2001 HIGHER SCHOOL CERTIFICATE EXAMINATION

Chemistry

Section I – Part B (continued)

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**

The mercury cell is used in batteries, and watches. It is useful because it is small, and easy to carry around. The dry cell is often used for torches and calculators and is very cheap. They were the first battery to be created and hence had a large impact on society. However, it does not create a large electricity flow for a battery of its size, and over time, and with use of the battery, the battery's zinc layer leaks and thus becomes dangerous. Hence the mercury cell was created because it carried sufficient electricity through its size, is cheap, and does not leak as easily as the dry cell. A chemical equation for the dry cell is $Zn_{(s)} \rightarrow Zn^{2+} + 2e^-$, this indicates the leakage of the zinc into the environment.

Dry cell

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**

pH can be measured with an indicator such as universal indicator.

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

The two solutions have different pH values because one is a strong acid and one is a weak acid. HCl when added with water completely ionises into H^+ and Cl^- and no HCl is left the reaction is complete. Citric acid when added with water does not completely ionise there is some product and some reactant in the final mixture. They are at equilibrium.

Marks

Question 21 (4 marks)

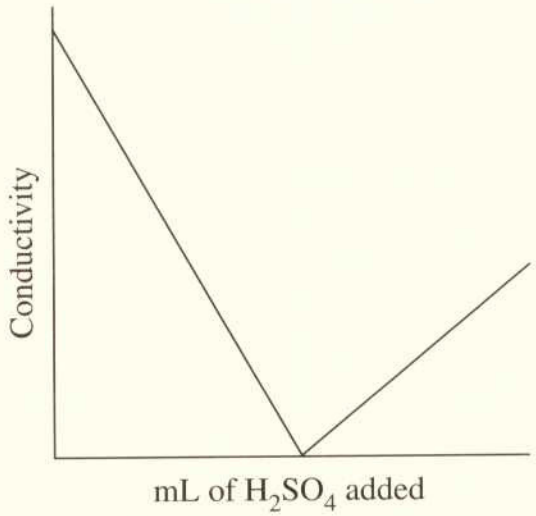
Barium hydroxide and sulfuric acid react according to the following equation:

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

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

An acid/base reaction to give salt and water.

(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.

The initial high conductivity of the $Ba(OH)_2$ solution was due to the fact that the ~~it~~ contained many ions in solution to conduct. As the H_2SO_4 was added these ions reacted with them, until a point where were no Barium ions left in solution they had all reacted. As the reaction proceeded a salt was formed - $BaSO_4$ which began to conduct electricity again. As the reaction progressed more of this salt was formed and so the conductivity rose.