

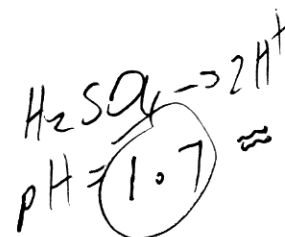
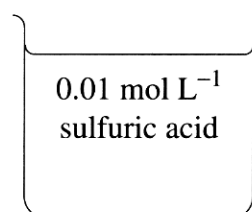
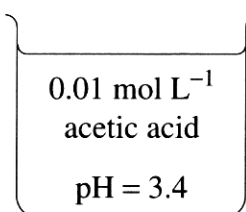
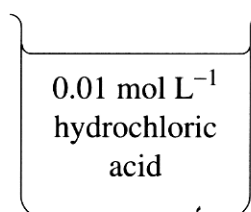
Chemistry

Section I – Part B (continued)

Marks

Question 22 (5 marks)

Solutions of hydrochloric acid, acetic acid and sulfuric acid were prepared. Each of the solutions had the same concentration (0.01 mol L^{-1}). The pH of the acetic acid solution was 3.4.



- (a) Calculate the pH of the hydrochloric acid solution. 1

HCl is monoprotic 100% ionised.
 $\text{pH} = -\log[\text{H}^+] = 2 \text{ for HCl.}$

- (b) Compare the pH of the sulfuric acid solution to the pH of the hydrochloric acid solution. Justify your answer. (No calculations are necessary.) 2

The sulfuric acid solution will have a lower pH than the hydrochloric acid solution because it is a diprotic acid $\text{H}_2\text{SO}_4(\text{aq}) \rightarrow 2\text{H}^+ + \text{SO}_4^{2-}$. It provides 2 H⁺ ions for every molecule of H_2SO_4 and hence the hydrogen ion concentration in the 0.01 molar solution will effectively be 0.02 resulting in a lower pH (more acidic).

- (c) Explain why the acetic acid solution has a higher pH than the hydrochloric acid solution. 2

The acetic acid is a weak acid, that is it is not 100% ionised like the HCl. As a weak acid it provides less H⁺ ions in solution for the same concentration. For the purpose of this comparison it is ~1% ionised compared to HCl and so less H⁺ ions are provided by the acetic and its [H⁺] is therefore lower. HCl is a strong acid because it completely ionises to H⁺ and Cl⁻ ions.