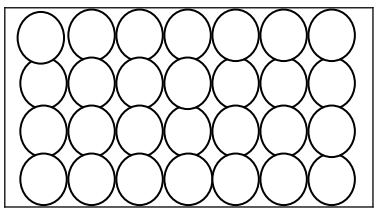
# CHEMISTRY

**Paper 1**

**1. B**
**2. D**
**3. A**
**4. B**
**5. C**
**6. A**
**7. C**
**8. B**
**9. B**
**10. A**
**11. B**
**12. A**
**13. D**
**14. D**
**15. D**
**16. A**
**17. C**
**18. B**
**19. A**
**20. D**
**21. A**
**22. B**
**23. A**
**24. A**
**25. C**
**26. B**
**27. B**
**28. B**
**29. A**
**30. D**
**31. A**
**32. A**
**33. A**
**34. D**
**35. A**
**36. A**
**37. B**
**38. C**
**39. D**
**40. C**
**41. D**
**42. D**
**43. D**
**44. B**
**45. C**
**46. B**
**47. D**
**48. B**
**49. D**
**50. C**

**PAPER 2**
**SECTION A**

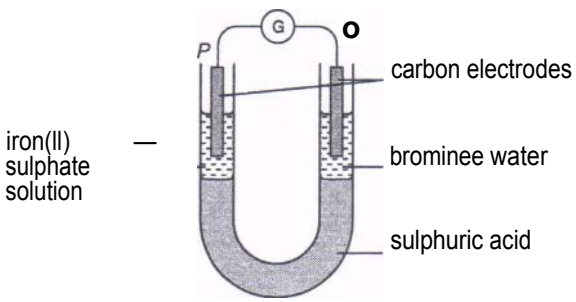
1 (a) (i) iodine
(ii) copper
(iii) solid
(iv) copper
(v)



(vi) Cu

(b) (i) $T_1 = 80^0C / 78^0C$
(ii) Energy is absorbed o overcome the force between molecules of naphthalene. So, there is no increase in temperature.
(iii) The naphthalene particles move faster as it changes between R and S

2 (a) 2.8.1
(b) $^{14}_{6}C$
(c)




(d) Carbon dioxide is acidic
Sodium oxide is basic
(e) 1) State of matter of carbon dioxide is gas / sodium oxide is solid
2) The melting or boiling period of sodium oxide is higher than carbon dioxide

3 (a) (i) I: grey powder to white
II: white powder to shiny grey / silvery powder / solid

(b) $Mg + H_2O \longrightarrow MgO + H_2$

(c) (i) Hydrogen
(ii) when it tested with the burning wooden splinter, the pop sound is heard

(d) $Mg + H_2O \longrightarrow MgO + H_2$

male Mg = 24 / 24
= 0.1 mol

From eg : 1 mol Mg = 1 mol MgO
0.1 mol = 0.1 mol

The mass of substance = o.1 x (24 + 16)
= 4.0 g

(e) $2Ag_2O + H_2 \longrightarrow 4Ag + 2H_2O$

(f) I: Steam
II: Silver oxide

4 (a) P: Antibiotics
Q: Analgesics
R: Psychotherapeutic drugs

(b) P: To prevent the growth of disease-spreading microorganisms
Q: To relieve or reduce pain
R: To treat patients with psychological problem

(c) To prevent bacteria from becoming more resistant to the antibiotic

(d) 1) it cause stomach irritation to some patient
2) it is believed to cause brain / liver damage to children

(e) To reduce glucose level in food.

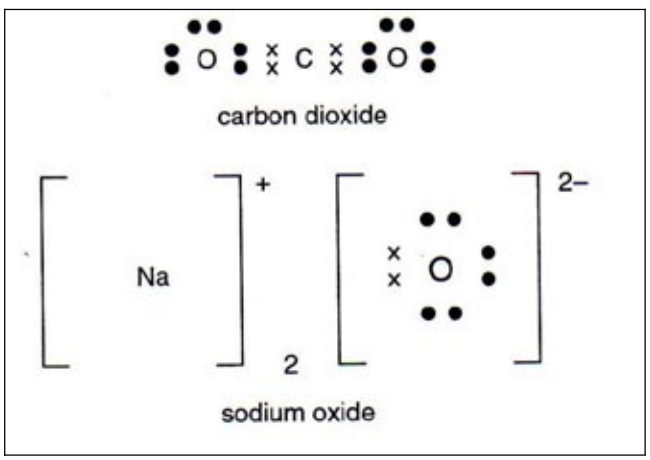
5 (a) oxidation

(b) (i) $C_6 H_{12} O_6$
(ii) Zymase

(c) (i) $CH_3 CH_2 OH$
(ii) Sulphuric acid / porcelain
(iii) Dehydration

(d) (i) Esterification , concentrated sulphuric acid
(ii) It has fruity smell / volatile
(iii) ester

6 (a)




(b) (i) from 0 to -1
(ii) from +2 to +3

(c) A few drops of hexacyanoferrate (III) are added to the product forhed in test tube P. if the products turns blue, it means that ion ferum (III) $Fe^{3+}$ is formed.

(d) (i) Bromine gas
(ii) ion ferum (III) $Fe^{2+}$

**SECTION B**

7 (a) - cleaning action of soap on the oily stains

- The structure of soap consists of ionic heads which are hydrophilic, and hydrocarbon tails which are hydrophobic.
- When the soap is mixed with water, the hydrophilic part will dissolve into water and reduce the tension on the water surface.
- With this, water can wet all surface better
- When the soap gets into contact with the oily stains, the hydrophilic part of the soap will dissolve in the oily stains while the hydrophilic par will dissolve in water,.

(b) - comparison between the cleaning effects in experiment W and Z

- The cleaning oily stains in Experiment W is more effective compare with that in Experiment X
- The oily stains in Experiment W can be removed while those in Experiment X cannot be removed.
- In Experiment X, the stains cannot be removed because soap forms scams with the $Mg^{2+-}$ and $Ca^{2+}$ ions in the hard water; these scams are insoluble in water.
- In Experiment W, stains can be removed because soft water does not contain the ions $Mg^{2+}$ and $Ca^{2+}$

- comparison between the cleaning effects in experiment X and Z

- The cleaning oily stains in Experiment Z is more effective then that in Experiment X.
- The oily stains in Experiment Z can be removed while those in Experiment X cannot be removed.
- In Experiment Z, detergent does not form scams in hard water. Detergent reacts with $Mg^{2+}$ and $Ca^{2+}$ ions to produce salts there soluble in water.
- Therefore, detergent is a suitable cleaning agent to remove oily stains and dirt.

(c) - Advantages

1. Detergents are effective in both soft water and hard water.
2. Detergents are cleaning agents that can be synthesized to have certain characteristics.

- Disadvantages

1. Detergents are not biodegradable; bacteria cannot decompose detergents.
2. The phosphate in detergents enhances the growth of water weed and algae when it gets in water bodies.

8 (a) Haber process in the manufacture of ammonia.

- One part of nitrogen gas and three parts of hydrogen gas, all are pure and dry, are mixed.
- The mixture of gasses is compressed at 200 – 500 atmospheres.
- Chemical reaction takes place, and ammonia is produced.
- Excess hydrogen and nitrogen gasses are then used in the next cycle of ammonia production
- Chemical equation for the reaction that occurs is $N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g)$

(b) Experiment to prepare ammonium sulphate fertilizer in the laboratory;

- 25 $cm^3$ of 1 $mol/dm^3$ sulphuric acid is poured into a beaker.
- 1.0 $mol/dm^3$ ammonia solution as added to the sulphuric acid. The mixture is the stirred using a glass rod.
- Addition of ammonia is stopped once the pungent smell of ammonia is detected.
- The solution mixture is then heated until it becomes saturated.
- The saturated solution is allowed to cool at room temperature
- Crystallization takes place, and white crystals of ammonium sulphate are formed
- The solutions filtered to obtain the ammonium sulphate crystals.
- The crystals are then dried on a filter paper.
- The chemical equation to represent the reaction that takes place is as follows; $2NH_3(aq) + H_2SO_4(aq) \longrightarrow (NH_4)_2SO_4(aq)$

(c) Uses of ammonia in daily

- To make nitrogenous fertilizers
- To make nitric acid by Ostwald process
- As a coolant
- As a cleansing agent
- Used in the manufacture of other chemicals

**SECTION C**

9 (a) - iron key can be electroplated with nickel by electrolysis
- iron key acts as cathode whereas nickel acts as anode and nickel sulphate act as the electrolyte.

(b) - the apparatus set-up for the electrolysis of sodium chloride solution is shown as below:
- the ions present in the sodium chloride solution are $Na^+$, $Cl^-$, and $OH^-$ ions
- when the switched is switch on, $Na^+$ and $H^+$ ions will be attracted to the cathode.
- the $H^+$ ions will be discharged to produce hydrogen gas because it is located at a lower position in the electrochemical series compared to $Na^+$ ions.

$$2H^+ + 2e \longrightarrow H_2$$

- the $Cl^-$ and $OH^-$ ions are attracted to anode
- the $OH^-$ ion will be discharged to produce oxygen gas because it is located at a power position in the electrochemical series

$$4OH^- \longrightarrow O_2 + 2H_2O + 4e$$

(c) - dilute sulphuric acid is filled into the U-tube as the salt bridge
- Aluminum sulphate solution is filled into one of the arm of the U-tube and zinc sulphate solution is filled into another arm of the U-tube
- aluminium plate and zinc plate are immersed respectively into aluminium sulphate as shown in the figure
- the circuit is completed

**10** (a)- scatter some cacium hydroxide/lime and add calcium phosphate/phosphate fertilizers to reduce the acidity of the soil and to supply nitrate ions which will be absorbed by the roots of the plants when it dissolved in water.

(b)- place salt X into a test tube and add with nitric acid heated and shake it. The gas released is flown into lime water. The presence of $CO_3^{-2}$ ions is indicated when the lime water turns chalky. Whe saltX is added with the nitric acid and heated, a colorless solution forms.
The solution containing the cation of X is added with dilute hydrochloric acid and is shaken gently. The formation of white precipitated indicates the presences of $Ph^2$ ions.

(c)- *step 1;*
- pour 25 $cm^3$ of 1 mol dm3 magnesium sulphate solution in a beaker and add with 25cm3 of mol dm 3 potassium carbonate solution
- the mixture is stirred. White magnesium carbonate preticitated form is filtered and dried in between filter papers
- the equation involved is

$$MgSO_4 + K_2CO_3 \longrightarrow {}_{MgCO}3 + K_2SO_4$$

PAPER 3

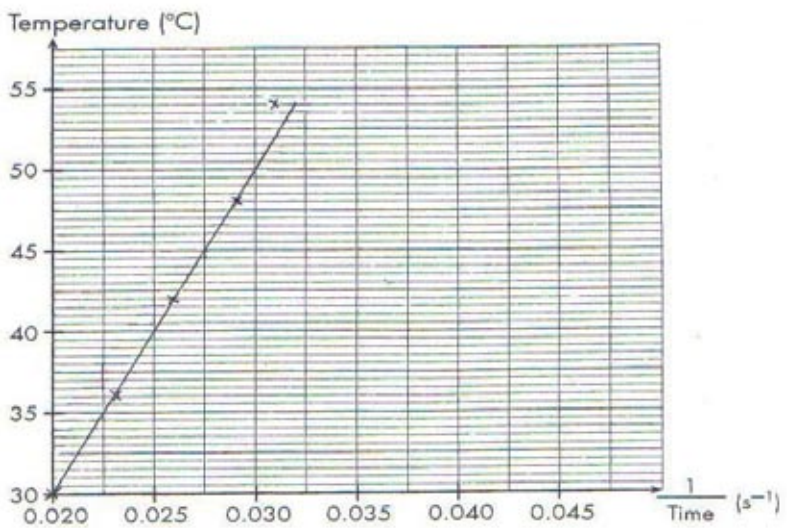
Question 1

(a) At temperature of 30ºC, time t1 = 50s
At temperature of 36ºC, time t2 = 44s
At temperature of 42ºC, time t3 = 39s
At temperature of 48ºC, time t4 = 35s
At temperature of 54ºC, time t5 = 32s

(b)

| Temperature (ºC) | 30 | 36 | 42 | 48 | 54 |
|---|---|---|---|---|---|
| Time (s) | 50 | 44 | 39 | 35 | 32 |
| 1/Time | 0.020 | 0.023 | 0.026 | 0.029 | 0.031 |

(c) (i)




(ii) Rate of reaction is directly proportional to temperature.

(d) 30s

(e) Increase in temperature increases the rate of reaction/The higher the temperature, the higher the rate of reaction.

(f) (i) Manipulated variable : temperature of reaction
Responding variable : rate of reaction
Constant variables : concentrations and volumes of sodium thiosulphate and hydrochloric acid

(ii) By heating sodium thiosulphate to various temperatures while maintaining fixed concentration.

(g) The lower the temperature, the lower the rate of food spoilage.

**Question 2**

(a)

| | |
|---|---|
| **Initial temperature of NaOH** | $25^0$C |
| **Initial temperature of HCl** | $26^0$C |
| **Maximum temperature of the mixture** | $37^0$C |

(b) (i) $NaOH + HC1 \rightarrow NaC1 + H_2O$

(ii) Average initial temperature

$$= \frac{(25 + 26)\ ^0C}{2}$$

$$= 25.5\ ^0C$$

The rise in temperature

$$= (37.0 - 25.5)\ ^0C$$

$$= 11.5\ ^0C$$

Total energy released

$$= mc\square$$

$$= 200 \times 4.2 \times 11.5$$

$$= 9660\ J$$

(c) (i) Number of moles of NaOH

$$= \frac{100 \times 2.0}{1000}$$

$$= 0.2 \text{ mol}$$

Number of moles of HCI

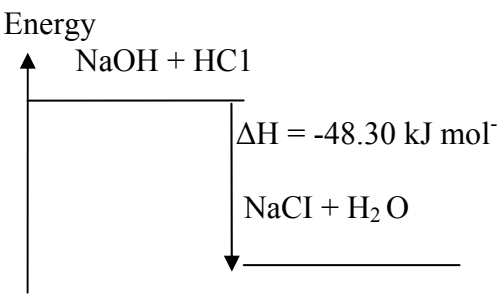
$$= \frac{100 \times 2.0}{1000}$$

$$= 0.2 \text{ mol}$$

The heat of neutralisation

$$= -\left(\frac{1}{0.2} \times 9660\right)$$

$$= -48.30 \text{ kJ mol}$$




(d) (i) The plastic cup becomes hot.

(ii) The neutralisation reaction is an exothermic reaction.

(e) - A plastic cup must be used for this experiment.

- The mixture must be constantly stirred using the thermometer.
- The temperature has to be monitored closely throughout the experiment so that the maximum temperature reached will be noted.
- The dilute acid has to be added as quickly and as carefully as possible to the alkali.

**Question 3**

(a) **Aim of the experiment:**
Is it true that vulcanised rubber is stronger than natural rubber?

(b) **Hypothesis:**
Vulcanised rubber is stronger and more elastic than natural rubber.

(c) **List of substances and apparatus:**
Latex, disulphur dioxide solution, a square glass pane, razor blade, beaker, weights, thread, clip, retort stand, ruler.

(d) **Procedure**

**A** Preparation of the vulcanised rubber.

1) Latex was poured onto a piece of square glass pane.
2) The layer of latex was adjusted to acquire a thickness of 1 mm.
3) The layer of latex was then left aside for two to three.
4) The piece of rubber so formed was then cut into two pieces, each of equal size.
5) One of the pieces was dipped into disulphur dioxide solution for about five minutes before being taken out and left to dry.

**B** Testing the properties of vulcanised rubber and natural rubber.

1) The piece of natural rubber was hung from a retort stand as shown in the figure given.
2) The original length of the natural rubber was measured.
3) A weight of 50 g was then hung from the end of the rubber piece and the extension of the rubber piece was measured.
4) After the weight was removed, the final length of the rubber piece was measured again.
5) Steps 1 or 4 were then repeated for the piece of vulcanised rubber.

(e) **Tabulation of data:**
The measurements were recorded in the following table:

| **Type of rubber** | **Original length (cm)** | **Extension with the weight added (cm)** | **Final length when the weight is remarked (cm)** |
|---|---|---|---|
| Natural rubber | | | |
| Vulcanised | | | |

**Discussion:**
Vulcanised rubber is stronger than natural rubber because the above results show that the extension in the vulcanised rubber was smaller than that in natural rubber.
Vulcanised rubber is also more elastic than natural rubber because the vulcanised rubber returned to its original length (final length = original length ) after the weight was removed.