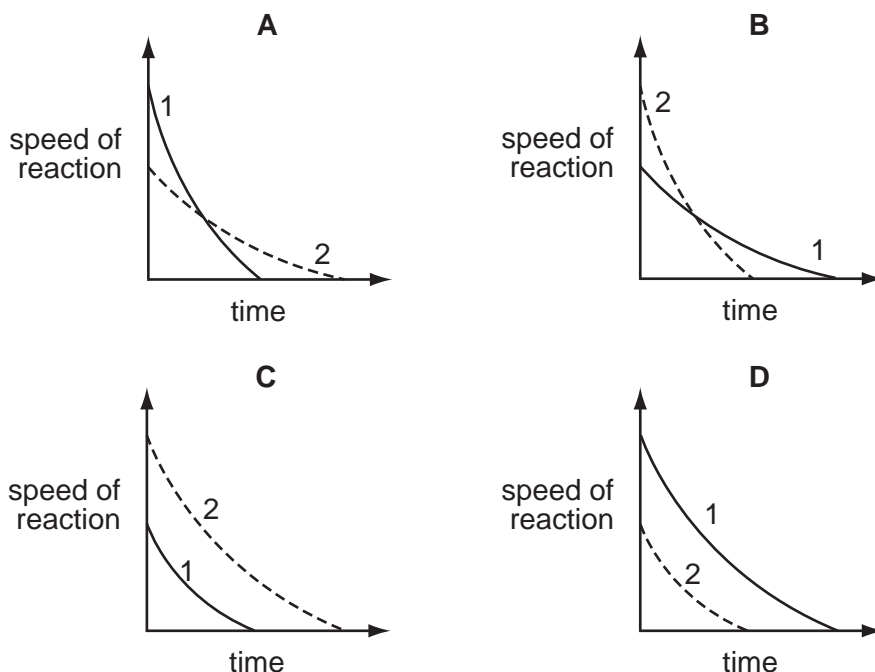


14 In two separate experiments, a substance is decomposed and the gas evolved is collected.

The graph shows the total volume of gas collected against time for each experiment.



Which graph shows how the speed of reaction varies with time in each experiment?



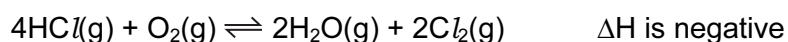
15 A colourless gas is passed into each of three different solutions. The results are shown in the table.

solution of	potassium iodide	acidified potassium dichromate(VI)	acidified potassium manganate(VII)
result	stays colourless	orange to green	purple to colourless

What is the colourless gas?

- A an acid
- B an alkali
- C an oxidising agent
- D a reducing agent

- 16 Chlorine can be manufactured by using the reversible reaction between hydrogen chloride and oxygen.



A mixture in dynamic equilibrium is present at 450°C.

Which change to the mixture will increase the amount of chlorine at equilibrium?

- A adding a catalyst
 - B adding more $\text{HCl}(\text{g})$
 - C decreasing the pressure
 - D increasing the temperature
- 17 Which pair of substances produce a precipitate when their aqueous solutions are mixed?
- A sodium chloride and barium nitrate
 - B sodium nitrate and barium chloride
 - C sodium nitrate and silver nitrate
 - D sodium sulphate and barium chloride
- 18 Which statement about catalysts is correct?
- A Catalysts are used in industry to reduce energy costs.
 - B Catalysts are used up during a reaction.
 - C Iron is used as a catalyst in the Contact Process.
 - D Transition metals do not make good catalysts.
- 19 Element X is a solid at room temperature.

It needs one electron per atom to gain the electronic structure of a noble gas.

It is the least reactive element in its group.

What is the element X?

- A At
- B Cs
- C F
- D Li

20 Elements **X** and **Y** are in Group VII of the Periodic Table.

X is a liquid at room temperature. **Y** is a solid at room temperature.

- 1 Atoms of **Y** have more protons than atoms of **X**.
- 2 Molecules of **Y** have more atoms than molecules of **X**.
- 3 **Y** displaces **X** from aqueous solutions of X^- ions.

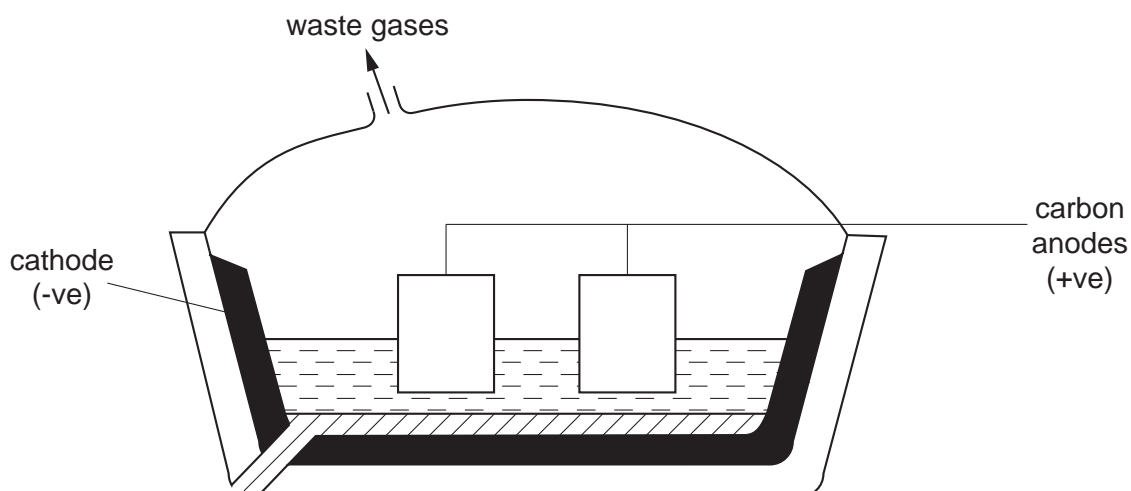
Which statements are correct?

- A** 1 only
- B** 2 only
- C** 3 only
- D** 1, 2 and 3
- 21 Metal **M** will displace copper from aqueous copper(II) sulphate solution, but will not displace iron from aqueous iron(II) sulphate solution. **M** is extracted from its oxide by heating the oxide with carbon.

What is the order of reactivity of these four metals?

	least reactive → most reactive			
A	sodium	metal M	iron	copper
B	sodium	iron	metal M	copper
C	copper	iron	metal M	sodium
D	copper	metal M	iron	sodium

22 The diagram shows the electrolytic production of aluminium.



What is the physical state of the aluminium oxide and aluminium during this process?

	aluminium oxide	aluminium
A	liquid	liquid
B	liquid	solid
C	solid	liquid
D	solid	solid

23 Aluminium is used to make saucepans because of its apparent lack of reactivity.

Which property of aluminium explains its unreactivity?

- A** It has a high electrical conductivity.
- B** It has a low density.
- C** It has a surface layer of oxide.
- D** It is in Group III of the Periodic Table.

24 Alloys are usually harder than the metals from which they are made.

Which difference between the metals explains the greater hardness of alloys?

- A** atomic radii
- B** densities
- C** electrical conductivities
- D** relative atomic masses

- 25 Which gas **cannot** be removed from the exhaust gases of a petrol powered car by its catalytic converter?
- A carbon dioxide
 - B carbon monoxide
 - C hydrocarbons
 - D nitrogen dioxide

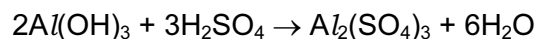
- 26 Which gas, present in pond water, decreases in concentration during eutrophication?
- A carbon dioxide
 - B methane
 - C nitrogen
 - D oxygen

- 27 The results of tests carried out on compound **X** are shown.

test	result
dilute hydrochloric acid added	gas given off which turned limewater cloudy
warm with aqueous sodium hydroxide	gas evolved which turned red litmus blue

What is compound **X**?

- A ammonium carbonate
 - B ammonium nitrate
 - C calcium carbonate
 - D calcium nitrate
- 28 Aluminium sulphate can be obtained as shown in the equation.

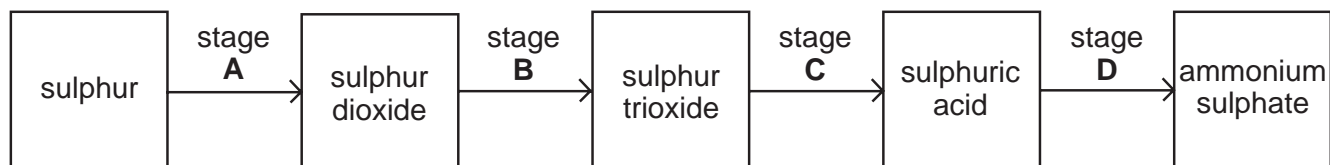


How many moles of sulphuric acid are needed to produce 0.5 mol of aluminium sulphate?

- A 0.5
- B 1.0
- C 1.5
- D 3.0

29 Ammonium sulphate is an important fertiliser.

During which stage in the manufacture of ammonium sulphate does a reaction with water occur?



30 The diagram shows the colours of the indicators, methyl orange and methyl red, at different pH values.

pH	2	3	4	5	6
colour of methyl orange	red		yellow		
colour of methyl red	red				yellow

The table shows the pH of four solutions.

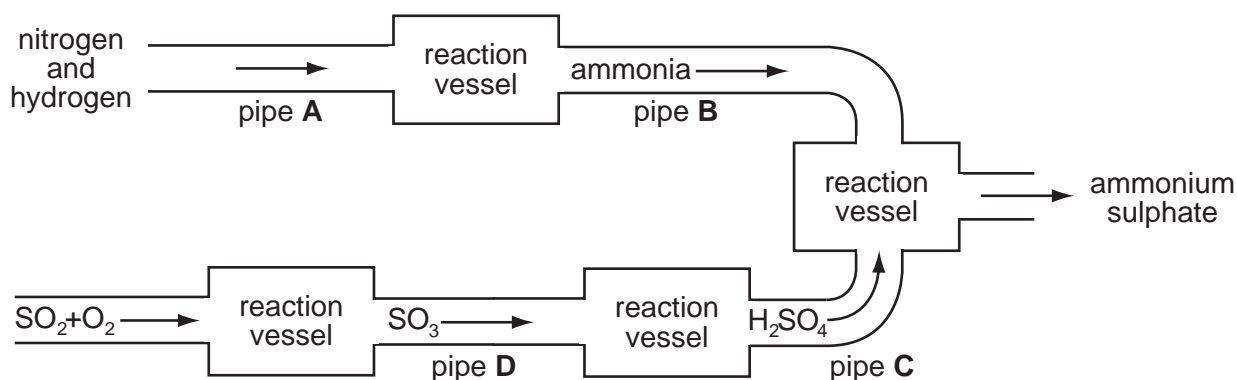
solution	W	X	Y	Z
pH	2	3	5	6

In which solutions will both indicators be yellow?

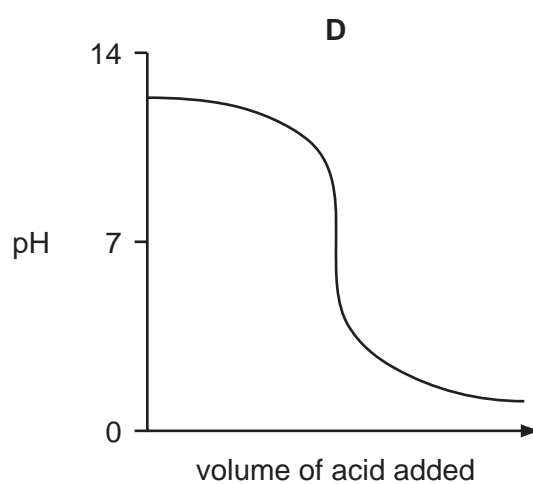
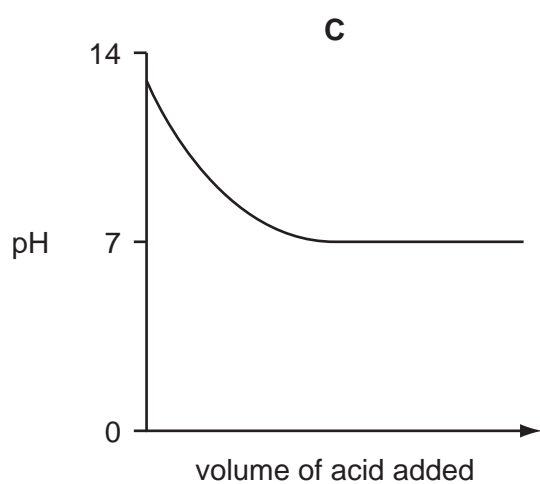
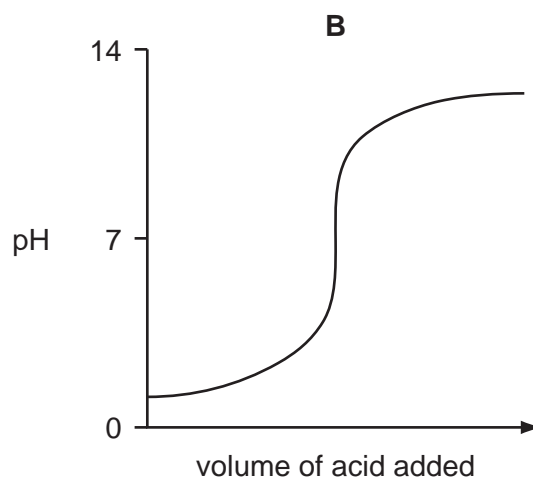
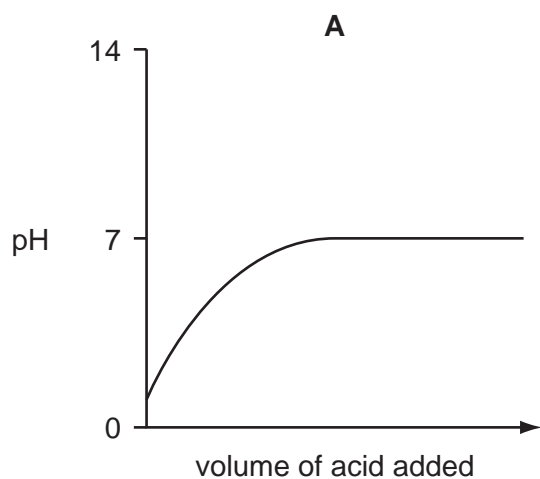
- A** W and X **B** X and Y **C** Y and Z **D** Z only

31 The diagram shows some of the stages in the manufacture of ammonium sulphate.

From which connecting pipe would a major leak most **increase** the pH value of rain?



32 Which graph shows the changes in pH as an excess of hydrochloric acid is added to aqueous sodium hydroxide?



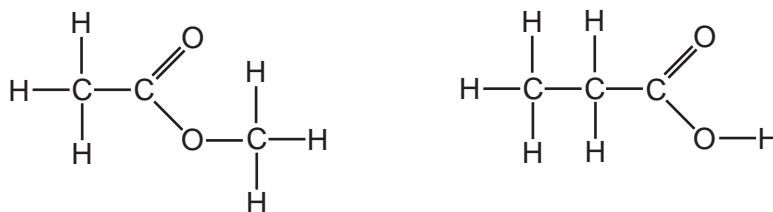
33 Two tests are carried out on a solution of compound X.

test	result
add nitric acid followed by aqueous silver nitrate	white precipitate formed
excess aqueous sodium hydroxide added	white precipitate formed that does not re-dissolve

What is compound X?

- A** aluminium chloride
- B** aluminium sulphate
- C** calcium chloride
- D** calcium sulphate

- 34 Which property of the alkanes does **not** increase as relative molecular mass increases?
- A boiling point
 B flammability
 C melting point
 D viscosity
- 35 What is the structure of the product of the reaction between butene, $\text{CH}_3\text{-CH}_2\text{-CH=CH}_2$, and bromine, Br_2 ?
- A $\text{CH}_2\text{Br-CH}_2\text{-CH}_2\text{-CH}_2\text{Br}$
 B $\text{CH}_2\text{Br-CH}_2\text{-CHBr-CH}_3$
 C $\text{CH}_3\text{-CHBr-CH}_2\text{-CH}_2\text{Br}$
 D $\text{CH}_3\text{-CH}_2\text{-CHBr-CH}_2\text{Br}$
- 36 Which formula represents a compound that will react with sodium carbonate to give off carbon dioxide?
- A CH_3OH
 B HCO_2CH_3
 C $\text{CH}_3\text{CO}_2\text{H}$
 D $\text{CH}_3\text{CO}_2\text{C}_2\text{H}_5$
- 37 The displayed formulae of two compounds are shown.



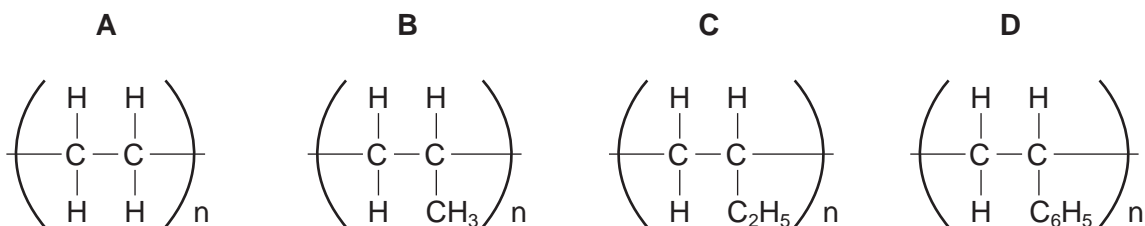
What are the similarities and differences between the two compounds?

	similarities	differences
A	molecular formulae	reactions
B	molecular formulae	relative molecular masses
C	structures	molecular formulae
D	structures	relative molecular masses

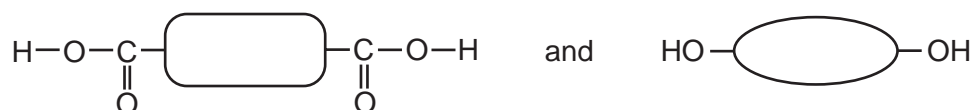
38 In which of the following are all the compounds members of the same homologous series?

- A CH₄ C₂H₆ C₃H₆
 B CH₄ C₂H₆ C₃H₈
 C C₂H₄ C₃H₆ C₄H₁₀
 D C₃H₄ C₃H₆ C₃H₈

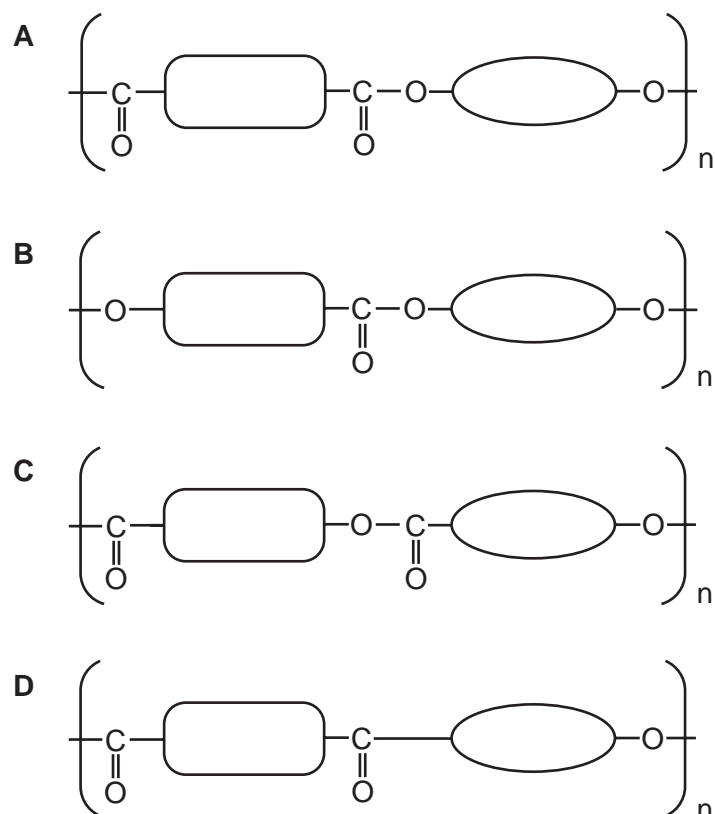
39 Which polymer has the empirical formula CH?



40 *Terylene* (a polyester) is made by condensation polymerisation of the two monomers shown.



What is the repeat unit of the polymer?



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DATA SHEET
The Periodic Table of the Elements

		Group									
		I	II	III	IV	V	VI	VII	0		
1	1										
7	9	3	4	5	6	7	8	9	10	2	
Li Lithium	Be Beryllium	H Hydrogen		B Boron	C Carbon	N Nitrogen	O Oxygen	F Fluorine	Ne Neon	He Helium	
23	24	11	12	13	14	15	16	17	18		
Na Sodium	Mg Magnesium	Al Aluminium	Si Silicon	P Phosphorus	S Sulphur	Cl Chlorine	Ar Argon				
39	40	19	20	21	22	23	24	25	26	27	
K Potassium	Ca Calcium	Sc Scandium	Ti Titanium	V Vanadium	Cr Chromium	Mn Manganese	Fe Iron	Co Cobalt	Ni Nickel	Cu Copper	
85	88	37	38	39	40	41	42	43	44	45	
Rb Rubidium	Sr Strontium	Y Yttrium	Zr Zirconium	Nb Niobium	Mo Molybdenum	Tc Technetium	Ru Ruthenium	Rh Rhodium	Pd Palladium	Ag Silver	
133	137	55	56	57	72	73	74	75	76	77	
Cs Caesium	Ba Barium	La Lanthanum	Hf Hafnium	Ta Tantalum	W Tungsten	Re Rhenium	Os Osmium	Ir Iridium	Pt Platinum	Au Gold	
226	227	87	88	89	90	91	92	93	94	95	
Fr Francium	Ra Radium	Ac Actinium									
*58-71 Lanthanoid series											
90-103 Actinoid series											
140	141	144	150	152	157	162	165	167	169	173	
Ce Cerium	Pr Praseodymium	Nd Neodymium	Sm Samarium	Eu Europium	Gd Gadolinium	Dy Dysprosium	Ho Holmium	Er Erbium	Tm Thulium	Yb Ytterbium	
232	238	92	94	95	96	98	99	100	101	102	
Th Thorium	Pa Protactinium	U Uranium	Pu Plutonium	Am Americium	Cm Curium	Bk Berkelium	Es Einsteinium	Fm Fermium	Md Mendelevium	No Nobelium	
90	91	92	94	95	96	97	99	100	101	103	
Lu Lutetium	Yb Ytterbium	Lu Lutetium	La Lanthanum	Ce Cerium	Pr Praseodymium	Nd Neodymium	Pm Promethium	Sm Samarium	Eu Europium	Gd Gadolinium	
71	70	71	72	73	74	75	76	77	78	79	
Lr Lawrencium	No Nobelium	Lu Lutetium	La Lanthanum	Ce Cerium	Pr Praseodymium	Nd Neodymium	Pm Promethium	Sm Samarium	Eu Europium	Gd Gadolinium	
103	102	71	72	73	74	75	76	77	78	79	

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

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