

## Analysis

[4541/1]

[4541/2]

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## Chemistry

Chapter	Paper 1					Paper2															Paper3									
						Section A					Section B					Section C														
	06	07	08	09	10	06	07	08	09	10	06	07	08	09	10	06	07	08	09	10	06	07	08	09	10					
1	Introduction to chemistry					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
2	The structure of atom					3	4	6	10	6	½	½	½	½	1	-	1	-	-	-	1	-	-	-	-	-	-	-	-	
3	Chemical formulae and equation					6	6	4	7	4	1½	½	½	-	-	-	-	-	½	-	-	-	-	-	-	-	-	-	-	
4	Periodic Table of elements					4	2	4	3	5	½	-	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	1	-	
5	Chemical bond					4	3	4	3	3	½	2	-	½	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
6	Electrochemistry					2	7	4	6	5	-	-	-	-	1	-	-	1	-	-	1	-	-	1	1	-	1	-	-	1
7	Acids and bases					3	4	4	3	4	-	-	-	-	1	-	-	-	1	-	-	-	1	1	-	-	-	-	1	
8	Salts					-	1	2	2	3	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	
9	Manufactured substances in industry					5	4	4	2	4	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
10	Rate of reaction					7	4	2	2	3	1	-	1	1	-	1	-	-	-	1	-	1	-	-	-	-	-	-	1	1
11	Carbon compound					6	5	3	5	4	-	-	1	1	-	-	-	-	½	½	-	1	-	-	-	1	-	1	-	
12	Oxidation and reduction					3	2	6	3	2	-	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	
13	Thermochemistry					4	6	3	2	4	-	-	1	1	-	-	-	-	-	-	-	-	-	-	1	1	1	-	-	
14	Chemical for consumer					1	2	4	1	3	1	1	-	-	-	-	-	1	-	½	-	-	-	-	-	-	-	-	-	
15	Total					50	50	50	50	50	6	6	6	6	6	2	2	2	2	2	2	2	2	2	2	2	2	2	2	

**Chemistry Paper 1**

**[4541/1]**

- What is a substance that used as a baking powder?
  - Sodium chloride
  - Sodium sulphate
  - Calcium carbonate
  - Sodium hydrogen carbonate.
- Which of the following statements is true about one mole of a substance?
  - 1 mole of magnesium contains  $6 \times 10^{23}$  molecules
  - 1 mole of carbon dioxide contains  $6 \times 10^{23}$  atoms
  - 1 mole of water contains the same number of molecules as the number of atoms in 12 g carbon-12.
  - 1 mole of carbon monoxide contains the same number of atoms as the number of atoms in 12 g carbon-12.

- Which of the following substance has a correct molecular formula?

	Substance	Molecular formula
I	Copper(II) nitrate	$\text{Cu}(\text{NO}_3)_2$
II	Silver chloride	$\text{AgCl}_2$
III	Sodium oxide	$\text{NaO}$
IV	Aluminium sulphate	$\text{Al}_2(\text{SO}_4)_3$

- I and II
  - I and III
  - I and IV
  - I, II and III
- Elements in Periodic Table are arranged according to the
    - Increasing of proton number
    - Increasing of nucleon number
    - Increasing of the size of atoms
    - Increasing of number of electron
  - Refer to the diagram below, which of the following is a true statement?



- Atom Y has 13 neutrons
- Electron arrangement of atom Y is 2.8.8.5
- Ion Y has 11 protons
- Ion Y has 11 electrons

- When metal in group 1 reacts with water, acidic solution and gas X produced. What is gas X?
  - Oxygen
  - Carbon dioxide
  - Chlorine
  - Hydrogen
- Table below shows the atom P, Q, R, S and its electron arrangement. Which of the following statement is true?

Atoms	Electron arrangement
P	2.1
Q	2.8
R	2.8.5
S	2.8.7

- Atom P has the smallest size.
  - Atom R is more electronegative than atom S.
  - Atom P is most electronegative
  - Atom S is smaller than atom R.
- Covalent bond between atoms nitrogen and atoms hydrogen is formed when
    - Atom nitrogen receives electron from atom hydrogen
    - Atom hydrogen receives electron from atom nitrogen
    - Atom hydrogen donates electron to atom nitrogen
    - Both atoms share their valence electron
  - Which of the following is a property of ionic compound
    - Need a lot of energy to break their bonds.
    - Able to conduct electricity in solid state
    - Soluble in organic solvent
    - Easily to volatile
  - Which of the following statements correctly describe a strong acid?
    - have a high pH value
    - Ionizes completely in water
    - Has a high concentration of hydrogen ions
    - reacts with alkali to produce salt and water
    - I and II
    - II and III
    - I, II and III
    - I, II, III and IV

11. Calculate the oxidation number of carbon in  $\text{CO}_3^{2-}$  ion?

- A. +4  
B. -4  
C. +5  
D. -5

12. Ion  $\text{X}^{2+}$  has an electron arrangement 2.8.8. What is proton number of atom X?

- A. 18  
B. 20  
C. 22  
D. 16

13. How many atoms that contain in 1 mol of chlorine gas,  $\text{Cl}_2$ ?

- A.  $6.0 \times 10^{23}$  atoms  
B.  $1.2 \times 10^{24}$  atoms  
C.  $3.0 \times 10^{23}$  atoms  
D.  $1.2 \times 10^{23}$  atoms

14. X and Y react to form compound XY.



Which of the following is true about compound produced?

- A. Dissolve in tetrachloromethane  
B. Exist as gas at room temperature  
C. Has high melting and boiling point  
D. Do not conduct electricity in the aqueous and molten state

15. Table below shows the proton number of elements P, Q, R and S.

Element	P	Q	R	S
Proton number	11	13	16	19

Arrange all these elements in the order of increasing atomic size

- A. S, R, Q, P  
B. R, Q, P, S  
C. P, Q, R, S  
D. S, P, Q, R

16. Which statement correct about noble gases

- A. Exist as diatomic molecules  
B. Do not form chemical bonds  
C. Form ions with different valencies  
D. Combine with transition metals to form coloured compounds

17. A jar contains  $1.8 \times 10^{22}$  molecules of oxygen gas. Calculate the mass of oxygen gas in this jar?

[ Relative Atomic Mass : O, 16 ; Avogadro constant ,  $6 \times 10^{23} \text{ mol}^{-1}$  ]

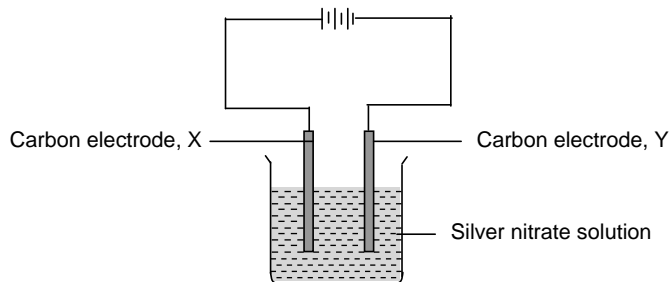
- A. 0.30 g  
B. 0.74 g  
C. 0.96 g  
D. 0.26 g

18. Calculate the mass of element M that combine with 2.88 g of element R to form a compound. The empirical formula of this compound is  $\text{MR}_2$ .

[ Relative Atomic Mass : R, 16 ; M, 55 ]

- A. 4.00 g  
B. 9.90 g  
C. 3.25 g  
D. 4.95 g

19. Diagram below shows the apparatus set up for electrolysis of silver nitrate solution.



What are the products at electrode X and Y?

	Electrode X	Electrode Y
A.	Oxygen gas	Silver metal
B.	Oxygen gas	Hydrogen gas
C.	Silver metal	Oxygen gas
D.	Hydrogen gas	Oxygen gas

20. Metal X forms an oxide with formula  $\text{X}_2\text{O}_3$ . If the formula of chloride ion is  $\text{Cl}^-$ , so the formula of chloride compound X is

- A.  $\text{XCl}$   
B.  $\text{XCl}_2$   
C.  $\text{XCl}_3$   
D.  $\text{X}_2\text{Cl}_3$

21. What is the product of reaction when zinc is reacted with sodium carbonate?

- I water
- II hydrogen gas
- III zinc carbonate
- IV carbon dioxide gas

- A. I and II
- B. II and III
- C. I, III and IV
- D. I, II, III and IV

22. Which of the following equation most suitable to prepare lead(II) sulphate salt?

- A.  $\text{Pb}(\text{NO}_3)_2 + \text{Na}_2\text{SO}_4 \rightarrow \text{PbSO}_4 + 2\text{NaNO}_3$
- B.  $\text{Pb}(\text{CH}_3\text{COO})_2 + \text{H}_2\text{SO}_4 \rightarrow \text{PbSO}_4 + 2\text{CH}_3\text{COOH}$
- C.  $\text{Pb}(\text{NO}_3)_2 + \text{MgSO}_4 \rightarrow \text{PbSO}_4 + \text{Mg}(\text{NO}_3)_2$
- D.  $\text{Pb} + \text{H}_2\text{SO}_4 \rightarrow \text{PbSO}_4 + \text{H}_2$

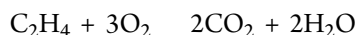
23. Which of the following solutions can show a pH value of 8?

- A.  $0.1 \text{ mol dm}^{-3}$  of ethanoic acid
- B.  $0.1 \text{ mol dm}^{-3}$  of hydrochloric acid
- C.  $0.1 \text{ mol dm}^{-3}$  of ammonia solution
- D.  $0.1 \text{ mol dm}^{-3}$  of sodium hydroxide solution

24. Calculate the volume of carbon dioxide gas released at STP when 2.12 g of sodium carbonate is added to the excess dilute hydrochloric acid.

[Relative Atomic Mass : C, 12 ; O, 16 ; Na, 23 ; 1 mol gas occupied  $22.4 \text{ dm}^3$  at STP]

- A.  $0.448 \text{ dm}^3$
- B.  $4.48 \text{ dm}^3$
- C.  $0.224 \text{ dm}^3$
- D.  $2.24 \text{ dm}^3$



25. Calculate the volume of oxygen gas that is needed to burn 14 g of ethene completely at room condition?

[Relative Atomic Mass : C, 12 ; H, 1 ; 1 mol gas occupied  $24 \text{ dm}^3$  at room condition]

- A.  $12 \text{ dm}^3$
- B.  $36 \text{ dm}^3$
- C.  $24 \text{ dm}^3$
- D.  $48 \text{ dm}^3$

26. Calculate the mass of copper(II) chloride must be dissolved in water to prepare  $200 \text{ cm}^3$   $0.3 \text{ moldm}^{-3}$  of copper(II) chloride solution.

[Relative Atomic Mass : Cu, 64 ; Cl, 35.5]

- A. 13.5 g
- B. 4.1 g
- C. 2.4 g
- D. 8.1 g

27. Table below shows the voltmeter reading for the different pairs of metal. Arrange metals K, L, M and N in descending order in the Electrochemical Series.

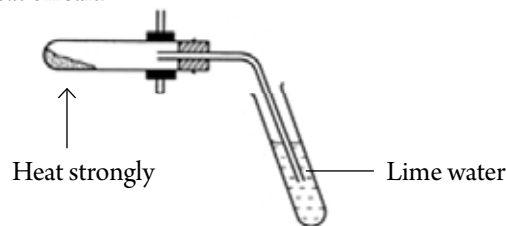
Pairs of metal		Voltmeter reading/v
Positive terminal	Negative terminal	
K	L	2.7
N	M	1.4
K	N	0.8
M	L	0.5

- A. L, N, K, M
- B. M, N, K, L
- C. L, M, N, K
- D. K, N, M, L

28.  $25 \text{ cm}^3$  of  $0.1 \text{ moldm}^{-3}$  sodium hydroxide solution is needed to neutralize  $20 \text{ cm}^3$  dilute sulphuric acid. Calculate the concentration of this sulphuric acid?

- A.  $0.125 \text{ moldm}^{-3}$
- B.  $0.05 \text{ moldm}^{-3}$
- C.  $0.0625 \text{ moldm}^{-3}$
- D.  $0.01 \text{ moldm}^{-3}$

29. Diagram below shows the set up apparatus to study the effect of heat on salt.



Which of the following salt will not turn lime water to cloudy?

- A. Sodium carbonate
- B. Lead(II) carbonate
- C. Copper(II) carbonate
- D. Zinc carbonate

30. Which of the following is true about alloy and its major component?

	Alloy	Major component
A.	Duralumin	Magnesium
B.	Steel	Tin
C.	Bronze	Copper
D.	Pewter	Zinc

31. A substance has the following properties:

- Hard and opaque
- Good insulator of heat and electricity
- Inert towards chemicals

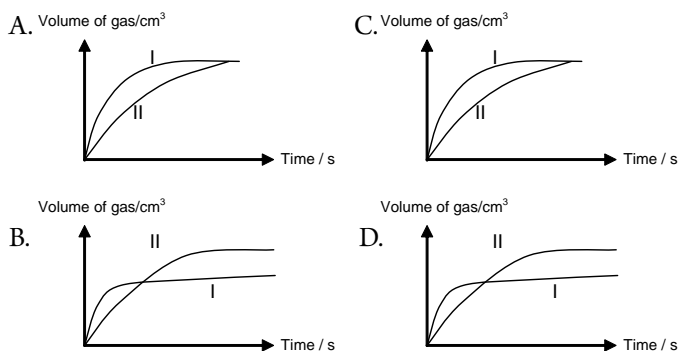
Which of following substances has the above properties?

- A. Ceramic  
B. Glass  
C. Metal  
D. Polymer

32. An experiment is carried out to study the rate of reaction between magnesium and hydrochloric acid to produce hydrogen gas.

Experiment	Substances
I	4 g of magnesium powder and 50 cm <sup>3</sup> of 2 mol dm <sup>-3</sup> hydrochloric acid
II	4 g of magnesium powder and 50 cm <sup>3</sup> of 1 mol dm <sup>-3</sup> hydrochloric acid

Which of the following the following graphs represents the two experiments?



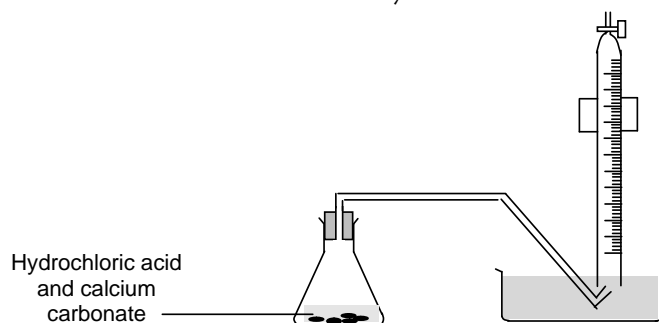
33. Which of the following is true about manufactured substances in industry and its uses?

	Manufactured substance in industry	Uses
A.	Polythene	Lenses
B.	Lead glass	Mirror
C.	Photochromic glass	Optical lenses
D.	Plastic reinforced with glass	Test tube

34. Which of the following reactants will give the highest initial rate of reaction?

- A. Excess of magnesium powder and 20 cm<sup>3</sup> of 1 mol dm<sup>-3</sup> hydrochloric acid  
B. Excess of magnesium powder and 20 cm<sup>3</sup> of 2 mol dm<sup>-3</sup> hydrochloric acid  
C. Excess of magnesium powder and 20 cm<sup>3</sup> of 1 mol dm<sup>-3</sup> sulphuric acid  
D. Excess of magnesium powder and 20 cm<sup>3</sup> of 2 mol dm<sup>-3</sup> sulphuric acid

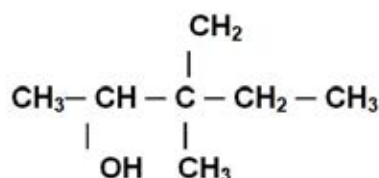
35. Diagram below shows the apparatus set-up used to study the rate of reaction of calcium carbonate and hydrochloric acid.



The rate of the above reaction can be increased by

- A. Grinding the marble chips  
B. Lowering the temperature of hydrochloric acid  
C. Using a larger flask  
D. Adding water to hydrochloric acid

36. Name the compound below using IUPAC nomenclature.



- A. 2,3-dimethyl pentan-2-ol  
B. 2,2-dimethyl pentan-2-ol  
C. 3,3-dimethyl pentan-2-ol  
D. 3,3-dimethyl pentan-4-ol

37. The following equation represents a reaction to prepare an ester.



Name the compound P.

- A. Ethanol  
B. Methanol  
C. Butanol  
D. Propanol

38. Which of the following statements is true about fat?

- I Saturated fat can be converted to unsaturated fat by hydrogenation process.
- II Fat form from the reaction between glycerol and fatty acid
- III Palm oil is an example unsaturated fat
- IV Fat is a natural ester

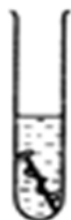
- A. I, II and III
- B. I, III and IV
- C. II, III and IV
- D. I, II, III and IV

39. Which of the following is an oxidation process?

- A. Propene changes into propane
- B. Lead(II) oxide loses its oxygen
- C. Magnesium atom forms magnesium ion.
- D. Chlorine molecule gains electrons.

40. When the propan-1-ol is oxidized by using acidified potassium dichromate(VI), compound X is produced. Which of the following statement is true about compound X?

- A. The formula of compound X is  $C_3H_7COOH$
- B. Compound X can conduct electricity
- C. Compound X can turn red litmus paper to blue
- D. Compound X is propene



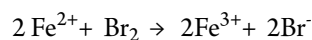
Gel + potassium hexacyanoferrat (III) + phenolphthalein

Iron nail is coiled with metal X

41. When the iron nail was coiled with metal X, after a few days the blue colour was observed around the iron nail. Which of the following metal might be metal X?

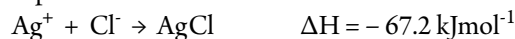
- A. Magnesium
- B. Zinc
- C. Aluminium
- D. Lead

42. Reaction between iron(II) sulphate solution and bromine can be represented by the equation below



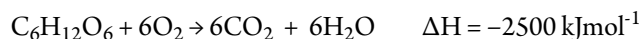
Which of the following is true about the reaction?

- A.  $Fe^{2+}$  is reduced
- B.  $Br_2$  is a reducing agent
- C.  $Fe^{2+}$  is an oxidizing agent
- D.  $Br_2$  accepts electrons



43. Calculate the change of temperature when  $50 \text{ cm}^3$  of silver nitrate solution  $0.1 \text{ moldm}^{-3}$  is added to  $50 \text{ cm}^3$  of dilute hydrochloric  $0.1 \text{ moldm}^{-3}$ .

- A.  $0.42 \text{ }^\circ\text{C}$
- B.  $0.84 \text{ }^\circ\text{C}$
- C.  $0.56 \text{ }^\circ\text{C}$
- D.  $0.80 \text{ }^\circ\text{C}$

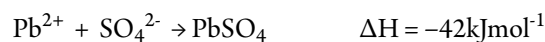


44. Calculate the heat change when 90 g of glucose is burnt completely in excess oxygen.

[Relative Atomic Mass : C, 12 ; H, 1 ; O, 16]

- A. 500 kJ
- B. 2500 kJ
- C. 5000 kJ
- D. 1250 kJ

45. The following equation shows the reaction for the formation of lead(II) sulphate salt.



Which of the following is true about this reaction?

	Heat change	Type of reaction
A.	Heat is released	Endothermic
B.	Heat is absorbed	Exothermic
C.	Heat is released	Exothermic
D.	Heat is absorbed	Endothermic

46. Which of the following the molecules is soap?

- A.  $\text{CH}_3(\text{CH}_2)_{14}\text{COOH}$
- B.  $\text{CH}_3(\text{CH}_2)_{14}\text{COONa}$
- C.  $\text{CH}_3(\text{CH}_2)_{15}\text{COOCH}_3$
- D.  $\text{CH}_3(\text{CH}_2)_2\text{OH}$

47. Ali facing a lot of family problems and he is under depression.

He cannot sleep normally for the last two weeks. Which of the following medicine could be suitable to treat him?

- A. Codeine
- B. Barbiturate
- C. Paracetamol
- D. Streptomycin

48. Vinegar is used widely in fruit pickle industry. Which type of food additive is represented by vinegar?

- A. Colouring agent
- B. Thickener
- C. Antioxidant
- D. Preservative

49. Which of the following characteristics shows that salt is suitable used as food preservative

- A. Saltiness
- B. Dehydrating property
- C. Easy to find
- D. Toxicity

50. Dry hydrogen chloride gas is passed through methyl benzene for a few minutes. Which of the following statements is true about the liquid produced?

- I it has a pH value of less than 7
- II it consists of hydrogen chloride molecules
- III it changes blue litmus to red
- IV it does not conduct electric current

- A. I and III only
- B. II and IV only
- C. I, II and III only
- D. I, II, III and IV

END OF QUESTION PAPER



SECTION A  
 Answer All Questions

1. Diagram 1 shows the two types of monomer X and Y.

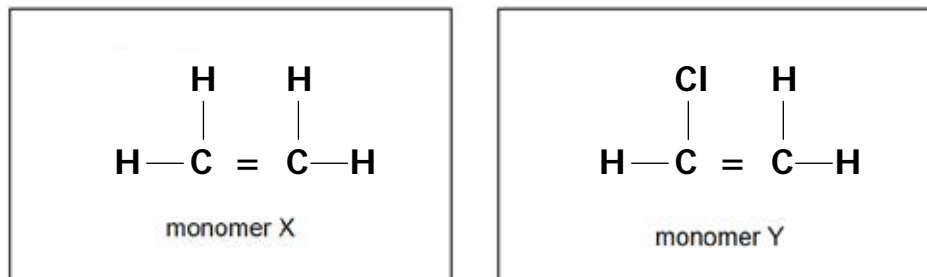


Diagram 1

- (a) Polymer is made up from the combining of repeated small units called monomer. Name the process forming of polymer?  
 \_\_\_\_\_ [1 mark]
- (b) (i) Polymer X is widely used in our daily life. Name the monomer of X.  
 \_\_\_\_\_ [1 mark]
- (ii) State one uses of polymer X in our daily life.  
 \_\_\_\_\_ [1 mark]
- (c) Polymer Y is used to replace metal pipe.
- (i) Draw the structure of polymer Y.  
 \_\_\_\_\_ [2 marks]
- (ii) State one advantage of uses of polymer Y than metal pipe.  
 \_\_\_\_\_ [1 mark]
- (d) The uses of synthetic polymer can cause environmental pollution. Explain how synthetic polymer can cause environmental pollution?  
 \_\_\_\_\_  
 \_\_\_\_\_ [2 marks]
- (e) Rubber is an example of natural polymer. Name the monomer of natural rubber.  
 \_\_\_\_\_ [1 mark]



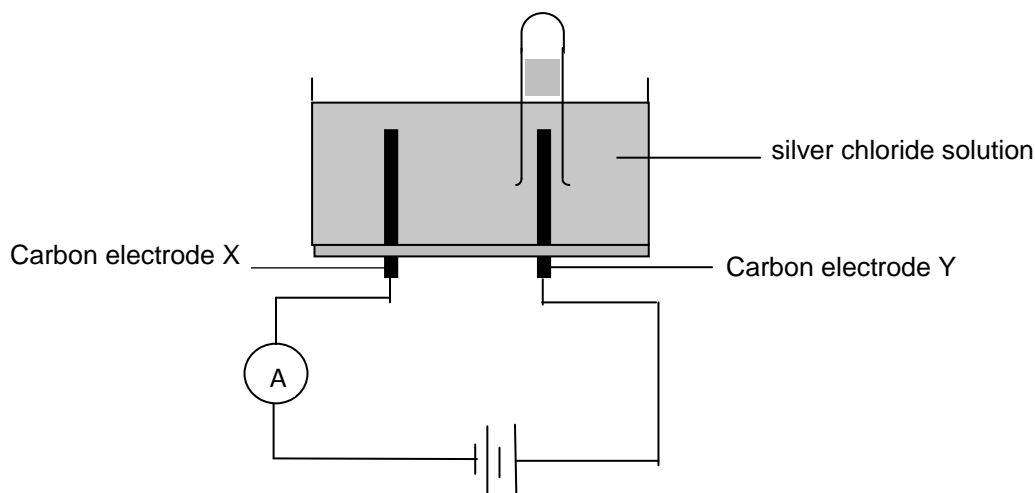
2. Table 1 shows the elements in period 3 in Periodic Table.

Element	Na	Mg	Al	Si	P	S	Cl	Ar
Proton number	11	12	13	14	15	16	17	18

Table 1

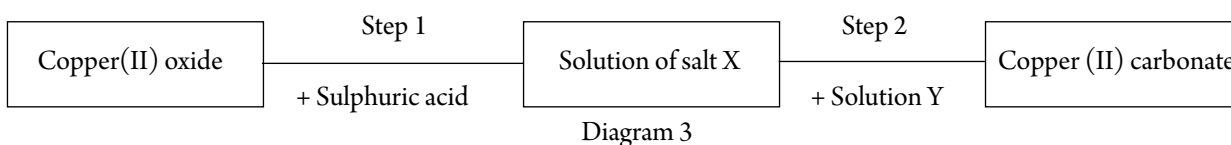
- (a) What is meant by proton number? [1 mark]
- \_\_\_\_\_
- (b) How does the atomic size change across the period 3? Explain your answer. [3 marks]
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- (c) Magnesium atom can form magnesium ion. State the number of protons and electrons in magnesium ion? [2 marks]
- Protons : \_\_\_\_\_
- Electrons : \_\_\_\_\_
- (d) Sulphur, S reacts with hydrogen to form a compound.
- (i) Name the type of chemical bond in the compound formed. [1 mark]
- \_\_\_\_\_
- (ii) Write the formula for the compound formed. [1 mark]
- \_\_\_\_\_
- (iii) Calculate the Relative Molecular Mass for the compound formed in (c)(ii).  
 [ Relative Atomic Mass : S, 32 ; H, 1 ] [1 mark]
- \_\_\_\_\_
- (e) (i) State the element which reacts with water to produce acidic solution? [1 mark]
- \_\_\_\_\_
- (ii) Name the acid that produced in (e)(i). [1 mark]
- \_\_\_\_\_

3. Diagram 2 shows the apparatus set up for the electrolysis of silver chloride solution by using carbon electrodes.



- (a) State the meaning of electrolysis. [2 marks]  
 \_\_\_\_\_
- (b) The yellow greenish gas is release at carbon electrode Y.  
 (i) Name the gas released. [1 mark]  
 \_\_\_\_\_
- (ii) Explain why the gas you mention in (b)(i) is released? [2 marks]  
 \_\_\_\_\_  
 \_\_\_\_\_
- (iii) Write the half equation occur in carbon electrode Y. [ 2 marks]  
 \_\_\_\_\_
- (c) The experiment is repeated by replacing carbon electrodes silver electrodes..  
 (i) State the observation at X. [1 mark]  
 \_\_\_\_\_
- (ii) Name the product at anode [1 mark]  
 \_\_\_\_\_
- (iii) State the factor that affecting the product at anode? [1 mark]  
 \_\_\_\_\_

4. Diagram 3 shows the steps in the preparation of copper(II) carbonate salt.



- (a) State the colour of copper(II) carbonate. [1 mark]  
 \_\_\_\_\_
- (b) Name salt X. [1 mark]  
 \_\_\_\_\_
- (c) (i) Suggest solution Y that is required to be added to solution of salt X to produce copper(II) carbonate. [1 mark]  
 \_\_\_\_\_
- (ii) Name the reaction to produce copper(II) carbonate in step II. [1 mark]  
 \_\_\_\_\_
- (d) 30 cm<sup>3</sup> of 0.2 mol dm<sup>-3</sup> sulphuric acid reacts with excess copper(II) oxide.  
 (i) Write the chemical equation for the reaction that takes place. [2 marks]  
 \_\_\_\_\_

- (ii) Calculate the mass of salt X that is produced.  
 [ Relative Atomic Mass; Cu, 64 ; S, 32 ; O, 16]

[3 marks]

- (e) Describe briefly how you can convert copper(II) carbonate to copper(II) oxide.

[1 mark]

5. Diagram 4 shows the change of a compound P into another compound through the several processes.



Diagram 4

- (a) Compound P is produced from the hydration of propene.

- (i) State the functional group of P.

[1 mark]

- (ii) Draw the isomers of compound P.

[2marks]

- (b) Compound P react with ethanoic acid to form compound Q and water.

- (i) Name the process X.

[1 mark]

- (ii) Name the compound Q.

[1 mark]

- (c) 3.0 g of compound P is burnt completely in excess oxygen.

- (i) Write the chemical equation for this reaction.

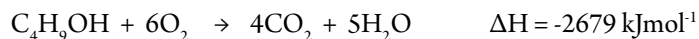
[2 marks]

- (ii) Calculate the volume of oxygen gas needed at room condition to burn compound P completely.

[ Relative Atomic Mass : C, 12 ; O, 16 ; H, 1;1 ( mol gas occupied 24 dm<sup>3</sup> at room condition)

[3 marks]

6. The thermochemical below represents the combustion reaction of butanol in the excess oxygen.



(a) State the meaning of heat of combustion.

[1 mark]

---

(b) 0.37 g of the butanol is used to heat 500 cm<sup>3</sup> of water.

Calculate:

(i) The heat released in this experiment.

[Relative Atomic Mass : C, 12 ; H, 1 ; O, 16]

[2 marks]

(ii) The temperature change of water.

[specific heat capacity of water,  $c = 4.2 \text{ Jg}^{-1} \text{ } ^\circ\text{C}^{-1}$ ]

[2 marks]

(c) Draw the energy level diagram for this reaction.

[2 marks]

(d) The heat of combustion of propanol from experiment actually lower than the actual value. State two reasons why.

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[2 marks]

---

(e) The experiment is repeated by using butanol to replace propanol. Predict the heat of combustion of butanol? Explain why.

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[2 marks]

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## SECTION B

[20 marks]

Answer any one question from this section

7. (a) By name one example, explain what is :
- Diprotic acid
  - Monoprotic acid. [4 marks]
- (b) State two chemical properties of acid. For the each properties, write the chemical equation involved. [6 marks]
- (d) Describe how to prepare 250 cm<sup>3</sup> of 1.0 mol dm<sup>-3</sup> potassium hydroxide starting from solid potassium hydroxide. In your explanation, shows also calculation steps. [Relative Atomic Mass ; K, 39 ; O, 16 ; H, 1] [10 marks]
8. (a) Ethane is an example of saturated hydrocarbon and ethene is an example of unsaturated hydrocarbon.
- Describe the chemical test how to differentiate between ethane and ethene. [6 marks]
  - By comparing the percentage of carbon between ethane and ethene, explain which compound produces more sootiness? [4 marks]
  - Ethene can be converted to ethane. Name the process involved and write the chemical equation for this reaction. [3 marks]
- (b) Compare the properties of vulcanized rubber and unvulcanized rubber. Your answer should include the following.
- Elasticity
  - Resistance toward oxidation
  - Resistant toward high temperature.
- Give the reasons for the each property. [7 marks]

SECTION C  
 [20 marks]

Answer any one question from this section

9. (a) Ammonia is use widely in our daily life. Ammonia is manufactured in industry by Harber process.
- (i) Write the equation for the formation of ammonia through the Harber process. [2 marks]
  - (ii) State three condition to produce optimum ammonia from Harber process. [3 marks]
  - (iii) If  $7.2 \text{ dm}^3$  of hydrogen gas is reacted with nitrogen gas at room condition, calculate the maximum ammonia produced? [1 mol gas =  $24 \text{ dm}^3$  at room condition] [3 marks]
  - (iv) Ammonium nitrate and ammonium sulphate are two common fertilizers made from ammonia. Which fertilizer is better for farmer? Explain why. [6 marks]
- (b) (i) Sulphuric acid is an example of manufactured substance in industry that has many uses in our daily life. State three uses of sulphuric acid. [3 marks]
- (ii) Sulphur dioxide gas is emitted to the environmental from the manufacture of sulphuric acid. Explain how sulphur dioxide can cause environmental pollution? [3 marks]

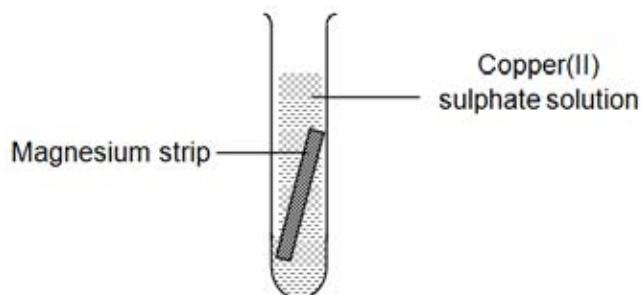
10. (a) Table 2 shows two reactions and their equation respectively.

Reaction	Equation
I	$\text{Pb}(\text{NO}_3)_2 + \text{K}_2\text{SO}_4 \rightarrow 2\text{KNO}_3 + \text{PbSO}_4$
II	$2\text{KBr} + \text{Cl}_2 \rightarrow 2\text{KCl} + \text{Br}_2$

Table 2

Based on the table 2, which reactions is redox reaction and non redox reaction. Explain your answer in term of change in oxidation number. [4 marks]

(b) Diagram 6 show the set up of apparatus of the displacement reaction.



From this reaction:

- (i) State two observations.
- (ii) Half equation for oxidation and reduction.
- (iii) Oxidizing agent and reducing agent [6 marks]

- (c) (i) State the meaning of rusting.
- (ii) The experiment was carried out to investigate the rusting of iron when it was coiled using copper and magnesium strip as shown in diagram 5.

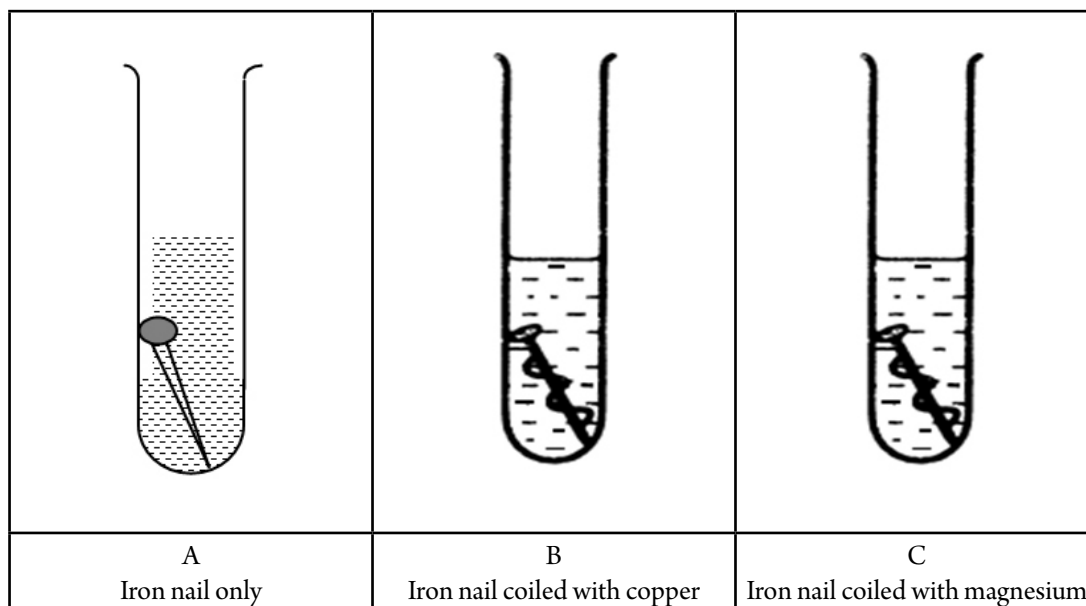


Diagram 5

State the observation in the test tube A, B and C. Explain why these observations can occur in all the test tubes.

[10 marks]

END OF QUESTION PAPER

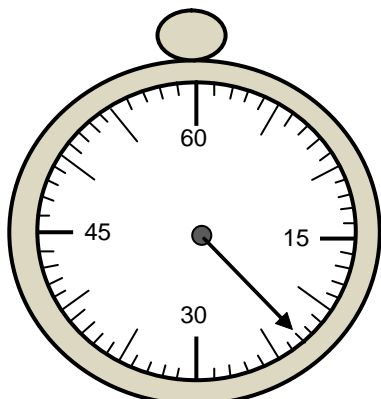


Chemistry Paper 3

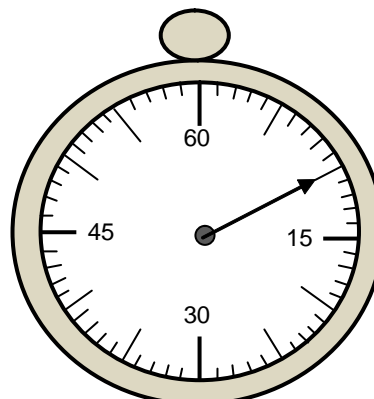
[4541/3]

Answer all questions

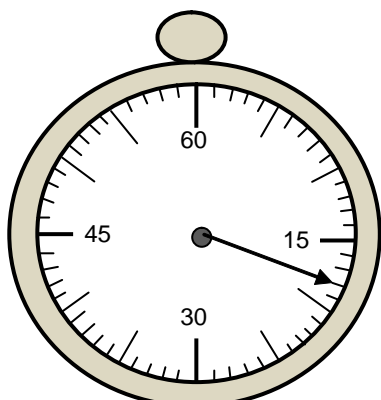
1. A student carries out an experiment to study the relationship between concentrations of hydrochloric acid with the rate of reaction. Five magnesium ribbons were cut out and rubbed by using sand paper. 5 cm of magnesium ribbon was added into 50 cm<sup>3</sup> of hydrochloric acid 0.1 moldm<sup>-3</sup> and the stop watch was started immediately. Time taken for the magnesium dissolve was recorded. The experiment was repeated by replacing 0.1 moldm<sup>-3</sup> of hydrochloric acid with 0.2 moldm<sup>-3</sup>, 0.3 moldm<sup>-3</sup>, 0.4 moldm<sup>-3</sup>, and 0.5 moldm<sup>-3</sup> hydrochloric acid. Diagram below shows the time taken for the magnesium ribbon to dissolve completely.



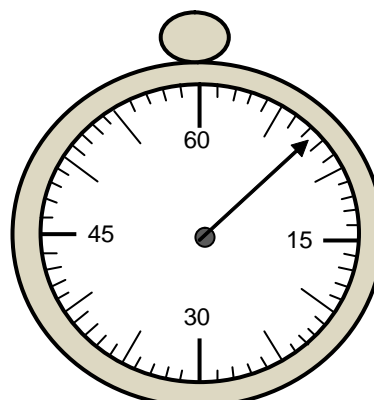
0.1 moldm<sup>-3</sup>  
 time taken : . \_\_\_\_\_ s



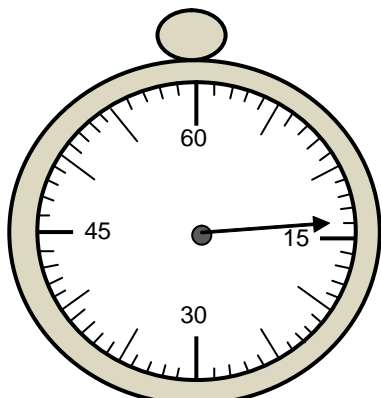
0.2 moldm<sup>-3</sup>  
 time taken : . \_\_\_\_\_ s



0.3 moldm<sup>-3</sup>  
 time taken : . \_\_\_\_\_ s



0.4 moldm<sup>-3</sup>  
 time taken : . \_\_\_\_\_ s



0.5 moldm<sup>-3</sup>  
 time taken : . \_\_\_\_\_ s

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- (a) Record the time taken for the magnesium ribbon to dissolve completely. [3 marks]
- (b) Construct the table to record the time taken and  $1/\text{time}$  for the each experiment.
- (c) Write the chemical equation between magnesium ribbon and hydrochloric acid. [3 marks]
- \_\_\_\_\_ [3 marks]
- (d) State the hypothesis for this experiment.
- \_\_\_\_\_ [3 marks]
- \_\_\_\_\_
- (e) State the:
- (i) Manipulated variable : \_\_\_\_\_
- (ii) Responding variable : \_\_\_\_\_
- (iii) Constant variable : \_\_\_\_\_ [3 marks]
- (f) Plot the graph concentration of hydrochloric acid against  $1/\text{time}$ . [3 marks]
- (g) If the experiment is repeated by replacing 50 cm<sup>3</sup> of 0.1 moldm<sup>-3</sup> hydrochloric acid with 50 cm<sup>3</sup> of 0.1 moldm<sup>-3</sup> sulphuric acid, predict for the time taken for 5 cm of magnesium ribbon to dissolve completely. Explain why.
- \_\_\_\_\_ [3 marks]
- \_\_\_\_\_
- \_\_\_\_\_
- (h) Using collision theory, explain how the concentration of hydrochloric acid affects the rate of reaction.
- \_\_\_\_\_ [3 marks]
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

- (i) Diagram below shows the pH values for several acids with difference concentration.

Acid	pH values
0.1 moldm <sup>-3</sup> of hydrochloric acid	2
0.1 moldm <sup>-3</sup> of ethanoic acid	5

Explain why the pH values between these two acids are different.

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[3 marks]

- (j) You are given hydrochloric acid, ethanoic acid, sulphuric acid, nitric acid and citric acid. Classify these all acid into strong acids and weak acids.

[3 marks]

**Pure copper can be bent easily, but bronze are very hard and cannot be bent easily**

2. Referring the statement above, plan an experiment in the lab to investigate the effect of alloying towards the hardness of pure metal than it alloy. Your answer should consist of the following:

- (i) Problem statement
- (ii) Hypothesis
- (iii) All the variables
- (iv) List of substances and apparatus
- (v) Procedures
- (vi) Tabulation of data.

[17 marks]

END OF QUESTION PAPER

# Jawapan

# Chemistry

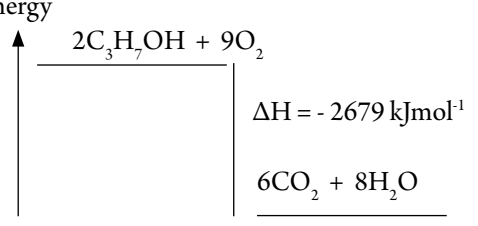
## Chemistry Paper 1

No	Ans	No	Ans	No	Ans	No	Ans	No	Ans
1	D	11	A	21	C	31	A	41	D
2	C	12	B	22	A	32	D	42	D
3	C	13	B	23	C	33	C	43	D
4	A	14	C	24	A	34	D	44	D
5	C	15	B	25	B	35	A	45	C
6	D	16	B	26	D	36	C	46	B
7	D	17	C	27	C	37	D	47	B
8	D	18	D	28	C	38	C	48	D
9	A	19	A	29	A	39	C	49	B
10	B	20	C	30	C	40	B	50	B

**Chemistry Paper 2**

Question	Mark scheme (sample answer)	Sub Mark	Total mark
1(a)	Polimerisation	1	
(b)(i)	Ethene	1	
(ii)	As plastic bag	1	
(c)(i)	$\left( \begin{array}{cc} \text{Cl} & \text{H} \\   &   \\ -\text{C} & -\text{C}- \\   &   \\ \text{H} & \text{H} \end{array} \right)_n$	1+1	2
(ii)	Cheaper // lighter	1	
(d)	- It non biodegradable // cannot compose by bacteria - when it is burnt, produce poisonous gases	1 1	
(e)	Isoprene // 2-methylbut-1,3-diene	1	9
		total	
2.(a)	Number of proton in nucleus of atom	1	
(b)	- Size decrease // size become smaller - because when proton increase, electron also increase - force attraction between nucleus and valence electron increase	1 1 1	3
(c)	Proton : 12 Electron : 10	1 1	2
(d)(i)	Covalent bond	1	
(ii)	SH <sub>2</sub>	1	
(iii)	34	1	
(e)(i)	Cl // chlorine	1	
(ii)	Hydrochloric acid	1	
		total	11

3. (a)	- The decomposition/break down of electrolyte into their constituents - by using electricity	1 1	2
(b)(i)	Chlorine gas	1	
(ii)	- Cl <sup>-</sup> ions are selective discharged - because Cl <sup>-</sup> ions are more concentrate than OH <sup>-</sup> ions	1 1	2
(iii)	2Cl <sup>-</sup> → Cl <sub>2</sub> + 2e <sup>-</sup> - able write reactants and product correctly - able to balance correctly	1 1	2
(c)(i)	Become thicker // grey shiny metal deposited // mass of silver increase	1	
(ii)	Silver metal	1	
(iii)	Type of electrode used	1	
		Total	10
4.(a)	Green	1	
(b)	Copper(II) sulphate	1	
(c)(i)	Sodium carbonate // potassium carbonate	1	
(ii)	Double decomposition reaction	1	
(d)(i)	H <sub>2</sub> SO <sub>4</sub> + CuO → CuSO <sub>4</sub> + H <sub>2</sub> O - able to write reactants correctly - able to write products correctly	1 1	2
(ii)	- mol of CuSO <sub>4</sub> = $\frac{0.2(30)}{1000}$ = 0.006  - 1 mol of CuSO <sub>4</sub> produce 1 mol of X Mol of X = 0.006  - mass of X = 0.006 x 160 = 0.96 g ....with correct unit	1  1  1	3
(e)	Heated strongly	1	
		Total	10

5. (a)(i)	Hydroxyl group	1	
(ii)	$  \begin{array}{c}  \text{H} \quad \text{H} \quad \text{H} \\    \quad   \quad   \\  \text{H} - \text{C} - \text{C} - \text{C} - \text{OH} \\    \quad   \quad   \\  \text{H} \quad \text{H} \quad \text{H}  \end{array}  \qquad  \begin{array}{c}  \text{H} \quad \text{H} \quad \text{H} \\    \quad   \quad   \\  \text{H} - \text{C} - \text{C} - \text{C} - \text{H} \\    \quad   \quad   \\  \text{H} \quad \text{OH} \quad \text{H}  \end{array}  $	1+1	2
(b)(i)	Esterification	1	
(ii)	Propyl ethanoate	1	
(c)(i)	$2\text{C}_3\text{H}_7\text{OH} + 9\text{O}_2 \rightarrow 6\text{CO}_2 + 8\text{H}_2\text{O}$ - able to write reactants and products correctly - able to balance correctly	1 1	2
(ii)	- mol of P = $\frac{3.0}{60}$ = 0.05  - 1 mol of P need 4.5 mol of oxygen gas Mol of oxygen = $0.05 \times 4.5$ = 0.225  - volume of oxygen gas = $0.225 \times 24$ = 5.4 dm <sup>3</sup> .....with correct unit	1  1  1	3
		Total	10
6. (a)	Heat change/release when 1 mol of substance is burnt completely in excess oxygen	1	
(b)(i)	- mol of butanol = $\frac{0.37}{74}$ = 0.005 - Q = $0.005 \times 2679 \text{ kJ}$ = 13395 Joule .....with correct unit	1 1	2
(ii)	13395 = $500 \times 4.2 \times \theta$ $\theta = 6.4^\circ\text{C}$ ..... with correct unit	1	
(c)	energy 		
	- Axis with energy level - Correct reactants and products	1 1	2
(d)	- heat is absorbed by copper can - heat is released to the surrounding - incomplete combustion occurred	1 1 1	Max.2
(e)	- increase - because more heat is released when the more of carbon dioxide and water molecules are formed.	1 1	2
		Total	10



7.(a)(i).	- e.g : sulphuric acid - acid that produce 2 mol of H <sup>+</sup> ions from 1 mol of acid	1 1	
(ii)	- e.g : hydrochloric acid // nitric acid - acid that produce 1 mol of H <sup>+</sup> ions from 1 mol of acid	1 1	4
(b)	- React with metal to produce hydrogen gas - e.g : $2\text{HCl} + \text{Mg} \rightarrow \text{MgCl}_2 + \text{H}_2$ - able to write correct formula for reactants and products - able to balance correctly	1 1 1	
	- React with metal carbonate to produce carbon dioxide gas - e.g : $2\text{HCl} + \text{CaCO}_3 \rightarrow \text{CaCl}_2 + \text{CO}_2 + \text{H}_2\text{O}$ - able to write correct formula for reactants and products - able to balance correctly	1 1 1	
	- React with metal oxide to produce salt and water - e.g : $2\text{HCl} + \text{CuO} \rightarrow \text{CuSO}_4 + \text{H}_2\text{O}$ - able to write correct formula for reactants and products - able to balance correctly	1 1 1	
	- Materials & apparatus : 250 cm <sup>3</sup> volumetric flask, electronic balance, glass rod. 100 cm <sup>3</sup> of beaker, potassium hydroxide pellets and distilled water.	Max. 6	6
(c)	- mol of KOH = $\frac{250(1.0)}{1000}$ = 0.25	1	
	- mass of KOH = 0.25 x 56 = 14 gram	1	
	- weight 14 g of potassium hydroxide pellets.	1	
	- put the potassium hydroxide into the beaker and add some distilled water.	1	
	- Stir the solution until all potassium hydroxide dissolve completely	1	
	- Pour the solution into 250 cm <sup>3</sup> volumetric flask.	1	
	- Rinse the beaker using distilled water and pour it into volumetric flask	1	
	- Add the distilled water slowly into volumetric flask until the calibration mark.	1	
	- shake the solution well	1	10
		total	20

8.(a)(i)	- Pour 2 cm <sup>3</sup> of ethane and ethene into two different test tubes.	1													
	- Add bromine water // acidified potassium manganate(VII) into the both test tubes	1													
	- Shake the both test tube well	1													
	- No change is observed for ethane	1													
	- Ethene will decolourised brown colour of bromine // purple colour of acidified potassium manganate(VII) to colourless	1													
	- because ethene has double bond between carbon atoms	1	6												
(ii)	- % carbon in ethane = $\frac{2(12)}{30} \times 100$ = 80.0%	1													
	- % carbon in ethene = $\frac{2(12)}{28} \times 100$ = 85.7%	1													
	- Ethene has higher percentage of carbon atom per molecule - Ethene produce more sootiness	1 1	4												
(iii)	- hydrogenation	1													
	- $C_2H_4 + H_2 \rightarrow C_2H_6$	1													
	- Catalyst : Nickel // platinum	1	3												
(b)	<table border="1"> <thead> <tr> <th></th> <th>Vulcanised rubber</th> <th>Unvulcanised rubber</th> </tr> </thead> <tbody> <tr> <td>Elasticity</td> <td>- elastic</td> <td>- More elastic - because it has sulphur cross link</td> </tr> <tr> <td>Resistant toward Oxidation</td> <td>- easily to oxidise - because it has double bond between carbon atoms</td> <td>- more resistant to oxidation</td> </tr> <tr> <td>Resistant toward high temperature</td> <td>- easily become soft and sticky at high temperature</td> <td>- more resistant to high temperature because it has higher relative molecular mass.</td> </tr> </tbody> </table>		Vulcanised rubber	Unvulcanised rubber	Elasticity	- elastic	- More elastic - because it has sulphur cross link	Resistant toward Oxidation	- easily to oxidise - because it has double bond between carbon atoms	- more resistant to oxidation	Resistant toward high temperature	- easily become soft and sticky at high temperature	- more resistant to high temperature because it has higher relative molecular mass.		
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			7												
		total	20												

9.(a)(i)	- $N_2 + 3H_2 \rightarrow 2NH_3$ - able to write reactants and products correctly - able to balance the chemical equation correctly	1 1	2
(ii)	- Catalyst : Iron powder - Temperature : $450^\circ C - 550^\circ C$ - Pressure : 250 atmosphere	1 1 1	3
(iii)	- mol of hydrogen gas = $\frac{7.2}{24}$ = 0.3  - From equation, 3 mol of hydrogen gas produce 2 mol of ammonia, So, 0.3 mol hydrogen gas produce 0.2 mol of ammonia.  - Volume of ammonia produce = $0.2 \times 24 \text{ dm}^3$ = $4.8 \text{ dm}^3$	1  1  1	3
(iv)	- % of N in $NH_4NO_3 = \frac{2(14)}{80} \times 100$ = 35.0%  - % of N in $(NH_4)_2SO_4 = \frac{2(14)}{132} \times 100$ = 21.2%  - Ammonium nitrate has higher percentage of nitrogen - Ammonium nitrate better for farmer	1 1 1 1 1	6
(b)(i)	- Use in manufacture of fertilisers - Use in manufacture of detergent - use as electrolyte in car batteries - use in manufacture of paint pigment	1 1 1 1	Max. 3
(ii)	- Sulphur dioxide dissolve in rain water - produce acid rain - Acid rain corrode the building when it react with metals and marmar.	1 1 1	3
		total	20

10.(a)	- Reaction I is non redox reaction - because no change in oxidation number for every element - Reaction II is redox reaction - because oxidation number of chlorine change from 0 to -1 // oxidation number of bromine change from -1 to 0	1 1 1 1	4
(b)(i)	- intensity of blue colour decrease - magnesium strip dissolve // mass of magnesium decrease - brown metal was deposited	1 1 1	Max.2
(ii)	- oxidation : $Mg \rightarrow Mg^{2+} + 2e$ - reduction : $Cu^{2+} + 2e \rightarrow Cu$	1 1	2
(iii)	- Oxidising agent : copper(II) ion - Reducing agent : magnesium metal	1 1	2
(c)(i)	- Process when the iron release its electron - with the present of oxygen and water	1 1	2
(ii)	Test tube A - The intensity of blue colour is low - Iron nail rust but little only	1 1	2
	Test tube B - The blue intensity is high - the iron nail rust heavily - because iron is more electropositive then copper in electrochemical series.	1 1 1	3
	Test tube C - The intensity of pink colour is high // the bubbles gas is released - iron nail is not rust - because iron is less electropositive than magnesium in electrochemical series	1 1 1	Max. 3
		total	20

Chemistry Paper 3

1.(a)	- 23.0 - 18.0 - 14.0 - 10.0 - 7.5 - 3 marks : All correct reading with 1 decimal point - 2 marks : All correct without decimal point or 4 correct to 1 decimal point - 1 mark : any three correct (with or without 1 decimal point)		3																									
(b)	<table border="1"> <thead> <tr> <th>Experiment</th> <th>Concentration of HCl (moldm<sup>-3</sup>)</th> <th>Time taken</th> <th>1/t (s<sup>-1</sup>)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>0.10</td> <td>23.0</td> <td>0.043</td> </tr> <tr> <td>2</td> <td>0.20</td> <td>18.0</td> <td>0.056</td> </tr> <tr> <td>3</td> <td>0.30</td> <td>14.0</td> <td>0.071</td> </tr> <tr> <td>4</td> <td>0.40</td> <td>10.0</td> <td>0.100</td> </tr> <tr> <td>5</td> <td>0.50</td> <td>7.5</td> <td>0.133</td> </tr> </tbody> </table> <p>- 3 marks : all 4 column correct with three decimal point for 1/t                      - 2 marks : all 4 column correct without decimal point for 1/t                      - 1 marks : no unit for each column and without decimal point for 1/t</p>	Experiment	Concentration of HCl (moldm <sup>-3</sup> )	Time taken	1/t (s <sup>-1</sup> )	1	0.10	23.0	0.043	2	0.20	18.0	0.056	3	0.30	14.0	0.071	4	0.40	10.0	0.100	5	0.50	7.5	0.133		3	
Experiment	Concentration of HCl (moldm <sup>-3</sup> )	Time taken	1/t (s <sup>-1</sup> )																									
1	0.10	23.0	0.043																									
2	0.20	18.0	0.056																									
3	0.30	14.0	0.071																									
4	0.40	10.0	0.100																									
5	0.50	7.5	0.133																									
(c)	Mg + 2HCl → MgCl <sub>2</sub> + H <sub>2</sub> - 3 marks : all correct formula for reactants, products with balanced. - 2 marks : all correct formula for reactants, products without balanced. - 1 mark : correct any reactants or products		3																									
(d)	The higher the concentration of hydrochloric acid the shortest time taken for magnesium ribbon dissolves.		3																									
(e)(i)	Manipulated : concentration of HCl		1																									
(ii)	Responding : time taken for magnesium dissolves		1																									
(iii)	Constant : length / size of magnesium ribbon		1	3																								
(f)	- 3 marks : all axes are labelled with correct unit, all point plotted correctly and smooth line - 2 marks : all above but axes labelled without unit or correct any two - 1 mark : any suitable answer.		3																									
(g)	- 11.5 s // half - sulphuric acid is diprotic acid whereas hydrochloric acid is monoprotic acid. - sulphuric acid contain twice of H <sup>+</sup> ions compare to hydrochloric acid - 3 marks : all correct - 2 marks : any two correct - 1 mark : any one correct		1 1 1	3																								
(h)	- higher concentration of HCl contain more number of H <sup>+</sup> ions per unit volume - frequency of collision between Mg and H <sup>+</sup> ions increase - frequency of effective collision increase, rate of reaction increase - 3 marks : all correct - 2 marks : any two correct - 1 mark : any one correct		1 1 1	3																								

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(i)	- hydrochloric acid is strong acid, ethanoic acid is weak acid - hydrochloric acid ionise completely in water, ethanoic acid ionise partially in water - hydrochloric acid produce higher concentration of H <sup>+</sup> ions than ethanoic acid - 3 marks : all correct - 2 marks : any two correct - 1 mark : any one correct	1 1 1	3																				
(j)	<table border="1" data-bbox="225 398 1137 539"> <thead> <tr> <th data-bbox="225 398 679 434">Strong acid</th> <th data-bbox="679 398 1137 434">Weak acid</th> </tr> </thead> <tbody> <tr> <td data-bbox="225 434 679 470">Hydrochloric acid</td> <td data-bbox="679 434 1137 470">Ethanoic acid</td> </tr> <tr> <td data-bbox="225 470 679 506">Sulphuric acid</td> <td data-bbox="679 470 1137 506">Citric acid</td> </tr> <tr> <td data-bbox="225 506 679 539">Nitric acid</td> <td></td> </tr> </tbody> </table> - 3 marks : all correct - 2 marks : any two correct - 1 mark : any one correct	Strong acid	Weak acid	Hydrochloric acid	Ethanoic acid	Sulphuric acid	Citric acid	Nitric acid		3													
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		total	30																				
2.(i)	- What is the hardness of pure copper compare to that of bronze?	3																					
(ii)	- The harder the substance, the smaller the diameter of dent produced.	3																					
(iii)	- Manipulated : Bronze and copper block - Responding : Diameter of dent produced - Constant : steel ball, mass of weighed, distance of weighed from the block .	3																					
(vi)	- Brass block, copper block, meter ruler, 1 kg of weighed, retort stand, steel ball, thread and cellophane tape.	3																					
(v)	1. A steel ball is taped on the copper block using a cellophane tape. 2. 1 kg of weighed is suspended about 1 meter from the copper block. 3. The weighed is released to the steel ball on the copper block 4. The dent produced is measured using the ruler. 5. Step 1 until 4 are repeated twice to get the average of dent produced. 6. Experiment was repeated by replace the copper block with brass block.	3																					
(vi)	<table border="1" data-bbox="225 1272 1062 1420"> <thead> <tr> <th data-bbox="225 1272 451 1308"></th> <th colspan="4" data-bbox="451 1272 1062 1308">Diameter of dent</th> </tr> <tr> <th data-bbox="225 1308 451 1344"></th> <th data-bbox="451 1308 604 1344">1</th> <th data-bbox="604 1308 758 1344">2</th> <th data-bbox="758 1308 911 1344">3</th> <th data-bbox="911 1308 1062 1344">Average</th> </tr> </thead> <tbody> <tr> <td data-bbox="225 1344 451 1379">Copper block</td> <td data-bbox="451 1344 604 1379"></td> <td data-bbox="604 1344 758 1379"></td> <td data-bbox="758 1344 911 1379"></td> <td data-bbox="911 1344 1062 1379"></td> </tr> <tr> <td data-bbox="225 1379 451 1420">Bronze block</td> <td data-bbox="451 1379 604 1420"></td> <td data-bbox="604 1379 758 1420"></td> <td data-bbox="758 1379 911 1420"></td> <td data-bbox="911 1379 1062 1420"></td> </tr> </tbody> </table>		Diameter of dent					1	2	3	Average	Copper block					Bronze block					3 total	18
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