Class/ Index Number /	Centre Number/ 'O' Level Index Number /	Name

新加坡海星中学

MARIS STELLA HIGH SCHOOL
PRELIMINARY EXAMINATION
SECONDARY FOUR

CHEMISTRY **6092/01**

Paper 1 Multiple Choice **30 August 2022**

1 hour

Additional Materials:
Optical Test Answer Sheet (OTAS) – 1 sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your class, index number, Centre number, O level index number and name in the spaces at the top of this page.

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 answer in **soft pencil** on the separate Answer Sheet.

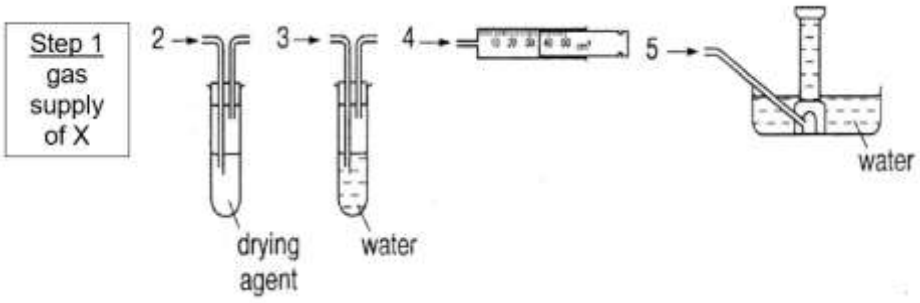
Read the instructions on the Answer Sheet very carefully.

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 question booklet.
A copy of the Periodic Table is printed on page 16.
The use of an approved scientific calculator is expected, where appropriate.

The total number of marks for this paper is 40.

At the end of the examination, hand in the following separately:
(1) Optical Test Answer Sheet (OTAS)
(2) Question Paper

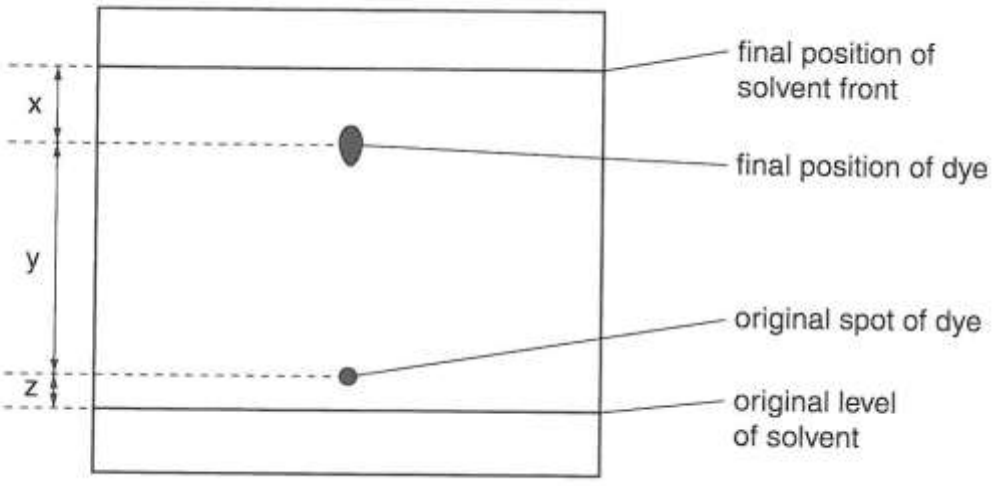
1 A gas X is insoluble in water and less dense than air. An impure supply of moist gas X contains a water-soluble impurity.



In which order should the pieces of apparatus shown be joined together after Step 1 to collect a pure, dry sample of X?

A 2,3,4 **B** 2,3,5 **C** 3,2,5 **D** 3,2,4

2 The diagram shows a chromatogram obtained when a single dye is analysed.
Three measurements, x, y and z are shown.



How is the R_f value of the dye calculated?

A $\frac{x}{x+y}$ **B** $\frac{y}{x+y}$ **C** $\frac{x}{x+y+z}$ **D** $\frac{y}{x+y+z}$

3 Solid samples of ammonium chloride, lead(II) chloride and sodium chloride were accidentally mixed together. Which of the following sequences outlines the best method to obtain the pure dry sample for each substance?

A dissolving, filtration, sublimation, crystallisation

B dissolving, fractional distillation, filtration, evaporation

C sublimation, dissolving, filtration, evaporation

D sublimation, filtration, evaporation, crystallisation

4 When heated steadily, an impure solid R melted over a range of 121 °C to 126 °C. Which of the following could be the melting point of R?

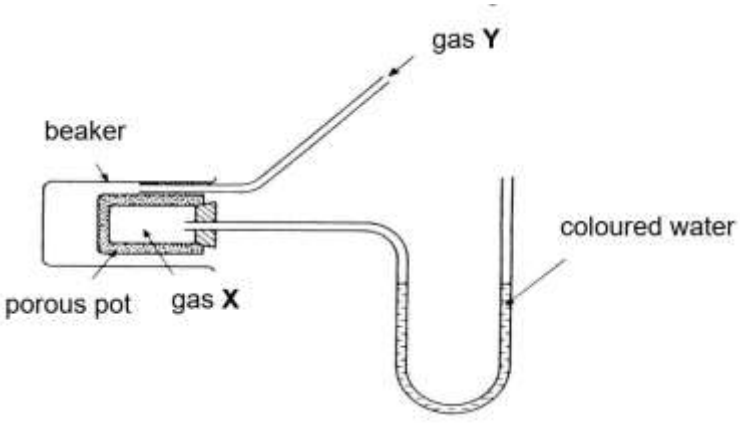
A 120 °C

B 121 °C

C 125 °C

D 128 °C

5 The apparatus below is used to show the diffusion of gases. Which pair of gases X and Y would cause no movement of the water?



	X	Y
A	CO	NO_2
B	CO_2	C_2H_6
C	N_2	C_2H_4
D	C_2H_4	C_2H_6

6 Benzene, C_6H_6, melts at 5.5 °C and boils at 80.1 °C.

Which statement best describes the changes in benzene as benzene is heated from room temperature to 90 °C?

A Benzene molecules lose energy and eventually, they move about freely.

B Benzene molecules gain energy and eventually, they vibrate and slide past one another.

C Benzene molecules lose energy and eventually, they vibrate about their fixed positions.

D Benzene molecules gain energy and eventually, they move about freely.

7 A new substance was discovered and a series of experiments were conducted on it. Which observation suggests that the substance **cannot** be an element?

A It had a fixed melting point.

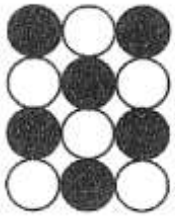
B Electrolysis of the molten substance gives two products.

C It dissolved in water to give a colourless solution.

D When heated in air, it could form two oxides.

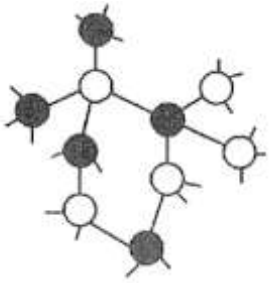
8 Which diagram best shows the structure of an alloy?

A



B

C



D

9 Three atoms M, E and T have mass numbers of 235, 238 and 239 respectively. M has 92 protons; E has 92 neutrons and T has 147 neutrons. Which of these atoms are isotopes?

A M, E and T

B M and E

C M and T

D E and T

10 Two particles having the same number of protons and neutrons but different numbers of electrons could be

A an atom and a molecule of the same element.

B an atom and an ion of the same element.

C ions of two different elements.

D an atom and an ion of different elements.

11 The table below shows information for five elements.
The symbols used here do not represent the actual chemical symbols of the elements.

element	P	Q	R	S	T
mass number	16	24	27	39	88
number of neutrons	8	12	14	20	50

Which two elements are in the same Group of the Periodic Table?

A P and R **B** P and S

C Q and S **D** Q and T

12 When a sulfur atom becomes a sulfide ion, the following changes could take place:

I the atomic number of sulfur increases by 2

II the atom gains 2 electrons

III the mass number of sulfur increases by 2

IV the ion formed has a 2+ charge

Which of the following options is correct?

A I, II and IV only

B I and II only

C II and IV only

D II only

13 The table below gives the number of protons, neutrons and electrons in particles I, J, K, L and M.
The symbols used here do not represent the actual chemical symbols of the elements.

particle	protons	neutrons	electrons
I	8	8	10
J	17	18	17
K	12	12	12
L	11	12	10
M	7	7	7

Which of the particles will form an ionic compound with I and what is the corresponding formula of the compound formed.

	particle	formula of compound
A	J	J_2I
B	K	KI
C	L	L_2I
D	M	MI_2

14 The table below shows the electrical conductivity of four substances:

substance	electrical conductivity
W	does not conduct under any condition
X	conducts when dissolved in water
Y	conducts when molten
Z	conducts when solid and when molten

Which of the following correctly identifies W, X, Y and Z?

	W	X	Y	Z
A	CH_3OH	NH_3	Al_2O_3	Au
B	NH_3	Al_2O_3	CH_3OH	Au
C	NH_3	CH_3OH	Al_2O_3	Au
D	Al_2O_3	NH_3	Au	CH_3OH

15 Excess aqueous lead(II) nitrate is added to aqueous potassium iodide. The precipitate formed is removed by filtration.
What ions are present in the filtrate?

A Pb^{2+} and I^-

B K^+ , NO_3^- , H^+ and OH^-

C K^+ , Pb^{2+} , NO_3^- , H^+ and OH^-

D K^+ , Pb^{2+} , I^- , NO_3^- , H^+ and OH^-

16 The melting point of aluminium oxide is much higher than melting point of calcium oxide. Which statement explains this?

A A calcium ion has a smaller charge than an aluminium ion.

B A calcium ion has more protons than an aluminium ion.

C A calcium ion has more shells of electrons than an aluminium ion.

D Calcium is more reactive than aluminium.

17 The formula of thalium sulfate is Tl_2SO_4 and that of ammonium vanadate is NH_4VO_3. Which of the following represents the formula of thalium vanadate?

A Tl_2VO_3

B $TlVO_4$

C $Tl(VO_3)_2$

D $TlVO_3$

18 Monosodium glutamate, commonly called MSG, is a popular seasoning and flavour enhancer. If the relative molecular mass of MSG is 169, and the formula of MSG is known to be $C_5H_8XO_4Na$, what is the element X in the compound?

A Chlorine

B Nitrogen

C Silicon

D Sulfur

19 A compound contains 0.291 g of carbon, 0.0484 g of hydrogen, 0.230 g of fluorine and 0.430 g of chlorine. The empirical formula of this compound is

A CHFCl

B C_2H_2FCl

C C_2H_4FCl

D CH_4FCl

20 8 g of a sample of X_2O_3 contains 0.1 mole of element X.
What is the mass of X in the sample?

A 1.6 g

B 2.4 g

C 5.6 g

D 11.2 g

21 Molecules of hydrogen(H_2) and chlorine(Cl_2) are produced when hydrogen chloride(HCl) decomposes. The equation for the decomposition is:

$$2HCl\ (g) \rightarrow H_2\ (g)\ +\ Cl_2\ (g)$$

Hydrogen chloride was added to a container which already contained some hydrogen. After the hydrogen chloride has decomposed for some time, the volumes of hydrogen chloride, hydrogen and chlorine in the container were determined. The volumes measured in cm^3 at room conditions, before and after the reaction are shown in the table.

	HCl	H_2	Cl_2
Before	200	20	0
After	X	100	80

What is the value of X?

A 0

B 20

C 40

D 160

22 Which element in the table is most likely to be a transition metal?

element	melting point(°C)	density(g/cm^3)	number of chlorides known
A	-7	3.10	3
B	113	2.07	1
C	1083	9.92	2
D	1521	1.12	1

23 Some properties of Group I elements are given.

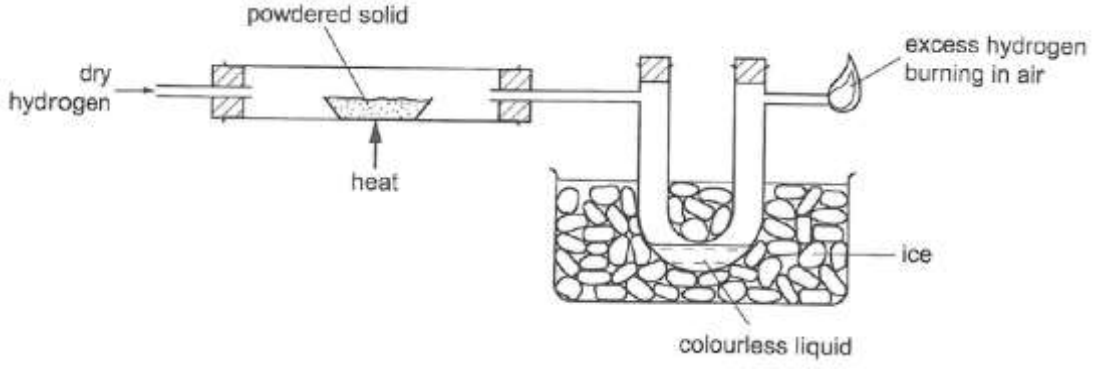
I reducing power
II density
III melting point

For which properties does the following order of elements apply?

(lowest) potassium < rubidium < caesium (highest)

A II only
B I and II only
C I and III only
D I, II and III

24 Dry hydrogen gas is passed over a powdered solid and then through a cooled U-tube before the excess of hydrogen is burned in air.



The U-tube contains a colourless liquid.
Which test could be used to show that the liquid is pure water?

A It turns anhydrous copper(II) sulfate blue.
B It freezes exactly at 0 °C.
C It turns cobalt(II) chloride paper pink.
D When it reacts with sodium, hydrogen is formed.

25 Which reaction(s) produces hydrogen gas?

reaction 1:	potassium with water
reaction 2:	zinc with steam
reaction 3:	copper with dilute hydrochloric acid

A 1 only
B 1 and 2 only
C 2 and 3 only
D All of the above

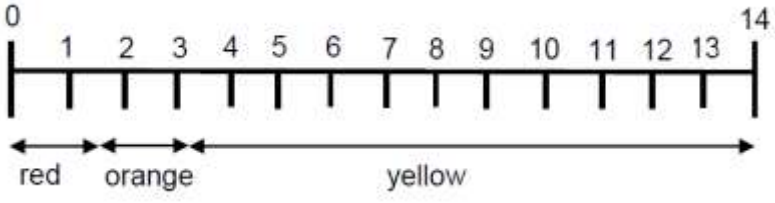
26 Four statements about the recycling of metals are listed.

1 More energy is required to mine and extract a metal than to recycle it.
2 The recycling of metals involves transport, separation and reprocessing.
3 Some metals are present in Earth's crust in very small quantities.
4 People in the future will need metals.

Which statements give valid reasons in recycling of metals.

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

27 The colours of an indicator X in solutions of different pH are shown below :



Which pair of solutions cannot be differentiated by using indicator X?

A aqueous solutions of ammonia and sulfuric acid at the same concentration
B aqueous solutions of ammonia and sodium chloride at the same concentration
C aqueous solutions of hydrogen chloride and ethanoic acid at the same concentration
D aqueous solutions of sodium hydroxide and ethanoic acid at the same concentration

28 An unknown sample of a mixture of two solids was heated strongly in a boiling tube. The gaseous products produced were collected in dry test tubes.

The following were observations of the gaseous products:

1 colourless and odourless

2 rekindles a glowing splint

3 volume of the gases collected in the test-tube decreased when the test-tube of gaseous products was inverted over aqueous sodium hydroxide

What could be the gaseous products collected on heating the mixture of the two solids?

A ammonia and oxygen

B nitrogen and oxygen

C carbon dioxide and oxygen

D all of the above

29 The table gives information about the solubilities of the hydroxides, carbonates, and sulfates of calcium, sodium and zinc.

	hydroxide	carbonate	sulfate
calcium	slightly soluble	insoluble	slightly soluble
sodium	soluble	soluble	soluble
zinc	insoluble	insoluble	soluble

What is the best way of making zinc carbonate?

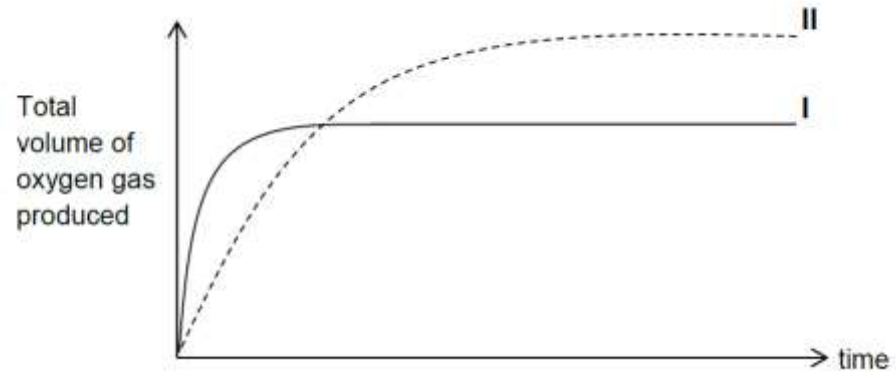
A Add aqueous sodium hydroxide to solid zinc hydroxide and then bubble in carbon dioxide gas.

B Add water to a mixture of solid zinc sulfate and solid calcium carbonate.

C Add water to solid zinc sulfate and then add in aqueous sodium carbonate.

D Add solid calcium hydroxide to aqueous zinc sulfate and then bubble in carbon dioxide gas.

30 Curve I in the diagram below was obtained from the decomposition of 100 cm^3 of 1 mol/dm^3 hydrogen peroxide solution, catalysed by manganese(IV) oxide.



This can be represented by the equation

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

With reference to the graph above, which alteration to the conditions would produce curve II?

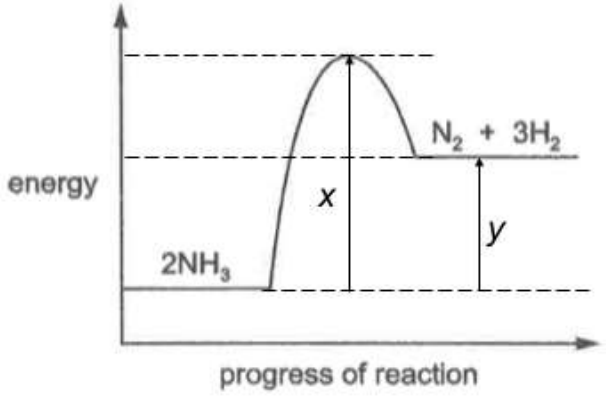
A using less manganese (IV) oxide

B lowering temperature

C adding some 0.1 mol/dm^3 hydrogen peroxide solution

D using a better catalyst

31 The energy profile diagram for the reversible reaction $2NH_3(g) \rightleftharpoons N_2(g) + 3H_2(g)$ is shown.



What is the activation energy of the reverse reaction?

A x **B** y **C** (x + y) **D** (x – y)

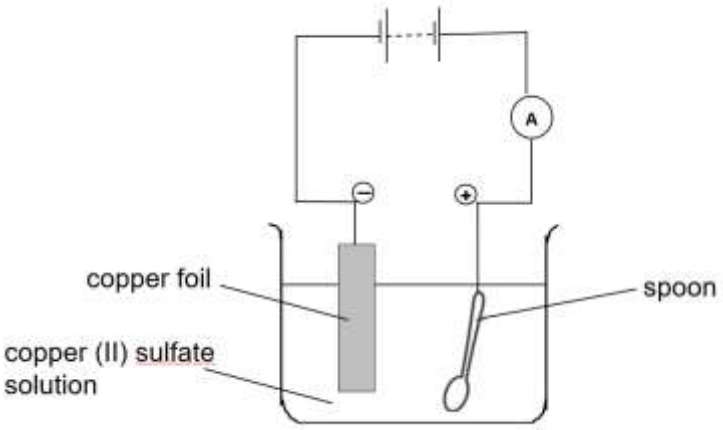
32 In which equation is the sign of the energy change, ΔH, shown correctly?

	equation	ΔH
A	$I_2(g) \rightarrow I_2(s)$	negative
B	$C(s) + O_2(g) \rightarrow CO_2(g)$	positive
C	$CO_2(g) \rightarrow C(g) + 2O(g)$	negative
D	$HCl(aq) + NaOH(aq) \rightarrow NaCl(aq) + H_2O(l)$	positive

33 Rubidium is above sodium in the reactivity series.
What is formed when concentrated aqueous rubidium chloride is electrolysed?

	products	
	negative electrode	positive electrode
A	chlorine	hydrogen
B	hydrogen	rubidium
C	hydrogen	chlorine
D	rubidium	chlorine

34 The apparatus shown below was set up to copper plate the metal spoon.



The electroplating did **not** work.
What was the mistake in the apparatus?

A A variable resistor should be included in the electrical circuit.

B Dilute sulfuric acid should be used as the electrolyte.

C The copper electrode should all be in the solution.

D The spoon should be the negative electrode.

35 Which statement is true about the hydrogen-oxygen fuel cell?

A Hydrogen gas is oxidised at the negative electrode to form water.

B Hydrogen gas is reduced at the negative electrode to form water.

C Oxygen gas is oxidised at the negative electrode to form hydroxide ions.

D Oxygen gas is reduced at the negative electrode to form hydroxide ions.

36 One of the fractions obtained by the fractional distillation of petroleum oil contains molecules with 1 to 4 carbon atoms in them. Which of the following molecules can be found in this fraction?

A ethane, ethanol, butane

B ethane, propanol, methanoic acid

C ethane, propene, pentane

D methane, ethane, propane

37 Which physical property of the alkanes does not increase as relative molecular mass increases?

A viscosity

B solubility

C melting point

D boiling point

38 The reaction between a hydrocarbon C_xH_{10} and chlorine can be represented as follows.

$$C_xH_{10}\,(g) + 2Cl_2\,(g) \rightarrow C_xH_8Cl_2\,(g) + 2HCl\,(g)$$

Which of the following is a correct statement?

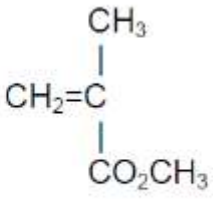
A It is an addition reaction.

B The molecular formula of the hydrocarbon is C_5H_{10}.

C Ultraviolet light is an essential condition for the reaction to take place.

D High temperature, high pressure and a catalyst are required in the reaction.

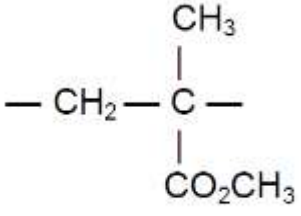
39 In an artificial hip joint, bone cement is used to attach the poly(ethene) cup for the joint to the pelvic girdle. Bone cement is formed by the polymerisation of methyl 2-methyl propenoate and the process is highly exothermic.



methyl 2-methylpropenoate

Which of the following are correct statements about this polymerisation?

1 The repeat unit of the polymer is



2 Less energy is released in forming the C – C bonds than absorbed in breaking a C = C bond.

3 The formation of the cement occurs by additional polymerisation.

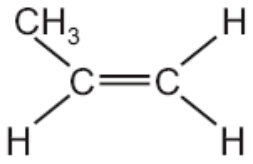
A 1 and 2 only

B 2 and 3 only

C 1 and 3 only

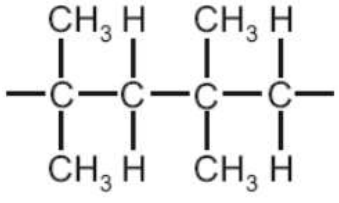
D 1, 2 and 3 only

40 The diagram shows the structure of a small molecule.

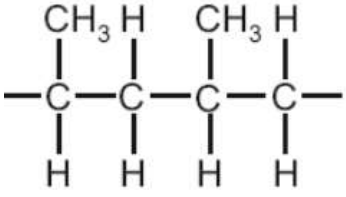


Which chain-like molecule is formed when these small molecules link together?

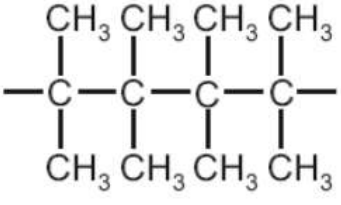
A



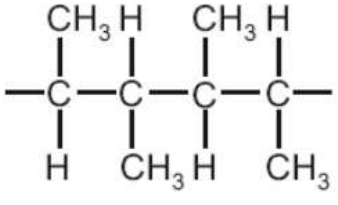
B



C



D



End of Paper

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.).