

# Acids, Bases and Salts

## CASE STUDY / PASSAGE BASED QUESTIONS

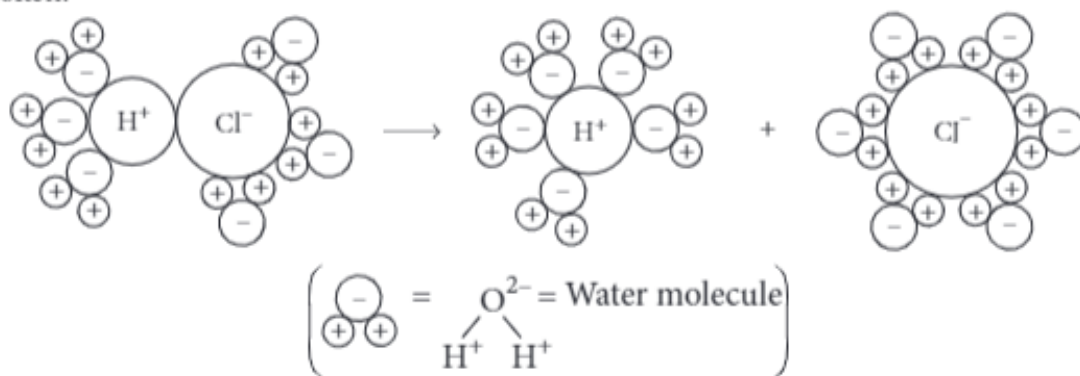
1

Read the following and answer any four questions from 1(i) to 1(v).

The acidic behaviour of acids is due to the presence of hydrogen( $H^+$ ) ions in them. They produce hydrogen ions in the presence of water. Water is a polar solvent and this property of water helps in weakening the bond between the ions and makes them soluble. Hence, acids and bases produce ions in aqueous solutions.

It may be noted that a dry HCl gas or a solution of hydrogen chloride in organic, non-polar solvents like toluene or benzene do not show acidic properties. This is because hydrogen chloride does not undergo ionization in toluene.

The reason why HCl splits into  $H^+$  and  $Cl^-$  ions in presence of water lies in the fact that water molecules, being polar, pull the  $H^+$  and  $Cl^-$  ions apart and thus, the bond in HCl is broken.



Dissociation of HCl into  $H^+$  and  $Cl^-$  ions in presence of water

- (i) Identify the wrong statement.
  - (a) Higher the hydronium ion concentration, lower is the pH value.
  - (b) Universal indicator is used to judge how strong a given acid or base is.
  - (c) As the pH value increases from 7 to 14, it represents increase in  $H^+$  ion concentration in the solution.
  - (d) Value less than 7 on the pH scale represents an acidic solution.
- (ii) If the pH of a solution is 8, then its  $[H^+]$  ion is
  - (a)  $\log 10^{-8}$
  - (b)  $10^8$
  - (c)  $10^{-8}$
  - (d) 8
- (iii) In terms of acidic strength, which one of the following is in the correct increasing order?

### Syllabus

Their definitions in terms of furnishing of  $H^+$  and  $OH^-$  ions, General properties, examples and uses, concept of pH scale (Definition relating to logarithm not required), importance of pH in everyday life; preparation and uses of Sodium hydroxide, Bleaching powder, Baking soda, Washing soda and Plaster of Paris.

(a) Water < Acetic acid < Hydrochloric acid

(b) Water < Hydrochloric acid < Acetic acid

(c) Acetic acid < Water < Hydrochloric acid

(d) Hydrochloric acid < Water < Acetic acid

(iv) Which of the following compounds does not give  $H^+$  ions in aqueous solution?

(a)  $H_3PO_4$

(b)  $C_2H_5OH$

(c)  $H_2CO_3$

(d)  $CH_3COOH$

(v) Four solutions labelled as P, Q, R and S have pH values 1, 9, 3 and 13 respectively.

Which of the following statements about the given solutions is incorrect?

(a) Solution P has higher concentration of hydrogen ions than solution R.

(b) Solution Q has lower concentration of hydroxide ions than solution S.

(c) Solutions P and Q will turn red litmus solution blue.

(d) Solution P is highly acidic while solution Q is weakly basic.

## 2

Read the following and answer any four questions from 2(i) to 2(v).

A compound, X of sodium forms a white powder. It is a constituent of baking powder and is used in some antacids. When heated it gives a compound, Y which is anhydrous and absorbs water to become a hydrated salt. When this salt is kept in open air, it loses water molecules in a process called efflorescence. When dissolved in water it forms a strong base and a weak acid, Z.

(i) What is the compound, X?

(a)  $NaHCO_3$

(b)  $Na_2CO_3$

(c)  $NaOH$

(d)  $NaCl$

(ii) The compound, Y is

(a)  $NaHCO_3$

(b)  $Na_2CO_3$

(c)  $Na_2CO_3 \cdot 10H_2O$

(d)  $NaCl$

(iii) What is the nature of the solution formed by dissolving Y in water?

(a) Alkaline

(b) Acidic

(c) Neutral

(d) It remains insoluble.

(iv) Identify the compound, Z.

(a)  $CO_2$

(b)  $H_2CO_3$

(c)  $NaOH$

(d)  $H_2O$

(v) Sodium carbonate is a basic compound because it is a salt of a

(a) strong acid and strong base

(b) weak acid and weak base

(c) strong acid and weak base

(d) weak acid and strong base.

## 3

Read the following and answer any four questions from 3(i) to 3(v).

Sodium chloride obtained from sea water or from lakes contains many impurities such as sulphates of sodium and magnesium along with chlorides of calcium and magnesium. The chlorides of calcium and magnesium are particularly undesirable on account of their deliquescent nature.

For its purification, common salt is dissolved in minimum quantity of water to get a saturated solution from which insoluble impurities are filtered off. Then hydrogen chloride gas is passed through the saturated solution and the crystals of pure  $NaCl$  separate out. The soluble impurities remain in the mother liquor. The crystals are filtered, washed and dried.

- (i) Select the correct statement regarding salt NaCl.
- Pure NaCl is hygroscopic in nature.
  - It is soluble in alcohol.
  - Pure NaCl is not hygroscopic, it shows hygroscopic nature due to impurities.
  - It is a brown crystalline solid.
- (ii) Nature of aqueous solution of common salt is
- acidic
  - alkaline
  - basic
  - neutral.
- (iii) In the given series of reactions, Y and Z respectively are
- $$\begin{array}{c}
 \text{NaCl} + \text{H}_2\text{O} + \text{CO}_2 + \text{NH}_3 \longrightarrow \text{X} + \text{Y} \\
 \qquad \qquad \qquad \downarrow \Delta, -\text{H}_2\text{O}, -\text{CO}_2 \\
 \text{Q} \xleftarrow{+10\text{H}_2\text{O}} \text{Z}
 \end{array}$$
- (Q is used in removing permanent hardness of water.)
- $\text{NaHCO}_3, \text{NaOCl}_2$
  - $\text{NH}_4\text{Cl}, \text{Na}_2\text{CO}_3$
  - $\text{Na}_2\text{CO}_3, \text{NH}_4\text{Cl}$
  - $\text{Na}_2\text{CO}_3, \text{NaHCO}_3$
- (iv) Which of the following compounds is alkaline in aqueous medium?
- $\text{Na}_2\text{CO}_3$
  - NaCl
  - $\text{H}_2\text{CO}_3$
  - $\text{CuSO}_4$
- (v) Some statements regarding salt NaCl are given below:
- It is prepared by chlor-alkali process.
  - It is a white crystalline substance.
  - It also exists in the form of rocks and is called rock salt.
  - It is a neutral salt, pH value of NaCl is 7.
- Select the correct statements.
- II and III only
  - III and IV only
  - I and IV only
  - II, III and IV only

#### 4

Read the following and answer any four questions from 4(i) to 4(v).

Chemically, Plaster of Paris (POP) is calcium sulphate hemihydrate, *i.e.*, containing half molecule of water of crystallisation. It is represented by the formula,  $\text{CaSO}_4 \cdot 1/2\text{H}_2\text{O}$ . Half molecule of water of crystallisation means that one water molecule is shared by two formula units of  $\text{CaSO}_4$ . Hence, we also represent its formula as  $(\text{CaSO}_4)_2 \cdot \text{H}_2\text{O}$ . The name, plaster of Paris, was given to this compound because for the first time, it was made from gypsum which was mainly found in Paris.

- (i) The difference of water molecules in gypsum and plaster of Paris is
- 5/2
  - 2
  - 1/2
  - 3/2
- (ii) Plaster of Paris hardens by
- giving off  $\text{CO}_2$
  - changing into  $\text{CaCO}_3$
  - combining with water
  - giving out water.
- (iii) Which of the following statements is incorrect?
- Plaster of Paris is used to ornate designs on walls and ceilings.
  - On heating gypsum above 373 K,  $\text{CaSO}_4$  is obtained.
  - Dead burnt plaster is  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ .
  - Setting of plaster is due to its hydration into gypsum.

- (iv) Select the incorrect statement with respect to gypsum.
- (a) It is slightly soluble in water.
  - (b) It is also known as alabaster.
  - (c) On heating gypsum at 373 K, it loses water molecules and becomes calcium sulphate hemihydrate.
  - (d) Chemical formula of gypsum is  $\text{CaSO}_4 \cdot 1/2\text{H}_2\text{O}$ .
- (v) Plaster of Paris is obtained by
- (a) adding water to calcium sulphate
  - (b) adding sulphuric acid to calcium hydroxide
  - (c) heating gypsum to a very high temperature
  - (d) heating gypsum to  $100^\circ\text{C}$ .

5

Read the following and answer any four questions from 5(i) to 5(v).

pH is quite useful to us in a number of ways in daily life. Some of its applications are :

**Control of pH of the soil :** Plants need a specific pH range for proper growth. The soil may be acidic, basic or neutral depending upon the relative concentration of  $\text{H}^+$  and  $\text{OH}^-$ . The pH of any soil can be determined by using pH paper. If the soil is too acidic, it can be corrected by adding lime to it. If the soil is too basic, it can be corrected by adding organic manure which contains acidic materials.

**Regaining shine of a tarnished copper vessel by use of acids :** A copper vessel gets tarnished due to formation of an oxide layer on its surface. On rubbing lemon on the vessel, the surface is cleaned and the vessel begins to shine again. This is due to the fact that copper oxide is basic in nature, which reacts with the acid (citric acid) present in lemon to form a salt (copper citrate) which is washed away with water. As a result, the layer of copper oxide is removed from the surface of the vessel and the shining surface is exposed.

**Self-defence by animals through chemical warfare :** Stings of bees and ants contain methanoic acid. When stung, it causes lot of pain and irritation. This can be cured by rubbing the affected area with mild base like baking soda.

- (i) When black copper oxide placed in a beaker is treated with dilute HCl, its colour changes to
- (a) white
  - (b) dark red
  - (c) bluish green
  - (d) no change.
- (ii) P is an aqueous solution of acid and Q is an aqueous solution of base. When these two are diluted separately, then
- (a) pH of P increases while that of Q decreases till neutralisation.
  - (b) pH of P decreases while that of Q increases till neutralisation.
  - (c) pH of both P and Q decrease.
  - (d) pH of both P and Q increase.
- (iii) Which of the following acids is present in bee sting?
- (a) Formic acid
  - (b) Acetic acid
  - (c) Citric acid
  - (d) Hydrochloric acid
- (iv) Sting of ant can be cured by rubbing the affected area with soap because
- (a) it contains oxalic acid which neutralises the effect of formic acid
  - (b) it contains aluminium hydroxide which neutralises the effect of formic acid
  - (c) it contains sodium hydroxide which neutralises the effect of formic acid
  - (d) none of these.



(i) Bleaching powder is used as

- (a) bleaching agent in textile, paper and jute industry  
(b) disinfectant for water to make water free of germs  
(c) oxidising agent in many industries  
(d) all of these.

(ii) Bleaching powder is also known as

- (a) calcium oxychloride (b) calcium hypochlorite  
(c) chloride of lime (d) all of these.

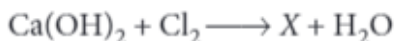
(iii) Bleaching powder gives smell of chlorine because it

- (a) is unstable (b) gives chlorine on exposure to atmosphere  
(c) is a mixture of chlorine and slaked lime (d) contains excess of chlorine.

(iv) Select the correct statement(s) regarding bleaching powder.

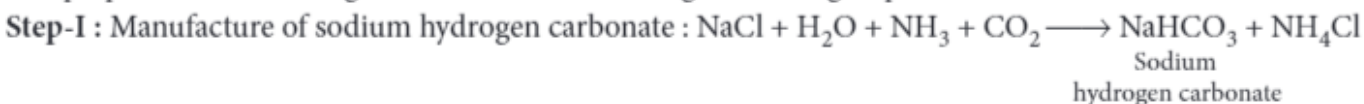
- (a) It is pale yellow powder having smell of chlorine.  
(b) It is sparingly soluble in water and gives milky suspension when dissolved in water.  
(c) As bleaching powder gives nascent oxygen, it shows bleaching property.  
(d) All of these.

(v) Identify the product 'X' in the given reaction.

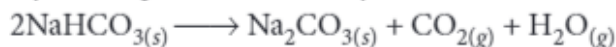


- (a)  $\text{CaOCl}_2$                       (b)  $\text{CaCl}_2$                       (c)  $\text{Ca}(\text{ClO}_3)_2$                       (d)  $\text{CaCO}_3$

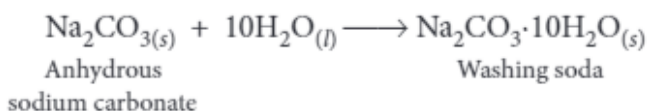
The preparation of washing soda is carried out through following steps :



**Step-II :** Thermal decomposition of sodium hydrogen carbonate : When dry crystals of sodium hydrogen carbonate are heated strongly, they decompose to form anhydrous sodium carbonate (soda ash).



**Step-III :** Recrystallisation of sodium carbonate : Sodium carbonate thus obtained is recrystallised to form crystals of washing soda.



- (i) Some of the uses of washing soda are given below :
- (I) It is used for removing permanent hardness of water.
  - (II) It is used in glass industry.
  - (III) It is used in paper industry.
  - (IV) It is used in the manufacture of sodium compounds such as borax.
- Select the correct option regarding uses of washing soda.
- (a) (I) and (II) only
  - (b) (II) and (III) only
  - (c) (II) and (IV) only
  - (d) (I), (II), (III) and (IV)
- (ii) What products will be formed along with water when sodium carbonate reacts with dilute hydrochloric acid?
- (a) CO and NaCl
  - (b) Na and CO<sub>2</sub>
  - (c) NaCl and CO<sub>2</sub>
  - (d) Na and CO
- (iii) Chief raw materials for the manufacture of washing soda are
- (a) sodium chloride, ammonia and limestone
  - (b) ammonia, sodium hydrogen carbonate and copper sulphate
  - (c) sodium hydroxide, calcium chloride and ammonia
  - (d) calcium chloride, sodium chloride and copper sulphate.
- (iv) What is the action of sodium carbonate on litmus paper?
- (a) Turns red litmus blue
  - (b) Turns blue litmus red
  - (c) No change on litmus
  - (d) Both (a) and (b)
- (v) What products will be obtained when solution of sodium carbonate and slaked lime is heated?
- (a) NaOH and CaCl<sub>2</sub>
  - (b) CaCO<sub>3</sub> and NaOH
  - (c) NaHCO<sub>3</sub> and NaOH
  - (d) NaCl and CaCO<sub>3</sub>

## 9

Read the following and answer any four questions from 9(i) to 9(v).

“Indicator is a chemical compound which is added to the solution in very small amount to detect its acidic or basic nature.” As they show colour change in acidic and basic medium, they are also called acid-base indicators. In other words, “an acid-base indicator is that substance which possesses one colour in acidic medium and a different colour in alkaline medium.”

Indicators, basically, are coloured organic substances either extracted from plants (natural indicators) or synthesised in the laboratory (synthetic indicators). A few common acid base indicators are : Litmus, phenolphthalein, methyl orange etc. In addition to these there are some naturally occurring substances which have different smell in acidic and basic medium. These substances are called olfactory indicators.

- (i) Which one of the following will turn red litmus blue?
- (a) Vinegar
  - (b) Baking soda solution
  - (c) Lemon juice
  - (d) Soft drinks
- (ii) A solution turns blue litmus red. The pH of the solution is probably
- (a) 8
  - (b) 10
  - (c) 12
  - (d) 6
- (iii) A solution in test tube ‘A’ turns red litmus blue, evolves hydrogen gas on reaction with zinc and does not react with sodium carbonate. Whereas, solution in test tube ‘B’ turns blue litmus red, liberates hydrogen gas on reaction with zinc and evolves carbon dioxide gas with sodium carbonate. Identify ‘A’ and ‘B’.
- (a) ‘A’ is an acid, ‘B’ is a base.
  - (b) ‘A’ is a base, ‘B’ is an acid.
  - (c) Both ‘A’ and ‘B’ are bases.
  - (d) Both ‘A’ and ‘B’ are acids.

(iv) Select the incorrect option.

| Indicator                            | Colour in acidic medium | Colour in basic medium |
|--------------------------------------|-------------------------|------------------------|
| (a) Litmus (Purple)                  | Red                     | Blue                   |
| (b) Flower of hydrangea plant (Blue) | Red                     | Green                  |
| (c) Red cabbage juice (Purple)       | Red or Pink             | Green                  |
| (d) Turmeric Juice (Yellow)          | Yellow                  | Reddish brown          |

(v) Which one of the following can be used as an acid-base indicator by visually impaired student?

- (a) Litmus                      (b) Turmeric                      (c) Vanilla essence                      (d) Methyl orange

10

Read the following and answer any four questions from 10(i) to 10(v).

Acids turn blue litmus red but have no effect on red litmus. Bases turn red litmus blue but have no effect on blue litmus. The sample in which phenolphthalein remains colourless while methyl orange changes to pink/red are acids while the samples in which phenolphthalein colour changes to pink and methyl orange changes to yellow are bases. Some observations of different sample solutions in litmus, phenolphthalein and methyl orange indicator are given in the table.

| Sample solution                | Red litmus solution | Blue litmus solution | Phenolphthalein indicator                | Methyl orange indicator                    |
|--------------------------------|---------------------|----------------------|------------------------------------------|--------------------------------------------|
| HCl                            | No colour change    | Red                  | Colourless                               | Red/ Pink                                  |
| H <sub>2</sub> SO <sub>4</sub> | No colour change    | Red                  | Colourless                               | Red/Pink                                   |
| HNO <sub>3</sub>               | No colour change    | Red                  | Colourless                               | Red/Pink                                   |
| CH <sub>3</sub> COOH           | No colour change    | Red                  | Colourless                               | Red/Pink                                   |
| NaOH                           | Blue                | No colour change     | Pink                                     | Yellow                                     |
| Ca(OH) <sub>2</sub>            | Blue                | No colour change     | Pink                                     | Yellow                                     |
| KOH                            | Blue                | No colour change     | Pink                                     | Yellow                                     |
| Mg(OH) <sub>2</sub>            | Blue                | No colour change     | Pink                                     | Yellow                                     |
| NH <sub>4</sub> OH             | Blue                | No colour change     | Pink (Becomes colourless after sometime) | Yellow (Becomes colourless after sometime) |

(i) Which of the following substances does not turn red litmus solution to blue?

- (a) Al(OH)<sub>3</sub>                      (b) Mg(OH)<sub>2</sub>                      (c) H<sub>3</sub>PO<sub>4</sub>                      (d) NH<sub>4</sub>OH

(ii) Phenolphthalein's colour in basic medium is \_\_\_\_\_ but in acid it is \_\_\_\_\_.

- (a) pink, colourless                      (b) yellow, pink                      (c) pink, orange                      (d) blue, red

(iii) Which of the following acids are edible?

- (I) Citric acid                      (II) Tartaric acid                      (III) Hydrochloric acid                      (IV) Carbonic acid  
(a) (I) and (II) only                      (b) (I), (II) and (IV) only                      (c) (I), (II) and (III) only                      (d) (I), (II), (III) and (IV)

(iv) The colour of methyl orange in neutral solution is

- (a) red                      (b) orange                      (c) yellow                      (d) purple.

(v) Which of the following cannot act as an indicator?

- (a) Methyl orange                      (b) Methyl chloride                      (c) Turmeric juice                      (d) Phenolphthalein

## ASSERTION & REASON

For question numbers 11-30, two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below :

- (a) Both A and R are true, and R is correct explanation of the assertion.
- (b) Both A and R are true, but R is not the correct explanation of the assertion.
- (c) A is true, but R is false.
- (d) A is false, but R is true.

11. **Assertion :** Calcium sulphate hemihydrate,  $\text{CaSO}_4 \cdot \frac{1}{2} \text{H}_2\text{O}$  is called plaster of Paris.

**Reason :** Plaster of Paris is used for producing moulds for pottery and ceramics and casts of statues.

12. **Assertion :** Phosphoric acid is a weak acid.

**Reason :** Phosphoric acid when dissolved in water dissociates partially and produces very little  $\text{H}^+$  ions.

13. **Assertion :** Antacids neutralize the effect of extra acid produced in the stomach during indigestion and thus provide relief.

**Reason :** Antacids are mild bases.

14. **Assertion :** HCl is a stronger acid than acetic acid.

**Reason :** On dissociation, HCl yields lesser hydrogen ions for the same concentration as compared to acetic acid.

15. **Assertion :**  $\text{pH} = 7$  signifies pure water.

**Reason :**  $\text{pH}$  of acetic acid is greater than 7.

16. **Assertion :**  $\text{pH}$  of ammonium nitrate solution is acidic.

**Reason :** Solution of a salt of weak base and strong acid is acidic.

17. **Assertion :** Acetic acid does not act as an acid in benzene solution.

**Reason :** Benzene is non-polar.

18. **Assertion :** Bleaching powder reacts with dilute acids to evolve chlorine.

**Reason :** The chlorine liberated by the action of dilute acids on bleaching powder is called available chlorine.

19. **Assertion :** Sodium carbonate pentahydrate is also known as washing soda.

**Reason :** Chief raw materials for the manufacture of washing soda are  $\text{NH}_3$ ,  $\text{NaCl}$  and  $\text{CaCO}_3$ .

20. **Assertion :** Common salt is used for the preparation of many chemicals such as sodium hydroxide, bleaching powder, baking soda, washing soda etc.

**Reason :** Main source of sodium chloride is sea water.

21. **Assertion :**  $\text{AlCl}_3$  is a basic salt.

**Reason :**  $\text{AlCl}_3$  is a salt of strong acid and a weak base.

22. **Assertion :** Baking soda is prepared by chlor-alkali process.

**Reason :** Brine decomposes to sodium hydroxide on passing electricity through it.

23. **Assertion :** Salt of  $\text{KNO}_3$  is formed by strong base and weak acid.

**Reason :** Salt of  $\text{NH}_4\text{Cl}$  is formed by weak base and strong acid.

24. **Assertion :** Strength of the acid or base decreases with dilution.

**Reason :** Ionization of an acid or a base increases with dilution.

25. **Assertion :** Higher the  $\text{H}^+$  ion concentration, lower is the  $\text{pH}$  value.

**Reason :** The  $\text{pH}$  of a neutral solution = 7, that of a basic solution  $< 7$  and that of an acidic solution  $> 7$ .

26. **Assertion :**  $\text{CH}_3\text{COOH}$  is used as vinegar in cooking and food preservatives.  
**Reason :** Strong acids are those acids which ionise almost completely in aqueous solution and hence produce a large amount of  $\text{H}^+$  ions.
27. **Assertion :** Tooth decay starts when the pH of the mouth is lower than 5.5.  
**Reason :** Enamel starts corroding below 5.5 pH.
28. **Assertion :** The chemical name of bleaching powder is calcium oxychloride.  
**Reason :** Bleaching powder is used as an oxidising agent in chemical industries.
29. **Assertion :** The process of dissolving an acid or a base in water is highly exothermic reaction.  
**Reason :** Water must always be added slowly to acid with constant stirring.
30. **Assertion :** Phenolphthalein is an acid-base indicator.  
**Reason :** Phenolphthalein gives different colours in acidic and basic medium.

## HINTS & EXPLANATIONS

1. (i) (c) : As the pH value increases from 7 to 14, it represents decrease in  $\text{H}^+$  ion concentration in the solution.

$$\begin{aligned}\text{(ii) (c) : pH} &= -\log_{10} [\text{H}^+] = 8 \\ \log_{10} [\text{H}^+] &= -8 \\ [\text{H}^+] &= 10^{-8} \text{ mol/L}\end{aligned}$$

(iii) (a)

(iv) (b) :  $\text{C}_2\text{H}_5\text{OH}$  is not an ionic compound, it is a covalent compound and hence does not give  $\text{H}^+$  ions in aqueous solution.

(v) (c) : (a) Lower the pH of the solution, more acidic is the solution and higher is the  $[\text{H}^+]$  ions.

Thus, solution P (pH = 1) has higher  $[\text{H}^+]$  ions than solution R (pH = 3).

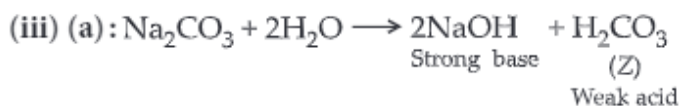
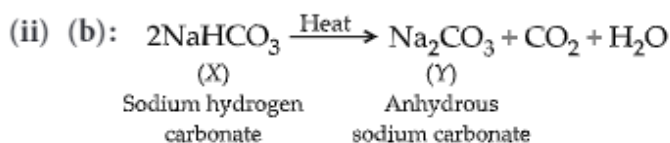
(b) Higher the pH of the solution, more basic is the solution and higher is the  $[\text{OH}^-]$  ions.

Thus, solution Q (pH = 9) has lower  $[\text{OH}^-]$  ions than solution S (pH = 13).

(c) Solution P (pH = 1) is acidic which turns blue litmus solution red whereas solution Q (pH = 9) is basic which turns red litmus solution blue.

(d) Solution P (pH = 1) is highly acidic while solution S (pH = 13) is highly basic and solution Q (pH = 9) is weakly basic.

2. (i) (a) : The compound of sodium that is a constituent of baking powder and is used in antacids, is sodium hydrogen carbonate ( $\text{NaHCO}_3$ ).



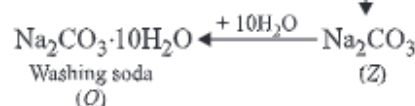
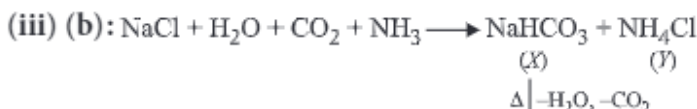
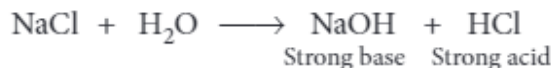
$\text{NaOH}$  ionises completely to give a large amount of  $\text{OH}^-$  ions whereas  $\text{H}_2\text{CO}_3$  ionises partially to give a small amount of  $\text{H}^+$  ions. Hence, the solution is overall alkaline.

(iv) (b) : Z is carbonic acid, a weak acid formed when  $\text{Na}_2\text{CO}_3$  is dissolved in water.

(v) (d)

3. (i) (c) :  $\text{NaCl}$  is insoluble in alcohol and it is a white crystalline solid. Pure  $\text{NaCl}$  is not hygroscopic in nature.

(ii) (d) : Aqueous solution of common salt is neutral in nature.



(iv) (a) : When  $\text{Na}_2\text{CO}_3$  (sodium carbonate) is dissolved in water then it forms alkaline aqueous

solution due to the formation of NaOH which is a strong alkali.

(v) (d): Sodium hydroxide (NaOH) is prepared by chlor-alkali process.

4. (i) (d): Gypsum is  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$  and plaster of Paris is  $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$ . Difference in number of water molecules =  $\frac{3}{2}$

(ii) (c): Plaster of Paris is hardened by combining with water.

(iii) (c): Dead burnt plaster is  $\text{CaSO}_4$  (anhydrous calcium sulphate).

(iv) (d): Gypsum :  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$   
Plaster of paris:  $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$

(v) (d): Gypsum on heating upto  $100^\circ\text{C}$  gives plaster of Paris.



5. (i) (c) :  $\text{CuO} + 2\text{HCl} \longrightarrow \text{CuCl}_2 + 2\text{H}_2\text{O}$   
(Bluish green)

(ii) (a): On diluting,  $\text{H}^+$  ion concentration reduces per unit volume thus, pH increases.

On the other hand, on diluting,  $\text{OH}^-$  concentration also reduces, pOH increases and pH decreases.

As,  $\text{pOH} + \text{pH} = 14$ .

Thus, pH of Q (basic solution) decreases while that of P (acidic solution) increases on dilution.

(iii) (c): Formic acid is the common name of methanoic acid, and it is present in bee sting.

(iv) (c)

(v) (b): Soil Y is acidic. Hence, it should be treated with powdered chalk to reduce its acidity.

6. (i) (b):  $\text{Na}_2\text{CO}_3 + \text{H}_2\text{O} + \text{CO}_2 \longrightarrow 2\text{NaHCO}_3$

(ii) (b):  $\text{NaHCO}_3 + \text{CH}_3\text{COOH} \longrightarrow \text{CH}_3\text{COONa} + \text{CO}_2\uparrow + \text{H}_2\text{O}$

Carbon dioxide gas is evolved which turns limewater milky. It extinguishes a burning splinter since it is not a supporter of combustion. It dissolves in sodium hydroxide solution and it is an odourless gas.

(iii) (c) :  $2\text{NaHCO}_3 \xrightarrow{\text{Heat}} \text{Na}_2\text{CO}_3 + \text{H}_2\text{O} + \text{CO}_2$   
 $\text{NaHCO}_3$  is soluble in water.

(iv) (b):  $\text{NaHCO}_3 + \text{CH}_3\text{COOH} \longrightarrow \text{CH}_3\text{COONa} + \text{CO}_2 + \text{H}_2\text{O}$

(v) (c) : It is not used in manufacture of soap.

7. (i) (d) (ii) (d)

(iii) (b): Bleaching powder gives chlorine on exposure to air by reacting with  $\text{CO}_2$ .

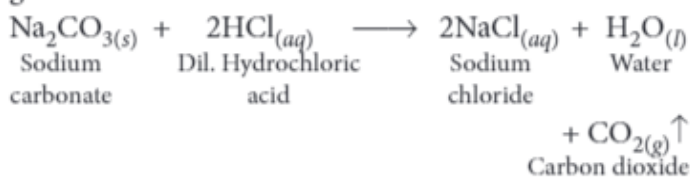


(iv) (d)

(v) (a) :  $\text{Ca}(\text{OH})_2 + \text{Cl}_2 \longrightarrow \text{CaOCl}_2 + \text{H}_2\text{O}$

8. (i) (d)

(ii) (c) :  $\text{Na}_2\text{CO}_3$  reacts with dilute acids to give  $\text{CO}_2$  gas with brisk effervescence.



(iii) (a): Chief raw materials for the manufacture of washing soda are sodium chloride (NaCl), ammonia ( $\text{NH}_3$ ) and limestone ( $\text{CaCO}_3$ ).

(iv) (a): Sodium carbonate turns red litmus blue.

(v) (b): Sodium hydroxide and calcium carbonate are formed when the solution of sodium carbonate and slaked lime,  $\text{Ca}(\text{OH})_2$  is heated.



9. (i) (b): Baking soda ( $\text{NaHCO}_3$ ) is basic in nature.

(ii) (d): The solution turns blue litmus red, hence it is acidic.

(iii) (b): Acids turn blue litmus red, liberate hydrogen gas with zinc and evolve carbon dioxide gas with metal carbonates. Bases turn red litmus blue, evolve hydrogen gas with zinc and do not react with metal carbonates.

| (iv) (b): Indicator               | Colour in acidic | Colour in basic medium |
|-----------------------------------|------------------|------------------------|
| Flowers of hydrangea plant (blue) | Blue             | Pink                   |

(v) (c) : Vanilla essence is an olfactory indicator. So, its smell is different in acidic and basic medium which can be detected easily by a visually impaired student.

10. (i) (c) (ii) (a)

(iii) (b): Citric and tartaric acid are from organic substances such as lemon and tamarind respectively and they are edible. Hydrochloric acid though formed inside stomach is not edible. Carbonic acid is a mild acid and is edible in the form of soda water.

(iv) (b)

(v) (b)

11. (b)

12. (a)

13. (a)

14. (c): On dissociation, HCl yields more hydrogen ions for the same concentration as compared to acetic acid.

15. (c): pH of acetic acid is less than 7.

16. (a): Ammonium nitrate is a salt of ammonium hydroxide (weak base) and nitric acid (strong acid).

17. (a): For ionization of an acid or base, polar solvents (like water) are required. As ionization does not take place in non-polar solvents (like benzene) so acetic acid does not act as an acid.

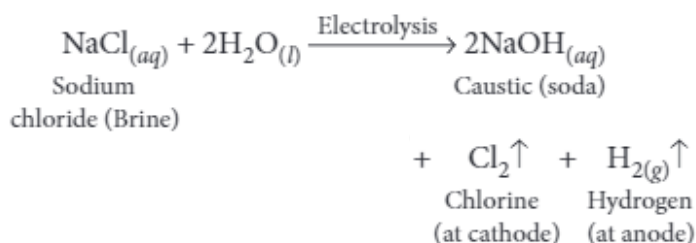
18. (b): The reaction involved is,  
 $\text{CaOCl}_2 + \text{H}_2\text{SO}_{4(\text{dilute})} \longrightarrow \text{CaSO}_4 + \text{H}_2\text{O} + \text{Cl}_2\uparrow$

19. (d): Washing soda is sodium carbonate decahydrate,  $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ .

20. (b)

21. (d):  $\text{AlCl}_3$  is an acidic salt as it is a salt of strong acid (HCl) and a weak base  $[\text{Al}(\text{OH})_3]$ .

22. (d): Caustic soda (sodium hydroxide, NaOH) is prepared by chlor-alkali process. Brine decomposes to sodium hydroxide. Chlorine gas is formed at the anode and hydrogen gas at the cathode. Sodium hydroxide solution is formed near the cathode.



23. (d):  $\text{KOH} + \text{HNO}_3 \longrightarrow \text{KNO}_3 + \text{H}_2\text{O}$   
 (Strong base) (Strong acid)

$\text{NH}_4\text{OH} + \text{HCl} \longrightarrow \text{NH}_4\text{Cl}$   
 (Weak base) (Strong acid)

24. (b): Ionization of an acid or a base increases on dilution but concentration of  $\text{H}^+$  or  $\text{OH}^-$  ions decreases per unit volume, thus strength of the acid or the base decreases with dilution.

25. (c): Higher the  $\text{H}^+$  ion concentration, lower is the pH value. The pH value less than 7 represents an acidic solution and value more than 7 represents a basic solution.

26. (b)

27. (a)

28. (b)

29. (c): The process of dissolving an acid or a base in water is highly exothermic reaction. Acid must always be added slowly to water with constant stirring.

30. (a): Phenolphthalein is a weak organic acid and may be represented as HPh.



(Colourless) (Colourless) (Pink)

In acidic medium, excess of  $\text{H}^+$  ions are present and so equilibrium is towards left and hence solution is colourless. While in basic medium,  $\text{OH}^-$  ions combine with  $\text{H}^+$  ions to form unionised water molecules and so equilibrium is towards right and hence solution has pink colour. Therefore, phenolphthalein is an acid-base indicator.