

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.

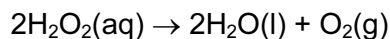
Any rough working should be done in this booklet.

A copy of the Periodic Table is to be found on page 16.

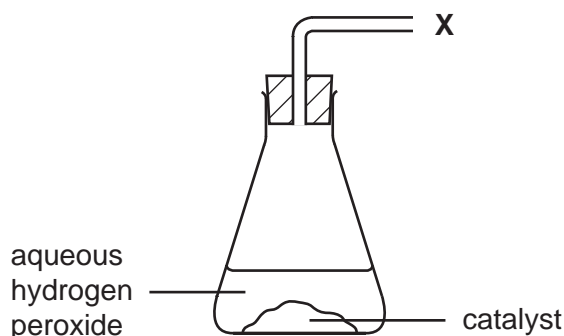
This document consists of **16** printed pages.



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



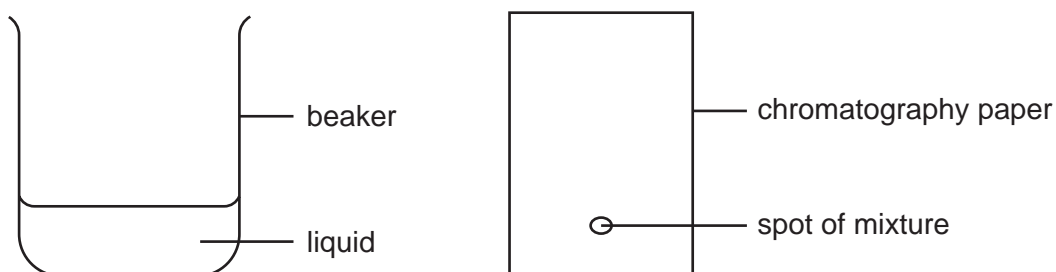
The diagram shows part of the apparatus used to measure the rate of decomposition.



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
<b>A</b>	carbon dioxide	oxygen	nitrogen
<b>B</b>	nitrogen	oxygen	carbon dioxide
<b>C</b>	oxygen	carbon dioxide	nitrogen
<b>D</b>	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

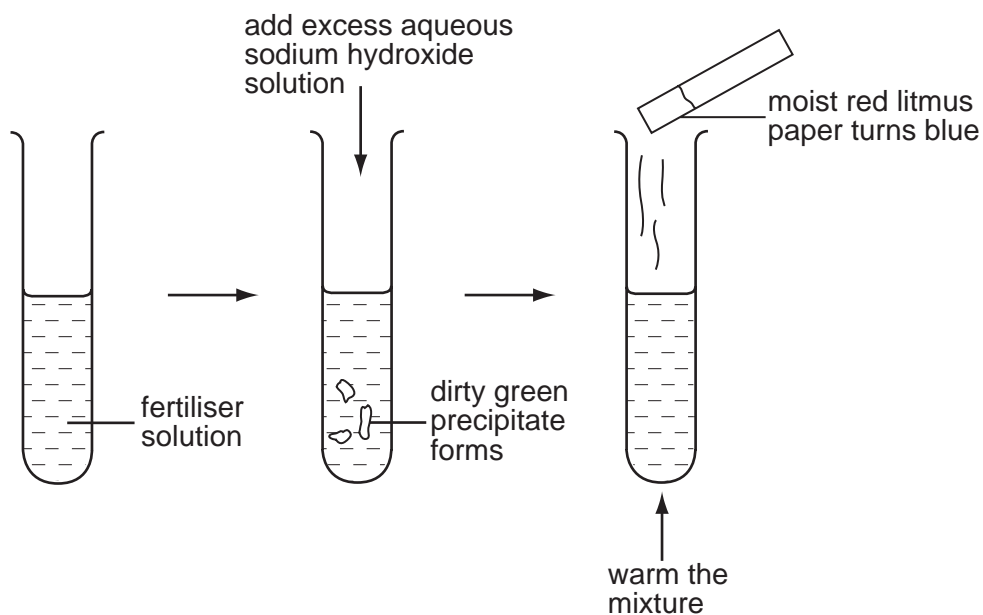
- 5 The relative molecular mass,  $M_r$ , of copper(II) sulphate,  $\text{CuSO}_4$ , is 160.

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

What is the percentage by mass of water in copper(II) sulphate crystals,  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ ?

- 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?

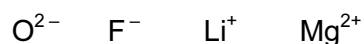
- A  $\text{NH}_4^+$  and  $\text{NO}_3^-$
- B  $\text{NH}_4^+$  and  $\text{Fe}^{2+}$
- C  $\text{Fe}^{2+}$  and  $\text{SO}_4^{2-}$
- D  $\text{Fe}^{3+}$  and  $\text{NO}_3^-$

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

How does  $^{238}\text{X}$  differ from  $^{235}\text{X}$ ?

- 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.

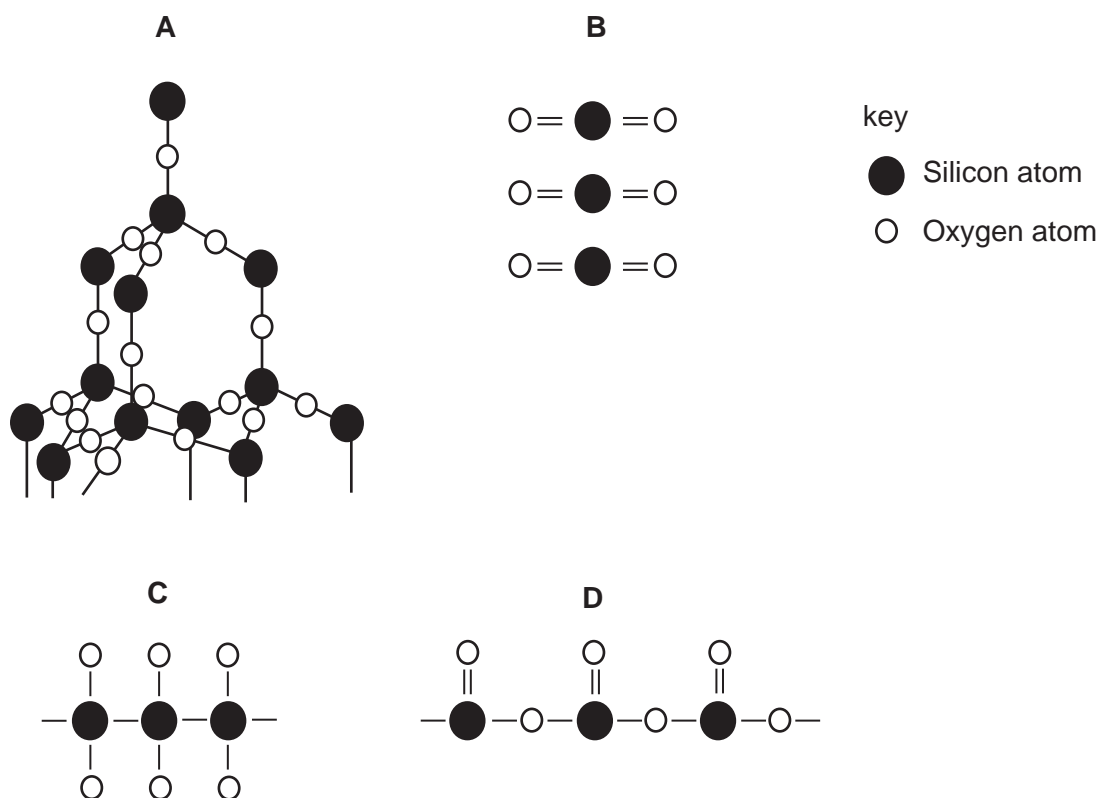
- 8 The formulae of the ions of four elements are shown below.



Which statement about these ions is correct?

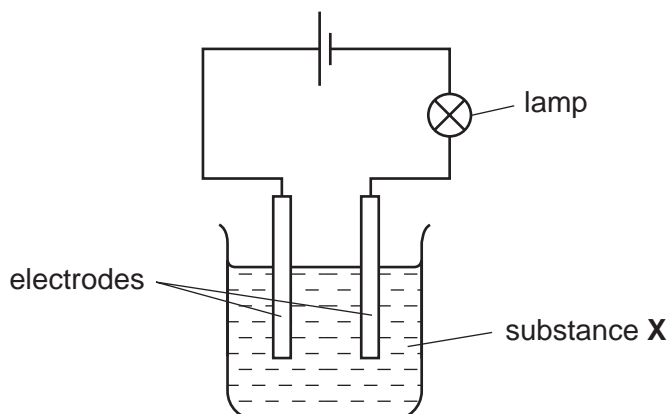
They all have

- 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,  $\text{SiO}_2$ ?



- 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  $Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$ .

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?

	$x$	$y$
<b>A</b>	2	4
<b>B</b>	2	5
<b>C</b>	4	3
<b>D</b>	4	5

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

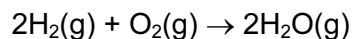
- A  $0.01 \text{ mol/dm}^3$
- B  $0.02 \text{ mol/dm}^3$
- C  $0.04 \text{ mol/dm}^3$
- D  $0.08 \text{ mol/dm}^3$

14 The formula of an oxide of uranium is  $UO_2$ .

What is the formula of the corresponding chloride?

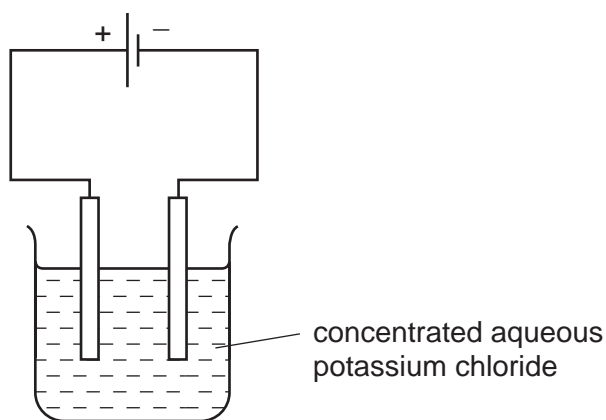
- A  $UCl_2$
- B  $UCl_4$
- C  $U_2Cl$
- D  $U_4Cl$

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



Which information does this equation give about the reaction?

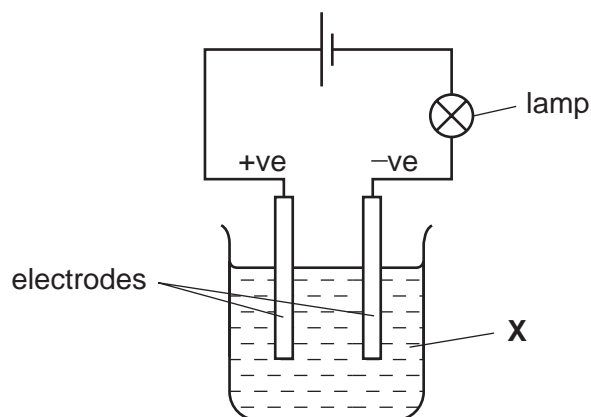
- A 36 g of steam can be obtained from 16 g of oxygen.  
 B 2 g of hydrogen combine with 1 g of oxygen.  
 C 2 mol of steam can be obtained from 1 mol of oxygen.  
 D 2 atoms of hydrogen combine with 2 atoms of oxygen.
- 16 A current was passed through concentrated aqueous potassium chloride,  $\text{KCl}$ , as shown.



Which entry in the table is correct?

	ions moving towards	
	the cathode (-ve)	the anode (+ve)
<b>A</b>	$\text{K}^+$ only	$\text{Cl}^-$ and $\text{OH}^-$
<b>B</b>	$\text{K}^+$ only	$\text{Cl}^-$ only
<b>C</b>	$\text{K}^+$ and $\text{H}^+$	$\text{Cl}^-$ only
<b>D</b>	$\text{K}^+$ and $\text{H}^+$	$\text{Cl}^-$ and $\text{OH}^-$

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



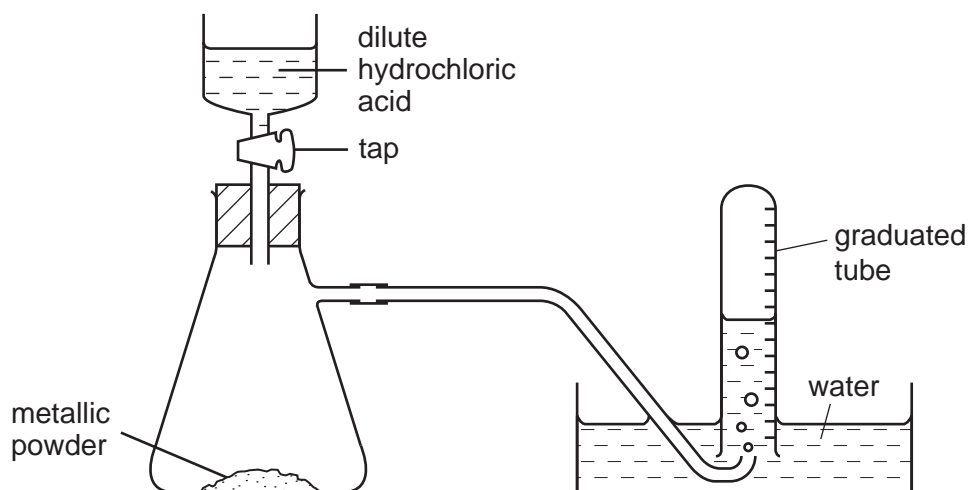
What is **X**?

- A aqueous sodium chloride
  - B bromine
  - C molten sodium chloride
  - D mercury
- 18 Which of the following changes is endothermic?

- A  $\text{H(g)} + \text{Cl(g)} \rightarrow \text{HCl(g)}$
- B  $\text{H}_2\text{O(g)} \rightarrow 2\text{H(g)} + \text{O(g)}$
- C  $\text{H}_2\text{O(l)} \rightarrow \text{H}_2\text{O(s)}$
- D  $2\text{H}_2\text{(g)} + \text{O}_2\text{(g)} \rightarrow 2\text{H}_2\text{O(l)}$



- 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:

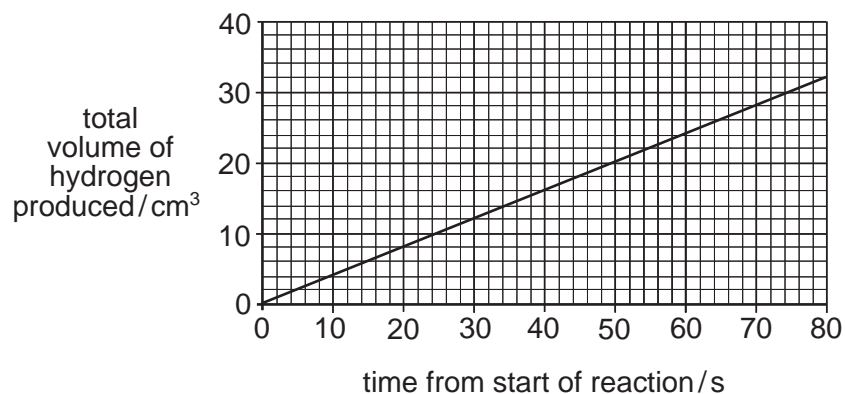
- pure magnesium
- pure zinc
- a mixture of magnesium and zinc

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

	greatest volume of H <sub>2</sub>	least volume of H <sub>2</sub>
<b>A</b>	magnesium	zinc
<b>B</b>	magnesium	the mixture
<b>C</b>	zinc	magnesium
<b>D</b>	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  $0.4\text{ cm}^3/\text{s}$       B  $2.5\text{ cm}^3/\text{s}$       C  $4\text{ cm}^3/\text{s}$       D  $40\text{ cm}^3/\text{s}$
- 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.

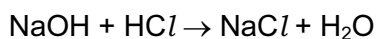
indicator	colour change		pH at which colour change takes place
	low pH	high pH	
methyl orange	red	yellow	4.0
bromothymol blue	yellow	blue	6.5
phenolphthalein	colourless	pink	9.0

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

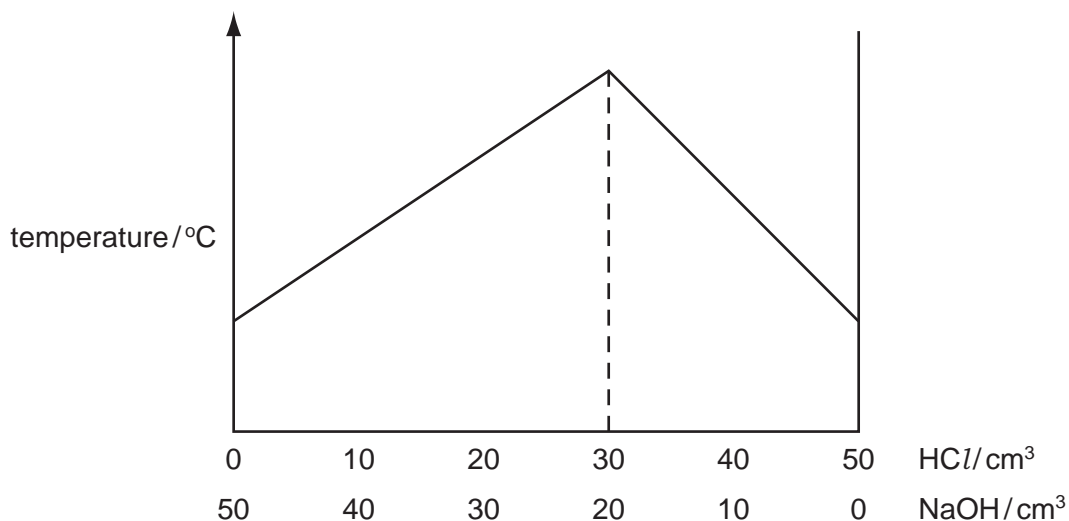
- A blue
- B green
- C orange
- D yellow

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

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



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



What is the concentration of the aqueous sodium hydroxide?

- A  $0.67 \text{ mol/dm}^3$
- B  $1.3 \text{ mol/dm}^3$
- C  $1.5 \text{ mol/dm}^3$
- D  $3.0 \text{ mol/dm}^3$

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

- A  $\text{BaCl}_2(\text{aq}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{BaSO}_4(\text{s}) + 2\text{HCl}(\text{aq})$   
 B  $\text{CuO}(\text{s}) + 2\text{HCl}(\text{aq}) \rightarrow \text{CuCl}_2(\text{aq}) + \text{H}_2\text{O}(\text{l})$   
 C  $\text{KOH}(\text{aq}) + \text{HCl}(\text{aq}) \rightarrow \text{KCl}(\text{aq}) + \text{H}_2\text{O}(\text{l})$   
 D  $\text{MgCO}_3(\text{s}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{MgSO}_4(\text{aq}) + \text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g})$

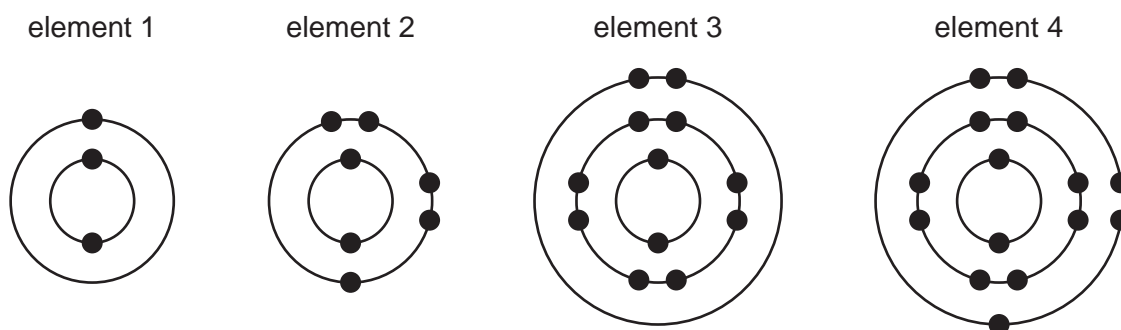
26 Which statement about the manufacture of ammonia by the Haber Process is correct?

- 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
<b>A</b>	acidic	amphoteric	basic
<b>B</b>	amphoteric	basic	acidic
<b>C</b>	basic	acidic	amphoteric
<b>D</b>	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

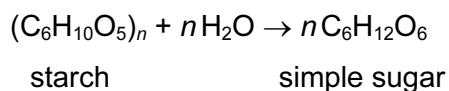
35 The water in a lake contains the following dissolved substances.

- 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.



This reaction is an example of

- A condensation.
- B hydrogenation.
- C hydrolysis.
- D polymerisation.

37 Methane, CH<sub>4</sub>, 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
<b>A</b>	C <sub>2</sub> H <sub>4</sub>	–88
<b>B</b>	C <sub>2</sub> H <sub>6</sub>	–185
<b>C</b>	C <sub>3</sub> H <sub>6</sub>	–69
<b>D</b>	C <sub>3</sub> H <sub>8</sub>	–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<sub>3</sub>H<sub>5</sub>O<sub>2</sub>Na.

What is compound **Y**?

- A** ethanol
- B** propane
- C** propanoic acid
- D** propanol

40 Which compound has an addition reaction with chlorine?

- A** C<sub>2</sub>H<sub>4</sub>
- B** C<sub>2</sub>H<sub>6</sub>
- C** C<sub>2</sub>H<sub>5</sub>OH
- D** CH<sub>3</sub>CO<sub>2</sub>H

**DATA SHEET**  
**The Periodic Table of the Elements**

		Group																							
I	II	III	IV	V	VI	VII	0					0													
7 <b>Li</b> Lithium 3	9 <b>Be</b> Beryllium 4	1 <b>H</b> Hydrogen 1	11 <b>B</b> Boron 5	12 <b>C</b> Carbon 6	14 <b>N</b> Nitrogen 7	16 <b>O</b> Oxygen 8	19 <b>F</b> Fluorine 9	20 <b>Ne</b> Neon 10					4 <b>He</b> Helium 2												
23 <b>Na</b> Sodium 11	24 <b>Mg</b> Magnesium 12	27 <b>Al</b> Aluminium 13	28 <b>Si</b> Silicon 14	31 <b>P</b> Phosphorus 15	32 <b>S</b> Sulphur 16	35.5 <b>Cl</b> Chlorine 17	40 <b>Ar</b> Argon 18																		
39 <b>K</b> Potassium 19	40 <b>Ca</b> Calcium 20	45 <b>Sc</b> Scandium 21	48 <b>Ti</b> Titanium 22	51 <b>V</b> Vanadium 23	52 <b>Cr</b> Chromium 24	55 <b>Mn</b> Manganese 25	56 <b>Fe</b> Iron 26	59 <b>Co</b> Cobalt 27	59 <b>Ni</b> Nickel 28	64 <b>Cu</b> Copper 29	65 <b>Zn</b> Zinc 30	70 <b>Ga</b> Gallium 31	73 <b>Ge</b> Germanium 32	75 <b>As</b> Arsenic 33	79 <b>Se</b> Selenium 34	80 <b>Br</b> Bromine 35	84 <b>Kr</b> Krypton 36								
85 <b>Rb</b> Rubidium 37	88 <b>Sr</b> Strontium 38	89 <b>Y</b> Yttrium 39	91 <b>Zr</b> Zirconium 40	93 <b>Nb</b> Niobium 41	96 <b>Mo</b> Molybdenum 42	101 <b>Ru</b> Ruthenium 44	101 <b>Ru</b> Ruthenium 44	103 <b>Rh</b> Rhodium 45	106 <b>Pd</b> Palladium 46	108 <b>Ag</b> Silver 47	112 <b>Cd</b> Cadmium 48	115 <b>In</b> Indium 49	119 <b>Sn</b> Tin 50	122 <b>Sb</b> Antimony 51	128 <b>Te</b> Tellurium 52	127 <b>I</b> Iodine 53	131 <b>Xe</b> Xenon 54								
133 <b>Cs</b> Caesium 55	137 <b>Ba</b> Barium 56	139 <b>La</b> Lanthanum 57	178 <b>Hf</b> Hafnium 72	181 <b>Ta</b> Tantalum 73	184 <b>W</b> Tungsten 74	190 <b>Os</b> Osmium 76	190 <b>Os</b> Osmium 76	192 <b>Ir</b> Iridium 77	195 <b>Pt</b> Platinum 78	197 <b>Au</b> Gold 79	201 <b>Hg</b> Mercury 80	204 <b>Tl</b> Thallium 81	207 <b>Pb</b> Lead 82	209 <b>Bi</b> Bismuth 83	210 <b>Po</b> Polonium 84	210 <b>At</b> Astatine 85	222 <b>Rn</b> Radon 86								
226 <b>Ra</b> Radium 88	227 <b>Ac</b> Actinium 89	<p>*58-71 Lanthanoid series</p> <p>90-103 Actinoid series</p>																							
140 <b>Ce</b> Cerium 58	141 <b>Pr</b> Praseodymium 59	144 <b>Nd</b> Neodymium 60	150 <b>Sm</b> Samarium 62	152 <b>Eu</b> Europium 63	157 <b>Gd</b> Gadolinium 64	159 <b>Tb</b> Terbium 65	162 <b>Dy</b> Dysprosium 66	165 <b>Ho</b> Holmium 67	167 <b>Er</b> Erbium 68	169 <b>Tm</b> Thulium 69	173 <b>Yb</b> Ytterbium 70	175 <b>Lu</b> Lutetium 71	232 <b>Th</b> Thorium 90	238 <b>U</b> Uranium 92	238 <b>Np</b> Neptunium 93	238 <b>Pu</b> Plutonium 94	238 <b>Am</b> Americium 95	238 <b>Cm</b> Curium 96	238 <b>Bk</b> Berkelium 97	238 <b>Cf</b> Californium 98	238 <b>Es</b> Einsteinium 99	238 <b>Fm</b> Fermium 100	238 <b>Md</b> Mendelevium 101	238 <b>No</b> Nobelium 102	238 <b>Lr</b> Lawrencium 103

**Key**

a	<b>X</b>
b	

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

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