UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CHEMISTRY **5070/01**

Paper 1 Multiple Choice

May/June 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.

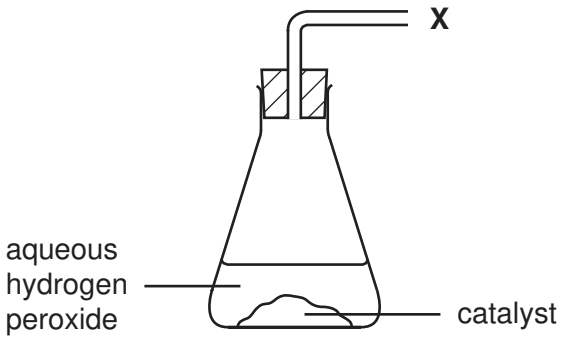
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
A copy of the Periodic Table is to be found on page 16.

This document consists of **16** printed pages.

1 Aqueous hydrogen peroxide undergoes catalytic decomposition as shown in the equation below.

$$2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$$

The diagram shows part of the apparatus used to measure the rate of decomposition.



Which piece of apparatus is connected at position **X**?

A burette

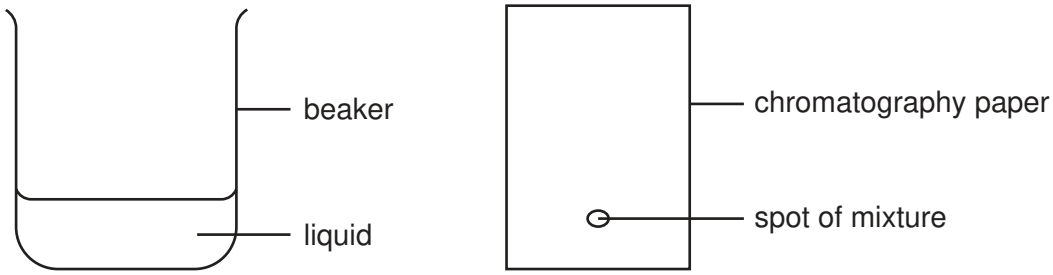
B gas syringe

C measuring cylinder

D pipette

2 A mixture of two substances is spotted on to a piece of chromatography paper.

The paper was inserted into a beaker containing a liquid.



For separation of the substances to occur the mixture must

A be placed so that the spot is just below the level of the liquid.

B be soluble in the liquid.

C contain substances of the same R_f values.

D contain substances that are coloured.

3 In a sample of air at 25 °C, the molecules of oxygen, nitrogen and carbon dioxide all move with different average speeds.

Which of the following lists the molecules in order of decreasing average speed?

	fastest ⟶ slowest		
A	carbon dioxide	oxygen	nitrogen
B	nitrogen	oxygen	carbon dioxide
C	oxygen	carbon dioxide	nitrogen
D	oxygen	nitrogen	carbon dioxide

4 Which of the following is the best method of obtaining pure water from ink?

A chromatography

B distillation

C filtration

D freezing

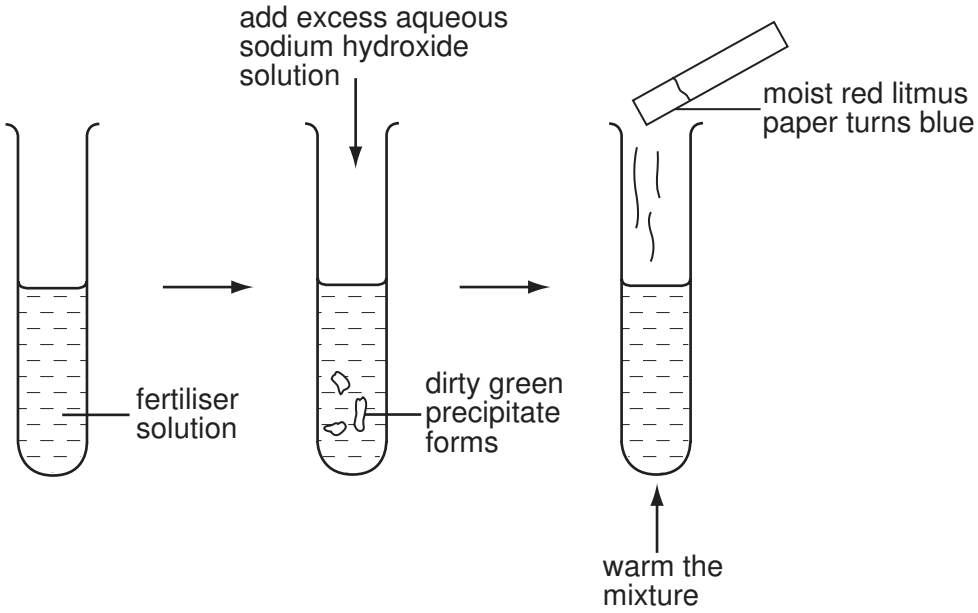
5 The relative molecular mass, M_r, of copper(II) sulphate, $CuSO_4$, is 160.

The relative molecular mass, M_r, of water is 18.

What is the percentage by mass of water in copper(II) sulphate crystals, $CuSO_4.5H_2O$?

A $\frac{18 \times 100}{160}$ **B** $\frac{5 \times 18 \times 100}{160 + 18}$ **C** $\frac{18 \times 100}{160 + 18}$ **D** $\frac{5 \times 18 \times 100}{160 + (5 \times 18)}$

6 A solution of fertiliser was tested as shown.



Which ions must be present in the fertiliser?

A NH_4^+ and NO_3^-

B NH_4^+ and Fe^{2+}

C Fe^{2+} and SO_4^{2-}

D Fe^{3+} and NO_3^-

7 An element X has two isotopes, ^{238}X and ^{235}X.

How does ^{238}X differ from ^{235}X?

A It has 3 more protons and 3 more electrons.

B It has 3 more protons, but no more electrons.

C It has 3 more neutrons and 3 more electrons.

D It has 3 more neutrons, but no more electrons.

8 The formulae of the ions of four elements are shown below.

O^{2-} F^{-} Li^{+} Mg^{2+}

Which statement about these ions is correct?

They all have

A the same number of electrons in their outer shells.

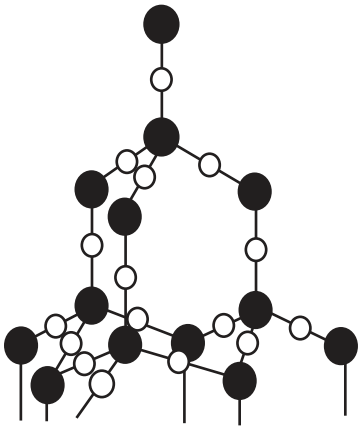
B the same electronic structure as a noble gas.

C the same number of protons in their nuclei.

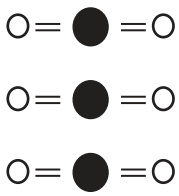
D more electrons than protons.

9 Which diagram represents the structure of sand, SiO_2?

A



B

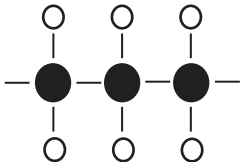


key

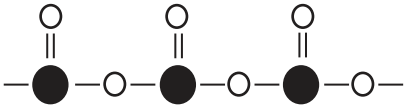
Silicon atom

Oxygen atom

C



D



10 What happens when sodium chloride melts?

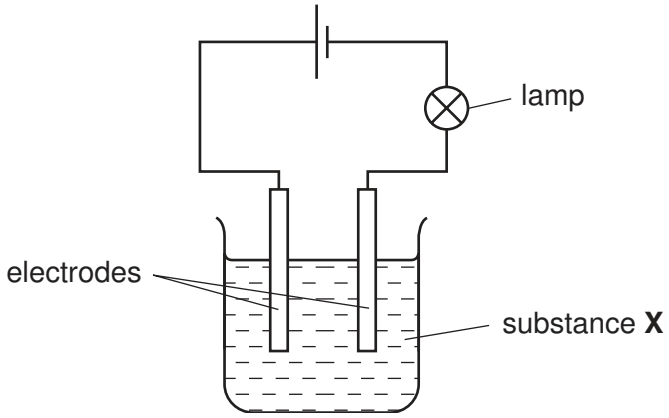
A Covalent bonds in a giant lattice are broken.

B Electrons are released from atoms.

C Electrostatic forces of attraction between ions are overcome.

D Molecules are separated into ions.

11 In the circuit below, the lamp lights up.



What could **X** be?

A a solution of ethanol in water

B a solution of sodium chloride in water

C liquid ethanol

D solid sodium chloride

12 The formula of china clay (aluminium silicate) was shown in an old book as $Al_2O_3.2SiO_2.2H_2O$.

This formula is shown in a modern book as $Al_2(OH)_x Si_2O_y$.

What are the values of *x* and *y* in the modern formula?

	x	*y*
A	2	4
B	2	5
C	4	3
D	4	5

13 What is the concentration of iodine, I_2, molecules in a solution containing 2.54 g of iodine in 250 cm^3 of solution?

A 0.01 mol / dm^3 **B** 0.02 mol / dm^3 **C** 0.04 mol / dm^3 **D** 0.08 mol / dm^3

14 The formula of an oxide of uranium is UO_2.

What is the formula of the corresponding chloride?

A UCl_2 **B** UCl_4 **C** U_2Cl **D** U_4Cl

15 The equation for the burning of hydrogen in oxygen is shown below.

$$2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$$

Which information does this equation give about the reaction?

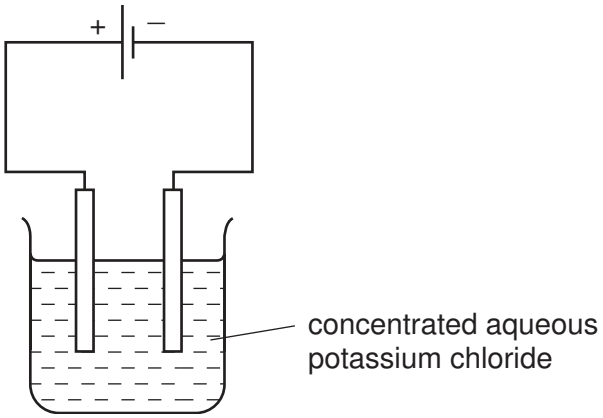
A 36 g of steam can be obtained from 16 g of oxygen.

B 2 g of hydrogen combine with 1 g of oxygen.

C 2 mol of steam can be obtained from 1 mol of oxygen.

D 2 atoms of hydrogen combine with 2 atoms of oxygen.

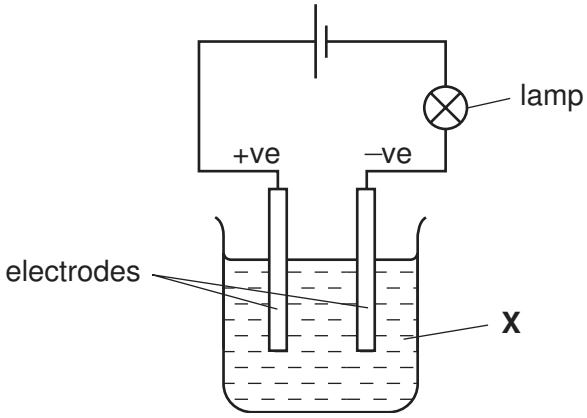
16 A current was passed through concentrated aqueous potassium chloride, KC*l*, as shown.



Which entry in the table is correct?

	ions moving towards	
	the cathode (-ve)	the anode (+ve)
A	K^+ only	Cl^- and OH^-
B	K^+ only	Cl^- only
C	K^+ and H^+	Cl^- only
D	K^+ and H^+	Cl^- and OH^-

17 When the experiment shown was set up, the bulb lit, but there were no decomposition products at the electrodes.



What is **X**?

A aqueous sodium chloride

B bromine

C molten sodium chloride

D mercury

18 Which of the following changes is endothermic?

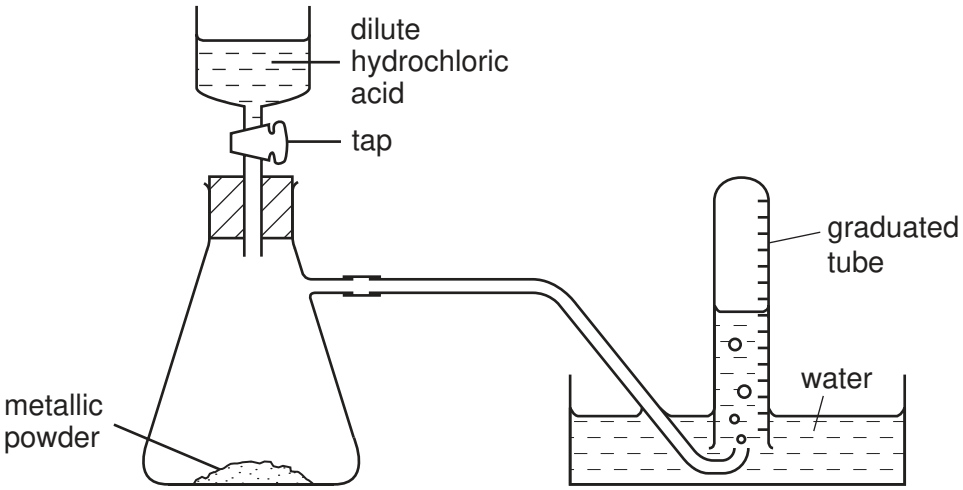
A $H(g) + Cl(g) \rightarrow HCl(g)$

B $H_2O(g) \rightarrow 2H(g) + O(g)$

C $H_2O(l) \rightarrow H_2O(s)$

D $2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$

19 The diagram shows apparatus for measuring the volume of hydrogen given off when an excess of dilute hydrochloric acid is added to powdered metal. The volume of gas is measured at room temperature and pressure.



The experiment is carried out three times, using the same mass of powder each time but with different powders:

- pure magnesium
- pure zinc
- a mixture of magnesium and zinc

Which powder gives the greatest volume of hydrogen and which the least volume?

	greatest volume of H_2	least volume of H_2
A	magnesium	zinc
B	magnesium	the mixture
C	zinc	magnesium
D	zinc	the mixture

20 Which change will increase the speed of the reaction between 1 mol of each of the gases, X and Y?

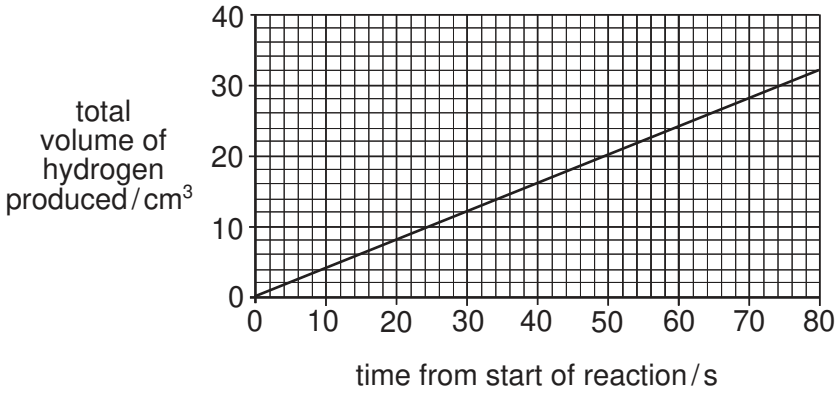
A a decrease in surface area of the catalyst

B a decrease in temperature

C a decrease in the volume of the reaction flask

D an increase in the volume of the reaction flask

21 Dilute hydrochloric acid was reacted with magnesium ribbon and the volume of hydrogen gas evolved was measured for the first 80 s.



What was the average rate of production of hydrogen?

A 0.4 cm^3 / s **B** 2.5 cm^3 / s **C** 4 cm^3 / s **D** 40 cm^3 / s

22 Small portions of aqueous potassium iodide and of acidified, aqueous potassium manganate(VII) were added to four solutions. The colour changes seen are shown in the table.

solution number	potassium iodide	potassium manganate(VII)
1	colourless to red	purple to colourless
2	colourless to red	no change
3	no change	purple to colourless
4	no change	no change

Which solutions contained an oxidising agent?

A 1 only **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 4 only

23 The table gives information about three indicators.

indicator	colour change low pH ⟶ high pH	pH at which colour change takes place
methyl orange	red ⟶ yellow	4.0
bromothymol blue	yellow ⟶ blue	6.5
phenolphthalein	colourless ⟶ pink	9.0

If equal volumes of these three indicators were mixed, which colour would be observed at pH 5?

A blue

B green

C orange

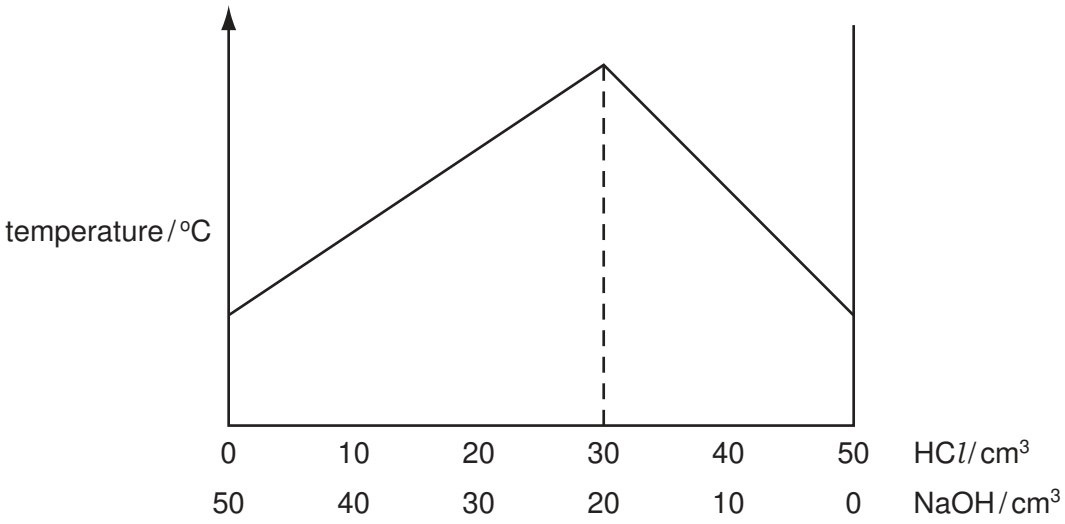
D yellow

24 A solution of hydrochloric acid has a concentration of $2\,mol/dm^3$.

Different volumes of the acid are added to different volumes of aqueous sodium hydroxide.

$$NaOH + HCl \rightarrow NaCl + H_2O$$

The maximum temperature of each mixture is measured. The graph shows the results.



What is the concentration of the aqueous sodium hydroxide?

A $0.67\,mol/dm^3$

B $1.3\,mol/dm^3$

C $1.5\,mol/dm^3$

D $3.0\,mol/dm^3$

25 Which method of preparation of a pure salt solution requires the use of a pipette and burette?

A $BaCl_2(aq) + H_2SO_4(aq) \rightarrow BaSO_4(s) + 2HCl(aq)$

B $CuO(s) + 2HCl(aq) \rightarrow CuCl_2(aq) + H_2O(l)$

C $KOH(aq) + HCl(aq) \rightarrow KCl(aq) + H_2O(l)$

D $MgCO_3(s) + H_2SO_4(aq) \rightarrow MgSO_4(aq) + H_2O(l) + CO_2(g)$

26 Which statement about the manufacture of ammonia by the Haber Process is correct?

A The reactants and product are elements.

B The reactants and product are gases.

C The reactants and product are compounds.

D The reactants are both obtained from the air.

27 Which of the following occurs in the Contact process?

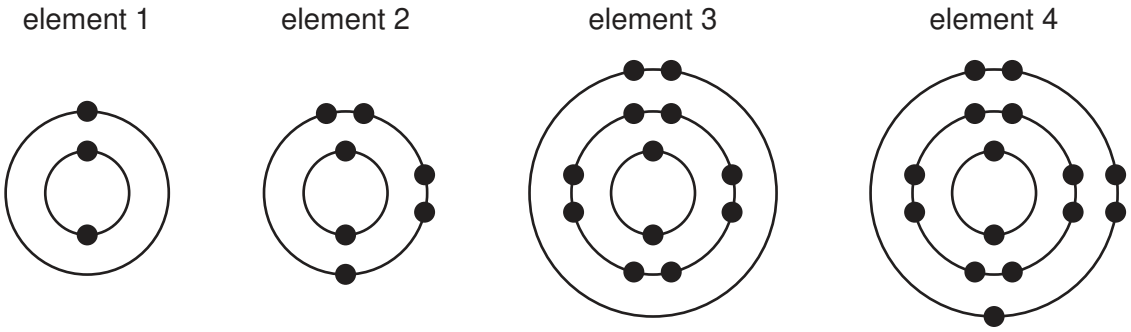
A Sulphur dioxide is dissolved in water.

B Sulphur trioxide is dissolved in water.

C Sulphur dioxide is dissolved in dilute sulphuric acid.

D Sulphur trioxide is dissolved in concentrated sulphuric acid.

28 The diagrams show the arrangements of the electrons of four elements.



Which two elements are metals?

A 1 and 2

B 1 and 3

C 2 and 4

D 3 and 4

29 Sodium, aluminium and sulphur are in the same period of the Periodic Table.

What trend in types of oxide occurs across this period?

	left →		right
A	acidic	amphoteric	basic
B	amphoteric	basic	acidic
C	basic	acidic	amphoteric
D	basic	amphoteric	acidic

30 Use the Periodic Table to decide which element has all four of the properties shown.

- high melting point
- variable oxidation states
- good electrical conductivity
- forms coloured compounds

A caesium, Cs

B cobalt, Co

C iodine, I

D strontium, Sr

31 Iron rusts when exposed to oxygen in the presence of water.

Which of these methods will **not** slow down the rate of rusting of an iron roof?

A attaching strips of copper to it

B coating it with plastic

C galvanising it with zinc

D painting it

32 Why does aluminium have an apparent lack of reactivity?

A Aluminium has a coating of aluminium oxide, preventing further reaction.

B Aluminium has a giant molecular structure that is too hard to break.

C Aluminium is low in the reactivity series.

D The activation energy for the reaction of aluminium with other elements is too high.

33 Which oxide can be reduced to the metal by hydrogen?

A calcium oxide

B copper(II) oxide

C magnesium oxide

D sodium oxide

34 The data gives the concentration, in parts of pollutant per billion parts of air, of polluting gases in four different industrialised cities.

In which city are limestone buildings under greatest threat from pollution?

city	sulphur dioxide	nitrogen dioxide	ozone
A	17	46	23
B	32	33	30
C	38	40	11
D	45	14	21

35 The water in a lake contains the following dissolved substances.

- mineral salts
- nitrates
- oxygen
- phosphates
- sewage

How many of these substances can cause eutrophication?

A 1 **B** 2 **C** 3 **D** 4

36 The equation represents the conversion of starch to a simple sugar.

$$(C_6H_{10}O_5)_n + n\,H_2O \rightarrow n\,C_6H_{12}O_6$$

starch simple sugar

This reaction is an example of

A condensation.

B hydrogenation.

C hydrolysis.

D polymerisation.

37 Methane, CH_4, the first member of the alkane homologous series, has a boiling point of –161 °C.

Which molecular formula and boiling point could be correct for another alkane?

	molecular formula	boiling point / °C
A	C_2H_4	–88
B	C_2H_6	–185
C	C_3H_6	–69
D	C_3H_8	–42

38 A student carries out three tests on a gas **X**.

test	results
damp red litmus paper	stays red
aqueous bromine	stays brown
lighted splint	gas burns

Which gas could be **X**?

A ammonia

B ethene

C methane

D oxygen

39 An organic compound, **Y**, reacts with sodium hydroxide to give a compound with formula $C_3H_5O_2Na$.

What is compound **Y**?

A ethanol

B propane

C propanoic acid

D propanol

40 Which compound has an addition reaction with chlorine?

A C_2H_4 **B** C_2H_6 **C** C_2H_5OH **D** CH_3CO_2H

DATA SHEET
The Periodic Table of the Elements

	Group																	
	I	II									III	IV	V	VI	VII	0
							1 H Hydrogen 1									4 He Helium 2
2nd period	7 Li Lithium 3	9 Be Beryllium 4									11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
3rd period	23 Na Sodium 11	24 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
4th period	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	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
5th period	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	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
6th period	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
7th period	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 / X / b	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.).