FUCHUN SECONDARY SCHOOL
END OF YEAR EXAMINATION 2017
SECONDARY 3 EXPRESS

NAME: _____

CLASS: _____ INDEX NUMBER: _____

SCIENCE CHEMISTRY

5076, 5078
Max mark: 85
5 OCTOBER 2017
1 h 45 mins

Additional materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A

Write in soft pencil.
Write your name, class and index number on the Answer Sheet in the spaces provided.
There are **twenty** questions on this section. Answer **all** questions. For each questions 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 OTAS provided.
Each correct answer will score one mark. A mark will nt be deducted for a wrong answer.
Any rough working should be done in this booklet.

Section B

Write in dark blue or black pen.
You may use a soft pencil for any diagrams, graphs or rough working.
Answer **all** questions in the spaces provided.

Section C

Answer **any two out of three** questions.
Write our answers in the spaces provided on the question paper.
The number of marks is given in brackets [ ]

A copy of the Periodic Table is printed on page 19.

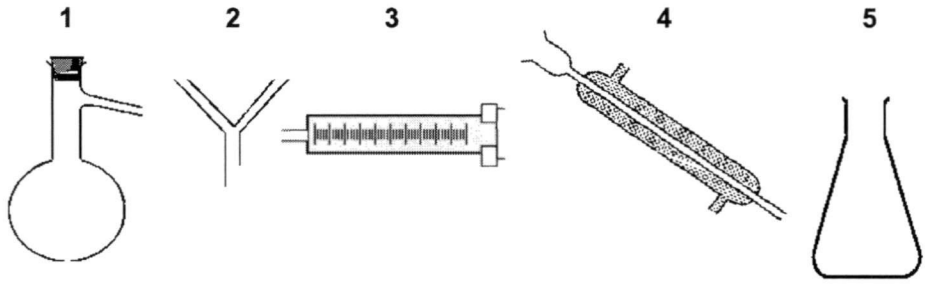
Section	Marks
A	
B	
C___	
C___	

Name of setter: Mr Nor Mohamad

This document consists of 19 pages.

Section A (20 marks)
Answer all questions.

1. The diagram shows some laboratory apparatus.



Which apparatus are needed to produce and collect pure water from seawater?

A 2 and 5

B 3 and 5

C 1, 2 and 4

D 1, 4 and 5

2. Ester is a sweet smelling organic substance which is commonly used as artificial flavouring. Which property of an ester could be used to check its purity?

A boiling point

B colour

C smell

D solubility in water

3. The relative atomic mass of naturally occurring chlorine is **not** a whole number. What is the reason for this?

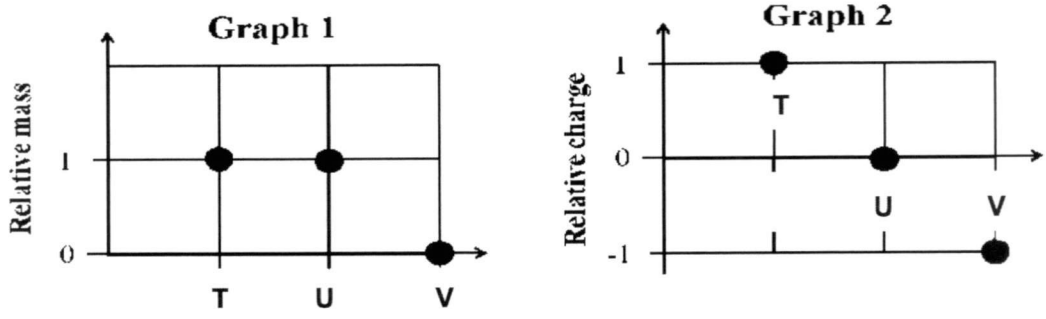
A Chlorine atoms can have different number of electrons.

B Chlorine atoms can have different number of electron shells.

C Chlorine atoms can have different number of neutrons.

D Chorine atoms can have different number of protons.

4. Given below are the relative masses and charges of subatomic particles **T**, **U** and **V**.



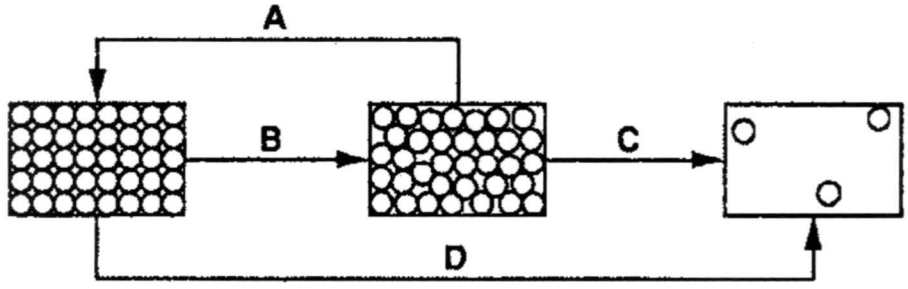
Which of the following correctly describes the identity of particles **T**, **U** and **V**?

	T	U	V
A	proton	neutron	electron
B	electron	proton	neutron
C	proton	electron	neutron
D	electron	neutron	proton

5. The table gives data about four substances.
In which substance are the particles vibrating in a fixed position at 200 °C?

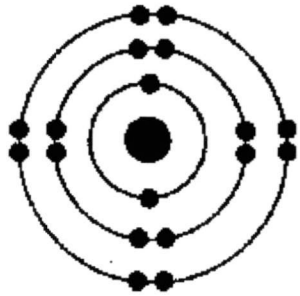
	melting point/ °C	boiling point/ °C
A	– 258	– 183
B	– 124	35
C	121	345
D	253	926

6. The diagram shows particles in a solid, a liquid and a gas.



Which arrow represents sublimation?

7. Which of the following has the electronic structure shown in the diagram below?



A Al^{3+}

B Cl^{-}

C Na^{+}

D Ne

8. Which **two** statements about an ionic bond are correct?

1 It can be formed between two non-metal atoms.
2 It can be formed between a metal atom and a non-metal atom.
3 It can be formed by sharing electrons between the atoms.
4 It can be formed by the transfer of electrons between atoms.

A 1 and 3

B 1 and 4

C 2 and 3

D 2 and 4

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

A air, pure water, potassium carbonate

B air, cobalt, zinc sulfate

C magnesium, pure water, sulfur

D sodium chloride, sulfur, zinc

10. A container of distilled water contains dissolved carbon dioxide. Which is the pH of this distilled water?

A 5

B 7

C 9

D 11

11. The chart shows the colour ranges of four different indicators.
Which indicator is blue in an acidic solution?

indicator	pH value 1 2 3 4 5 6 7 8 9 10 11 12 13 14
A	colourless → ← blue
B	red → ← blue
C	red → ← blue → ← yellow
D	yellow → ← blue

12. Which substance is used to increase the pH in a soil?

A ammonum nitrate

B calcium hydroxide

C magnesium sulfate

D potassium chloride

13. Element L burns in air to form a product that dissolves sparingly in water to give an alkaline solution. What is element L?

A bromine

B carbon

C magnesium

D neon

14. Which quantity is the same for one mole of argon and one mole of carbon monoxide measured at room temperature and pressure?

A mass

B number of atoms

C number of molecules

D volume

15. A chemist carried out an experiment to find the relative molecular mass (M_r) of a compound. The M_r of the compound was 28. Which one of the following could be the compound?

A CH_4

B C_2H_4

C C_2H_6

D CO_2

16. What is the relative molecular mass of hydrated copper (II) nitrate, $Cu(NO_3)_2.3H_2O$?

A 111

B 143

C 242

D 10152

17. Which of the following is the correct chemical formula of manganese (IV) oxide?

A Mn_4O

B MnO_2

C Mn_2O_4

D MnO_4

18. Which statement about the elements in Group I of the Periodic Table is correct?

A The proton (atomic) number is 1 greater than that of the element above it.

B They have increasing boiling point down the group.

C They become less reactive down the group.

D They form chlorides with similar formula.

19. Which of the following does **not** correctly describe the trend on descending Group VII?

A Down Group VII, colour darkens.

B Down Group VII, melting point increases.

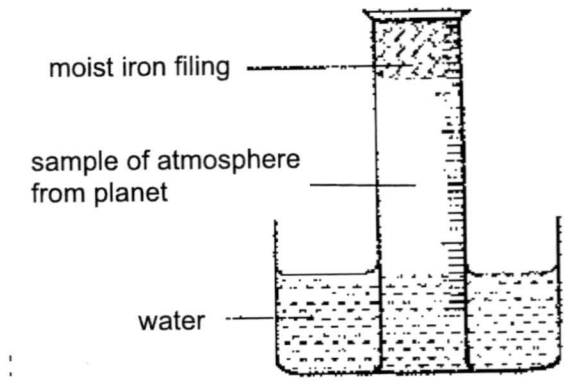
C Down Group VII, reactivity increases.

D Down Group VII, density increases.

20. The atmosphere of a newly discovered planet contains the following gases.

carbon dioxide	20%
nitrogen	40%
noble gases	10%
oxygen	30%

The apparatus below was set up with a 100 cm^3 sample of the atmosphere of the planet in the graduated tube. The volume of the sample is measured at intervals until no further change in volume took place.



What volume of the sample will remain?

A 10 %

B 30%

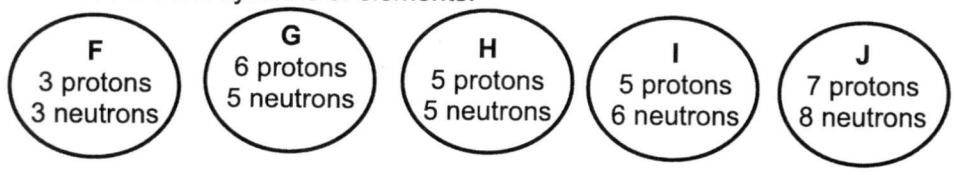
C 70%

D 80 %

-End Of Section A-

Section B (45 marks)
Answer all questions. Write your answers in the spaces provided.

1. The diagram below shows the nuclei of five different atoms. The nuclei labelled **F, G, H, I** and **J**. These are not symbols of elements.



Which letter(s) from **F, G, H, I** and **J** represent(s) [5]

(a) the nucleus of an atom with an atomic number of six, ...

(b) the nucleus of an atom with a relative atomic mass of six, ...

(c) two nuclei from different isotopes of the same element, ... and .....

(d) the nucleus of an atom with one electron in its outermost shell, ...

(e) the nucleus of an atom which forms a negatively charged ion. .....

2. The table shows some information about substance **A** to **E.** [4]

substance	melting point /°C	boiling point /°C	Does it conduct electricity when it is a solid?	Does it conduct electricity when it is a liquid?
A	– 95	69	no	no
B	146	730	no	yes
C	35 – 50	367 – 410	no	no
D	1240	2100	yes	yes
E	1650	2230	no	no

(a) Which substance is most likely a metal? .....

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

(c) Which substance is a mixture? .....

(d) Which substance is most likely to have a giant ionic structure? ....

3. Name the pieces of apparatus best used to carry out the following procedures. [4]

(a) Add 150 cm^3 of liquid to a beaker. .....

(b) Add 25.0 cm^3 of acid to a flask. .....

(c) Measure the boiling point of a liquid. .....

(d) Separate a precipitate from a solution. .....

4. Oxides can be classified into four groups based on their reactions with acids and alkalis.

(a) In Fig 4.1 below, complete the name of the groups of oxides. [2]

(b) Classify the oxides listed below into the correct column. [4]

aluminium oxide	calcium oxide	carbon monoxide	zinc oxide
copper (II) oxide	sodium oxide	phosphorous (V) oxide	sulfur trioxide

Oxides				
reaction with acids or alkali	**reacts only with acids**	**reacts only with alkalis**	**reacts with both acids and alkalis**	**no reaction**
type of oxide				**neutral**
examples of oxides				

Fig 4.1

(c) Give the chemical formula of these oxides: [2]

aluminium oxide :.....

copper (II) oxide : .....

5. Aspirin is a medicine that is used as a painkiller. It is salicylic acid.
A student makes a sample of aspirin. He thinks it contains some impurities.

(a) The student uses chromatography to produce a chromatogram, as shown in Fig 5.1.
He uses his own aspirin, pure samples of aspirin and salicylic acid.

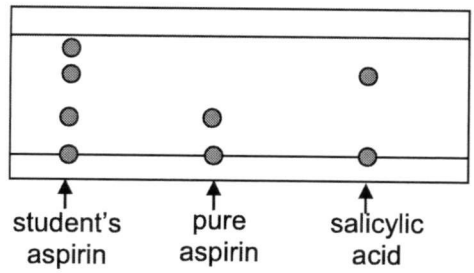


Fig. 5.1

Using the chromatogram in Fig. 5.1, comment on the purity of the student's aspirin sample. Explain your answer. [2]

.....

.....

(b) Salicylic acid is soluble in ethanol.

	melting point / °C	boiling point / °C
salicylic acid	159	211
ethanol	– 141	78

Another student wrongly mixes a bottle of ethanol with some salicylic acid and realises her mistake. She decides to use the method shown in Figure 5.3 to separate the two substances.

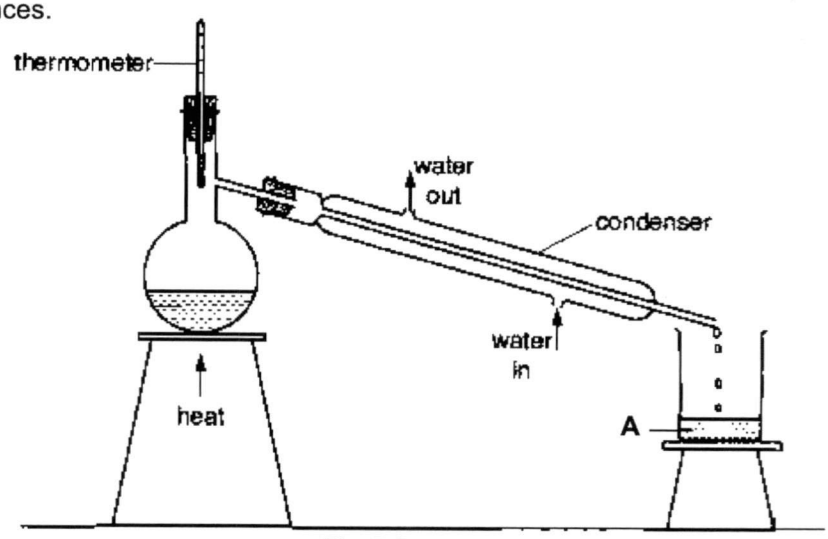


Fig 5.3

(i) State the general name for this method of separation. [1]

.....

(ii) Which substance, salicylic acid or ethanol, will be collected at point A? Explain your answer [2]

.....

.....

6. Clean air is a mixture of gases

(a) Name the gas that makes up 0.97% of clean, dry air. [1]

.....

(b) On cooling, the gases in clean air may liquefy. Describe what happens to the **arrangement** and **movement** of the particles in these gases as they become liquids. [2]

change in arrangement .....

.....

change in movement .....

.....

(c) Methane and carbon monoxide are two air pollutants. Give a source of each pollutant and describe one of the problems that each can cause. [4]

(i) methane

source : .....

problem : .....

(ii) carbon monoxide

source : .....

problem : .....

7. When potassium burns with oxygen, potassium forms potassium ion while oxygen forms oxide ion.
Each potassium ion has a 1+ charge while each oxide ion has a 2– charge.

(a) Draw a 'dot and cross' diagram to show the electronic structure of potassium oxide. [2]

(b) Use your diagram in **(a)** to explain how and why this change has taken place. [3]

.....

.....

.....

.....

.....

.....

8. Zinc is reacted with dilute nitric acid. Effervescence was observed and the gas produced was collected in the laboratory.

(a) Name the apparatus used to collect and measure the gas produced. [1]

.....

(b) **(i)** A solution is made by dissolving 12.6 g of nitric acid in water and making the volume up to 500 cm^3. Calculate the concentration, in g/dm^3, of this solution. [1]

concentration =.....g/dm^3

(ii) A solution contains 12.6 g of nitric acid, HNO_3 in 2 dm^3. Calculate the concentration of this solution in mol/dm^3. [1]
[Relative atomic masses: A_r: *H*, 1; *N*, 14; *O*, 16]

concentration = ...mol/dm^3

(c) (i) Write a balanced chemical equation for the reaction between zinc and nitric acid. State symbols are not required. [2]

.....

(ii) What is the volume of gas produced when 4.5 g of zinc is reacted with excess dilute nitric acid? [2]
[The volume of one mole of any gas is 24 dm^3 at room temperature and pressure]

volume =.....dm^3

-End Of Section B-

Section C (20 marks)
Answer two out of three questions.

1. **(a)** Nitrogen can combine with hydrogen atoms to form ammonia.

(i) Name the type of chemical bond found in a molecule of ammonia. [1]

.....

(ii) Draw a "dot and cross" diagram to show the bonding in a molecule of ammonia. [2]

(b) Explain why

(i) ammonia is a gas at room temperature and pressure, [2]

.....

.....

.....

.....

(ii) gaseous ammonia cannot conduct electricity. [1]

.....

.....

(c) Ammonia is a colourless pungent gas. Describe a positive test for ammonia. [1]

test :.....

observation:.....

.....

(d) Ammonia can be produced when ammonium chloride is reacted with another chemical. Name a chemical that reacts with ammonium chloride to produce ammonia gas, and state the condition required. Write down a balanced chemical equation for the reaction. [3]

chemical : .....

condition required :.....

chemical equation : .....

2. **(a)** The Periodic Table contains an element with proton number 10 and another element with proton number 18.

(i) Give the electronic structure of these **two** elements. Use these to explain why both elements appear in the same group of the Periodic Table. [2]

electronic structure of element with proton number 10 : .....

electronic structure of element with proton number 18 : .....

.....

(ii) Explain why both elements are chemically unreactive. [1]

.....

.....

(ii) Name one of these two elements, and state one use of this element. [1]

name : .....

use : .....

(b) Sea water contains potassium bromide, KBr.

Gaseous chlorine can be bubbled into sea water to displace the bromine.

(i) Describe and explain the observation. [2]

.....

.....

.....

(ii) Write a balanced chemical equation for the reaction.
State symbols are **not** required. [1]

.....

(iii) Suggest another halogen that can be used to displace bromine. [1]

.....

(iv) 18 dm^3 of chlorine gas is used to displace bromine from sea water.
Calculate the mass of bromine displaced. [2]

mass of bromine = ...g

3. Magnesium sulfate has been shown to be an effective aid in the fight against blemishes and acne when applied to problematic areas. If combined with water and made into a cream, it can be applied on the face to remove blackheads.

(a) Magnesium sulfate can be produced by reacting magnesium carbonate with a suitable acid.

(i) Identify the acid used. [1]

acid used : .....

(ii) Describe the steps taken to produce a clean and dry magnesium sulfate crystals. [4]

steps : .....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(b) **(i)** Write a balanced chemical equation for the reaction in **(a)**.
State symbols are **not** required. [2]

.....

(ii) Describe a positive test for the gas formed. [1]

test : .....

observation: .....

.....

(c) Name another substance, other than magnesium carbonate, that can react with the named acid from **(a)** to prepare magnesium sulfate. [1]

.....

(d) The method in **(a)** cannot be used to prepare barium sulfate.
Explain why. [1]

.....

-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.).

FCS 2017 3E EOY Science Chemistry

Mark Scheme

Section A (20 marks)

Q1	Q2	Q3	Q4	Q5
D	**A**	**C**	**A**	**D**
Q6	Q7	Q8	Q9	Q10
D	**B**	**D**	**B**	**A**
Q11	Q12	Q13	Q14	Q15
D	**B**	**C**	**D**	**B**
Q16	Q17	Q18	Q19	Q20
C	**B**	**D**	**C**	**C**

Sections B and C (Max: 65 marks)

Notation used in marking:

- *ECF: Error Carry Forward*
- *BOD: Benefit of Doubt*

Section B (45 marks)

QUESTION 1

1 (a) G [1]

1 (b) F [1]

1 (c) H and I [1]

1 (d) F [1]

1 (e) J or G [1]

QUESTION 2

2 (a) D [1]

2 (b) A [1]

2 (c) C [1]

2 (d) B[1]

QUESTION 3

3 (a) measuring cylinder [1]

3 (b) pipette [1]

3 (c) thermometer [1]

3 (d) filter funnel [1]

QUESTION 4

4

Oxides				
reaction with acids or alkali	*reacts only with acids*	*reacts only with alkalis*	*reacts with both acids and alkali*	[2 m for all correct] [1 m if 2 are correct and 0m if only one is correct
type of oxide	basic	acidic	amphoteric	
	Calcium oxide Coper (II) oxide Sodium oxide	Phosphorous (V) oxide Sulfur trioxide	Aluminium oxide Zinc oxide	Carbon monoxid
	[1m for every 2 correct oxides classified. No half marks awarded]			

4(iii) aluminium oxide : Al_2O_3 [1m]

Copper (II) oxide : CuO [1m]

QUESTION 5

5(a) The student's aspirin is not pure [1m] as there is another point that doesn't belong to the pure aspirin or salicylic acid [1m] {or} it is made of a mixture pure aspirin, salicylic acid and another unknown substance. [1m]

5(b)(i) simple distillation

5(b)(ii) ethanol [1m] , as ethanol has a lower boiling point of 78°C and will be distillate first [1m]

QUESTION 6

6(a) Argon [1m]

(b)(I) the particles are in a disorderly(randomly arrangement; close to each other [1m]

{Many missed out on the disorderly arrangement hence mark not awarded}

(ii) the particles are moving slower. [1m]

(c)(i) decay of vegetation (plant or animal matter)/ waste gases from livestock [1m]

Green house gas / trap energy from the sun which causes global warming. [1m]

(c)(ii) incomplete combustion of fuel [1m]

CO binds to red blood cell {RBC} which cause the RBC not to be able to transport O_2 in the body. /lead to breathing difficulties/ respiratory problems[1m]

QUESTION 7

7(a) . [1m] for 2 correct cations drawn / place a "2" in front of the K^+ ion.

. [1m] for the correct oxide ion drawn.

7(b) K has one electron in the outermost shell which it loses to form the ion. [1m]

O has six electrons in the outemost shell hence it gains 2 electrons to form the ion[1m]

The ions formed has a completely filled valence electron shells made up of 8 valence electrons. [1m] {many missed out on the third point}

QUESTION 8

8(a) gas syringe . [1m]

8(b)(i) 25.2. [1m]

8(b)(ii) 0.1. [1m]

8(c)(i) $Zn + 2\ HNO_3 \rightarrow Zn(NO_3)_2 + H_2$. [1m for correct formula] .[1m for balanced eqn]

8(c)(ii) 0.15 mol of Zn. [1m]

0.15mol of H_2 produced

3.6dm^3 of H_2. [1m]

SECTION C (Max: 20 Marks)

QUESTION 1

1 (a) (i) covalent bond [1m]

(a)(ii) 2m for correct number of electrons shared, and correct number of atoms.

1(b)(i) ammonia is a simple covalent molecule. There is only weak intermolecular forces of attractions [1m] which require low heat tovercome (Not broken). . [1m]

(b)(ii) there is no free ions or free moving electrons to conduct electricity

d a damp red litmus paper at the mouth of the test tube.

The damp red litmus paper will turn blue. . [1m]

{many missed out on "damp" hence mark not awarded}

(d) sodium hydroxide or calcium hydroxide . [1m]

Warm/ Heat the mixture. [1m]

$NH_4Cl + NaOH \rightarrow NaCl + NH_3 + H_2O$. [1m]

QUESTION 2

2(a)(i) 2.8 ; 2.8.8 [1m]

Both have 8 electrons in the outermost shell or both have 8 valence electrons [1m]

2(a)(ii) The outermost shell is completely filled . [1m]

2(a)(iii)neon –making neon lights

Argon – filling up light bulbs

Helium – filling up balloons / blimp [1m for any correct]

2(b)(i) the yellowish –green gas will disappear and the solution will turn orange/reddish brown [1m]

Chlorine is more reactive than bromine. [1m]

2(b)(ii) $2KBr + Cl_2 \rightarrow 2KCl + Br_2$ [1m]

2b(iii) Fluorine. [1m]

2b (iv) no of mole of Cl_2 = 0.75 mol [1m]

= no of mol of Br_2 produced.

Mass of Br_2 = 0.75 X 160

= 120 g [1m]

QUESTION 3

3(a)(i) sulfuric acid . [1m]

(ii) Add **excess** magnesium to sulfuric acid ;

Filter off (excess) magnesium carbonate;

Heat the filtrate until it is saturated;

leave it to cool and crystals to form;

Filter/collect the crystals and Dry the crystals with filter paper

[1m for each correct step max 4 m]

3(b)(i) **$H_2SO_4 + MgCO_3 \rightarrow MgSO_4 + H_2O + CO_2$** [1m for correct formula] [1m for balanced eqn]

3(b)(ii) Bubble the gas into limewater/calcium hydroxide

white precipitate produced in the lime water [1m]

3(c) magnesium (metal)/magnesium oxide/magnesium hydroxide [1m]

3(d) it is non soluble salt [1m]