Geylang Methodist School (Secondary)
End-of-Year Examination 2016

CHEMISTRY **5073/01**

Paper 1 Multiple Choice **Sec 3 Express**

Additional materials : OAS **45 minutes**

Setter : Ms Tong Ai Li **10 October 2016**

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name, class and register number on the Answer Sheet in the spaces provided unless this has been done for you.

There are **thirty** 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.

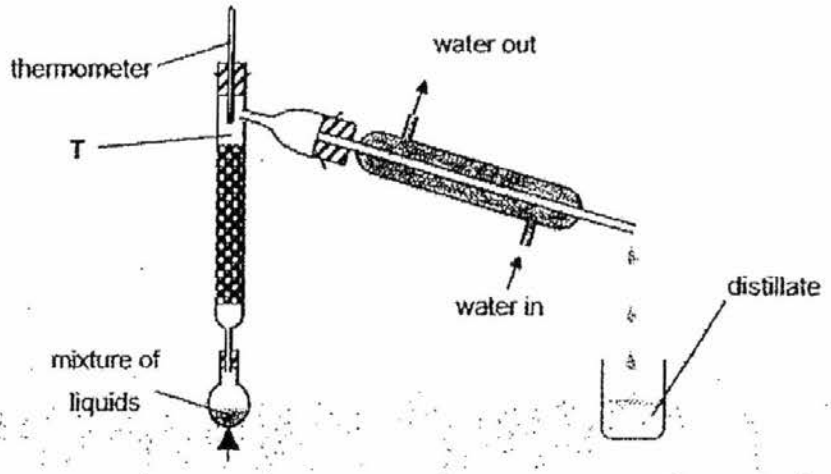
Read the instructions on the Answer Sheet very carefully.

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 13.

This document consists of 13 printed pages and 1 blank page.

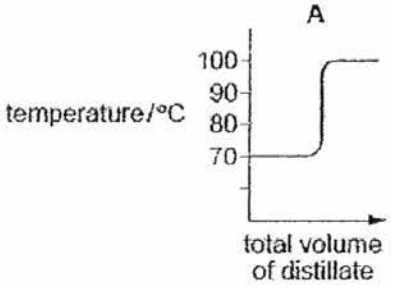
[Turn over

1 The diagram below shows the apparatus used to separate hexane (boiling point, 70°C) and heptane (boiling point, 98°C).

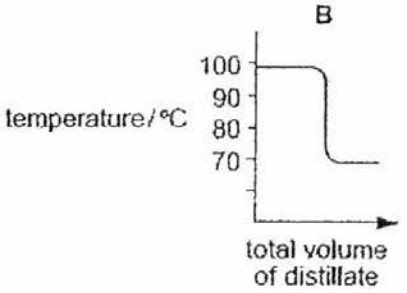


Which graph would be obtained if the temperature at point T was plotted against the total volume of distillate collected?

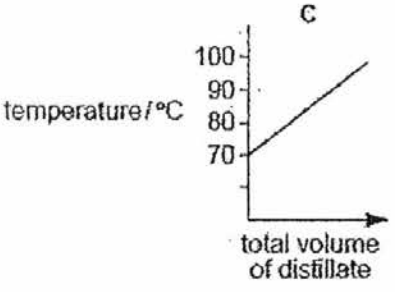
A



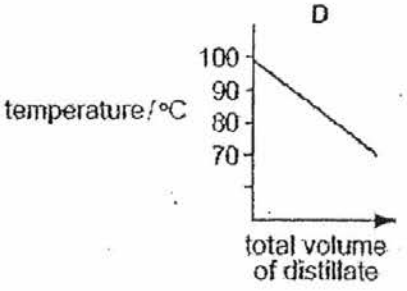
B



C



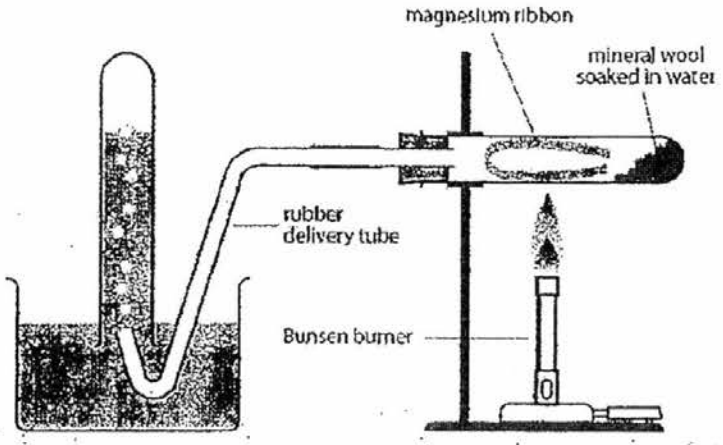
D



2 At which temperature does a concentrated aqueous solution of sodium chloride begin to boil?

A 96 °C B 99 °C C 100 °C D 104 °C

3 The apparatus below is used to show a laboratory method of producing hydrogen gas.



What is the property of hydrogen gas shown through this method of gas collection?

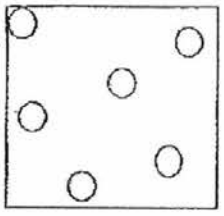
A Hydrogen gas is flammable.

B Hydrogen gas is insoluble in water.

C Hydrogen gas is less dense than air.

D Hydrogen gas is pure as impurities are removed by water.

4 The diagram below shows the arrangement of particles in a substance.



Which statement best describes this substance?

A It occupies a fixed volume.

B It has a high energy content.

C Its particles do not collide with one another.

D Its particles have very strong attractive forces between themselves.

5 A mixture of propane, butane, hydrogen sulfide and carbon dioxide at -30 °C is allowed to cool down gradually to -200 °C.

	melting point / °C	boiling point / °C
propane	-188	- 42
butane	-135	-1
hydrogen sulfide	- 85	- 51
carbon dioxide	- 56	-78

Which compound will solidify first?

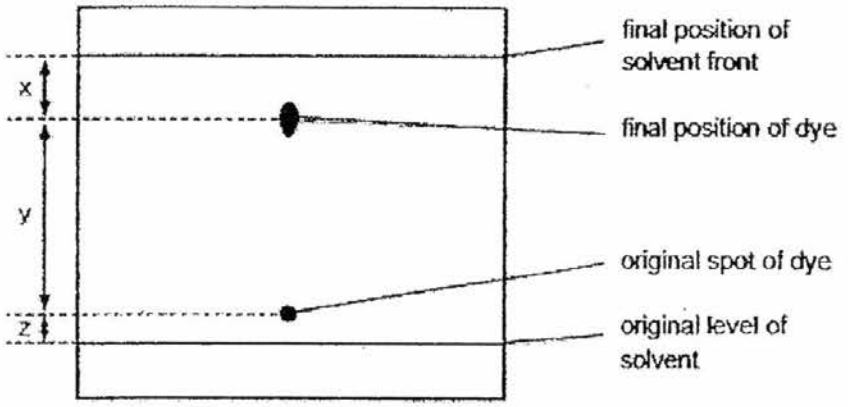
A propane

B butane

C hydrogen sulfide

D carbon dioxide

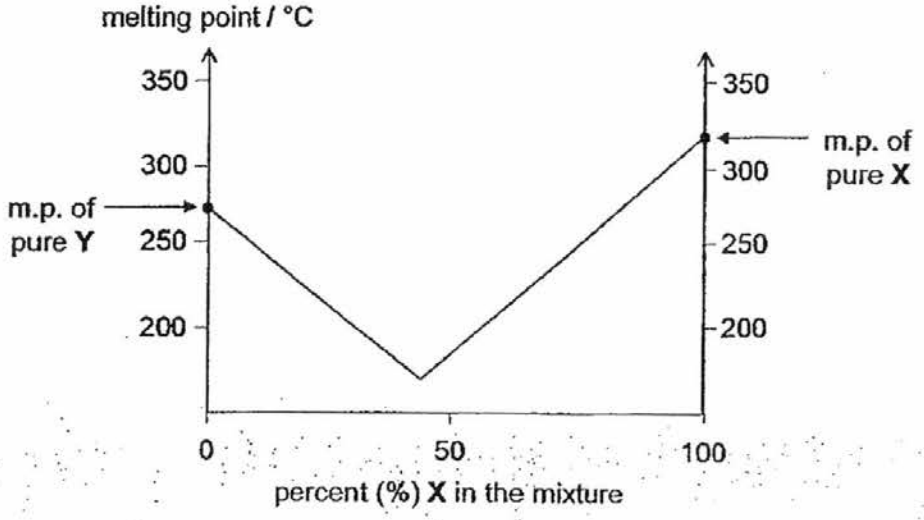
6 The diagram shows the chromatogram obtained by analysis of a single dye. Three measurements x, y and z are shown.



How is the R_f value of the dye calculated?

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

7 The graph below gives the melting points of mixtures of substances **X** and **Y**.



The graph shows that any mixture of **X** and **Y** must have a melting point

A above that of **Y**.

B below that of **X**.

C below that of both **X** and **Y**.

D between that of **X** and **Y**.

8 Which group of substances contains an element, a mixture, and a compound?

A air, sea water, hydrogen

B nitrogen, hydrogen, ammonia

C iron, water, rust

D oxygen, air, water

9 What is the relative formula mass of cobalt(II) chloride hexahydrate, $CoCl_2 \cdot 6H_2O$?

A 121

B 158

C 169

D 238

10 The electronic structure of an anion X^{3-} is 2.8.8.

What is the electronic structure of atom **X**?

A 2.8.3
B 2.8.5
C 2.8.8.3
D 2.8.8.5

11 An atom of element **X** has 20 electrons while an atom of element **Y** has 7 electrons.

What is the formula of the compound formed from **X** and **Y**?

A X_2Y_5
B X_5Y_2
C X_3Y_2
D XY_2

12 An element T has two isotopes, ^{18}T and ^{20}T. Its relative atomic mass was found to be 19.2.

What proportion of the lighter isotope could be present?

A 40 % B 50 % C 60 % D 70 %

13 **Silicon carbide** has a structure similar to diamond while **boron nitride** has a structure similar to graphite. **Bronze** is an alloy of copper and tin.

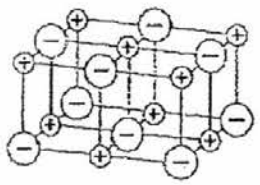
How many of the following statements about the 3 substances are correct?

1. All are bonded covalently.
2. All except silicon carbide conduct electricity when solid.
3. All have high melting points.
4. All are insoluble in water.

A 1 B 2 C 3 D 4

14 Which diagram best represents the structure of copper(II) sulfate?

A



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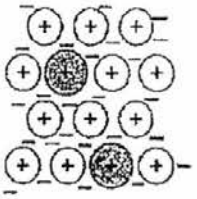

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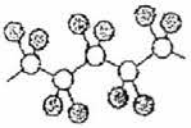
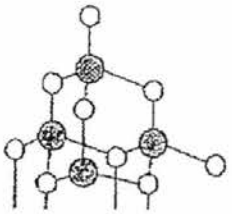
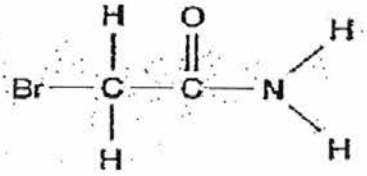


D



15 The structure of a molecule is shown below.



How many valence electrons are **not** involved in covalent bonding?

A 10

B 12

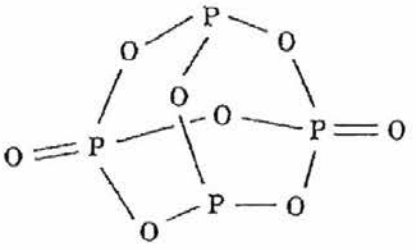
C 16

D 18

16 Which particles are responsible for the conduction of electricity through metals and salt solutions?

	metals	salt solution
A	positive ions	electrons
B	positive ions	positive and negative ions
C	electrons	electrons
D	electrons	positive and negative ions

17 The structural formula of a molecule is shown in the figure below.



What are the correct molecular and empirical formulas?

	molecular formula	empirical formula
A	PO_2	P_4O_8
B	P_4O_6	P_4O_6
C	P_4O_8	PO_2
D	P_4O_{10}	P_2O_5

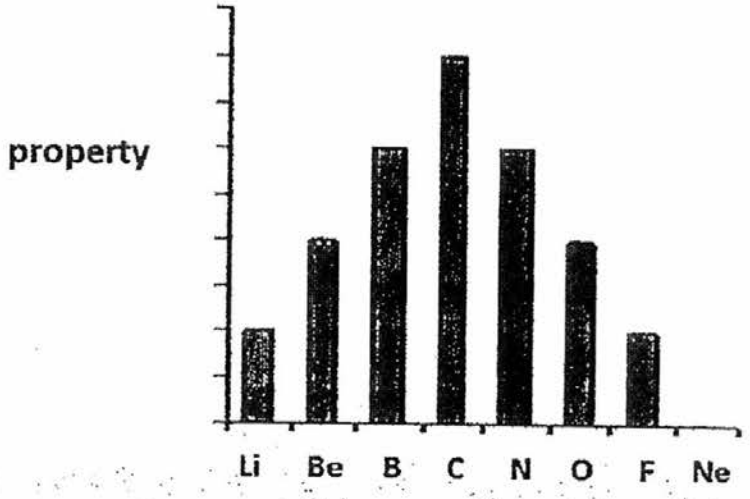
18 The complete combustion of ethyne, C_2H_2, in air has the following chemical equation.

$$w\ C_2H_2\ (g) + x\ O_2\ (g) \rightarrow y\ CO_2\ (g) + z\ H_2O\ (l)$$

Deduce the values of *w*, *x*, *y* and *z*.

	w	*x*	*y*	*z*
A	1	1	1	1
B	1	1	2	1
C	2	1	4	2
D	2	5	4	2

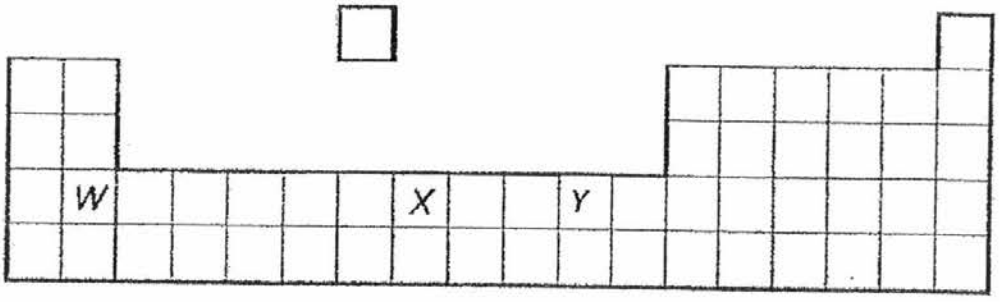
19 The bar chart shows the period of elements from lithium to neon.



Which property of these elements is shown in the chart?

A the valency of each element
B the number of shells holding the electrons
C the proton number
D the relative atomic mass

20 The diagram shows an outline of part of the Periodic Table.



Which of the following statements is **not** correct?

A Elements **X** and **Y** have more protons than **W**.
B Elements **W, X** and **Y** have the same reactivity.
C Elements **X** and **Y** can conduct electricity in solid states.
D Element **X** is more metallic than **Y**.

21 Which statement about the alkali metals is true?

A They form covalent bonds with Group VII elements.

B They form oxides on reacting with water.

C Their melting points decrease on descending Group I.

D Their reactivity decreases on descending Group I.

22 The table gives the formulae of the catalysts used in some industrial processes.

process	catalyst
Haber process	Fe + Mo
Contact process	V_2O_5
cracking of alkanes	$Al_2O_3 + SiO_2$
polymerisation of ethene	$Al(C_2H_5)_3 + TiCl_4$
manufacture of silicones	CuCl

How many different transition metals are included, as elements or as compounds, in the list of catalysts?

A 4 B 5 C 6 D 7

23 The results of three halogen displacement experiments are shown in the table below.

experiment	halogen added	halide solution		
		X^-	Y^-	Z^-
1	X_2	-	Y_2 displaced	Z_2 displaced
2	Y_2	No reaction	-	No reaction
3	Z_2	No reaction	Y_2 displaced	-

What are halogens **X**, **Y** and **Z**?

	X	Y	Z
A	Br	Cl	I
B	Br	I	Cl
C	Cl	Br	I
D	Cl	I	Br

24 Which of the following oxide is most easily reduced by carbon?

A iron(II) oxide

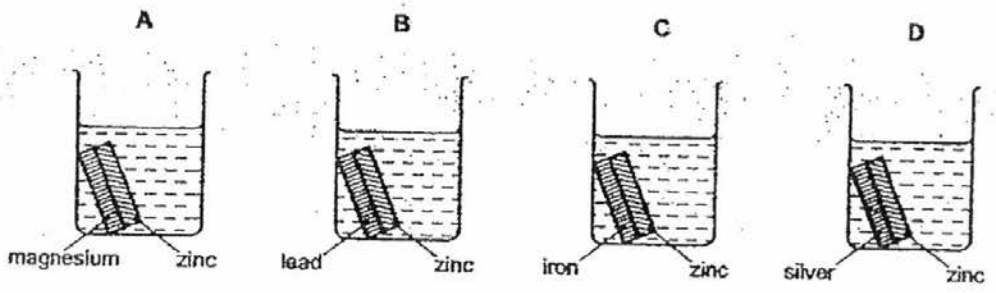
B copper(II) oxide

C lead(II) oxide

D magnesium oxide

25 Each beaker contains two strips of metal fastened together and immersed in hydrochloric acid. All strips are of the same size.

Which beaker contains the **least** number of zinc ions after 10 minutes?



26 The carbonate of metal Z is a white solid. It decomposes when heated to form carbon dioxide and a yellow solid oxide.

What is metal Z?

A lead B copper C potassium D sodium

27 The table below summaries the reactions of metals P and Q with cold water, steam and dilute hydrochloric acid.

metal	reaction with cold water	reaction with steam	reaction with dilute hydrochloric acid
P	yes	yes	yes
Q	no	no	yes

Which of the following statements is **not** true?

A P would displace Q from a salt solution of Q.

B P can be extracted from its ore by heating with coke.

C There is no reaction when the oxide of P is strongly heated.

D The carbonate of P is thermally more stable than the carbonate of Q.

28 Which of the following substances is used to remove acidic impurities from iron ore in the blast furnace?

A slag
B coke
C silicon dioxide
D limestone

29 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

30 The formula of a metallic oxide is $\mathbf{M}_2O$. The oxide contains 60% by mass of the element **M**.

What is the relative atomic mass of **M**?

A 12
B 20
C 24
D 40

End of Paper 1

DATA SHEET
The Periodic Table Of The Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 0
							1 H Hydrogen 1										4 He Helium 2
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
23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
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
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
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
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 +															

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
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

*58-71 Lanthanoid series
+90-103 Actinoid series

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.).

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Geylang Methodist School (Secondary)
End-of-Year Examination 2016

Candidate Name

Class

Index Number

CHEMISTRY **5073/02**

Paper 2 **Sec 3 Express**

Additional materials: Writing Paper **1 hour 30 minutes**

Setter: Mr Lim Zong Han **10 October 2016**

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A
Answer all questions in the spaces provided on the Question Paper.

Section B
Answer all questions.
Write all answers on the writing paper provided.

At the end of the examination,
1) tie all Section B answer papers securely and
2) hand in answers to Sections A and B separately.

The number of marks is given in brackets [ ] at the end of each question or part question.
A copy of the Periodic Table is printed on page 15.

For Examiner's Use		
Section A		
Section B	B8	
	B9	
	B10	
	Total	

Section A

Answer **all** the questions in this section in the spaces provided.

The total mark for this section is 40.

A1 Use the information in the table to answer the following questions.

substance	melting point/°C	boiling point/°C	does it conduct electricity when it is a solid?	does it conduct electricity when it is molten?
A	-95	69	no	no
B	1251	1970	no	yes
C	1240	2100	yes	yes
D	1650	2230	no	no

(a) Which substance is most likely to be a metal?

.....

[1]

(b) Which substance is a liquid at room temperature?

.....

[1]

(c) Which substance is most likely silicon dioxide?

.....

[1]

(d) **(i)** What type of bonding is present in substance B?

.....

[1]

(ii) Explain your answer.

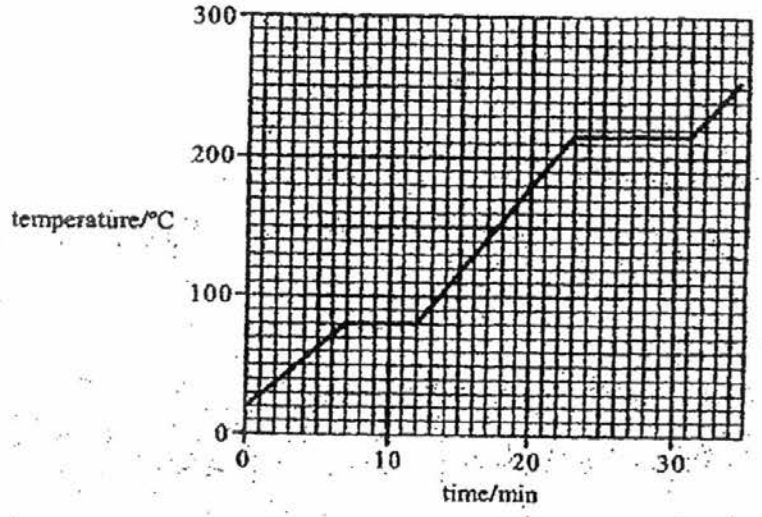
.....

.....

[2]

[Total: 6]

A2 The graph below shows the heating curve of a pure substance.



(a) (i) What is the melting point of the substance?

..... [1]

(ii) Explain in terms of kinetic particle theory, what happens during the melting of the substance.

.....

.....

.....

.....

..... [2]

(iii) Explain why the substance cannot be water.

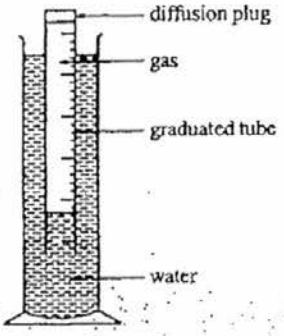
.....

.....

.....

..... [1]

(b) The figure below shows the apparatus for measuring the rates of diffusion of gases. The time taken for 100 cm^3 of some gases at room temperature and pressure to diffuse from this apparatus are shown in the table below.



Gas	Time / s
Carbon Monoxide – CO	132
Chlorine – Cl_2	211
Methane – CH_4	100
Nitrogen – N_2	?
Oxygen – O_2	141

(i) Suggest the time that 100 cm^3 of nitrogen would take to diffuse out from the apparatus. Give a reason to your answer.

.....

.....

.....

..... [1]

(ii) Name a gas which will diffuse faster than any of the gases shown in the table.

..... [1]

[Total: 6]

A3 Complete the table below.

ion	formula	number of protons	number of neutrons	number of electrons
potassium	$^{39}_{19}K^+$			
oxide	$^{16}_{8}O^{2-}$			

[3]

[Total: 3]

A4 Hydrogen fluoride is a highly dangerous gas, forming corrosive hydrofluoric acid upon contact with moisture. It is prepared by adding concentrated sulfuric acid to calcium fluoride. The reactions take place at room temperature as follow.

$$CaF_2(s) + H_2SO_4(l) \rightarrow 2HF(g) + CaSO_4(s)$$

When 15.6 g of calcium fluoride was reacted with 1.25 dm^3 of 0.16 mol/dm^3 sulfuric acid at room temperature and pressure, 9.6 dm^3 of hydrogen fluoride was formed.

(a) Calculate the relative molecular mass, M_r, of calcium fluoride.

[1]

(b) Calculate the number of moles of calcium fluoride.

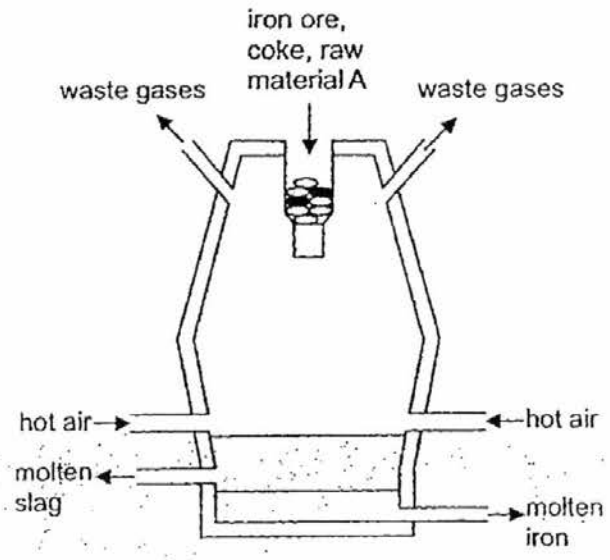
[1]

(c) Calculate the number of moles of oxygen atoms present in 1.25dm^3 of 0.16 mol/dm^3 sulfuric acid.

[2]

[Total: 4]

A5 The diagram below shows a Blast Furnace.



(a) Name the iron ore.

..... [1]

(b) Write the chemical name and chemical formula of material A.

..... [1]

(c) State the gaseous reducing agent in the furnace.

..... [1]

(d) Write the chemical equation for the reaction in which the gaseous reducing agent is produced. Include state symbols.

..... [2]

[Total: 5]

A6 Potassium which has an atomic number of 19 is a Group I element.

(a) Describe two observations when a small piece of potassium is added to water.

.....

..... [2]

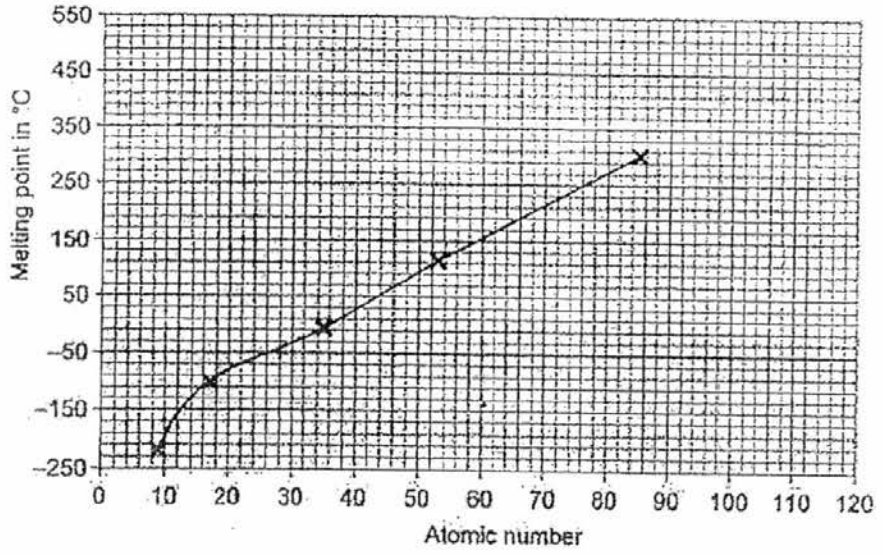
(b) Potassium fluoride is an ionic solid with a high melting point.

Draw 'dot and cross' diagrams of potassium fluoride. Show only the valence electrons.

[3]

[Total: 5]

A7 The graph below shows the melting point of group VII elements.



(a) Describe how the melting point changes as the atomic number increases.

..... [1]

(b) Ununseptium, Uun, is in Group VII with an atomic number of 117. It has not been discovered yet.

Use the graph to predict its melting point.

..... [1]

(c) Compare the reactivity of ununseptium and iodine.

Give a reason to your answer.

.....

..... [2]

(d) Write the chemical formula of the compound formed when magnesium reacts with ununseptium.

..... [1]

[Total: 5]

A8 Metal X has a charge of +2 while metal Y has a charge of +3 in all their compounds. Metal X lies between potassium and aluminium, and metal Y lies between zinc and lead in the reactivity series.

(a) How can metal X be extracted from its ore?

..... [1]

(b) Suggest one method to prevent metal Y from corrosion.

..... [1]

(c) Silicon (IV) oxide is often found as an impurity in the ore of metal Y.

Describe how this impurity is removed from the ore.

.....

..... [2]

(d) The iron produced by the Blast Furnace is converted into steel. Steel is harder and stronger than pure iron.

Why is steel harder and stronger than pure iron?

.....

.....

..... [2]

[Total: 6]

End of Section A

Section B

Answer **all** the questions in this section.

Write your answers on the separate answer paper provided.

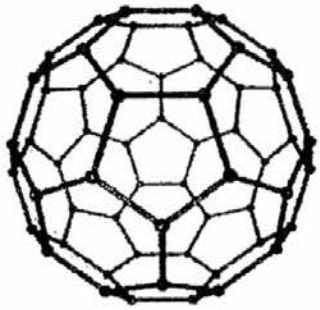
The total mark for this section is 30.

B9 For hundreds of years, carbon was believed to exist as only two allotropes – graphite and diamond.

Graphite has an approximate value of 1.5 on the Mohs Scale of Mineral Hardness. The Mohs Scale measures the relative hardness on a scale of 1 to 10, with 10 being the hardest substance on earth.

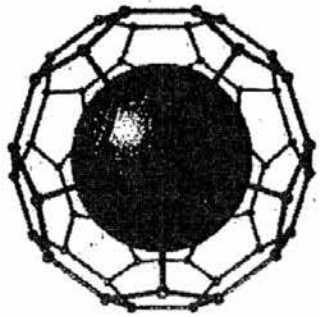
In 1985, three chemistry professors, Robert Curl, Harold Kroto and Richard Smalley discovered a third allotrope of carbon. This third allotrope had a structure that resembled a soccer ball, with sixty carbon atoms covalently-bonded into a spherical shape consisting of hexagons and pentagons.

They named this new allotrope ***buckminsterfullerene***, after the famous American architect Richard Buckminster Fuller, well-known for his architectural domes of a similar design to that of the arrangement of carbon atoms in ***buckminsterfullerene***.



Structure of *buckminsterfullerene*

In 1993, ***buckminsterfullerene*** molecule with a noble gas atom trapped within its structure was successfully created.



Structure of *buckminsterfullerene*, with a trapped argon atom

(a) Suggest the value for diamond on the Mohs Scale. [1]

(b) From the context of the above information, explain what is meant by 'allotropes'. [1]

(c) State the chemical formula of ***buckminsterfullerene***. [1]

(d) The structure of ***buckminsterfullerene*** is similar to the structure of graphite.

Would you expect ***buckminsterfullerene*** to conduct electricity?

Explain with reference to its bonding and structure. [2]

(e) Diamond has a very high melting point of approximately 3500 °C. ***Buckminsterfullerene***, on the other hand, sublimes at 500 °C.

Explain in terms of bonding and structure, why the melting point of diamond is significantly higher than the sublimation point of ***buckminsterfullerene***. [3]

(f) The figure above shows an argon atom trapped inside a 'cage' ***buckminsterfullerene***. Based on the structure shown, suggest

(i) the main reason why it should be considered a compound, [1]

(ii) the main reason why it should be considered a mixture. [1]

[Total: 10]

B10 The following is an abstract from the internet.

Nitrogen is an **element** with a melting point of - 210 °C and boiling point of -186 °C. Nitrogen is a colourless, odourless, tasteless and mostly inert diatomic gas at standard conditions. The extremely strong bond in nitrogen dominates nitrogen chemistry, causing difficulty for both organisms and industry in breaking the bond to convert the nitrogen into useful **compounds**. However, when these compounds burn, explode, or decay back into nitrogen gas they release large amounts of often useful energy.

(a) The website uses the words **element** and **compound.**

Explain what these words mean. [2]

(b) Draw the electronic arrangement in a nitrogen molecule. Show the outershell electrons only. [2]

(c) Using your answer in **(b)**, explain why elemental nitrogen:
1. is considered to be a diatomic molecule;
2. has "the extremely strong bond". [2]

(d) There are several different oxides of nitrogen with different formulae and properties.

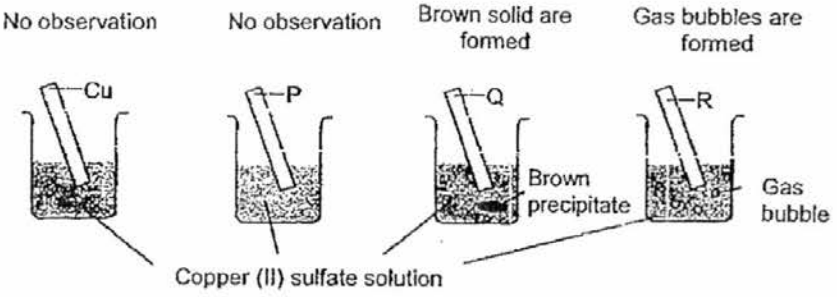
Two oxides of nitrogen are analysed and the table shows some data from the analysis.

	mass of nitrogen/g	mass of oxygen/g	relative molecular mass
oxide 1	0.35	0.78	46
oxide 2	0.68	1.63	92

Use the data to work out the empirical and molecular formulae of the two oxides. [4]

[Total: 10]

B11 A series of experiments concerning copper, three other metals, P, Q, R and their oxides are summarised in the following:



	CuO	P_2O	QO	RO
action of heat on metal oxide	no reaction	metal P is formed	no reaction	no reaction

(a) **(i)** Explain the observations in the reaction of Q and R with copper(II) sulfate solution. [2]

(ii) Write the two chemical equations for the reactions in **(a)(i)**. Include state symbols. [4]

(iii) Suggest why metal P is formed upon direct heating of the oxide of P. [1]

(iv) Arrange the four metals in descending order of reactivity. [1]

(b) Metal carbonates decompose when heated to give carbon dioxide and solid metal oxide.

A student decides to investigate the thermal stability of the carbonates of four metals W, X, Y and Z. He heats each metal carbonate in a test-tube and records the time taken to collect 10 cm^3 of carbon dioxide in the table below.

metal carbonate	time taken to collect 10 cm^3 of CO_2 /s
W carbonate	250
X carbonate	100
Y carbonate	75
Z carbonate	460

(i) Using the results above, arrange metals W, X, Y, Z in decreasing order of reactivity. [1]

(ii) State the relationship between the reactivity of metal and the time taken for decomposition of its carbonate [1]

[Total: 10]

End of paper 2

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School	Geylang Methodist School (Sec)
Exam	EOY 2016
Level	Sec 3E
Subject	Chem (SPA) Answers

Paper 1

1	2	3	4	5	6	7	8	9	10
A	**D**	**B**	**B**	**D**	**A**	**B**	**D**	**D**	**B**
11	12	13	14	15	16	17	18	19	20
C	**A**	**C**	**A**	**B**	**D**	**C**	**D**	**A**	**B**
21	22	23	24	25	26	27	28	29	30
C	**B**	**D**	**B**	**A**	**A**	**B**	**D**	**D**	**A**

Paper 2

Section A

S/N	Answers	Remarks
A1	**(a)** C **(b)** A **(c)** D **(d)** (i) ionic bonding (ii) Ionic compounds have **high melting and boiling points** and **conducts electricity in the molten states but not solid states**	1M 1M 1M 1M 1M 1M
A2	**(a)** **(i)** 80 °C **(ii)** Temperature **remains constant** as heat energy is **absorbed to break the forces of attraction** between particles. **(iii)** Pure water will melt at 0 °C and boil at 100 °C. This substance melts at 80 °C and boils at 215 °C. **(b)** **(i)** 132 s. N_2 will take the same time to diffuse as **CO** as they have the **same relative molecular** mass **(ii)** Hydrogen or helium	 1M 1M 1M 0M if students mentioned particles dirft apart 1M 0M if students mentioned either m.p or b.p. 1M 1M 0M if students give formula. 0M if students give correct name but wrong formula.

A3

ion	*formula*	*number of protons*	*number of neutrons*	*number of electrons*
potassium	$^{39}_{19}K^{+}$	19	20	18
oxide	$^{16}_{8}O^{2-}$	8	8	10

3M – all correct answer
2M – 4 to 5 correct answers
1M – 2 to 3 correct answers
0M – 0 to 1 correct answers

A4

a) Mr of $CaF_2 = 40 + 19 \times 2$
$= 78$ — 1M

b) No of mol of $CaF_2 = 15.6/78 = 0.2$ — 1M

c) No of mol of sulfuric acid $= 1.25 \times 0.16 = 0.2$ — 1M

No of mol oxygen in sulfuric acid $= 0.2 \times 4 = 0.8$ — 1M

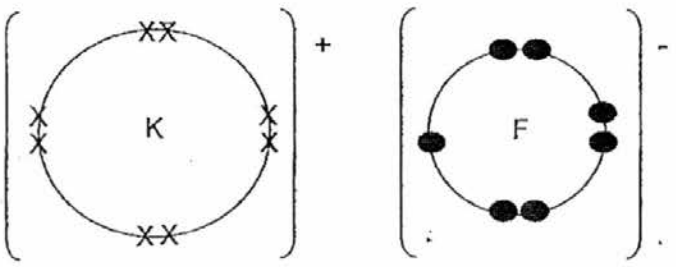
A5

a) Haematite — 1M
b) Calcium carbonate, $CaCO_3$ — 1M
c) Carbon monoxide — 1M
d) $CO_2(g) + C(s) \rightarrow 2CO(g)$ — 1M Correct balanced eqn
1M Correct state symbols

A6

(a) Potassium darts round the water surface or extremely fast reaction/ catches fire then small explosion occurs / sparks — 1M
Effervescence / fizzing / potassium dissolves completely / potassium melts / decrease in size. — 1M

(b)



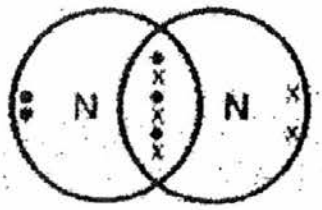
Correct number of electrons: 1M

Correct charges: 1M

A7	**(a)** Melting point increases. [1] **(b)** 470°C to 510°C [1] **(c)** It is less reactive than iodine.[1] Going **down the Group VII** element in the periodic table, the **reactivity decreases** Since Uun is below iodine, therefore its reactivity is **lower**. *Accept if students explain in terms of the distance between nucleus and valence electrons* **(d)** $MgUun_2$ *0 mark if student wrote chemical equation instead*	1M 1M 1M 1M 1M
A8	**(a)** Electrolysis **(b)** Painting, sacrificial protection, galvanizing *Accept any other possible answer* **(c)** Add **calcium carbonate** into the blast furnace. **Calcium oxide** formed will react with silicon (IV) oxide to **form calcium silicate.** **(d)** In pure iron, atoms are **arranged regularly in layers**. In steel, **atoms of another element have different size** from the atoms of pure iron, thus **breaking up the regular arrangement**. Different sized atoms **cannot slide over each other easily**, thus making alloy much harder than pure metal.	1M 1M 1M 1M 1M 1M

Section B

S/N	Answers	Remarks
B9	**(a)** 10	1M
	(b) Different structures of the same element.	1M
	(c) C_{60}	1M
	(d) Yes.	1M
	each carbon atom is bonded to three other atoms and there is one lone electron that is not involved in bonding. These mobile/delocalized electrons enable *buckminsterfullerene* to conduct electricity.	1M
	(e) Diamond has a **giant covalent structure** while buckminsterfullerene has a **simple covalent structure**.	1M
	Therefore a **greater amount of energy** is required to overcome the **strong covalent bonds** in diamond.	1M
	While less energy is required to overcome the **weak intermolecular forces** in buckminsterfullerene.	1M
	(f) (i) fixed ratio of constituents (60 carbon atoms and 1 argon atom)	1M
	(ii) argon and carbon atoms are not chemically bonded to each other.	1M

S/N	Answers	Remarks
B10	**(a)** Element: A substance that cannot be broken down into any simpler substances by ordinary chemical or physical means. *Accept: made up of 1 type of atom* Compound: A substance that is made up of 2 or more elements chemically combined together. **(b)**  **(c)** 2 atoms of nitrogen combined to form 1 molecule. *Accept: share 3 pair of electrons OR 6 electrons* The atoms have triple bonds between them. **(d)** **Oxide 1** No. of mol of N: 0.35/14 = 0.25 → 1 No. of mol of O: 0.78/16 = 0.04875 → 2 Empirical formula: NO_2 [1] Molecular formula: 46 = (14+2x16)x → x = 1 → NO_2 [1] **Oxide 2** No. of mol of N: 0.68/14 = 0.04857 → 1 No. of mol of O: 1.63/16 = 0.1019 → 2 Empirical formula: NO_2 [1] Molecular formula: 92 = (14+2x16)x → x = 2 → N_2O_4 [1]	1M 1M 1M – correct number shared pair of electrons 1M – correct number of unused electrons 1M 1M 1M 1M 1M 1M

S/N	Answers		Remarks
B11	**(a)**		
	(i)	Q is more reactive than Cu, so Q can displace Cu from its salt solution	1M
		R is a reactive metal, so it reacts with water instead of $Cu\backslash SO_4$ solution	1M
	(ii)	$Q(s) + CuSO_4(aq) \rightarrow QSO_4(aq) + Cu(s)$ $R(s) + 2H_2O(l) \rightarrow 2R(OH)_2(aq) + H_2(g)$	For each equation, 1M Correct balanced eqn 1M Correct state symbols
	(iii)	P is a **less reactive** metal. The bond between P and oxygen is weak. Oxide of P decomposes easily into P and oxygen	1M
	(iv)	R, Q, Cu, P	1M
	(b)		
	(i)	Z, W, X, Y	1M
	(ii)	The more reactive the metal, the longer time it takes to decompose its carbonate.	1M