

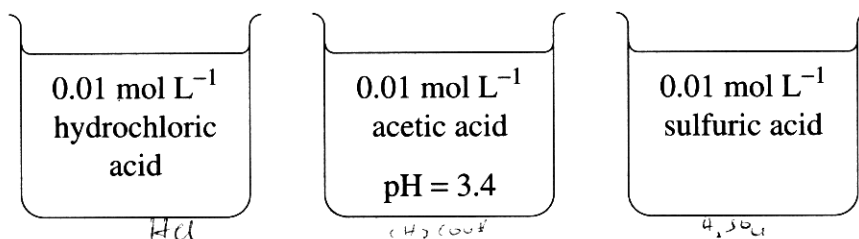
Chemistry

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
- (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

~~$(H_3O^+)(OH^-) = 10^{-14}$~~
 ~~$H_3O^+ = \frac{10^{-14}}{5.0} \Rightarrow 1 \times 10^{-12}$~~
 ~~$pH = -\log[H_3O^+] = -\log(1 \times 10^{-12}) = 12$~~
 ~~$pH = -\log(H_2SO_4)$~~
 ~~$= -\log(0.01)$~~
 ~~$= 2$~~

The HCl solution is more acidic, with a lower pH, this being a reflection of the strength of the HCl acid which ionises fully in solution. Acetic acid is notably weak than HCl and ionises to a mild extent. ~~to this case, we see~~ Furthermore, acetic acid, formula (CH_3COOH) , has three times the hydrogen ion concentration than resulting in a solution with

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

The HCl solution contains ~~only one~~ ^{one} hydrogen atom per molecule, whilst the acetic acid solution ~~(CH_3COOH)~~ ^{the hydroxide ion} contains ~~as~~ as can be seen by its ~~formula~~ formula. Therefore, since ~~more hydrogen ions are present, the acid~~ the hydroxide ion is present, the pH will favour the basic end of the scale therefore resulting in a higher pH than HCl. Also, it is a reflection of the factors noted above.