Name: _____ ( ) Class: _____

WHITLEY SECONDARY SCHOOL

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PRELIMINARY EXAMINATION 2022

SUBJECT	**:**	**Chemistry (6092/01)**
LEVEL	**:**	**Secondary 4 Express**
DATE	**:**	**29 August 2022**
DURATION	**:**	**1 hour**
SETTER	**:**	**Ms Ng Soo Hoon**
VETTERS	**:**	**Ms Charlene Lye and Mr Ng Mun Leong**

READ THESE INSTRUCTIONS FIRST
Write your name, class and index number in the spaces at the top of this page.

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, class and index number on the Answer Sheet in the spaces provided unless this has been done for you.

There are **forty** questions. 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.

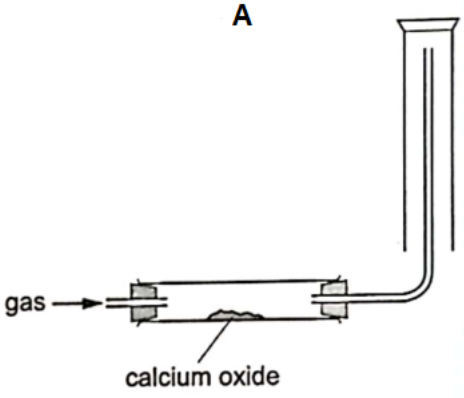
Read the instructions on the Answer Sheet very carefully.

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 **15**.
The use of an approved scientific calculator is expected, where appropriate.

1 A gas turns moist blue litmus paper red, is soluble in water and is less dense than air.

Which diagram shows a correct way of drying and collecting the gas?

A



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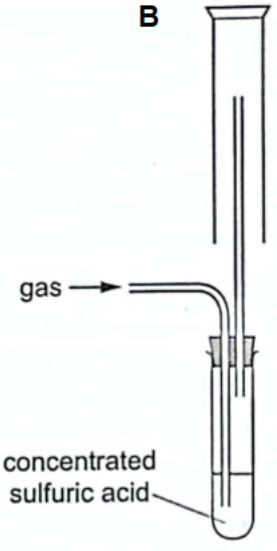

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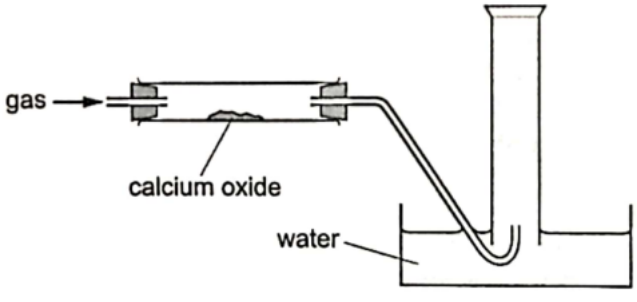

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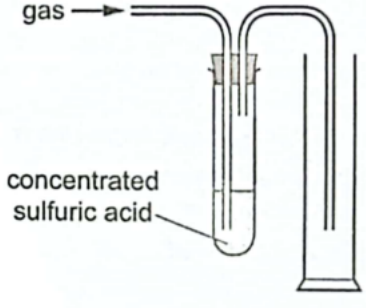
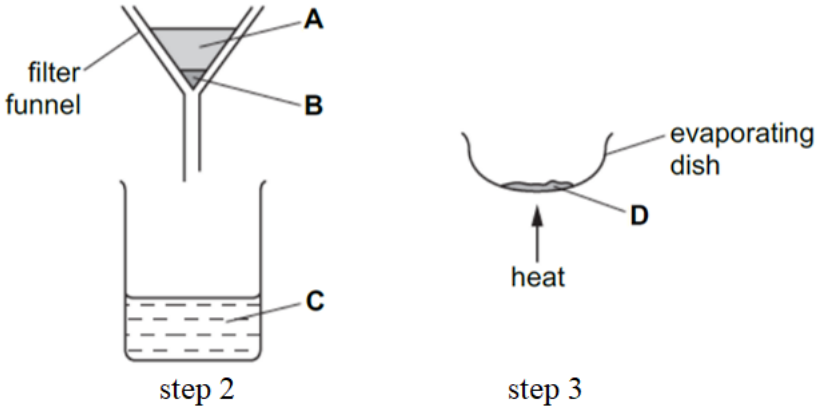


2 A mixture of sand and sodium chloride can be separated in three steps.

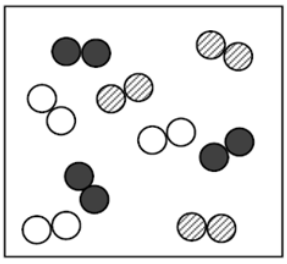
Step 1 is to add water to the mixture.
The diagram shows Steps 2 and 3.

Where is pure sodium chloride collected?



3 A gaseous mixture is made up of nitrogen, oxygen and nitrogen monoxide.
Which diagram could show a pure sample of this mixture?

A



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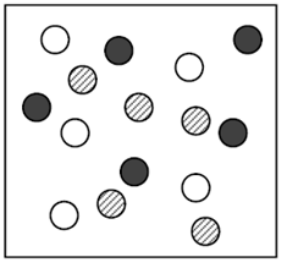

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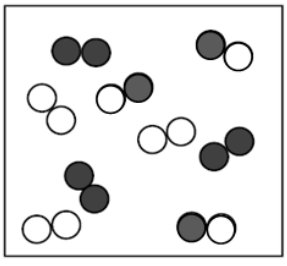

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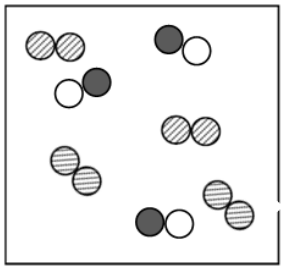
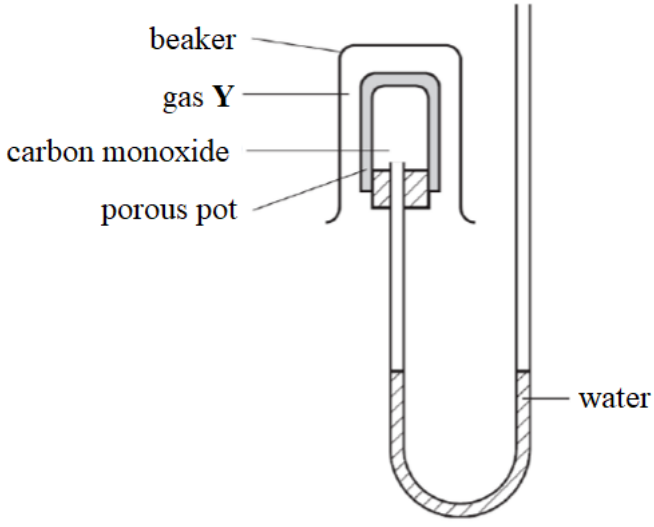


4 A beaker of an unknown gas **Y** was inverted over a porous pot containing carbon monoxide as shown. The apparatus was left for a while but the water level did not change.



The gas **Y** could have been

A ammonia.

B carbon dioxide.

C chlorine.

D nitrogen.

5 The boiling points of some gases are given in the following table.

gases	boiling point /°C
nitrogen	−196
xenon	−108
oxygen	−183

A mixture of liquid oxygen, nitrogen and xenon at −200 °C was heated up by 15 °C.

Which of the substances will still be in the liquid state at this higher temperature?

A nitrogen only

B xenon only

C a mixture of nitrogen and oxygen

D a mixture of oxygen and xenon

6 An element, **R**, has p protons and n neutrons in its nucleus.

Which of the following gives a possible correct number of protons, neutrons and electrons in a negative ion of an isotope of **R**?

	protons	neutrons	electrons
A	p	n + 1	p + 1
B	p	n + 1	p − 1
C	p + 1	n	p + 1
D	p + 1	n	p − 1

7 Which statement explains why potassium chloride, KCl, has a lower melting point than calcium oxide, CaO?

A Potassium is more reactive than calcium.

B The melting point of potassium is lower than calcium.

C Potassium chloride is covalent but calcium oxide is ionic.

D The forces of attraction between K^+ and Cl^- is weaker than that between Ca^{2+} and O^{2-}.

8 Which particles are responsible for the conduction of electricity through metals?

A electrons only

B electrons and positive ions

C negative ions only

D negative ions and positive ions

9 The atomic numbers and mass numbers of elements **P** and **Q** are given below:

element	atomic Number	mass number
P	20	40
Q	9	19

What is the relative molecular mass of the compound formed between **P** and **Q**?

A 29 **B** 38 **C** 59 **D** 78

10 68 g of hydrogen peroxide decomposes in the presence of manganese(IV) oxide to give 1.2 dm^3 of oxygen gas as follows.

$$2H_2O_2 \rightarrow O_2 + 2H_2O$$

What is the percentage purity of the hydrogen peroxide?

A 2.5% **B** 5.0% **C** 10.0% **D** 15.0%

11 In an experiment, 4.0 cm^3 of 1.0 mol/dm^3 aqueous copper(II) sulfate and 8.0 cm^3 of 1.0 mol/dm^3 aqueous sodium carbonate are mixed.

$$CuSO_4(aq) + Na_2CO_3(aq) \rightarrow Na_2SO_4(aq) + CuCO_3(s)$$

What does the reaction vessel contain once the reaction is complete?

A a colourless solution only

B a green precipitate and a blue solution

C a green precipitate and a colourless solution

D a white precipitate and a colourless solution

12 Elements **X**, **Y** and **Z** are all in the same period of the Periodic Table.

X forms an amphoteric oxide.

Solid **Y** does not conduct electricity.

Z forms an ionic oxide, **Z**O.

In which order do the elements appear in the Periodic Table?

A **X** → **Y** → **Z**

B **Y** → **X** → **Z**

C **Z** → **X** → **Y**

D **Z** → **Y** → **X**

13 20 cm^3 of an aqueous 1.0 mol/dm^3 solution of the hydroxide of metal **X**, exactly neutralises 60 cm^3 of aqueous 0.5 mol/dm^3 sulfuric acid.

What is the formula for the sulfate of **X**?

A X_2SO_4 **B** XSO_4 **C** $X_2(SO_4)_3$ **D** $X(SO_4)_2$

14 The information below concerns 3 elements **X**, **Y** and **Z**.

X: Its oxide is decomposed by heat to the element.

Y: Its carbonate is not decomposed by heat.

Z: Its oxide is not decomposed by heat but its carbonate decomposes.

In order of decreasing reactivity, the 3 elements should be arranged as

A **Y**, **Z**, **X** **B** **X**, **Y**, **Z** **C** **Y**, **X**, **Z** **D** **X**, **Z**, **Y**

15 The oxides of three elements, **T**, **U** and **V**, are added to water.

	oxide of **T**	oxide of **U**	oxide of **V**
water added	dissolved to form a solution of pH 2	insoluble	dissolved to form a solution of pH 10

The oxide of U is white in colour.

What are **T**, **U** and **V**?

	T	**U**	**V**
A	calcium	aluminium	sulfur
B	calcium	copper	sulfur
C	sulfur	aluminium	calcium
D	sulfur	copper	calcium

16 Which of the following reagents cannot be used to differentiate sodium hydroxide solution from sodium chloride solution?

A aqueous calcium nitrate solution

B aqueous copper(II) nitrate solution

C aqueous lithium nitrate solution

D aqueous zinc nitrate solution

17 An indicator has just been produced in the laboratory. The table shows the colours of the indicator at different pH values.

pH	colour
0 – 3	red
3.5 – 5	green
6 – 14	purple

This new indicator would be suitable for distinguishing

A aqueous potassium nitrate and aqueous potassium hydroxide.

B aqueous hydrogen chloride and carbon dioxide.

C aqueous ammonia and aqueous potassium hydroxide.

D water and aqueous potassium chloride.

18 **Y** is a white solid mixture that has the following properties.

Y dissolves in water.

When dilute hydrochloric acid is added to an aqueous solution of **Y**, bubbles are produced.

When chlorine is bubbled through an aqueous solution of **Y**, the solution turns red-brown.

What is present in **Y**?

A calcium carbonate, $CaCO_3$, and potassium bromide, KBr

B copper(II) carbonate, $CuCO_3$, and magnesium iodide, MgI_2

C sodium carbonate, Na_2CO_3, and sodium bromide, NaBr

D sodium nitrate, $NaNO_3$, and ammonium bromide, NH_4Br

19 An atmospheric pollutant can be removed by the process of reduction.

Which pollutant is removed by this process?

A carbon monoxide in a catalytic convertor

B nitrogen dioxide in acid rain by reaction with calcium carbonate

C nitrogen oxide in a catalytic convertor

D sulfur dioxide from flue gases by reaction with calcium carbonate

20 An aqueous ammonia is added to a solution of a salt. A white precipitate is formed which dissolves in an excess of aqueous ammonia. Which metal ion could the salt contain?

A Al^{3+} **B** Ca^{2+} **C** Cu^{2+} **D** Zn^{2+}

21 Iron pipes corrode rapidly when exposed to seawater.

Which metal, when attached to the iron pipes, would **not** offer protection against corrosion?

A aluminium

B magnesium

C copper

D zinc

22 Steel is an alloy of iron with a very small percentage of carbon.

Which statement is correct?

A A decrease in the percentage of carbon makes the steel more brittle.

B An increase in the percentage of carbon makes the steel softer.

C Carbon disrupts the metallic structure of iron.

D Iron atoms are the same size as carbon atoms.

23 Which of the underlined substances acts as a reducing agent?

A $2Mg + \underline{O_2} \rightarrow 2MgO$

B $\underline{Cu^{2+}} + Zn \rightarrow Cu + Zn^{2+}$

C $\underline{FeO} + H_2SO_4 \rightarrow FeSO_4 + H_2O$

D $CuO + \underline{H_2} \rightarrow Cu + H_2O$

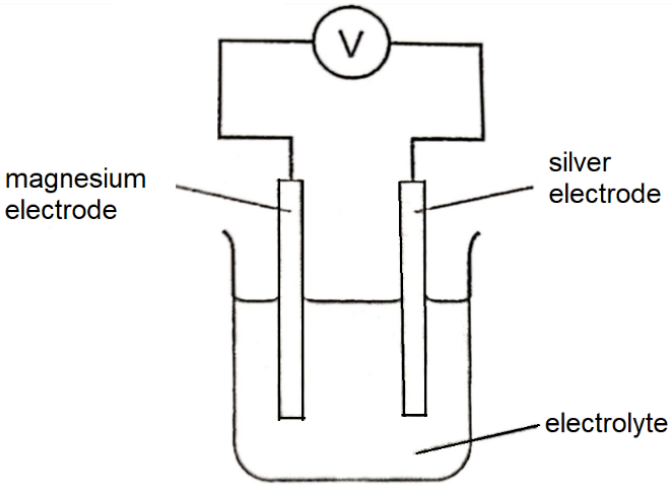
24 Metal **M** forms a chloride $\mathbf{M}Cl_2$.

M is between copper and silver in the reactivity series.

If a concentrated aqueous solution of $\mathbf{M}Cl_2$ is electrolysed, which reactions will occur at the cathode and the anode?

	cathode (negative electrode)	anode (positive electrode)
A	$\mathbf{M}^+ + e^- \rightarrow \mathbf{M}$	$2Cl^- - 2e^- \rightarrow Cl_2$
B	$\mathbf{M}^+ + e^- \rightarrow \mathbf{M}$	$4OH^- - 4e^- \rightarrow 2H_2O + O_2$
C	$\mathbf{M}^{2+} + 2e^- \rightarrow \mathbf{M}$	$2Cl^- - 2e^- \rightarrow Cl_2$
D	$\mathbf{M}^{2+} + 2e^- \rightarrow \mathbf{M}$	$4OH^- - 4e^- \rightarrow 2H_2O + O_2$

25 The diagram below shows a cell.



Which statement about the cell is correct?

A Electrons pass from the magnesium electrode to the silver electrode through the electrolyte.

B The cell shows that silver is more reactive than magnesium.

C The magnesium electrode loses electrons.

D The silver electrode is oxidised.

26 In an electrolysis experiment, the same amount of charge deposited 68.9 g of silver and 6.64 g of chromium.

What is the charge on the chromium ion?

A +2 **B** +3 **C** +5 **D** +6

27 Which statement about the alkali metals is correct?

A Their melting points decrease on descending the group.

B Their reactivities decrease on descending the group.

C They form covalent bonds with the halogens.

D They form oxides on reacting with water.

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

A addition of a dilute acid to a carbonate

B complete combustion of methane

C complete combustion of ethene

D gently heating crystals of hydrated sodium carbonate, $Na_2CO_3.10H_2O$

29 Which statement about transition elements is incorrect?

A Catalysts are transition elements or their compounds.

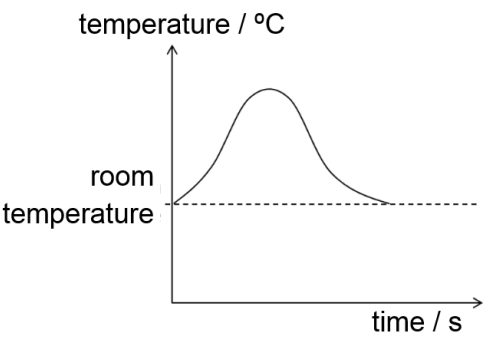
B All coloured compounds contain transition elements.

C Transition elements conduct electricity because they have variable oxidation states.

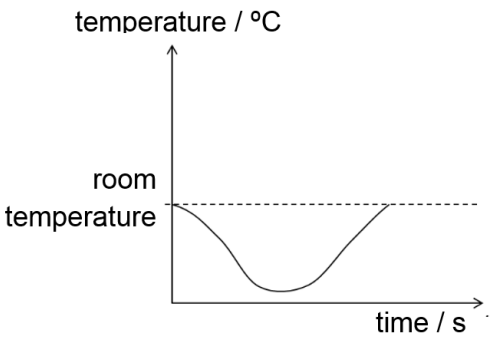
D Transition elements have high melting points due to strong attraction between positive ions and a ‘sea of electrons’.

30 Which graph shows how the temperature alters as aqueous sodium hydroxide is added to diluted sulfuric acid and then the resulting solution is left to stand?

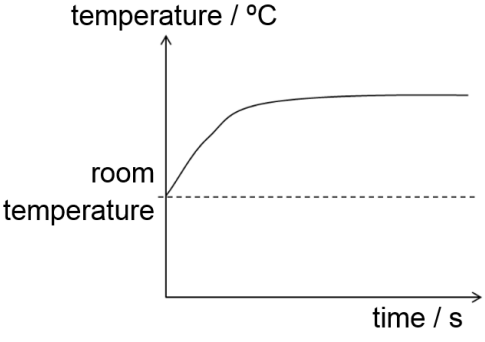
A



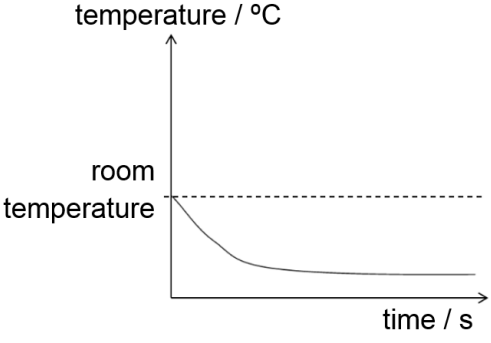
B



C



D



31 The equations for three reactions are given below:

Reaction **1** $H_2 \rightarrow 2H$

Reaction **2** $2H + O \rightarrow H_2O$

Reaction **3** $HCl \rightarrow H + Cl$

Which of these reaction(s) is/are endothermic?

A Reaction **1** only.

B Reactions **1** and **2** only.

C Reactions **1** and **3** only.

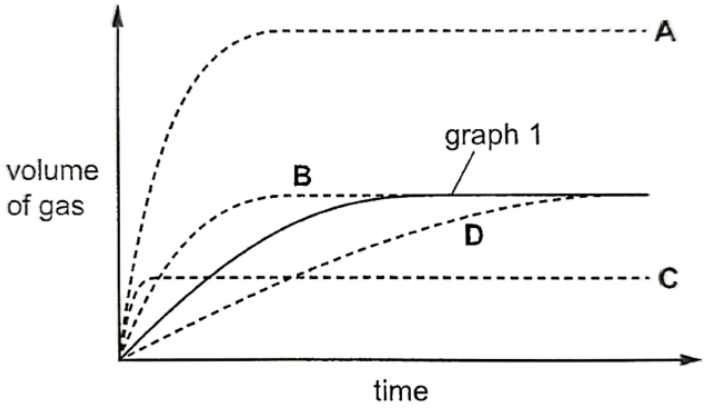
D Reactions **2** and **3** only.

32 A sample of 0.5 g of magnesium ribbon is reacted with an excess of 1 mol /dm^3 hydrochloric acid.

The volume of hydrogen produced over time is measured.

The results are plotted to give graph 1.

Which graph would be produced when 0.5 g of magnesium ribbon is reacted with an excess of 2.0 mol / dm^3 hydrochloric acid under the same conditions?



33 In the reaction between zinc and hydrochloric acid, the following changes could be made to the conditions.

1 increase in concentration of the acid

2 increase in particle size of the zinc

3 increase in pressure on the system

4 increase in temperature of the system

Which pair of changes will increase the rate of reaction?

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

34 Which of the following properties shows an increase in the alkane series from butane → propane → ethane → methane?

A boiling point

B flammability

C melting point

D viscosity

35 In the reaction between 23 g of ethanol and excess hydrogen bromide, the mass of bromoethane obtained is 27 g.

$$C_2H_5OH + HBr \rightarrow C_2H_5Br + H_2O$$

What is the percentage yield of bromoethane?
[M_r: C_2H_5OH, 46; C_2H_5Br, 109]

A 25% **B** 50% **C** 60% **D** 75%

36 Hydrocarbon **Q**, on heating with a catalyst, forms a solid compound, **R**.

Both **Q** and **R** have the same empirical formula.

What type of reaction is this?

A addition polymerisation
B condensation polymerisation
C hydrogenation
D substitution

37 Petroleum can be separated into fractions using fractional distillation.

Which statements are correct?

1 Alkanes used in polishes and waxes have a higher boiling point than those used as diesel fuel.
2 Any of the fractions could be used as fuels because their enthalpy changes of combustion are negative.
3 The fraction used for petrol (gasoline) is extracted from higher up the fractionating column than the fraction used for paraffin (kerosene).
4 The fraction obtained at a particular point in the fractionating column always contains the same compounds in the same ratio.

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

38 The cracking of one mole of **X**, a large alkane, produces two moles of ethene, two moles of propene and one mole of propane.

How many carbon atoms does one molecule of **X** contain?

A 8 **B** 10 **C** 13 **D** 16

39 What is added to polyunsaturated vegetable oils to form solid margarine?

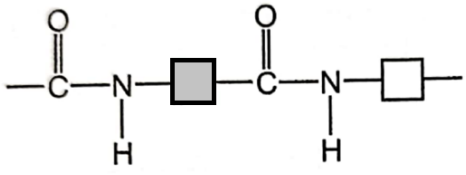
A bromine

B hydrogen

C oxygen

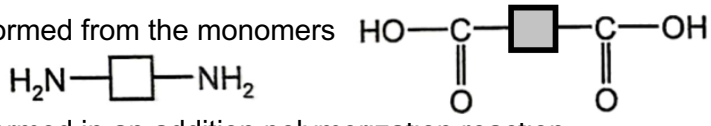
D water

40 The diagram shows the partial structure of a polymer.



What statement about this polymer is correct?

A It is a polyamide.

B It is formed from the monomers 

C It is formed in an addition polymerization reaction.

D The partial structure shown is that of nylon.

END OF PAPER 1

The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	0
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9		**Key** proton (atomic) number atomic symbol name relative atomic mass									5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24											13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium -	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57 – 71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89 – 103 actinoids	104 Rf Rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –		114 Fl flerovium –		116 Lv livermorium –		

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –

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