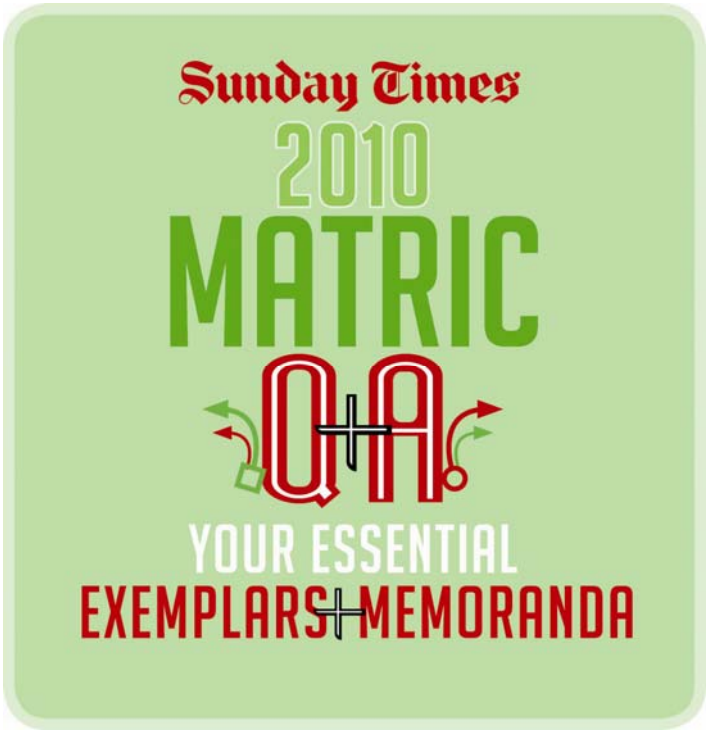


PHYSICAL SCIENCES PAPER 2 MEMORANDUM

QUESTION 1

1.1 Carboxylic acids ü (1)
1.2 Electrolysis of sodium chloride ü (1)
1.3 Le Chateliers Principle ü (1)
1.4 Electrolysis ü (1)
1.5 Isomer ü (1)**[5]**

QUESTION 2

2.1 Fertilizer mixed in the ratio 3:1:5 (38%) contains 4.2% phosphorus. ü ü (2)
2.2 A cell with capacity 2Ah produces 2A x 1H x 60 x 60 = 7200 As = 7200C ü ü (2)
2.3 The melting points and boiling points of alkanes increase with increasing molecular mass. ü ü (2)
2.4 The salt bridge of a Zn/Cu electrochemical cell must have a metal salt, e.g. KNO_3, as the ions must be free to move in order to conduct electricity. ü ü (2)
2.5 The equilibrium constant is affected by temperature only. ü ü (2)**[10]**

QUESTION 3

3.1 C ü ü (2)
3.2 B ü ü (2)
3.3 B ü ü (2)
3.4 C ü ü (2)
3.5 D ü ü (2)**[10]**

SECTION A: SUBTOTAL = [25]

SECTION B

QUESTION 4

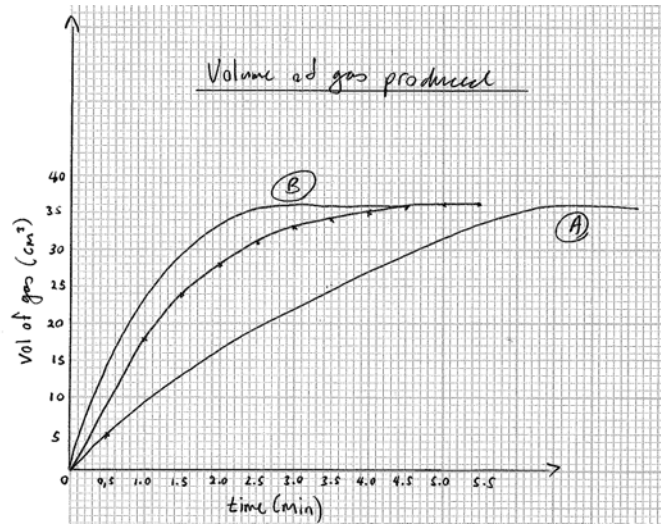
4.1.1 Particle size/surface area ü (1)

4.1.2 Reaction rate /time for reaction. ü (1)

4.1.3 Volume of acid.
Concentration of acid.
No. of tablets/mass of tablets.
Temperature
Any TWO relevant üü (2)

4.1.4 The smaller the particle size the faster the reaction rate ü since there will be a <u>greater surface)e area</u> ü \ <u>more effective collisions</u> between reactant particles. (2)

4.1.5



Heading- 1 mark; scales- 1 mark; label of axes with unit- 1 mark; plotting of points- 2 marks; smooth curve- 1 mark (6)

4.2 The graph will be lower than the original graph in 4.1.5 üü With lower concentration there are less particles to react therefore less effective collisions in a given unit of timeü, so the reaction rate is slower. Same final volume because the same mass metal carbonate is used with the same volume of acid. ü (4)

4.3 The graph will be above the original graph in4.1.5.üü Greater surface area will increase the chance of effective collisions. ü Same final volume of gas when reaction is complete because the same mass metal carbonate is used with same volume and concentration of acid. ü (4)

4.4 5 minutes. ü (1)

4.5 Rate decreases progressively with time. ü At the start of the reaction the number of reacting ions (H^+ ,Cl^- , CO_3^{2-} , Ca^{2+}) are at a maximum and the reaction rate is highü. As the ions react and ions are removed from the solution, the number of successful collisions decreases and the reaction rate decreases. **(**3)

4.6 $n = \frac{m}{M}$ ü $= \frac{0,7}{100}$ ü $= 0,007$mol ü of $CaCO_3$

$CaCO_3$: HCℓ
Mol ratio 1 : 2
0,007 : 0,014
<u>\ Vol. of HCℓ</u>
$V = \frac{n}{C}$ ü $= \frac{0,014}{0,1}$ ü $= 0,14dm^3$ ü
(140cm^3) (6)**[30]**

QUESTION 5

5.1 If an external stress (change in temperature, change in pressure or change in concentration) is applied üto a system at chemical equilibrium, then the system will

change in such a way as to counteract the stress. ü
(2)

5.2 No, they were incorrect. ü Heating favours the endothermic reaction. ü As the colour changed from pink to blue when heated, the reverse reaction was favoured ü which is therefore endothermic. The forward reaction is thus exothermic. (4)

5.3 a decrease ü
b no effect ü
c increase ü
d increase ü
e no effect ü
f no effect ü (6)

5.4 a: Concentration of Cl^- is increased and reverse reaction is favoured ü
c: Exothermic reaction is favoured by lower temperature ü
e: Catalyst will only speed up the reaction. ü (3)

5.5 $K_c = \frac{[Co(H_2O)_6^{+2}][Cl^-]}{[CoCl_4^{-2}][H_2O]^6}$ ü ü (2)

5.6 It is the number that shows us to what extent the reactants have changed into products ü or the ratio of product over reactants at equilibrium. ü (2)

5.7.1 10 seconds ü (1)

5.7.2 $[Co(H_2O)_6]^{+2} + 4Cl^- \rightleftharpoons CoCl_4^{-2} + 6H_2O$ ü (1)

5.7.3 Water or cobalt(II)chloride was added to the system,. ü ü According to le Chateliers principle the system reacts to oppose the disturbance by favouring the forward reaction and the reaction rate increases until a new equilibrium is reached. ü ü (4)

5.7.4 A catalyst will have no effect on the equilibrium; it will speed up both the forward and reverse reactions equally. ü ü (2)**[27]**

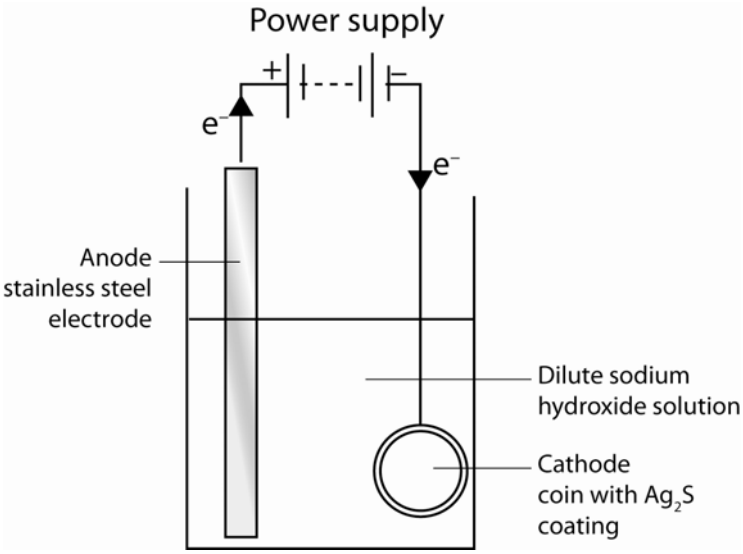
QUESTION 6

6.1 Electrical energy to chemical energy ü (1)

6.2 Reducing agent is the substance which donates electrons in a redox reaction. ü (1)

6.3 The direction of electron flow through the external circuit is from the steel electrode to the coin. ü ü (2)

6.4



Correct direction of current; ü Power supply; ü correctly drawn and labelled ü ü ü (5)

6.5.1 $2H_2O(l) \rightarrow O_2(g) + 4H^+(aq) + 4e^-$ ü (1)

6.5.2 $Ag_2S\ (s) + 2e^-$ à $2Ag(s) + S^{-2}(aq)$ ü (1)

6.5.3 Cathode ü (1)

6.5.4 $2Ag_2S\ (s) + 2H_2O\ (l)$ à $O_2(g) + 4H^+(aq) + 4Ag(s) + 2S^{-2}(aq)$ üü (2)

6.6 An electrochemical cell is formed with aluminium as the anode and the silver core as the cathode. ü

$2Al(s) + 3Ag_2S\ (s)$ à $6Ag(s) + 3S^{-2}(aq) + 2Al^{+3}(aq)$ üü

Since the reaction has a positive emf, the reaction will occur and silver is not lost from the coin.

E cell = E cathode – E anode

= 0.71 – (-1.66)

= 2.37 V ü (4)**[17]**

QUESTION 7

7.1 Chemical energy to electrical energy. ü (1)

7.2 Primary cell ü (1)

7.3 A primary cell reaction takes place in one direction only ü, whereas a secondary cell the reaction is reversible. ü (2)

7.4 Cell capacity is a measure of the number of hours ü a cell can supply a certain amount of current before its voltage drops below an acceptable level. ü (2)

7.5 q = It ü

I = q/t= 50/5 ü = 10A ü (3)

7.6 Increase in temperature speeds up redox reaction. ü This happens even when the cell is not in use. ü Amount of chemicals is thus now less to produce electricity ü and the life span of the cell is less. ü (4)

7.7 Torch cells; camera; portable radio; lap top üüü (3)

7.8 2 positives üü

– allows for portable items and technology

– rechargeable varieties reduce waste and pollution

– quiet, reliable source of power

– can be low cost, easy to use, widely available.

2 negatives üü

– disposable lead to solid waste and pollution

– may heat up, leak even explode

– can be expensive

– may have short life span and low power output. (4)**[20]**

QUESTION 8

8.1 A ü (1)

8.2 E and H ü (1)

8.3 $C_4H_8 + Br_2$ à $CH_3CH_2CHBrCH_2Br$ üü (3)

Halogenation/addition reaction ü

8.4 Propyl pentanoate ü and water ü (2)

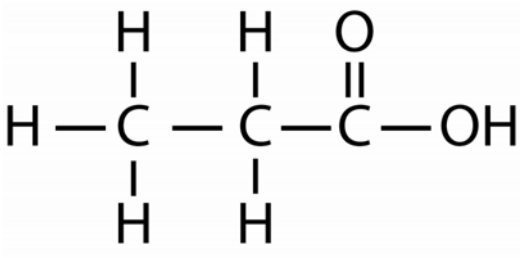
8.5 Ketones; ü propanone ü (2)

8.6 octanoic acid ü (1)

8.7.1 Methyl ethanoate üü (2)

8.7.2 methanol ü and ethanoic acid ü (2)

8.7.3 Propanoic acid ü



ü ü (3)

8.7.4 Concentrated sulphuric acid ü (1)**[18]**

QUESTION 9

9.1 Reaction with oxygen (Combustion) releases a huge amount of energy. ü ü (2)

9.2 Boiling points increase ü as the molecular mass increases ü the covalent bond strength increases therefore increasing the boiling points. ü (3)

9.3 Hydrogen bonding. ü (1)

9.4 Van der Waals forces between alcohol molecules increase ü with increase in molecule size. Hydrogen bonds between alcohol molecules are stronger ü than Van der Waals forces between molecules of alkanes. ü (3)

9.5 $CH_4[g] + 2O_2[g]$ ü $\rightarrow CO_2[g] + 2\ H_2O[g]$ + energy ü balancing ü (3)**[12]**