2001 HIGHER SCHOOL CERTIFICATE EXAMINATION

Chemistry

4	9	2		

Centre Number

Section I – Part B (continued)

1	1	8	7	5	5	9	9	

Student Number

Marks

Question 19 (7 marks)

Name ONE type of cell, other than the dry cell or lead–acid cell, you have studied. Evaluate it in comparison with either the dry cell or lead–acid cell, in terms of chemistry and the impact on society. Include relevant chemical equations in your answer. **7**

Silver button cell. Unlike the dry cell, silver button cell does not use NH_4Cl as a form of electrolyte It uses KOH in a paste form. It is much smaller than dry cell ~~but it cannot be ... aged like the lead-acid cell~~ In the button cell, zinc oxide is used and the bottom is made of silver oxide as the cathode. The zinc ... oxidises $Zn_{(s)} + 2OH^-_{(aq)} \rightarrow ZnO_{(s)} + 2e^- + H_2O$ and the silver oxide is reduced $Ag_2O_{(s)} + 2e^- + H_2O_{(l)} \rightarrow 2Ag_{(s)} + 2OH^-_{(aq)}$

overall: $Zn_{(s)} + Ag_2O_{(s)} \rightarrow ZnO_{(s)} + 2Ag_{(s)}$

Due to its small size it can be used in small devices like hearing aids and watches, replacing the mercury button cell that contains dangerous heaving metal However it produces ~~much~~ less electricity than ~~lead-acid cell~~ dry cell and is also more expensive due to the high cost of silver, than the dry cell. Both dry cell and the silver button cell cannot be recharged and have no serious danger to environment on disposal, and are commonly used by society for electrical devices that are used in our daily ~~life~~ lives.

Marks

Question 20 (4 marks)

A 0.1 mol L^{-1} solution of hydrochloric acid has a pH of 1.0, whereas a 0.1 mol L^{-1} solution of citric acid has a pH of 1.6.

(a) State ONE way in which pH can be measured. **1**

Using a pH meter

(b) Explain why the two solutions have different pH values. **3**

The pH is a measure of the hydrogen ion concentration (or more strictly, $[H_3O^+]$). The two solution have the same concentrations yet different pH values due to the degree of ionisation of their molecules. The HCl completely ionises, whereas the citric acid only partially ionises in solution. Thus the HCl is a stronger acid, resulting in a higher $[H^+]$, thus resulting in a lower pH. The ionisation is explained in the following reactions: $HCl_{(aq)} \longrightarrow H^+_{(aq)} + Cl^-_{(aq)}$

citric acid $\Rightarrow$ $HA_{(aq)} \rightleftharpoons H^+_{(aq)} + A^-_{(aq)} + HA$

Marks

Question 21 (4 marks)

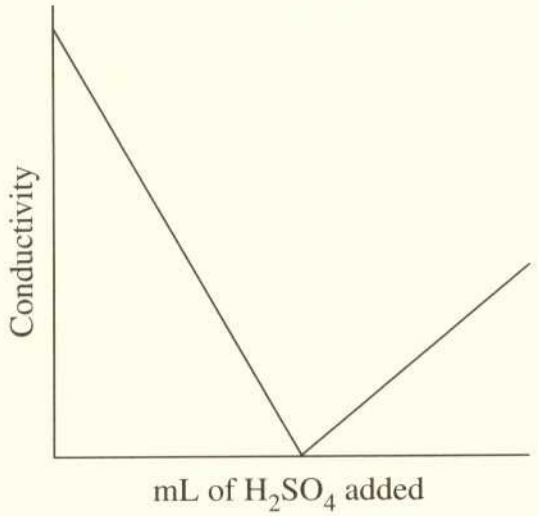
Barium hydroxide and sulfuric acid react according to the following equation:

$$Ba(OH)_2(aq) + H_2SO_4(aq) \rightarrow BaSO_4(s) + 2H_2O(l)$$

(a) Name this type of chemical reaction. **1**

Neutralisation

(b) A 20 mL sample of barium hydroxide was titrated with 0.12 mol L^{-1} sulfuric acid. The conductivity of the solution was measured throughout the titration and the results graphed, as shown. **3**



Explain the changes in conductivity shown by the graph.

Originally the sample contained Ba^{2+} & OH^- ions. These ions allowed the solution to conduct. As the acid was added the Ba^{2+} ions reacted with SO_4^{2-} ions to create $BaSO_4(s)$ which is not soluble in water the OH^- reacted with H^+ to make water which is not conductive, above. at the end pt. there were no ions in solution therefore no conductance. All the Ba^{2+}, SO_4^{2-}, OH^- and H^+ ions had reacted. After the end point as more acid was added ions were created H^+ & SO_4^{2-} because the $Ba(OH)_2$ was all used up. So because of the added ions the solution started to conduct.