Acids, Bases and Salts

CHAPTER 2

TRY YOURSELF

ANSWERS

1. In aqueous solution, hydrochloric acid ionizes completely to give more H^+ ions and therefore, it is a strong acid. In aqueous solution, acetic acid ionizes partially to give less H^+ ions and therefore, it is a weak acid.

2. Acetic acid is highly soluble in water but still it is a weak acid because acetic acid gets partially ionised in water *i.e.,* it gives a limited number of H^+ ions in water.

3. (i) An acid reacts with a reactive metal to form a salt and hydrogen gas.

(ii) An acid reacts with a carbonate to produce a salt, water and carbon dioxide gas.

For the first test, add magnesium ribbon to liquid *X* and test for hydrogen gas. The lighted splint is burnt with a 'pop' sound.

For the second test, add calcium carbonate to liquid *X* and test for carbon dioxide gas. The gas produces a white precipitate with limewater.

4. (a) When calcium oxide is treated with hydrochloric acid, calcium chloride (salt) and water is formed.

(b) When limestone is treated with hydrochloric acid, calcium chloride, water and CO_2 gas is formed.

(c) Magnesium on treatment with hydrochloric acid produce metal salt *i.e.,* $MgCl_2$ and hydrogen gas.

5. All water soluble bases contain hydroxyl or hydroxide ions (OH^-).

6. Diacidic Bases :

$Ca(OH)_2$; Calcium hydroxide

$Mg(OH)_2$; Magnesium hydroxide

Monoacidic Bases :

NaOH; Sodium hydroxide

NH_4OH; Ammonium hydroxide

7. As the concentration of OH^- ions increases, basicity of solution increases or *vice-versa*.

8. Strong Bases :

NaOH; Sodium hydroxide

KOH; Potassium hydroxide

Weak Bases :

NH_4OH; Ammonium hydroxide

$Ca(OH)_2$; Calcium hydroxide

9. (i) Bases have bitter taste.

(ii) Some metals react with bases to liberate hydrogen gas.

$$\underset{\text{Sodium hydroxide}}{2NaOH} + \underset{\text{Zinc metal}}{Zn} \longrightarrow \underset{\text{Sodium zincate}}{Na_2ZnO_2} + \underset{\text{Hydrogen gas}}{H_2\uparrow}$$

10. (i) In the acidic solution, the colour of blue litmus will change to red.

(ii) In the acidic solution, the colour of methyl orange will change to red.

(iii) In the acidic solution, phenolphthalein will remain colourless.

11. Olfactory indicators are those substances which give different odours in acidic and basic medium.

Onions and vanilla essence can act as olfactory indicators.

12. An acid-base indicator is a substance which has one colour in the acidic medium and a different colour in the basic medium. Examples of synthetic indicators are phenolphthalein and methyl orange.

13. (c) : 10^{-4} M HCl $\Rightarrow [H^+] = 10^{-4}$ M

After dilution, $[H^+] = 10^{-6}$, pH = 6 M

14. $[H^+]_I = 10^{-6}$ M, $[H^+]_{II} = 10^{-4}$ M

$$\text{Thus, change in } [H^+] = \frac{10^{-4}}{10^{-6}} = 100 \text{ times}$$

15. Solution *X* turns orange, it means *X* has pH around 4 and solution *Y* turns red, it means it has pH around 2. As we know, lower the pH, stronger is the acid, therefore solution *Y* is the stronger acid.

16. A universal indicator is a mixture of several indicators. It shows different colours at different concentrations of hydrogen ions in a solution. It is used to measure the strength of acidic or basic solutions.

17. If the soil is too acidic only then farmer can use lime and slaked lime because plants also need a specific pH range for proper growth.

18. When it rains, the gases like CO_2, SO_2 etc. of the atmosphere dissolve into it and hence its pH become < 7. When pH of rain water falls below 5.6, it is called acid rain. When this acid rain flows into the river, the pH of river water falls and the survival of aquatic life becomes difficult.

19. (i) NaCl is a salt of strong acid and strong base. Therefore, its solution is neutral with pH = 7.

(ii) $CuSO_4$ is a salt of strong acid (H_2SO_4) and weak base ($Cu(OH)_2$). Hence, its solution is acidic with pH < 7.

(iii) Na_2CO_3 is a salt of strong base (NaOH) and weak acid (H_2CO_3). Hence, its solution is basic with pH > 7.

20. Acidic salts : Aluminium chloride, zinc sulphate, ammonium chloride

Basic salts : Sodium acetate

Neutral salts : Sodium sulphate

21. Neutral or normal salt of sodium : Sodium chloride (NaCl). It does not hydrolyse in water and so solution of NaCl contains no extra H^+ or OH^- ions.

Acidic salt of sodium : Sodium hydrogen sulphate ($NaHSO_4$). It hydrolyses in water to give strong acid, H_2SO_4.

Basic salt of sodium : Sodium acetate (CH_3COONa). It hydrolyses in water to give strong base, NaOH.

22. (i) NaCl is a salt of strong acid and strong base. Therefore, its solution is neutral with pH = 7.

(ii) $ZnSO_4$ is a salt of strong acid (H_2SO_4) and weak base ($Zn(OH)_2$). Hence, its solution is acidic with pH < 7.

(iii) CH_3COONa is a salt of strong base (NaOH) and weak acid (CH_3COOH). Hence, its solution is basic with pH > 7.

23. Common salt is an essential ingredient in our daily life. Chemically, it is called sodium chloride.

24. The white powder is bleaching powder, $CaOCl_2$. It is prepared by passing Cl_2 gas over dry slaked lime.

$$\underset{\text{Slaked lime}}{Ca(OH)_{2(s)}} + Cl_{2(g)} \longrightarrow \underset{\text{Bleaching powder}}{CaOCl_{2(s)}} + H_2O_{(l)}$$

25. $Na_2CO_3 + 2HCl \longrightarrow 2NaCl + CO_2 + H_2O$

26. When chlorine is passed over slaked lime at 313 K then bleaching powder is formed.

$$\underset{\text{Slaked lime}}{Ca(OH)_{2(s)}} + \underset{\text{Chlorine}}{Cl_{2(g)}} \xrightarrow{313\text{ K}} \underset{\text{Bleaching powder}}{CaOCl_{2(s)}} + \underset{\text{Water}}{H_2O_{(l)}}$$

Bleaching powder is used :

(i) for bleaching cotton fibres/fabrics in textile industries and wood pulp in paper industries.

(ii) as a disinfectant.

27. A commonly used compound for making chalks and other pottery articles is plaster of Paris. Its chemical formula is $CaSO_4\cdot\frac{1}{2}H_2O$. It is obtained by heating gypsum ($CaSO_4\cdot 2H_2O$) at 373 K which partially loses water of crystallization. When $CaSO_4\cdot 2H_2O$ is strongly heated, it loses whole of water of crystallization and gives anhydrous calcium sulphate which is used as a drying agent. Thus '*X*' is $CaSO_4\cdot 2H_2O$; *Y* is $CaSO_4\cdot\frac{1}{2}H_2O$ and '*Z*' is $CaSO_4$.

$$\underset{(X)}{CaSO_4\cdot 2H_2O} \xrightarrow[373\text{ K}]{\text{Heat}} \underset{(Y)}{CaSO_4\cdot\frac{1}{2}H_2O} + \frac{3}{2}H_2O$$

$$\underset{(X)}{CaSO_4\cdot 2H_2O} \xrightarrow[\text{Heat}]{>100^\circ C} \underset{(Z)}{CaSO_4} + 2H_2O$$

28. Water of crystallization is the fixed number of water molecules present in one formula unit of a salt. For example, chemical formula of hydrated copper sulphate is $CuSO_4\cdot 5H_2O$. Copper sulphate has 5 molecules of water of crystallization. Sodium carbonate ($Na_2CO_3\cdot 10H_2O$) contains ten molecules of water of crystallization.

29. The chemical formula of hydrated copper sulphate is $CuSO_4\cdot 5H_2O_{(s)}$ and anhydrous copper sulphate is $CuSO_{4(s)}$.

$$\underset{\text{(Blue)}}{CuSO_4\cdot 5H_2O} \xrightarrow{\text{Heat}} \underset{\text{(White)}}{CuSO_4} + H_2O$$

$$\underset{\text{(White)}}{CuSO_4} + 5H_2O \longrightarrow \underset{\text{(Blue)}}{CuSO_4\cdot 5H_2O}$$

30. (i) 5 molecules of water

(ii) 10 molecules of water

(iii) 2 molecules of water