Name	Class	Index Number

ANG MO KIO SECONDARY SCHOOL
MID-YEAR EXAMINATION 2017
SECONDARY THREE EXPRESS

CHEMISTRY

6092

Total Mark: 100

4 May 2017 / Thursday

Setter: Miss Tay Siew Peng / Mr Vincent Voo
Additional Materials: OTAS Sheet, Writing Papers

2 hours 30 minutes

READ THESE INSTRUCTIONS FIRST
Write your Name, Class and Index Number in the spaces at the top of this paper.
You may use a soft pencil for any diagrams, graphs or rough working.
You should show the essential steps in any calculations.
Do not use staples, paper clips, highlighters, glue or correction fluid/tape.

Section A
Answer **all** the questions in Section A on the OTAS paper provided. Write your name, class and index number on the OTAS paper in the spaces provided. **Use only 2B pencil on the OTAS paper.**

Section B
Answer **all** the questions in Section B in the spaces provided on the question paper. **Additional papers attached will not be marked**.

Section C
Answer **only three** questions in Section C in the spaces provided on the question paper.
Questions 1 and 2 are compulsory questions. Choose **either** question **EITHER 3** or **OR 3**.

At the end of the examination, hand in Sections A, B and C 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 25.

For Examiner's use	
Section A	
Section B	
Section C	
TOTAL	

This document consists of **25** printed pages, including the cover page.

[Turn over]

Section A: Multiple Choice Questions [30 Marks]

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 Multiple Choice Answer Sheet.

1. In which one of the following substances are the particles closest together?

   A. dry ice
   B. molten iron
   C. oxygen gas
   D. aqueous sodium chloride

2. The boiling points of some elements are shown in the table below.

element	boiling point / °C
W	– 74
X	– 98
Y	– 37
Z	– 89

   A mixture of liquids **W**, **X**, **Y** and **Z** at – 100°C is allowed to warm up gradually by 10°C. Which of the substance(s) will still be in the liquid state at the higher temperature?

   A. **X** only
   B. **X** and **Z**
   C. **W** and **Y**
   D. **W**, **Y** and **Z**

3. Which statement explains why two different gases, carbon monoxide (CO) and ethene (C_2H_4) diffuse at the same rate at room temperature and pressure?

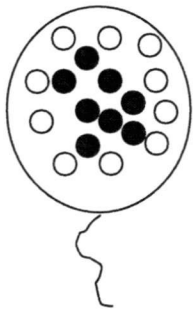
   A. They both contain the element carbon.
   B. They are made up of covalent molecules.
   C. They have the same relative molecular mass.
   D. The intermolecular forces of attraction found in both gases are the same.

4. A pure substance **M** melts at 18°C and boils at 85°C. Which of the following is likely to be impure **M**?

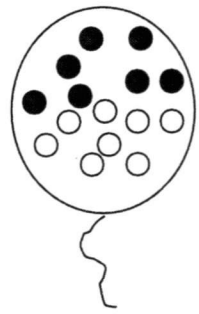
   A. A substance that melts at 16°C and boils at 84°C.
   B. A substance that melts at 16°C and boils at 86°C.
   C. A substance that melts at 20°C and boils at 84°C.
   D. A substance that melts at 20°C and boils at 86°C.

5. Which diagram shows the arrangement of particles inside a balloon filled with a mixture of hydrogen gas, ○ and carbon dioxide gas, ●?

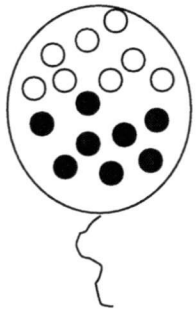
A.



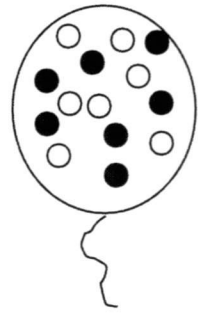
C.



B.

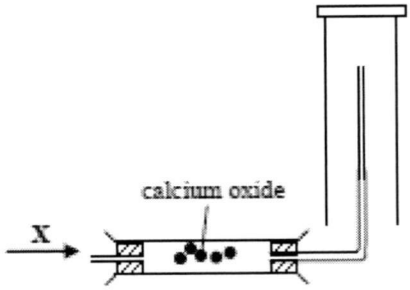


D.

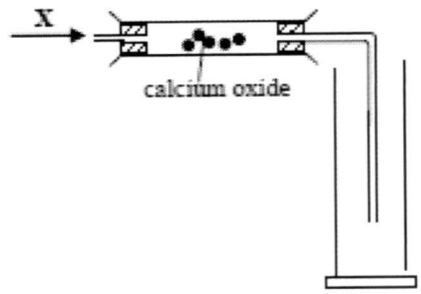


6. A gas, **X** is less dense than air, very soluble in water and is an alkali. Which method is used to collect a dry sample of the gas?

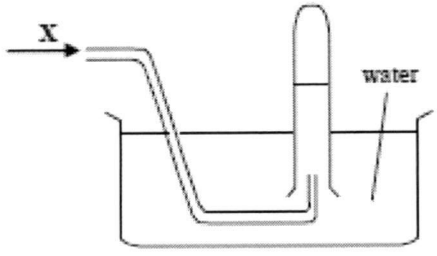
A.



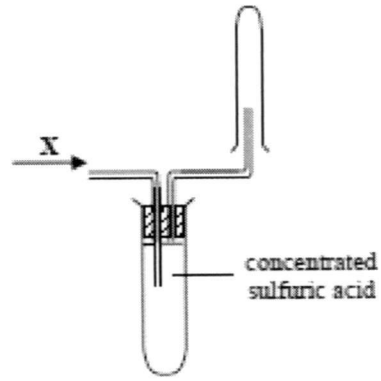
C.



B.

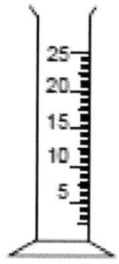


D.

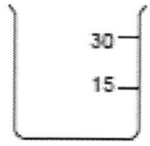


7. Which apparatus is most accurate in measuring 24.5 cm^3 of liquid?

A.

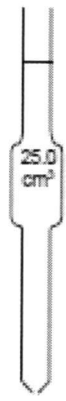


C.



B.

D.



8. Which one of the following sets contains an element, a compound and a mixture (not in any specific order)?

A. brass, air, sulfur
B. gold, carbon monoxide, magnesium chloride
C. rain water, zinc oxide, silicon
D. sulfur, graphite, silver nitrate

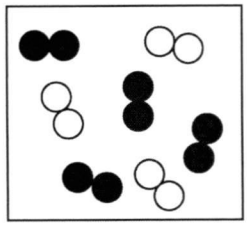
9. Which one of the following shows that substance **Z** is a compound?

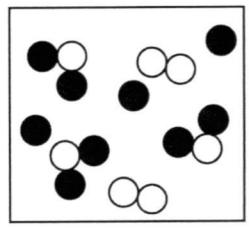
A. When heated, **Z** melts at 100°C.
B. When heated, **Z** decomposes to form a solid and a gas.
C. When heated, **Z** boils to give off a violet gas.
D. Using chromatography technique, **Z** separates into three different colour dyes.

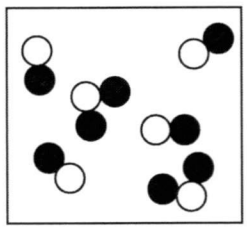
10. In an experiment, the melting point of a white crystalline solid **Q** is found to be 801°C, the same as pure sodium chloride. To verify the identity of **Q**, two parts of **Q** is mixed with one part of pure sodium chloride. The melting point of the mixture is found to be 785°C. Therefore, it can be deduced that

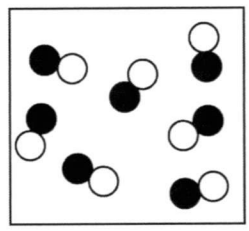
A. **Q** is a mixture.
B. **Q** is not sodium chloride.
C. **Q** is pure sodium chloride.
D. **Q** may contain sodium chloride.

11. Which one of the following diagrams shows a mixture of compounds?

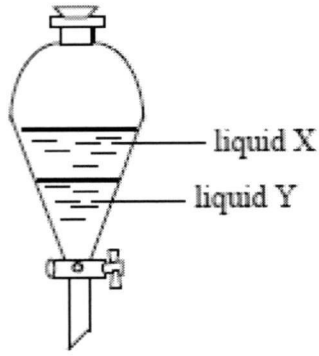
A. 

C. 

B. 

D. 

12. Two liquids, **X** and **Y**, are placed in a separating funnel. Two layers are formed as shown in the following diagram.



It can be deduced that _____.

A. liquid **X** is oil
B. liquid **X** is denser than liquid **Y**
C. liquid **X** and liquid **Y** are immiscible liquids
D. liquid **X** has a lower boiling point than liquid **Y**

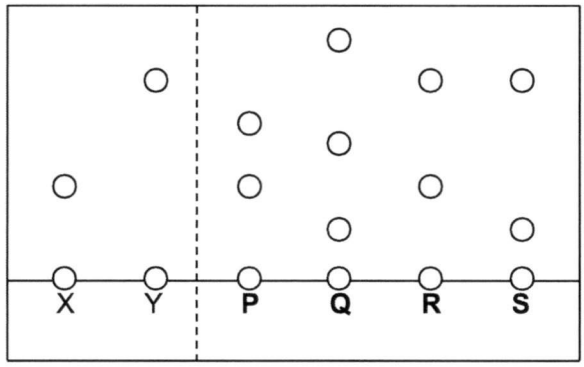
13. The following reaction can be used to prepare copper(II) hydroxide.

copper(II) sulfate	+	sodium hydroxide	⟶	copper(II) hydroxide	+	sodium sulfate
pale yellow solution		*colourless solution*		*blue solid*		*colourless solution*

Which one of the following separation techniques is used to obtain copper(II) hydroxide from the resulting mixture?

A. chromatography
B. evaporation to dryness
C. filtration
D. fractional distillation

14. The chromatogram shows the dyes contained in four different preserved food labelled **P**, **Q**, **R** and **S**. Dyes X and Y are harmful.



Which of the preserved food are not suitable for consumption?

A. **R** only
B. **Q** and **R**
C. **P** and **S**
D. **P**, **R** and **S**

15. The table shows some information about the solubilities of three solids.

solid	solubility in ethanol	solubility in water
X	yes	no
Y	no	yes
Z	no	no

The following procedures could be carried out to obtain pure **Y** from a mixture of **X**, **Y** and **Z**.

1. filter
2. evaporate filtrate to dryness
3. add ethanol
4. add water

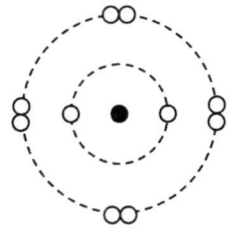
In what order should the procedures be carried out?

A. 1, 2, 3, 4
B. 4, 3, 1, 2
C. 3, 1, 2 (omit stage 4)
D. 4, 1, 2 (omit stage 3)

16. The technique of paper chromatography depends on the _____.

A. difference in the colour of the samples
B. difference in the sample sizes
C. relative solubility of the samples
D. types of solvent used

17. The diagram shows the arrangement of electrons in a particle with an ionic charge of –2. Which element does the atom of this partice belong to?



A. Ne
B. O
C. Mg
D. F

18. Which one of the following statements is correct for the atoms of $^{31}_{15}\mathbf{X}$ and $^{32}_{16}\mathbf{Y}$?

A. They have the same number of neutrons.
B. They are isotopes of the same element.
C. They are in the same Group in the Periodic Table.
D. They both have two electron shells surrounding the nucleus.

19. An ion, **X** has 18 electrons and 15 neutrons. It forms an ionic compound, $\mathbf{X}Cl_3$ with the element chlorine. What is the mass number of **X** ion?

A. 30
B. 33
C. 36
D. 40

20. An **ion** of $^{34}_{16}\mathbf{Z}$ has _____.

A. 16 protons and 34 neutrons
B. 16 electrons and 18 neutrons
C. a total number of 34 protons and electrons
D. a relative atomic mass of 50

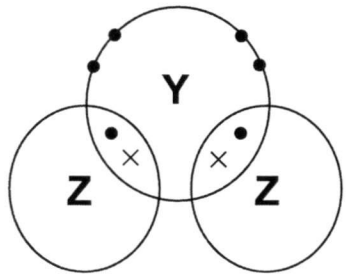
21. A bromine atom and a bromide ion have _____.

A. similar physical properties
B. similar chemical properties
C. the same number of protons
D. the same number of electrons

22. What particles are present in solid potassium chloride and in molten potassium chloride?

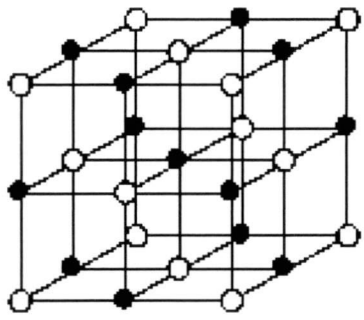
	solid potassium chloride	molten potassium chloride
A.	ions	ions
B.	ions	atoms
C.	molecules	molecules
D.	atoms	molecules

23. The diagram below shows the electron arrangement in a molecule of the compound YZ_2. Which pair of the elements could be **Y** and **Z**?



	Y	Z
A.	oxygen	hydrogen
B.	oxygen	chlorine
C.	sulfur	calcium
D.	sulfur	helium

24. The diagram shows the structure of sodium chloride.



Key :
● Na^+
○ Cl^-

Which statement about this structure is correct?

A. Each chloride ions is in contact with only one sodium ion.
B. Each chloride ion is in contact with only four sodium ions.
C. Each sodium ion is in contact with only four chloride ions.
D. Each sodium ion is in contact with only six chloride ions.

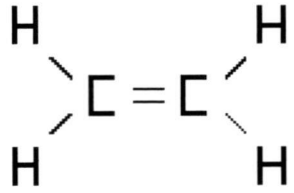
25. The table shows the properties of some substances. Which substance is an ionic compound?

	melting point / °C	**electrical conductivity of**	
		solid	**liquid**
A.	29	able to conduct	able to conduct
B.	121	not able to conduct	not able to conduct
C.	933	not able to conduct	able to conduct
D.	1550	able to conduct	able to conduct

26. Elements **X**, **Y** and **Z** have atomic numbers of 9, 10 and 11 respectively. Which of the following statements regarding **X**, **Y** and **Z** is correct?

A. **X** and **Z** can combine to form an ionic compound **ZX**.
B. **X** and **Y** can combine to form a covalent compound.
C. **Y** is a member of Group VII in the Periodic Table.
D. **Z** is a non-metal.

27. What is the total number of shared electrons in an ethene molecule?



A. 6
B. 8
C. 10
D. 12

28. Which one of the following substances contains both covalent and ionic bonds?

A. hydrogen chloride gas
B. solid magnesium carbonate
C. solid carbon dioxide
D. molten lithium bromide

29. How many atoms are there in one unit of ammonium sulfate?

A. 4
B. 10
C. 15
D. 16

30. A metal **X** forms a carbonate salt with the formula, $\mathbf{X}CO_3$ while a non-metal **Y** forms a sodium salt with the formula, $Na_2\mathbf{Y}$. What is the formula of the substance formed between **X** and **Y**?

A. XY
B. $\mathbf{X_2Y}$
C. $\mathbf{XY_2}$
D. $\mathbf{X_2Y_3}$

End of Section A

Name: _____ ( ) Class: _____ Marks: _____/40

Section B: Structured Questions [40 marks]

Answer all questions in this section. Write your answers in the spaces provided in the question paper.

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

substance	melting point / ^{0}C	solubility in water
chlorine oxide	-121	soluble in both cold and hot water
hydrogen	-259	insoluble
hydrogen sulfide	-85	soluble in cold water but insoluble hot water
methane	-182	insoluble
tar	softens between 10 and 79	insoluble

(a) Draw a labelled diagram to show how to collect and measure 25cm^3 of methane gas. [2]

(b) Which substance is a mixture? [1]

_____

(c) Write the chemical formula of the substance which has the lowest melting point. [1]

_____

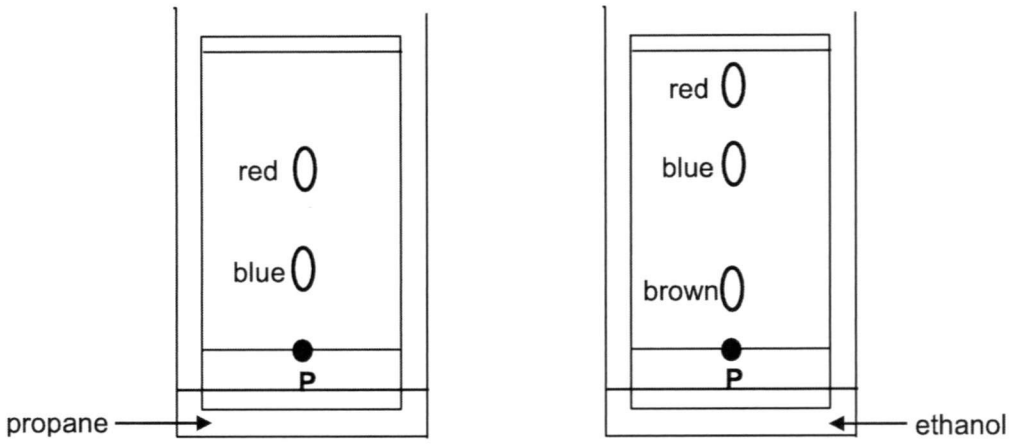
(d) Write the chemical formula of the substance which contains sulfur as one of its elements. [1]

_____

(e) Draw a 'dot and cross' diagram to show the bonding in chlorine oxide. Show only the valence electrons. [2]

[Total:7]

2 A sample of paint **P** was collected. Two different experiments were set up to analyse the paint, each using the same paint but with a different solvent: propane and ethanol. Below are the results of the experiments. **Diagram is drawn to scale.**



Experiment A **Experiment B**

(a) Calculate the R_f value of the red and blue spots on the chromatogram from **Experiment A.** [2]

Red | Blue

(c) **(i)** State two differences between the chromatograms in **Experiment A** and **Experiment B**. [1]

_____

_____

(ii) Explain why the chromatograms are different although the paint used is the same. [2]

_____

_____

_____

_____

(d) **(i)** According to the Kinetic Particle Theory, all matters are made up of particles (ions, atoms or molecules) constantly moving in a random motion. Hence, state the type of particles present in liquid ethanol. [1]

_____

(ii) Explain using Kinetic Particle Theory, why a bottle of liquid ethanol left in the room will decrease in volume within one hour. [2]

_____

_____

_____

_____

[Total:8]

3 The number of protons, neutrons, and electrons in particles **A** to **F** are given in the following table:

particle	number of protons	number of neutrons	number of electrons
A	3	6	2
B	8	9	10
C	12	12	12
D	17	18	17
E	17	20	17
F	18	22	18

Identify which of the above particles:

(a) is an atom of a metal, _____ [1]

(b) is an atom of a non-metal, _____ [1]

(c) is an atom of a noble gas, _____ [1]

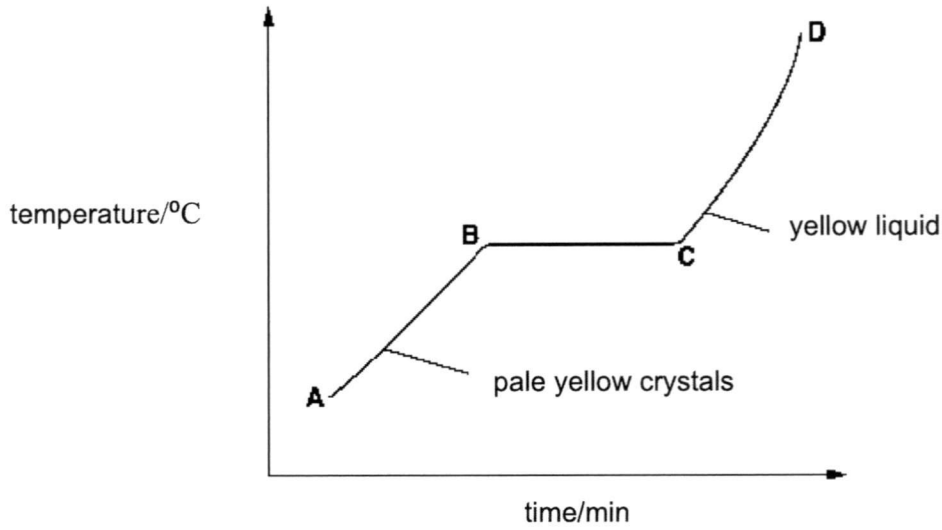
(d) Are isotopes of the same element, _____ [1]

(e) is a positive ion. _____ [1]

(f) combine to form ionic compound _____ [1]

[Total:6]

4 Nitrogen dioxide, NO_2, is a dark brown gas.
When nitrogen dioxide is cooled, it first forms a yellow liquid and thereafter pale yellow crystals. In an experiment, these crystals are heated and the temperature is measured every minute. The following graph is obtained.



(a) Name the process taking place in the region **B – C**. [1]

_____

(b) Explain why the temperature remains constant in the region **B – C**. [1]

_____

_____

(c) Describe the arrangement and movement of the nitrogen dioxide molecules in the region **C – D**. [2]

_____

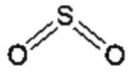
_____

_____

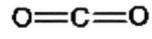
_____

[Total:4]

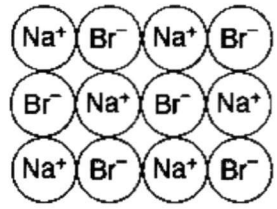
5 The diagram shows the structures of various compounds.



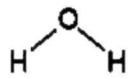
A



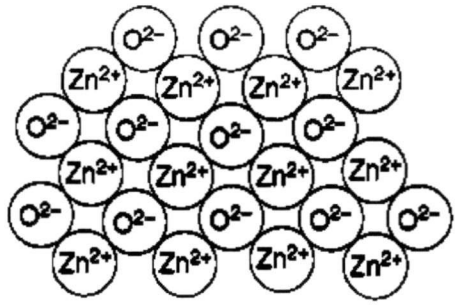
B



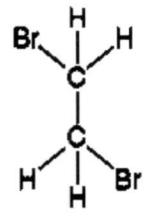
C



D



E



F

(a) **(i)** Which of the compound(s) in the above diagram can conduct electricity in molten state. [1]

_____

(ii) Explain why the compound(s) in **(a)(i)** can conduct electricity in molten state. [1]

_____

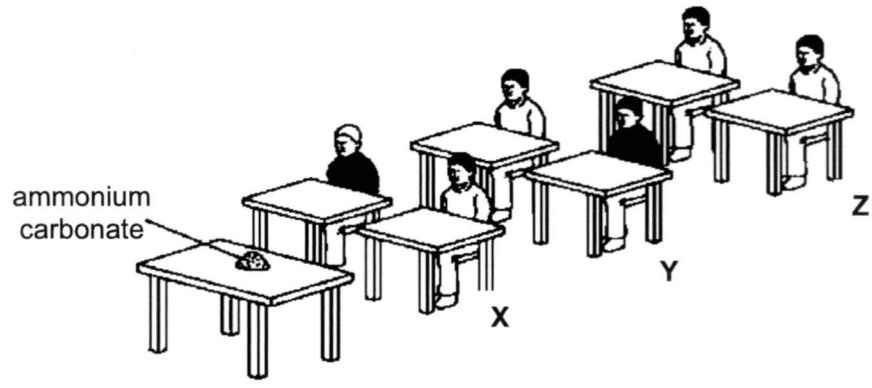
(b) Both compound **C** and **E** have high melting point. However, compound **E** has a higher melting point than compound **C**. Explain. [2]

(c) Explain in terms of structure and bonding, why compound **A** and **B** exist as gas at room temperature. [2]

[Total:6]

6 Smelling salts are sometimes used to 'wake up' people who feel dizzy. The main chemical in smelling salts is ammonium carbonate. Ammonium carbonate breaks down slowly at room temperature to release ammonia gas, carbon dioxide gas and water.

A few crystals of ammonium carbonate were put on a bench at the front of a classroom. The students in row **X** could smell the ammonia 10 seconds after the smelling salts had been put on the bench. The students in row **Z** could smell the ammonia after 40 seconds.



(a) Suggest how long it will take for students in row **Y** to smell the ammonia. [1]

(b) Name the process responsible for this phenomenon and explain the results using ideas about moving particles. [2]

_____

_____

_____

(c) State and explain how the results will differ if a heater was placed in the classroom. [2]

_____

_____

_____

[Total: 5]

7 A metal **X** reacts readily with element **Y** to form an ionic compound with a chemical formula of $\mathbf{X_2Y_3}$.

(a) State and explain whether element **Y** is a metal or a non-metal. [2]

_____

_____

_____

_____

(b) State the chemical formula of the following compound: [2]

(i) hydroxide of **X**:

_____

(ii) Compound formed between **Y** and lithium:

_____

[Total: 4]

******* End of Section B *******

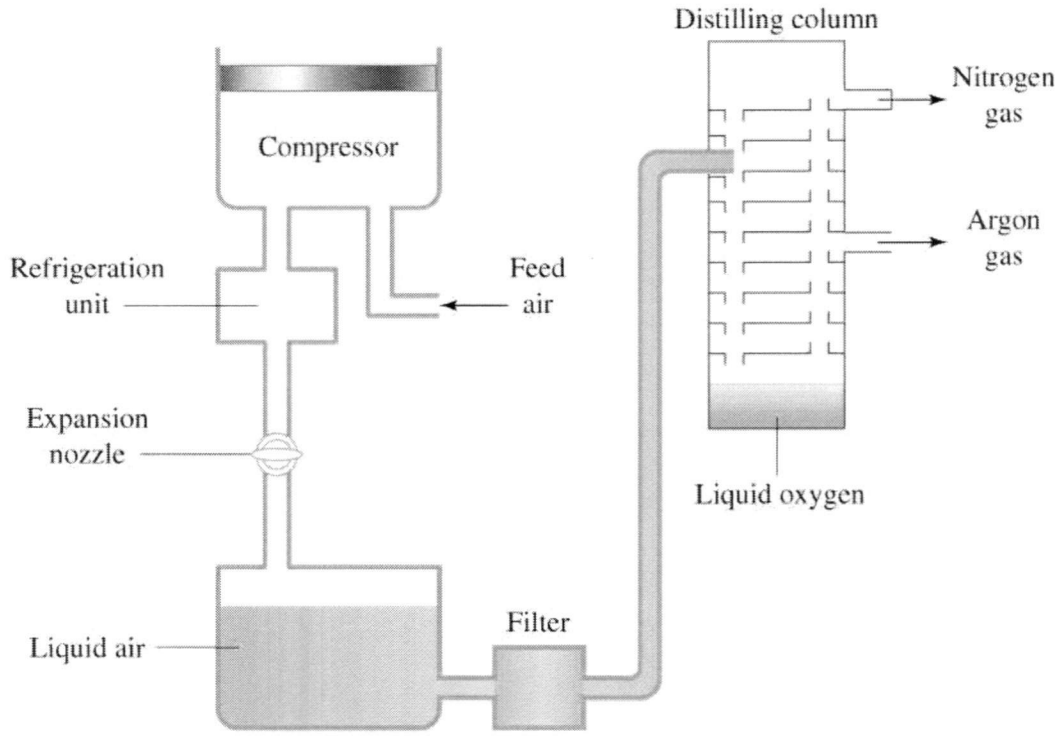
Name: _____ ( ) Class: _____ Marks: _____/30

Section C: Free Response Questions [30 Marks]
Answer **three** questions from this section. Questions 1 and 2 are compulsory.
Choose **EITHER 10** or **OR 10** as your third question.
Write your answers in the space provided.

8 Earth's atmosphere consists of a mixture of gases and some of these gases like oxygen and nitrogen are useful in the medical industry. Hence separating air is an important process.
The table below shows the properties of components found in the Earth's atmosphere.

Components in Earth's atmosphere	melting point/°C	boiling point/°C
argon	-189	-186
water vapour	0	100
carbon dioxide	-78	-78
neon	-249	-246
nitrogen	-210	-196
oxygen	-219	-183

Separation of air to obtain oxygen, argon and nitrogen



Source: http://www.pythagorasandthat.co.uk

Step1: The air is compressed and cooled to -200°C to obtain liquid air
Step 2: Filter to remove some gases
Step 3: Warm the liquefied gas through the distilling column

(a) Name the component in the Earth's atmosphere that is not found in the liquid air at -200°C. [1]

(b) Describe how the movement and the arrangement of the oxygen molecules changes as it is cooled from room temperature to -200°C. [4]

(c) There are only 2 components which are removed by the filter at -200°C. Identify these 2 gases and explain why they are removed by the filter. [2]

(d) Briefly describe how the liquefied air is separated into different components through the distilling column. [3]

9 The table below shows the properties of some elements in the Periodic Table.

Element	Relative atomic mass	Atomic numbers	Electronic Configuration	Atomic radius/Å
Lithium	7	3	2,1	1.67
Chlorine	35.5	17	2,8,7	0.79
Sodium	23	11	2,8,1	1.90
Magnesium	24	12	2,8,2	1.45
Silicon	28	14	2,8,4	0.88
Fluorine	19	9	2,7	0.42
Selenium	79	34	?	1.03
Bromine	80	35	2,8,18,7	0.94

(a) Explain why the relative atomic mass of chlorine is not a whole number. [2]

(b) **(i)** With reference to the data above, describe how the atomic radius changes across the period and down the group. [2]

(ii) Explain in terms of atomic structure, your answer in **(b)(i)** [3]

(c) Derive the electronic configuration of selenium. [1]

_____

(d) Draw the "dot and cross" diagram of the compound formed between magnesium and fluorine. Show only the valence electrons. [2]

EITHER

10 (a) Allotropes are different forms of element and graphite is an allotrope of carbon. It can conduct electricity.

(i) Name another allotrope of carbon. [1]

_____

(ii) Describe the structure present in graphite and hence, predict **two** other physical properties of graphite. [5]

_____

_____

_____

_____

_____

_____

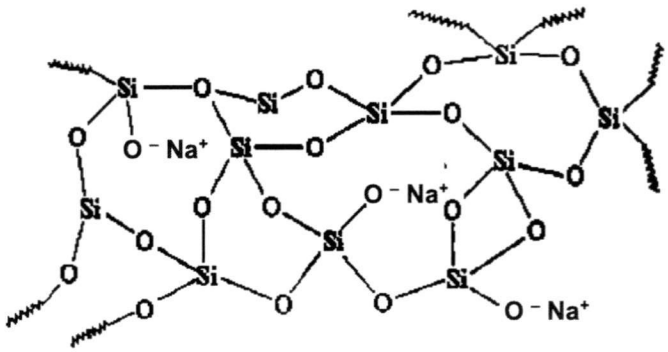
_____

_____

_____

_____

(b) Soda-lime glass is made by heating a mixture of calcium carbonate, sodium carbonate and sand in a furnace at high temperature. A part of the simplified structure of soda-lime glass is shown below.



(i) Describe **two** differences between the structures of graphite and the soda-lime glass. [2]

_____

_____

_____

(ii) When soda-lime is melted, it conducts electricity. [1]

Use the information in the diagram to explain this fact.

_____

_____

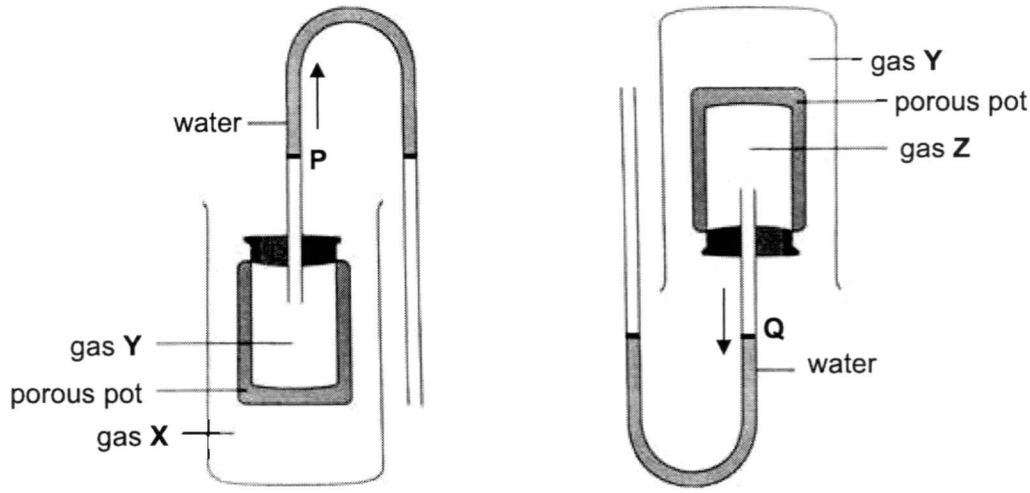
(iii) How is this similar or different from the way graphite conducts electricity? [1]

_____

_____

OR

10 The apparatus shown below was used to investigate the speed of diffusion of gases.



After a period of time, the water level at **P** in **Experiment 1 rises** and the water level at **Q** in **Experiment 2 falls**.

(a) **(i)** State the relationship between relative molecular mass and speed of diffusion. [1]

_____

_____

(ii) Explain the change of the water level in **Experiment 1** and **Experiment 2**. [4]

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(iii) Arrange **X**, **Y** and **Z** in order of increasing relative molecular mass. [1]

_____

(b) In **Experiment 1**, Gas **X** was then replaced with the following gases and the observations of the water level were recorded.

Gas X	Observation	Relative molecular mass of gas X
Hydrogen (H_2)	Water level at **P** rises.	2
Carbon dioxide (CO_2)	Water level at **P** falls.	
Methane (CH_4)	Water level at **P** rises.	16
Chlorine (Cl_2)	Water level at **P** falls.	71
Nitrogen (N_2)	Water level at **P** remains unchanged	

(i) Complete the table above. [2]

(ii) From the information given in the table above, what can you deduce about the relative molecular mass of Gas **Y**? Explain your answer. [2]

_____

_____

_____

_____

******* **End of Section C** *******

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.).

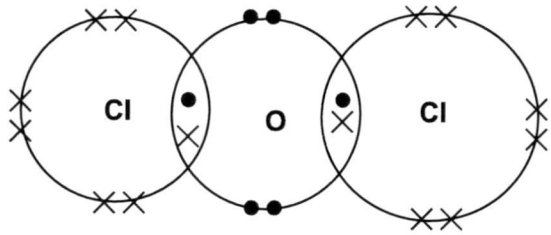
ANG MO KIO SECONDARY SCHOOL
MID YEAR EXAMINATION 2017
SECONDARY THREE EXPRESS
PURE CHEMISTRY [6092]

ANSWER SCHEME

Section A: Multiple Choice Questions [30 Marks]

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

ANG MO KIO SEC SCH
Mid-Year Examination 2017 Markers Report
Sect B

				Markers Report
1	**(a)**			
	(b)	tar	1	
	(c)	H_2	1	
	(d)	H_2S	1	
	(e)	1m for drawing two chlorine and one oxygen atoms with complete outer shell electrons, 1m for drawing a pair of shared electrons between chlorine and oxygen atoms.  	2	

					Markers Report
2	**(a)**		R_f of red spot = 2.5/4.1= 0.610 R_f of blue spot = 1.1/4.1 = 0.268	1 1	
	(b)	**(i)**	The <u>number</u> of spots and <u>position</u> of spots are different.	1	
		(ii)	Brown is soluble in ethanol but insoluble in propane Both red and blue dye is more soluble in ethanol than in propane.	1 1	
	(c)	**(i)**	Type of particle: molecule	1	
		(ii)	<u>Particles in liquid ethanol (molecules) will absorb heat energy</u> from surrounding to <u>overcome the force of attraction</u> between the molecules. When these attraction force is overcome, ethanol will evaporate.	1 1	

				Markers Report
3	(a)	C	1	
	(b)	D/E	1	
	(c)	F	1	
	(d)	D and E	1	
	(e)	A	1	
	(f)	A and B	1	

				Markers Report
4	(a)			
	(b)	overcome the weak intermolecular forces of attraction between them.	1	
	(c)	The molecules are closely packed but in a disorderly manner. The molecules are sliding over each other.	1 1	

					Markers Report
5	(a)	(i)	C and E	1	
		(ii)	Free moving ions	1	
	(b)	E consists of Zn^{2+} and O^{2} whose charge is greater than Na^{+} and Br^{-} in C. Stronger electrostatic forces of attractions in E than in C		1 1	
	(c)	• They have <u>simple molecular structure</u> • and <u>weak intermolecular forces.</u> • <u>Small amount of energy is required</u> to overcome these weak intermolecular forces. • Hence its <u>boiling point is lower than room temperature.</u>		4 points -2m 3 or 2 point - 1m	

				Markers Report
6	(a)	25 seconds (accept from 20 to 30 s) **no unit no mark**	1	
	(b)	The process is <u>diffusion</u>. The ammonia gas particles move from a region of <u>higher concentration</u> (front bench) to a region of <u>lower concentration</u> (towards the students).	1 1	

	(c)	Students will be able to detect the ammonia at a faster rate/shorter time. ammonia particles will gain energy from the increase in surrounding temperature and thus diffuse faster.	1 1	

						Markers Report
7	(a)	Non-metal Metal and non-metal elements combine to for ionic compound			1 1	
	(b)	(i)	$X(OH)_3$		1	
		(ii)	Li_2Y		1	

Sect C

				Markers Report
8	(a)		1	
	(b)	At room temperature, the oxygen molecules are very far apart and move randomly in all direction As the temperature decreases, the oxygen molecules loses energy and move slower Till they become closely packed at -183 C And can only slide over one another.	1 1 1 1	 Accept: Lose kinetic energy Many did not state the temperature.
	(c)	Water vapour and carbon dioxide 200°C, these 2 gases are solid.	1 1	Many are unable to identify the gas.
	(d)	Through repeated evaporation and condensation, the liquefied air is separated into different fraction. Nitrogen which has the lowest boiling point will be distilled first at the top fraction While liquid oxygen with the highest boiling point will be collected at the lowest fraction.	1 1 1	Very badly done. Must state that Nitrogen is distilled first and oxygen distilled last

					Markers Report
9	(a)	It exists as isotopes The relative atomic mass shown is the <u>average atomic mass</u> of chlorine isotopes.		1 1	Some students identify the Chlorine isotopes as Cl-35 and Cl-36, marks deducted for this. Instead of writing "average atomic mass" students show the correct calculations using the correct values, thus 1m given.
	(b)	(	atomic radius increases down the group. By comparing sodium, magnesium, silicon and chlorine, the atomic radius decreases across the period	1 1	1m given if students state the correct trend but no reference made to the data.
		(ii)	Down the group, the <u>number of electron shells increases</u>, hence the atomic radius increases Across the period, the <u>number of protons in the nucleus increases</u> Hence the <u>electrostatic forces of attractions</u> between the nucleus and the electrons are <u>stronger</u>, <u>pulling them closer</u> towards the nucleus.	1 1 1	Accept: • "Period number increase" instead of "down the group" • "group number increases" instead of "across the period" Do not accept: • Down the period • Across the group
	(c)	2, 8, 18, 6		1	
	(d)				Correct charge-1m Correct transferring of electrons-1m

EITHER

					Markers Report
10	**(a)**	**(i)**	Diamond	1	
		(ii)	It has high melting point and it is soft. Graphite has a giant molecular structure Large amount of energy is required to overcome the strong covalent bond The layers of atoms are held by weak intermolecular forces that can be overcome by small amount of energy Allowing the layer of atoms to slide over each other	1 1 1 1 1	Accept: insoluble in water and organic solvent Do not accept: 3-dimensional sturucture.
	(b)	**(i)**	Graphite: regular arrangement, no ions/all atoms covalently bonded, larger spaces in structure Soda-lime glass: irregular arrangement, ions present, compact structure	1 1	Accept: Graphite consists of only covalent bond while soda-lime consists of only ionic and covalent bond.
		(ii)	Free mobile ions to carry and pass electric charges to one another, allowing a flow of charge.	1	Accept: ions slide pass each other
		(iii)	Graphite: mobile electrons Soda-lime glass: mobile ions	1	

OR

<table>
<tr><th></th><th></th><th></th><th></th><th></th><th>Markers Report</th></tr>
<tr><td>10</td><td>(a)</td><td>(i)</td><td colspan="2">The <u>higher the relative molecular mass, the slower the speed of diffusion</u></td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td colspan="2">In experiment 1, <u>Gas X is able to diffuse into the porous pot faster than Gas Y</u> diffusing out of the porous pot. As the <u>pressure/number of molecules in the porous pot increases</u> , the water level at P rises.

In experiment 2, <u>Gas Y is able to diffuse into the porous pot faster than Gas Z</u> diffusing out of the porous pot. As the <u>pressure/number of molecules in the porous pot increases</u> , the water level at Q falls.</td><td>1

1

1

1</td><td></td></tr>
<tr><td></td><td></td><td>(iii)</td><td colspan="2"><u>X, Y, Z</u></td><td>1</td><td></td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td colspan="2"><table>
<tr><th>Gas X</th><th>Observation</th><th>Relative molecular mass of gas X</th></tr>
<tr><td>(H_2)</td><td>Water level at P rises.</td><td>2 x (mass no of H) =2</td></tr>
<tr><td>Carbon dioxide (CO_2</td><td>Water level at P falls.</td><td>44</td></tr>
<tr><td>Methane (CH_4)</td><td>Water level at P rises.</td><td>Mass no of C +4 x (mass no of H) =16</td></tr>
<tr><td>Chlorine (Cl_2)</td><td>Water level at P falls.</td><td>71</td></tr>
<tr><td>Nitrogen (N_2)</td><td>Water level at P remains unchanged</td><td>28</td></tr>
</table></td><td>1

1</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td colspan="2">As the <u>water level remains unchanged when X is replaced by nitrogen</u> , it shows that <u>both gases diffuse at the same speed</u> Hence, the <u>relative molecular mass of Gas Y is 28</u> .</td><td>1

1</td><td>Accept ECF if the values of the molecular is wrong</td></tr>
</table>