

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CHEMISTRY

5070/01

Paper 1 Multiple Choice

October/November 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 16.

You may use a calculator.

This document consists of **14** printed pages and **2** blank pages.

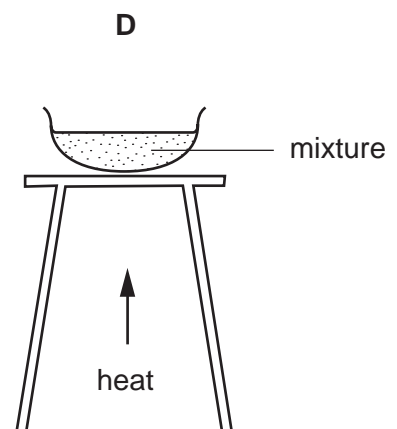
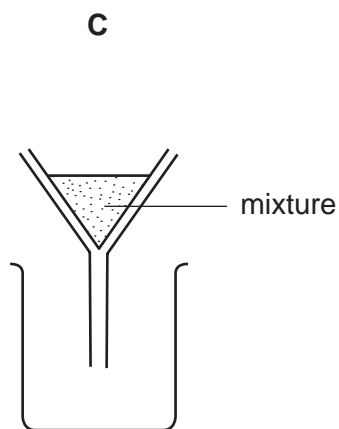
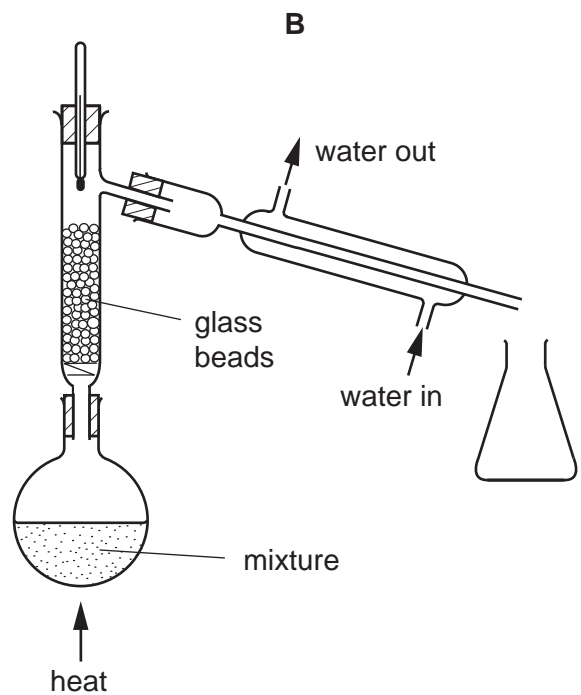
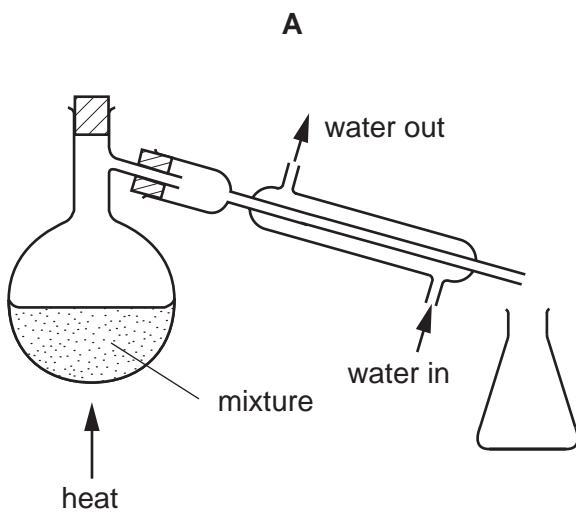


1 Which of the following is a pure compound?

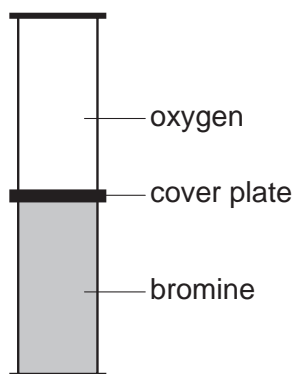
- A ethanol
- B petrol
- C steel
- D tap water

2 Substance **X** melts at 53°C and boils at 100°C . It does not dissolve in water and it does not react with water.

Which diagram shows the method most suitable for separating **X** from a mixture of **X** and water?

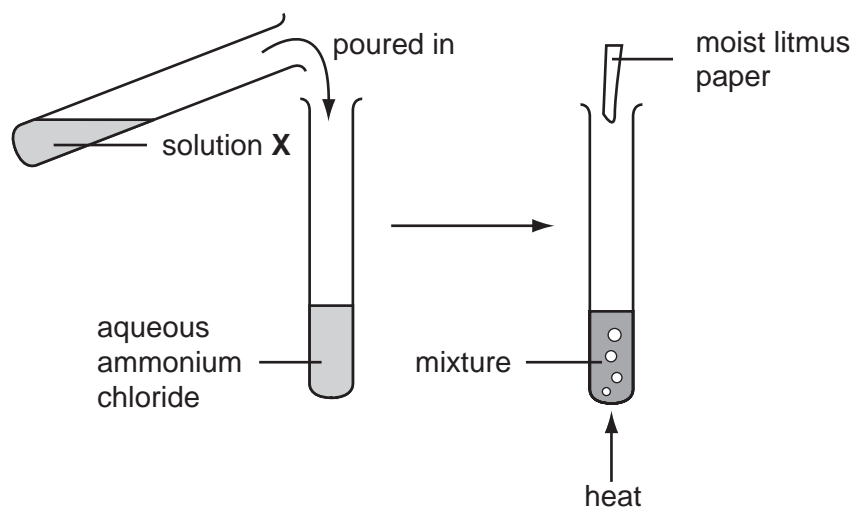


- 3 The coverplate is removed from the gas jars shown in the diagram. After several days, the colour of the gas is the same in both jars.



Which statement explains this change?

- A Oxygen and bromine gases have equal densities.
 - B Oxygen and bromine molecules are in random motion.
 - C Oxygen and bromine molecules diffuse at the same rate.
 - D Equal volumes of oxygen and bromine contain equal numbers of molecules.
- 4 The diagrams show an experiment with aqueous ammonium chloride.

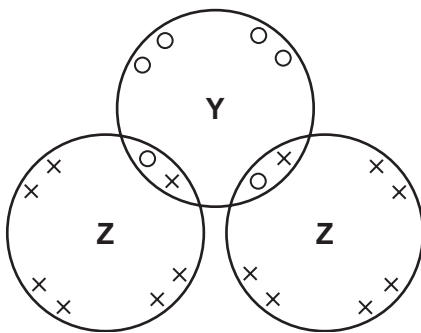


A gas, Y, is produced and the litmus paper changes colour.

What are solution X and gas Y?

	solution X	gas Y
A	aqueous sodium hydroxide	ammonia
B	aqueous sodium hydroxide	chlorine
C	dilute sulphuric acid	ammonia
D	dilute sulphuric acid	chlorine

- 5 Which two gases each change the colour of damp red litmus paper?
- A ammonia and chlorine
 B ammonia and hydrogen chloride
 C carbon dioxide and chlorine
 D carbon dioxide and sulphur dioxide
- 6 The atoms $^{31}_{15}\text{P}$ and $^{32}_{16}\text{S}$ have the same
- A nucleon number.
 B number of electrons.
 C number of neutrons.
 D number of protons.
- 7 The diagram shows the arrangement of electrons in a molecule of compound YZ_2 .



key

- outer electron of a Y atom
 × outer electron of a Z atom

What are elements Y and Z?

	Y	Z
A	calcium	chlorine
B	carbon	oxygen
C	oxygen	hydrogen
D	sulphur	chlorine

- 8 Which **two** statements about a covalent bond are correct?
- 1 It can be formed between two metal atoms.
 - 2 It can be formed between two non-metal atoms.
 - 3 It is formed by the transfer of electrons between atoms.
 - 4 It is formed by sharing electrons between atoms.
- A 1 and 3 B 1 and 4 C 2 and 3 D 2 and 4

- 9 Which statement explains why sodium chloride, NaCl , has a lower melting point than magnesium oxide, MgO ?
- A Sodium chloride is covalent but magnesium oxide is ionic.
- B Sodium is more reactive than magnesium.
- C The attraction between Na^+ and Cl^- is weaker than that between Mg^{2+} and O^{2-} .
- D The melting point of sodium is lower than that of magnesium.
- 10 Four substances have the following electrical properties.

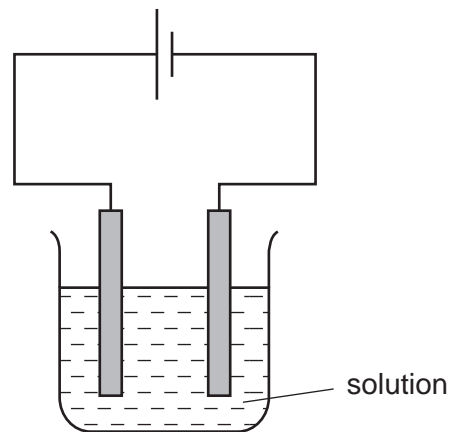
substance	property
W	does not conduct under any conditions
X	conducts only in aqueous solution
Y	conducts in both the molten and solid states
Z	conducts in both the molten and aqueous states

What are these four substances?

	W	X	Y	Z
A	HCl	S	NaCl	Pb
B	Pb	HCl	NaCl	S
C	S	HCl	Pb	NaCl
D	S	NaCl	HCl	Pb

- 11 What is the ratio of the volume of 2 g of hydrogen to the volume of 16 g of methane, both volumes at r.t.p.?
- A 1 to 1 B 1 to 2 C 1 to 8 D 2 to 1

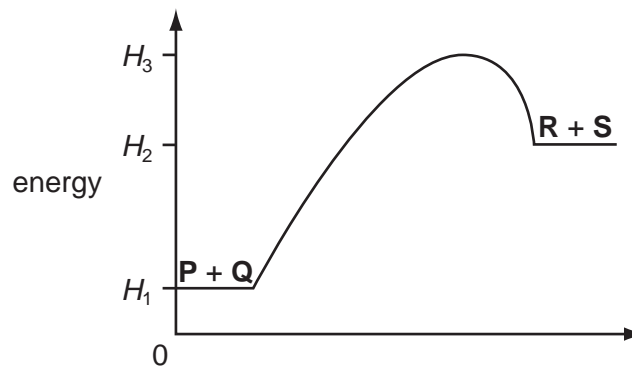
- 12 The diagram shows the electrolysis of a concentrated aqueous solution containing both copper(II) ions and sodium ions.



Which metal is deposited at the negative electrode and why?

	metal deposited	reason
A	copper	copper is less reactive than sodium
B	copper	copper is more reactive than hydrogen
C	sodium	copper is less reactive than hydrogen
D	sodium	copper is more reactive than sodium

- 13 The energy profile diagram below is for a reaction $\text{P} + \text{Q} \rightarrow \text{R} + \text{S}$.

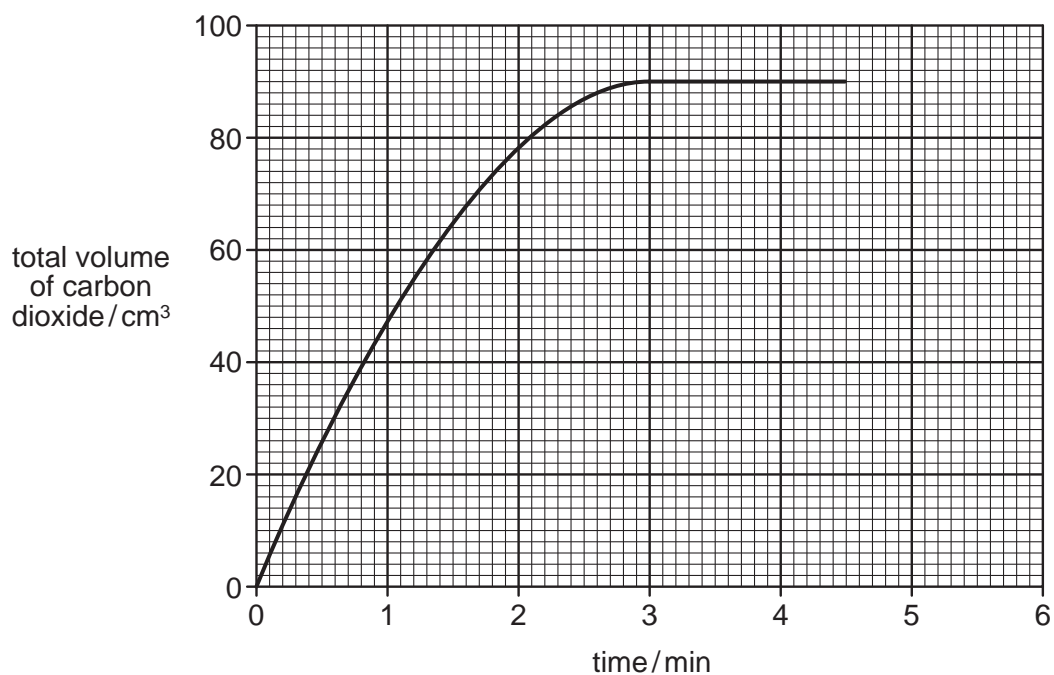


Which statement is correct?

- A** The activation energy of the reaction is $(H_3 - H_1)$.
B The activation energy of the reaction is $(H_3 - H_2)$.
C ΔH is $(H_1 - H_2)$.
D ΔH is $(H_1 - H_3)$.

- 14 The rate of the reaction between a given mass of calcium carbonate and an excess of hydrochloric acid is studied by collecting the carbon dioxide in a graduated syringe.

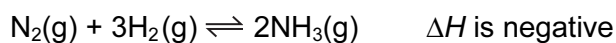
The results are shown in the graph.



How much time is required for half the calcium carbonate to react?

- A** 0.95 min **B** 1.5 min **C** 2.0 min **D** 3.0 min
- 15 Ammonia is made by a reversible reaction between nitrogen and hydrogen.

The equation for the reaction is shown.



What is the effect of increasing the pressure in this process?

- A** Less ammonia is formed.
B Less heat is produced.
C More ammonia is formed.
D The reaction slows down.

- 16 Separate samples of hydrogen peroxide are added to aqueous potassium iodide and to acidified potassium dichromate(VI). The iodide ions are oxidised and dichromate(VI) ions are reduced.

What colour changes are seen?

	potassium iodide	acidified potassium dichromate(VI)
A	colourless to brown	purple to colourless
B	brown to colourless	purple to colourless
C	colourless to brown	orange to green
D	brown to colourless	orange to green

- 17 In which line in the table is **all** the information correct?

	reaction at electrode	electrode	product
A	$2X^- \rightarrow X_2 + 2e^-$	cathode	metal
B	$X^+ + e^- \rightarrow X$	anode	metal
C	$2X^- \rightarrow X_2 + 2e^-$	anode	non-metal
D	$X^+ + e^- \rightarrow X$	cathode	non-metal

- 18 Which two reagents could be used to prepare the insoluble salt copper(II) carbonate?

- A** $\text{CuO(s)} + \text{Na}_2\text{CO}_3\text{(aq)}$
- B** $\text{CuO(s)} + \text{MgCO}_3\text{(s)}$
- C** $\text{CuSO}_4\text{(aq)} + \text{Na}_2\text{CO}_3\text{(aq)}$
- D** $\text{CuSO}_4\text{(aq)} + \text{MgCO}_3\text{(s)}$

- 19 Which statement does **not** describe a property of a weak acid in solution?

- A** It forms a salt with sodium hydroxide.
- B** It has a pH of between 8 and 9.
- C** It is only partly dissociated into ions.
- D** It reacts with sodium carbonate to give off carbon dioxide.

- 20 Which products are formed when dilute hydrochloric acid reacts with the substances shown in the table?

	substance	products
A	iron	iron(II) chloride + hydrogen only
B	iron(II) carbonate	iron(II) chloride + carbon dioxide gas only
C	iron(II) oxide	iron(II) chloride + oxygen gas only
D	iron(II) sulphate	iron(II) chloride + sulphur dioxide only

- 21 Which pollutant increases the growth of algae in rivers and streams?

- A** chlorine
B heavy metal ions
C nitrate ions
D sulphur dioxide

- 22 When chlorine water is added to a colourless solution of **X**, a dark brown solution is obtained.

What is **X**?

- A** KCl **B** KI **C** $NaBr$ **D** NaF

- 23 Many properties of an element and its compounds can be predicted from the position of the element in the Periodic Table.

What property could **not** be predicted in this way?

- A** the acidic or basic nature of its oxide
B the formula of its oxide
C the number of isotopes it has
D its metallic or non-metallic properties

- 24 The element with a proton number 12 has similar chemical properties to the element with the proton number

- A** 2. **B** 11. **C** 13. **D** 20.

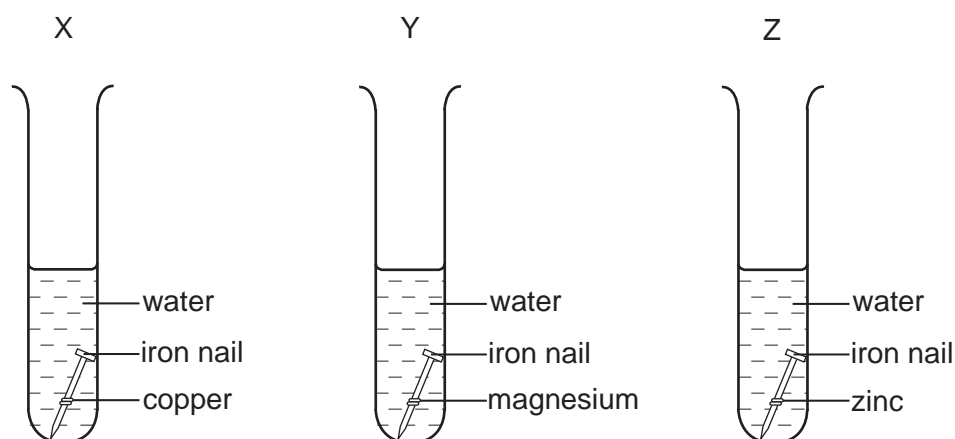
- 25 What is the mass of aluminium in 204 g of aluminium oxide, Al_2O_3 ?

- A** 26 g **B** 27 g **C** 54 g **D** 108 g

26 Which process does **not** result in the formation of **both** carbon dioxide and water?

- A addition of a dilute acid to a carbonate
- B burning ethanol
- C burning methane
- D heating crystals of hydrated sodium carbonate

27 Experiments are set up to investigate the sacrificial protection of iron.



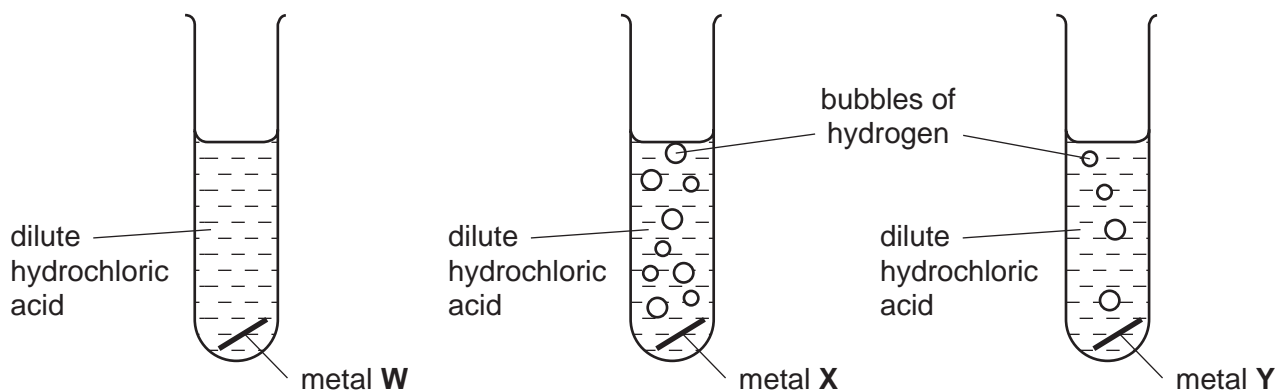
In which test-tubes will the iron rust?

- A X only
 - B Y only
 - C X and Z only
 - D Y and Z only
- 28 One mole of compound **X** gives three moles of ions in aqueous solution. **X** reacts with ammonium carbonate to give an acidic gas.

What is compound **X**?

- A calcium hydroxide
- B ethanoic acid
- C sodium hydroxide
- D sulphuric acid

29 The diagrams show the reactions of three different metals with dilute hydrochloric acid.



What are metals **W**, **X** and **Y**?

	W	X	Y
A	copper	magnesium	zinc
B	copper	zinc	magnesium
C	magnesium	zinc	copper
D	zinc	magnesium	copper

30 Which statements about the pollutant carbon monoxide are correct?

- 1 It is a colourless, odourless gas.
- 2 It is formed by incomplete combustion of natural gas.
- 3 It reacts with haemoglobin in the blood.

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

31 Which gas is **not** produced when hydrocarbons are burnt in the internal combustion engine?

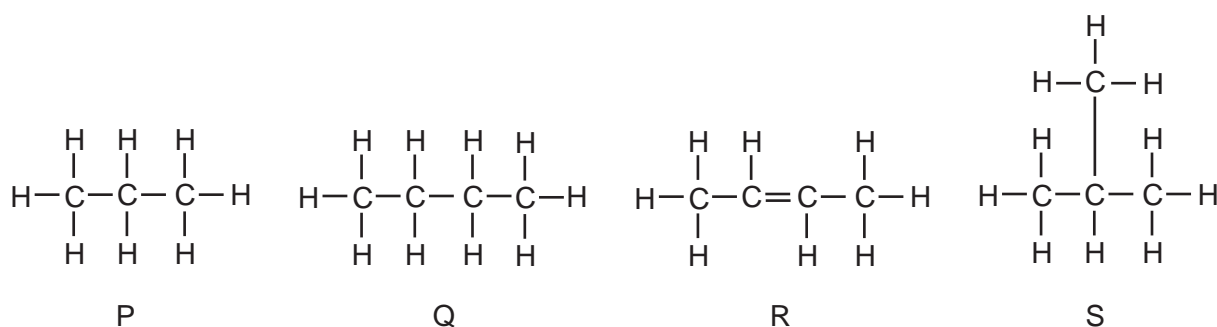
- A** carbon dioxide
B carbon monoxide
C hydrogen
D nitrogen oxides

32 Cholesterol is an organic molecule that occurs in the blood stream.

What type of compound is cholesterol?

- A an acid
- B an alcohol
- C an alkane
- D an alkene

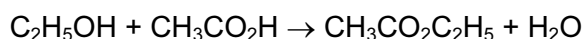
33 The diagrams show four hydrocarbons P, Q, R and S.



Which two hydrocarbons are isomers of each other?

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

34 When ethanol reacts with ethanoic acid, the ester ethyl ethanoate is formed.



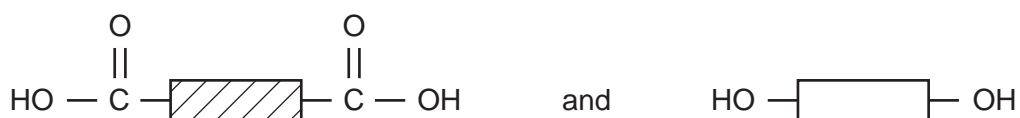
What is the formula of the ester formed when methanol reacts with butanoic acid ($\text{C}_3\text{H}_7\text{CO}_2\text{H}$)?

- A $\text{C}_2\text{H}_5\text{CO}_2\text{C}_2\text{H}_5$
- B $\text{C}_3\text{H}_7\text{CO}_2\text{C}_2\text{H}_5$
- C $\text{CH}_3\text{CO}_2\text{C}_3\text{H}_7$
- D $\text{C}_3\text{H}_7\text{CO}_2\text{CH}_3$

35 Which of these polymers is a protein?

- A $(\text{C}_2\text{H}_3\text{Cl})_n$
- B $(\text{C}_2\text{H}_3\text{NO})_n$
- C $(\text{C}_5\text{H}_8\text{O}_2)_n$
- D $(\text{C}_6\text{H}_{10}\text{O}_5)_n$

- 36 Which natural resource is being depleted by the manufacture of plastics?
- A air
B fossil fuels
C metal ores
D water
- 37 Which statement is true about ethanol?
- A It is formed by the catalytic addition of steam to ethene.
B It is an unsaturated compound.
C It is formed by the oxidation of ethanoic acid.
D It reacts with ethyl ethanoate to form an acid.
- 38 Which element is **least** likely to be found in a macromolecule?
- A carbon
B hydrogen
C oxygen
D sodium
- 39 What is the catalyst used in the preparation of ethyl ethanoate from ethanol and ethanoic acid?
- A concentrated sulphuric acid
B nickel
C vanadium(V) oxide
D yeast
- 40 A macromolecule is made from the two monomer molecules shown below.



What is the macromolecule?

- A a carbohydrate
B a polyamide
C a polyester
D a protein

DATA SHEET
The Periodic Table of the Elements

		Group																																																																					
		I	II	III	IV	V	VI	VII	0																																																														
7	9	Li Lithium 3	Be Beryllium 4	<table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">H Hydrogen 1</td> </tr> </table>										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																																												
1	H Hydrogen 1																																																																						
23	24	Na Sodium 11	Mg Magnesium 12	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																																																								
39	40	K Potassium 19	Ca Calcium 20	55	Mn Manganese 25	56	Fe Iron 26	59	Co Cobalt 27	64	Cu Copper 29	65	Zn Zinc 30	70	Ga Gallium 31	73	Ge Germanium 32	75	As Arsenic 33	79	Se Selenium 34	80	Br Bromine 35	84	Kr Krypton 36																																														
85	88	Rb Rubidium 37	Sr Strontium 38	91	Zr Zirconium 40	96	Mo Molybdenum 42	101	Ru Ruthenium 44	103	Rh Rhodium 45	106	Pd Palladium 46	112	Cd Cadmium 48	115	In Indium 49	119	Sn Tin 50	122	Sb Antimony 51	128	Te Tellurium 52	127	I Iodine 53	131	Xe Xenon 54																																												
133	137	Cs Caesium 55	Ba Barium 56	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	210	Po Polonium 84	210	At Astatine 85	210	Rn Radon 86																																								
87	88	Fr Francium 87	Ra Radium 88	226	La Lanthanum 57	227	Ac Actinium 89	<table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td style="text-align: center;">140</td> <td style="text-align: center;">Ce Cerium 58</td> <td style="text-align: center;">141</td> <td style="text-align: center;">Pr Praseodymium 59</td> <td style="text-align: center;">144</td> <td style="text-align: center;">Nd Neodymium 60</td> <td style="text-align: center;">145</td> <td style="text-align: center;">Pm Promethium 61</td> <td style="text-align: center;">150</td> <td style="text-align: center;">Sm Samarium 62</td> <td style="text-align: center;">152</td> <td style="text-align: center;">Eu Europium 63</td> <td style="text-align: center;">157</td> <td style="text-align: center;">Gd Gadolinium 64</td> <td style="text-align: center;">162</td> <td style="text-align: center;">Dy Dysprosium 66</td> <td style="text-align: center;">163</td> <td style="text-align: center;">Ho Holmium 67</td> <td style="text-align: center;">167</td> <td style="text-align: center;">Er Erbium 68</td> <td style="text-align: center;">168</td> <td style="text-align: center;">Tm Thulium 69</td> <td style="text-align: center;">173</td> <td style="text-align: center;">Yb Ytterbium 70</td> <td style="text-align: center;">175</td> <td style="text-align: center;">Lu Lutetium 71</td> </tr> <tr> <td style="text-align: center;">232</td> <td style="text-align: center;">Th Thorium 90</td> <td style="text-align: center;">238</td> <td style="text-align: center;">Pa Protactinium 91</td> <td style="text-align: center;">238</td> <td style="text-align: center;">U Uranium 92</td> <td style="text-align: center;">238</td> <td style="text-align: center;">Np Neptunium 93</td> <td style="text-align: center;">238</td> <td style="text-align: center;">Pu Plutonium 94</td> <td style="text-align: center;">238</td> <td style="text-align: center;">Am Americium 95</td> <td style="text-align: center;">238</td> <td style="text-align: center;">Cm Curium 96</td> <td style="text-align: center;">238</td> <td style="text-align: center;">Bk Berkelium 97</td> <td style="text-align: center;">238</td> <td style="text-align: center;">Cf Californium 98</td> <td style="text-align: center;">238</td> <td style="text-align: center;">Es Einsteinium 99</td> <td style="text-align: center;">238</td> <td style="text-align: center;">Fm Fermium 100</td> <td style="text-align: center;">238</td> <td style="text-align: center;">Md Mendelevium 101</td> <td style="text-align: center;">238</td> <td style="text-align: center;">No Nobelium 102</td> <td style="text-align: center;">238</td> <td style="text-align: center;">Lr Lawrencium 103</td> </tr> </table>										140	Ce Cerium 58	141	Pr Praseodymium 59	144	Nd Neodymium 60	145	Pm Promethium 61	150	Sm Samarium 62	152	Eu Europium 63	157	Gd Gadolinium 64	162	Dy Dysprosium 66	163	Ho Holmium 67	167	Er Erbium 68	168	Tm Thulium 69	173	Yb Ytterbium 70	175	Lu Lutetium 71	232	Th Thorium 90	238	Pa Protactinium 91	238	U Uranium 92	238	Np Neptunium 93	238	Pu Plutonium 94	238	Am Americium 95	238	Cm Curium 96	238	Bk Berkelium 97	238	Cf Californium 98	238	Es Einsteinium 99	238	Fm Fermium 100	238	Md Mendelevium 101	238	No Nobelium 102	238	Lr Lawrencium 103
140	Ce Cerium 58	141	Pr Praseodymium 59	144	Nd Neodymium 60	145	Pm Promethium 61											150	Sm Samarium 62	152	Eu Europium 63	157	Gd Gadolinium 64	162	Dy Dysprosium 66	163	Ho Holmium 67	167	Er Erbium 68	168	Tm Thulium 69	173	Yb Ytterbium 70	175	Lu Lutetium 71																																				
232	Th Thorium 90	238	Pa Protactinium 91	238	U Uranium 92	238	Np Neptunium 93	238	Pu Plutonium 94	238	Am Americium 95	238	Cm Curium 96	238	Bk Berkelium 97	238	Cf Californium 98	238	Es Einsteinium 99	238	Fm Fermium 100	238	Md Mendelevium 101	238	No Nobelium 102	238	Lr Lawrencium 103																																												
				<p>*58-71 Lanthanoid series 90-103 Actinoid series</p>																																																																			

Key

a	X	b
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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.).