

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 takes the shape of a button cell and is significantly smaller than the dry-cell. It is similar to the dry cell in that it is not rechargeable (not a reversible reaction). The mercury cell has a lower voltage than the dry cell but has a current that remains very ~~current~~ constant throughout its life. This fact and its size made it appropriate for applications such as in hearing aids. However, mercury is a heavy metal with very harmful effects on the environment. This fact has resulted in its production being ceased around the world.

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

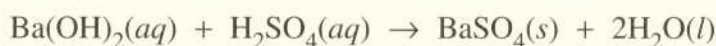
- (b) Explain why the two solutions have different pH values.

3

.....
Hydrochloric acid (HCl) is a strong acid so it fully ionises into H^+ and Cl^- ions, whereas citric acid is a weak acid so it only partially partially ionises. As pH is completely proportional to the concentration of H^+ ions ($-\log_{10}[\text{H}^+]$) then the pH's are different.

Question 21 (4 marks)

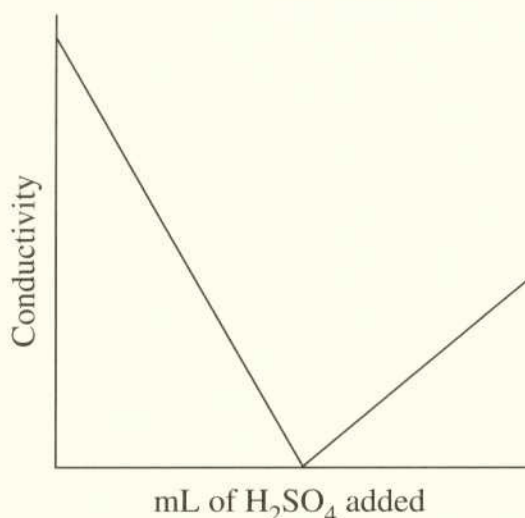
Barium hydroxide and sulfuric acid react according to the following equation:



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

Precipitation

- (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.

Electrical conductivity is proportional to the concentration of ions free to move in a solution (electrolyte).
~~As the concentration of ions decreases, the electrical conductivity is reduced.~~ Electrical conductivity is reduced at neutralisation of Ba(OH)_2 and H_2SO_4 as they form salt and water, which reduces ion concentration and thus electrical conductivity of the solution, this is shown by the lowest point on the graph, where the moles of Ba(OH)_2 and H_2SO_4 are in the correct proportion for neutralisation. The greater the disparity between the molar ratio of the acid and base, the more concentration of ions in the solution and thus the greater electrical conductivity. This explains the V shape of the graph.