Chapter 4

# Acids, Bases and Salts

- The term acid, in fact, comes from the latin term acere, which means 'Sour'. In everyday life we come across many compounds that chemists classify as acids.
- **Common Acids are:**

| Acid | Occurrence |
|---|---|
| Tartaric acid | Grapes, tamarind, *imli*, unripe mango |
| Latic acid | Sour milk, curd |
| Formic acid | Ant's sting |
| Ascorbic acid (vitamin C) | Citrus fruits, *Amla* |
| Acetic acid | Vinegar |
| Tannic acid | Tea |
| Citric acid | Citrus fruits like orange and lemon |
| Oxalic acid | Spinach |
| Malic acid | Apple |
| Hydrochloric acid | Stomach |

- **Organic acids** are naturally occurring acids and are mostly found in plants and animals. These acids are the compounds of carbon.
- **Mineral acids or inorganic acids** are synthesised from minerals found on earth.
- **Concentrated acid :** An acid that has a relatively high percentage of the acid dissolved in the aqueous solution is classified as a concentrated acid
- **Dilute acid :** An acid, which has a relatively low percentage of the acid dissolved in the aqueous solution, is classified as a dilute acid.
- **Strong acids** give a large number of hydrogen ions or gets completely dissociated when dissolved in water. Mineral acids are generally strong acids.
- **Weak acids** give very few hydrogen ions or gets partially ionised when dissolved in water. For example, citric acid, acetic acid and formic acid.
- **Properties of acids**

  **Physical properties :**

  (i) *Acids are sour in taste* e.g. *lemon juice* is sour in taste as it contains an acid.

  (ii) Generally acids are good conductors of electricity.

  (iii) Mineral acids are corrosive in nature.

  **Chemical properties :**

  **(i) Action of metals :** Metals generally react with dilute acids to form their respective salt and hydrogen.

$$\underset{\text{Magnesium}}{Mg(s)} + \underset{\text{Hydrochloric acid}}{2HCl(aq)} \longrightarrow \underset{\text{Magnesium Chloride}}{MgCl_2(aq)} + \underset{\text{Hydrogen}}{H_2(g)}$$

  **(ii) Action with metal oxides (Basic oxides) :** The oxides that can add an hydroxyl ion ($OH^-$) to their molecules are called basic oxides. Metal oxides are generally basic oxides. These oxides get *neutralised* when they react with acids. These reactions are mostly carried upon heating e.g.

$$\underset{\text{Sodium oxide (Basic oxide)}}{Na_2O(s)} + \underset{\text{Hydrochloric acid}}{2HCl(aq)} \longrightarrow \underset{\text{Sodium Chloride}}{2NaCl(aq)} + \underset{\text{Water}}{H_2O(\ell)}$$

  **(iii) Action with metal hydroxides (Basic hydroxides) :** Acids undergo neutralization reaction with basic hydroxides (metal hydroxides) to form salt and water (i.e. neutralisation reaction)

$$\underset{\text{Pot.Hydroxide}}{2KOH(aq)} + \underset{\text{Carbonic acid}}{H_2CO_3(aq)} \longrightarrow \underset{\text{Pot.Carbonate}}{K_2CO_3(aq)} + \underset{\text{Water}}{2H_2O(\ell)}$$

  **(iv) Action with metal carbonates and metal hydrogen carbonates :** Acids react with carbonates and hydrogen carbonates to form their respective salts, water and carbondioxide gas.

$$\underset{\text{Zinc carbonate}}{ZnCO_3(s)} + \underset{\text{Sulphuric acid}}{H_2SO_4(aq)} \longrightarrow \underset{\text{Zinc sulphate}}{ZnSO_4(aq)} + \underset{\text{Water}}{H_2O(\ell)} + \underset{\text{Carbon dioxide}}{CO_2(g)}$$

- **Uses of Acids:**

  (i) In batteries of cars and invertors. Sulphuric acid is used in automobile batteries.

  (ii) In manufacture of synthetic fibres and plastics.

  (iii) In preparing dyes, detergents, glucose from starch, fertilisers, explosives, etc.

  (iv) For descaling pipes and cleaning metal surfaces and sanitary wares.

  (v) Acetic acid is used in flavouring food items like pickles.
- Bases are compounds which taste bitter example milk of magnesia. Ammonium hydroxide, or ammonia water, is very irritating to the nose and the eyes. This substance, called a hydroxide, or a base, is often used in home for cleaning.
- **Common Bases are:**

| Base | Occurrence |
|---|---|
| Sodium hydroxide | Soap |
| Calcium hydroxide | Lime water |
| Potassium hydroxide | Soap |
| Ammonium hydroxide | Window cleaning solution |
| Magnesium hydroxide | Milk of Magnesia |

- **Concentrated base :** A base that has a relatively high percentage of the base in the aqueous solution is classified as a concentrated base.
- **Dilute base :** A base, which has a relatively low percentage of the base dissolved in the aqueous solution, is classified as a dilute base.

- **Strong bases** gives a large number of hydroxide ion or gets completely ionized when dissolved in water. For example, sodium hydroxide and potassium hydroxide.
- **Weak bases** give lesser number of hydroxide ions or gets partially ionized. When dissolved in water. For example, ammonium hydroxide.
- **Properties of bases :**

  **Physical properties :**

  (i) They have a bitter taste.
  (ii) Soluble bases are good conductors of electricity.
  (iii) They are soapy liquids, slippery to touch.
  (iv) They are corrosive in nature. e.g. KOH, NaOH (caustic alkalies)

  **Chemical Properties :**

  **(i) Reaction of metals with bases :** Metals (e.g. Zn, Al, Sn) dissolve in NaOH (an alkali) to liberate hydrogen gas.

$$Zn + 2NaOH \longrightarrow \underset{\text{[Sod. Zincate]}}{Na_2ZnO_2} + H_2$$

  **(ii) Action with acids :** Bases combine with acids to form salt and water only. It is a *neutralisation reaction.*

$$3NaOH(aq) + H_3PO_4(aq) \longrightarrow \underset{\text{Trisodium phosphate}}{Na_3PO_4(aq)} + 3H_2O(l)$$

(Phosphoric acid)

- **Uses of Bases:**
  (i) Magnesium hydroxide and calcium hydroxide are used as antacid to neutralize acidity in the stomach.
  (ii) A clear solution of calcium hydroxide is known as lime water, and commonly used as laboratory reagent.
  (iii) Sodium hydroxide (caustic soda) is used in manufacturing of soap, synthetic fibres like rayon.
- Basicity of an acid does not depend upon the number of H atoms present but upon number of replaceable H atoms. For example, acetic acid ($CH_3COOH$) has four H atoms. But only one is replaced. It is monobasic in nature. Phosphoric acid ($H_3PO_4$) has three H atoms and all of them can be replaced. It is a tribasic acid.

  For acids, we use the term basicity because $H^+$ ions of the acid can be replaced only when it reacts with a base. Similarly, the term acidity is used for bases because $OH^-$ ions of the base can be replaced only when it reacts with an acid.
- When water is added to the acid or a base, it results in decrease in concentration of $H^+(H_3O^+)$ or $OH^-$ per unit volume. Such a process is known as **dilution.**
  (i) Process of dissolving acids or bases in water is exothermic.
  (ii) Care must be taken while mixing concentrated nitric acid or sulphuric acid with water. The acid must always be added to water with constant stirring. If water is added to a concentrated acid, the heat generated may cause the mixture to splash out and cause burns.
- A substance which gives different colour in acidic and basic media and helps to differentiate the two types is known as an **Indicator.** Natural indicators can be extracted from a wide variety of flowers, fruits, roots, leaves and other parts of plants
- **Litmus** (a natural dye) is one of the most common and naturally available indicator. It is extracted from lichens (combination of alga and tungus). When this litmus is added to an acidic solution, it turns red and when added to a basic solution, it turns blue.
- **Tumeric powder (*haldi*),** which is used for flavouring food is also used as an natural indicator. Turmeric (*curcuma longa*) is a rhizomatous herbaceous perennial plant of ginger family. Turmeric stains turns red when washed with soap solution (basic media).
- **China rose** is obtained from a shrubby chinese rose (*Rosa Chinesis*). China rose indicator is prepared by keeping the *gudhal* petals in warm water for some time. The solution becomes coloured after some time and acts as an indicator. China rose indicator gives brown color in acidic media and green color in basic media.
- ***Phenolphthalein*** is a synthetic indicator. It turns colorless in acidic solutions and pink in basic solutions. If the concentration of indicator is particularly strong, it can appear purple.
- ***Methyl orange*** is also a synthetic indicator used more oftenly because of clear colour change. In a solution becoming less acidic, methyl orange moves from red to orange and finally to yellow with the reverse occuring for a solution increasing in acidity.
- ***Universal indicators :*** It is a mixture of indicators often sold readymade as solution which can indicate pH values, usually over a range of 3-11, by successive changes of colour. The universal indicator show different colours at different concentrations of hydrogen ions in solution. For measurement of hydrogen ion concentration in a solution we generally use a **pH Scale.**
- **pH Scale :** It is a scale that is used for measuring $H^+$ion (Hydrogen ion) concentration of a solution.

  The term pH stands for "potential" of "hydrogen". It is the *amount of hydrogen ions in a particular solution.*

  For acids pH < 7

  For bases pH > 7

  For neutral substances pH = 7
- **Importance of pH in Daily Life**

  **(i) Blood pH :** For proper functioning our body needs to maintain blood pH between 7.35 and 7.45. Values of blood pH greater than 7.8 or less than 6.8 often results in death.

  **(ii) Acid rain :** When pH of rain water is less than 5.6, it is called acid rain. Rain containing excess of acids is called an acid rain. Rain becomes acidic when pollutants like carbon dioxide, sulphur dioxide and nitrogen dioxide are released into the atmosphere and these oxides dissolve in rain drops to form carbonic acid, sulphuric acid and nitric acid, respectively. Acid rain causes huge damage to buildings, historical monuments, especially marble structures etc.

  **(iii) pH in our digestive system :** We know that hydrochloric acid (HCl) produced in our stomach helps in digestion of food without harming stomach. However excess of acid causes indigestion and leads to pain as well as irritation. To get rid of this people use bases called "antacids". A popular antacid is "Milk of magnesia" which is insoluble magnesium hydroxide, $Mg(OH)_2$.

**(iv) pH of the soil :** For their healthy growth plants require a specific pH. Farmers use fertilisers to improve crop yield. But excessive use of fertilisers makes the soil acidic. Plants do not grow well in either too acidic or too basic soil. If the soil is too acidic, basic quick lime (calcium oxide) or slaked lime (calcium hydroxide) is added to it. If the soil is too basic, organic matters that releases acids are added to it, to neutralise basic nature of soil.

**(v) pH change as the cause of tooth decay :** Tooth decay starts when the pH of mouth is lower than 5.5. Tooth enamel, made up of calcium phosphate is the hardest substance in the body. It does not dissolve in water, but is corroded when the pH in mouth is below 5.5.

**(vi) Self defence by animals and plants through chemical warfare :** We have already learnt that bee-sting leaves an acid (formic acid or methanoic acid, HCOOH) which causes pains and irritation. To get relief from it we apply a mild base like baking soda.

- Many factories wastes are acidic in nature. If it is allowed to flow into the water bodies, it causes huge damage to water plants and animals. Therefore, all factory waste should be neutralised by adding basic substances berfore releasing into the water bodies.
- **Salts :** A **salt** is an *ionic compound* which dissociates to yield a positive ion other than hydrogen ion ($H^+$) and negative ion other than hydroxyl ion ($OH^-$) e.g.

$$\underset{\text{(fused / aqueous solution)}}{NaCl} \longrightarrow Na^+ + Cl^-$$

- **Classification of Salts**

**(i) Acidic Salt :** If a polybasic acid (Example, $H_2SO_4$, $H_3PO_4$, $H_2SO_3$ etc.) is neutralised partly by a base, the salt formed is acidic.

$$H_2CO_3 + NaOH \longrightarrow NaHCO_3 + H_2O.$$

**(ii) Normal Salt :** In case the acid and base neutralise completely the salt formed is a normal salt.

$$\underset{\text{(Carbonic acid)}}{H_2CO_3} + 2NaOH \rightarrow \underset{\text{(Normal salt)}}{Na_2CO_3} + H_2O$$

**(iii) Basic Salts :** This type of salts are formed by incomplete neutralization of a base with an acid or by partial replacement of hydroxy radicals of a diacids or triacidic base with an acid radical.

$Pb(OH)NO_3$ - Basic lead nitrate.

$$[Pb(OH)_2 + HNO_3 \longrightarrow Pb(OH)NO_3 + H_2O]$$

**(iv) Double Salt** - Such a salt is formed by mixing saturated solution of two simple salts followed by crystallisation of the saturated solution.

**Example :** $FeSO_4(NH_4)_2SO_4.6H_2O$ — Mohr's salt – it is a mixture of $FeSO_4$ (Simple salt) and $(NH_4)_2SO_4$ (Simple salt)

**(v) Complex salt** - Such a salt is formed by mixing saturated solution of simple salts followed by crystallisation of the solution similar to double salts.

Potassium mercuric iodide - $K_2[HgI_4]$

Simple ion - $K^+$

Complex ion - $[HgI_4]^{2-}$

- **Sodium hydroxide (NaOH) or Caustic soda :** It is prepared on commercial scale by the electrolysis of strong solution of sodium chloride (NaCl) also called **brine.** The process is called **chlor-alkali process.**

The overall reaction taking place is :

$$2NaCl\,(aq) + 2\,H_2O(\ell) \longrightarrow H_2(g) + Cl_2(g) + 2NaOH\,(aq)$$

Chlorine gas is given off at the anode, and hydrogen gas at the cathode. Sodium hydroxide solution is formed near the cathode.

**Uses :**

(i) Sodium hydroxide is most used base in the laboratory.

(ii) It is used in many industries, mostly as strong chemical base in manufacture of pulp and paper, textiles, drinking water, soap and detergents etc.

(iii) It is used as a *drain cleaner.*

- **Baking soda, sodium hydrogen carbonate, ($NaHCO_3$) :** It is produced using sodium chloride as one of the raw materials.

$$NaCl + H_2O + CO_2 + NH_3 \longrightarrow NH_4Cl + NaHCO_3$$

When heated the following reaction occurs

$$2\,NaHCO_3 \xrightarrow{\text{heat}} Na_2CO_3 + H_2O + CO_2$$

**Uses :**

**(i) In baking powder :** The most practical use of baking soda is as a *leavening agent in baking.* In combination with a liquid and an acid, baking soda undergoes a chemical reaction that releases bubbles of carbon dioxide. Trapped in butter these carbon dioxide bubbles enable the baked food to rise.

**(ii) As an antacid :** The cause of acidity is presence of excess HCl in stomach. Baking soda reacts with acid due to its alkaline nature and neutralizes acidity (i.e. acts as an antacid).

$$NaHCO_3 + HCl \longrightarrow NaCl + H_2O + CO_2$$

**(iii) In fire extinguishers :** It is used in *soda-acid fire exinguisher:* In soda acid fire extinguishers, $CO_2$, formed by the action of $H_2SO_4$ on baking soda, expells water from the fire extinguisher which exinguishes the fire.

- During summer, the milkmen usually add a very small amount of baking soda to fresh milk. It acts as a preservative. Actually in hot weather milk is expected to decompose and release lactic acid which is likely to make milk sour. Baking soda ($NaHCO_3$) reacts with acid to form salt and water. In this way it neutralises the acid and the milk does not become sour.
- **Washing soda, $Na_2CO_3.10H_2O$, Sodium carbonate :** Sodium carbonate can be obtained by heating baking soda; recrystallisation of sodium carbonate gives washing soda. It is also a basic salt.

$$Na_2CO_3 + 10H_2O \longrightarrow Na_2CO_3 \cdot 10H_2O$$

Sodium carbonate — Hydrated sodium carbonate (Washing soda),

**Uses :**

(i) Sodium carbonate (washing soda) is used in glass, soap and paper industries.

(ii) It is used in the manufacture of sodium compounds such as borax.

(iii) It is used for removing permanent hardness of water.

- **Bleaching powder :** Calcium hypochlorite is a chemical compound with formula $CaOCl_2$. It is a yellowish powder with smell of chlorine. It is widely used for water treatment and as a bleaching agent (bleaching powder). It is a yellow white solid which has a strong smell of chlorine.

  **Manufacture of bleaching powder :** It is manufactured by the following method.

  $$2Ca(OH)_2 + 2Cl_2 \longrightarrow CaOCl_2 + CaCl_2 + 2H_2O$$

  **Uses:**

  (i) Calcium hypochlorite is used for the disinfection of drinking water or swimming pool water.

  (ii) Calcium hypochlorite (known as 'bleaching powder') is also used for bleaching cotton and linen and used in the manufacture of chloroform.

- **Plaster of Paris, $CaSO_4$ .1/2 $H_2O$ :** It can be obtained by heating gypsum $(CaSO_4.2H_2O)$ i.e. by calcination of gypsum.

  $$(CaSO_4.2H_2O) + \text{heat} \longrightarrow (CaSO_4.\frac{1}{2}H_2O) + \frac{1}{2}H_2O$$

  Plaster of paris is a white powder and on mixing with water it changes to gypsum once again giving a hard solid mass.

  $$CaSO_4 + 2H_2O \rightarrow CaSO_4.2H_2O.$$

  **Uses :** It is used

  (i) for interior decoration. As a false ceiling, studio sets etc.

  (ii) for making moulds or casts for toys, pottery, cermics etc.

  (iii) in surgical bandages for setting fractured bones.

  (iv) in setting up of air-tight apparatus by sealing the gaps.

- Plaster of Paris must be always stored in air-tight bags. In case moisture is present, it will slowly change into gypsum which is very hard. This means that it will no longer be useful either for setting fractured bones or in making moulds.
- **Hygroscopy :** The property of a substance to absorb moisture when exposed to atmosphere at ordinary temperature but do not dissolve in it is known as **hygroscopy** and such a substance is known as hygroscopic substance e.g. Anhydrous calcium chloride ($CaCl_2$), Conc.$H_2SO_4$, phosphorous pentoxide ($P_2O_5$), quick lime (CaO) etc.
- Aqua regia consists of 3 parts HCl to 1 part $HNO_3$ ,it is an Excellent oxidant ,Can dissolve gold and platinum ,it produces yellow fumes from the reaction of HCl and $HNO_3$ to produce nitrosyl chloride, NOCl, chlorine gas, $Cl_2$, and water, $H_2O$.

# Exercise 1

**DIRECTIONS :** This section contains multiple choice questions. Each question has 4 choices (1), (2), (3) and (4) out of which only one is correct.

1. Ammonium hydroxide is a weak base because
   (1) it has low vapour pressure
   (2) it is only slightly ionised
   (3) it is not a hydroxide of any metal
   (4) it has low density
2. On passing excess of carbon dioxide through lime water
   (1) milkiness of lime water increases
   (2) there is no change in milkiness of lime water
   (3) milkiness of lime water disappears
   (4) None of the above is correct.
3. HCl gas changes the colour of
   (1) dry litmus paper
   (2) wet litmus paper
   (3) Both dry and wet litmus paper
   (4) None of the above is correct
4. Which of the following is an alkali ?
   (1) $Ca(OH)_2$ (2) KOH
   (3) $Mg(OH)_2$ (4) $CaCO_3$
5. The poisonous effect of acid present in stings of bees and ants can be neutralised by use of a solution that contains
   (1) acetic acid (2) formic acid
   (3) sodium hydroxide (4) sodium chloride.
6. When the stopper of a bottle containing colourless liquid was removed, the bottle gave smell like that of vinegar. The liquid in the bottle could be
   (1) hydrochloric acid
   (2) sodium hydroxide solution
   (3) acetic acid solution
   (4) saturated sodium hydrogen carbonate solution
7. The colour of pH paper when put in distilled water changed to green. Now some common salt is added to water and pH paper is tested in this solution. The colour of pH paper in this case is likely to be
   (1) green (2) yellow
   (3) red (4) blue
8. A drop of liquid sample was put on pH paper. The colour of pH paper turned blue. The liquid sample could be
   (1) lemon juice
   (2) hydrochloric acid
   (3) sodium hydrogen carbonate
   (4) ethanoic acid.
9. Which of the following is not required to find the pH of a given sample ?
   (1) pH paper (2) Litmus paper
   (3) Universal indicator (4) Standard pH chart
10. Universal indicator solution is named as such because
    (1) it is available universally
    (2) it has a universal appearance
    (3) it can be used for entire pH range
    (4) All the above are correct

11. The pH of gastric juice that is released during digestion is
(1) more than 7 (2) 7
(3) less then 7 (4) can't be predicted

12. Acids and bases are important because of
(1) their use in industry
(2) their effects on human health
(3) their effect on farmer's crop
(4) All the above are correct.

13. Which of the following is a weak base ?
(1) NaOH (2) KOH
(3) $NH_4OH$ (4) None of these

14. A salt derived from strong acid and weak base will dissolve in water to give a solution which is
(1) acidic (2) basic
(3) neutral (4) None of these

15. Plaster of Paris is made from
(1) lime stone (2) slaked lime
(3) quick lime (4) gypsum

16. Chemical formula of baking soda is
(1) $MgSO_4$ (2) $Na_2CO_3$
(3) $NaHCO_3$ (4) $MgCO_3$

17. Washing soda has the formula
(1) $Na_2CO_3.7H_2O$ (2) $Na_2CO_3.10H_2O$
(3) $Na_2CO_3.H_2O$ (4) $Na_2CO_3$

18. Plaster of Paris hardens by
(1) giving of $CO_2$
(2) changing into $CaCO_3$
(3) combining with water
(4) giving out water

19. Which of the following is 'quicklime'?
(1) CaO (2) $Ca(OH)_2$
(3) $CaCO_3$ (4) $CaCl_2.6H_2O$

20. Plaster of Paris has the formula
(1) $CaSO_4.1/2H_2O$ (2) $CaSO_4.H_2O$
(3) $CaSO_4.1.1/2H_2O$ (4) $CaSO_4.2H_2O$

21. Which of the following compounds is neutral to litmus ?
(1) $NaNO_3$ (2) $CuSO_4.5H_2O$
(3) $NaHCO_3$ (4) $Ca(OH)_2$

22. The pH is less than 7 of the solution of
(1) $FeCl_3$ (2) NaCN
(3) NaOH (4) NaCl

23. A compound whose aqueous solution will have the highest pH—
(1) NaCl (2) $Na_2CO_3$
(3) $NH_4Cl$ (4) $NaHCO_3$

24. If pH of A, B, C and D are 9.5, 2.5, 3.5 and 5.5 respectively, then strongest acid is
(1) A (2) C
(3) D (4) B

25. Aqueous solution of which of the following salt will change the colour of red litmus to blue?
(1) $Na_2CO_3$ (2) $Na_2CO_3.10H_2O$
(3) Both of these (4) None of these

26. If the tartaric acid is not added in baking powder, sometimes the cake has a bitter taste. This bitter taste is due to which of the following compounds present in cake?
(1) $NaHCO_3$ (2) $Na_2CO_3$
(3) $CO_2$ (4) All of these

27. Which of the following is known as dead burnt plaster?
(1) Quick lime (2) Slaked lime
(3) Lime stone (4) Gypsum

28. Select the reaction that is called *'slaking of lime'*
(1) $CaCO_3 \longrightarrow CaO + CO_2$
(2) $CaO + 2HCl \longrightarrow CaCl_2 + H_2O$
(3) $CaCO_3 + H_2O \longrightarrow Ca(OH)_2 + CO_2$
(4) $CaO + H_2O \longrightarrow Ca(OH)_2$

29. Which of the following pairs of substances are chemically same?
(1) Lime water and milk of lime
(2) Dead burnt plaster and gypsum
(3) Both the above
(4) None of the above is correct

30. Baking powder is
(1) a mixture (2) a compound
(3) an element (4) a salt

31. The chemical name of bleaching powder is
(1) calcium chloride (2) calcium oxychloride
(3) calcium chloroxide (4) none of these

32. Which of the following is not a hydrated salt?
(1) Blue vitriol (2) Baking soda
(3) Washing soda (4) Epsom salt

33. Select the one that does not give $CO_2(g)$ when treated with dil $H_2SO_4$.
(1) Marble (2) Lime stone
(3) Lime (4) Baking soda

34. When HCl (g) is passed through water, it
(1) does not ionise in solution
(2) ionises in solution
(3) gives both hydrogen ions and hydroxyl ions in solution.
(4) None of the above is correct

35. Which of the following indicators is colourless in acidic medium?
(1) Methyl orange (2) Turmeric powder
(3) Litmus (4) Phenolphthalein

36. An indicator that turns reddish-brown when dissolved in soap solution is
(1) litmus (2) china rose
(3) turmeric powder (4) None of these

37. Which of the following is a strong acid:
(1) Acetic acid (2) Citric acid
(3) Nitric acid (4) Tartaric acid

38. The presence of which of the following acid causes indigestion:
(1) Citric acid (2) Oxalic acid
(3) Acetic acid (4) Hydrochloric acid

39. When few drops of lemon are mixed with milk
(i) it turns sour
(ii) no change takes place
(iii) properties of milk are changed
(iv) properties of milk remain same
Which of the above statements is/are correct?
(1) (ii) & (iii) (2) (i) & (ii)
(3) (i) & (iii) (4) (i) only

40. Which of the following is a strong base?
(1) Ammonium hydroxide ($NH_4OH$)
(2) Sodium hydroxide (NaOH)
(3) Water ($H_2O$)
(4) Sulfuric acid ($H_2SO_4$)

41. Acids are ..... in taste while bases are ..... in taste
(1) sweet, salty (2) sweet, sour
(3) sour, salty (4) sour, bitter

42. A base which dissolves in water is called
(1) soluble base (2) alkali
(3) acid (4) oxide

43. Choose the correct statement(s)
(i) Most of the acids are water soluble
(ii) Acids react with metallic oxides and hydroxides to form metallic salt and water only.
(iii) Acids react with metallic carbonates to form metallic salt and hydrogen gas and water
(iv) Acetic acid is used as a food preservative
(1) (i) & (ii) only (2) (iii) & (iv)
(3) (i), (ii) & (iv) (4) all the above

44. Acid rain is caused due to .....
(1) $CO_2, O_2, SO_2$ (2) $CO_2, NO_2, H_2$
(3) $SO_2\ N_2, O_2$ (4) $CO_2, SO_2, NO_2$

45. The acidic soil which is not good for healthy growth of plants, is neutralized by
(1) ammonium hydroxide ($NH_4OH$)
(2) calcium oxide (CaO)
(3) sodium hydroxide (NaOH)
(4) magnesium hydroxide ($Mg(OH)_2$

46. Acid contained in the sting of an ant is.....
(1) acetic acid (2) formic acid
(3) lactic acid (4) ascorbic acid

47. Natural indicator litmus is extracted from
(1) lichens (2) earthworms
(3) ants (4) algae

48. The industrial waste is ..... in nature
(1) acidic (2) basic
(3) neutral (4) both (1) & (2)

49. When vinegar reacts with baking soda the gas evolved is
(1) hydrogen (2) oxygen
(3) carbon dioxide (4) nitrogen dioxide

50. When magnesium oxide (MgO) reacts with water to form magnesium hydroxide [$Mg(OH)_2$], a base it turns ..... litmus to .....
(1) blue, red (2) blue, colourless
(3) red, blue (4) colourless, blue

51. While preparing copper sulphate crystals from copper sulphate solution, dilute sulphuric acid is used instead of concentrated sulphuric acid, because
(1) concentrated sulphuric acid is corrosive in nature
(2) dilute sulphuric acid makes large crystals
(3) concentrated acid is ineffective
(4) Both (1) & (2)

52. Which of the following gas is evolved on reaction of dilute hydrochloric acid with sodium sulphite?
(1) Carbon dioxide (2) Hydrogen
(3) Sulphur dioxide (4) Sulphur trioxide

53. On which of the following acid rain has adverse effects?
(1) Marble structures (2) Historical monuments
(3) Aquatic life (4) All of these

54. Which of the following is acidic salt(s)
(i) Sodium bisulphate (ii) Potasium chloride
(iii) Potassium bisulphite (iv) Sodium carbonate
(1) (i), (ii) and (iv) (2) (ii) and (iv)
(3) (i), (ii) and (iii) (4) (i) and (iii)

55. pH of human body varies within the range of
(1) 6.0 to 6.5 (2) 5.5 to 5.8
(3) 7.0 to 7.8 (4) 7.0 to 11.0

56. Calamine solution contains
(1) zinc hydroxide
(2) zinc carbonate
(3) sodium hydrogen carbonate
(4) magnesium hydroxide

57. Why bases are kept in glass bottles?
(1) Bases produce $OH^-$ ions in aqueous solutions
(2) Basic solutions are conducting in nature
(3) Bases are corrosive in nature
(4) Basis have soapy texture

58. Which of the following statement regarding bases is false?
(1) Bases produce hydroxide ions when dissolved in water
(2) Bases are soapy to touch
(3) Bases are extremly corrosive in nature
(4) Basic solutions are non conducting in nature

59. Which of the following statement is true?
(1) Acids are bitter in taste
(2) Bases are sour in taste
(3) The reaction between acid and a base is exothermic reaction
(4) The reaction between an acid and a base is endothermic reaction.

60. Which of the following statement is false?
(1) China rose is a natural indicator
(2) Repeated cultivation by farmers makes soil acidic
(3) Ant or bee sting contains acetic acid
(4) Majorly factories waste are acidic in nature

61. Which of the following is the best explanation of statement; Ammonium hydroxide is a commonly used alkali
(1) It is a weak base insoluble in water
(2) It is a weak base soluble in water
(3) It is a strong base insoluble in water
(4) It is a strong base soluble in water

62. What happens when a solution of an acid is mixed with a solution of a base in a test tube ?
(i) The temperature of the solution increases
(ii) The temperature of the solution decreases
(iii) The temperature of the solution remains the same
(iv) Salt formation takes place
(1) (i) only (2) (i) and (iii)
(3) (ii) and (iii) (4) (i) and (iv)

63. During the preparation of hydrogen chloride gas on a humid day, the gas is usually passed through the guard tube containing calcium chloride. The role of calcium chloride taken in the guard tube is to
(1) absorb the evolved gas
(2) moisten the gas
(3) absorb moisture from the gas
(4) absorb $Cl^-$ ions from the evolved gas

64. A sample of soil is mixed with water and allowed to settle. The clear supernatant solution turns the pH paper yellowish-orange. Which of the following would change the colour of this pH paper to greenish-blue?
(1) Lemon juice (2) Vinegar
(3) Common salt (4) An antacid

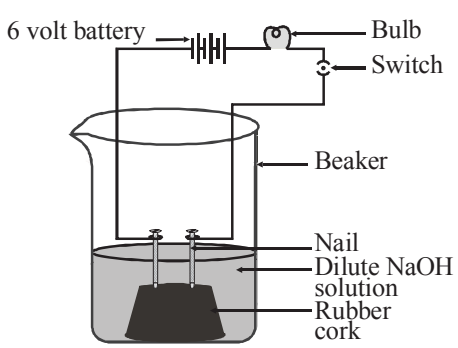
65. If a few drops of a concentrated acid accidentally spills over the hand of a student, what should be done?
(1) Wash the hand with saline solution
(2) Wash the hand immediately with plenty of water and apply a paste of sodium hydrogencarbonate
(3) After washing with plenty of water apply solution of sodium hydroxide on the hand
(4) Neutralise the acid with a strong alkali

66. Sodium hydrogencarbonate when added to acetic acid evolves a gas. Which of the following statements are true about the gas evolved?
(i) It turns lime water milky
(ii) It extinguishes a burning splinter
(iii) It dissolves in a solution of sodium hydroxide
(iv) It has a pungent odour
(1) (i) and (ii) (2) (i), (ii) and (iii)
(3) (ii), (iii) and (iv) (4) (i) and (iv)

67. Common salt besides being used in kitchen can also be used as the raw material for making
(i) washing soda (ii) bleaching powder
(iii) baking soda (iv) slaked lime
(1) (i) and (ii) (2) (i), (ii) and (iv)
(3) (i) and (iii) (4) (i), (iii) and (iv)

68. To protect tooth decay we are advised to brush our teeth regularly. The nature of the tooth paste commonly used is
(1) acidic (2) neutral
(3) basic (4) corrosive

69. In an attempt to demonstrate electrical conductivity through an electrolyte, the following apparatus (Fig.) was set up. Which among the following statement(s) is (are) correct ?
(i) Bulb will not glow because electrolyte is not acidic
(ii) Bulb will glow because NaOH is a strong base and furnishes ions for conduction.
(iii) Bulb will not glow because circuit is incomplete
(iv) Bulb will not glow because it depends upon the type of electrolytic solution




(1) (i) and (iii) (2) (ii) and (iv)
(3) (ii) only (4) (iv) only

70. Which of the following statements is not correct?
(1) All metal carbonates react with acid to give a salt, water and carbon dioxide
(2) All metal oxides react with water to give salt and acid
(3) Some metals react with acids to give salt and hydrogen
(4) Some non metal oxides react with water to form an acid

71. Which of the following is(are) true when HCl (g) is passed through water?
(i) It does not ionise in the solution as it is a covalent compound.
(ii) It ionises in the solution
(iii) It gives both hydrogen and hydroxyl ion in the solution
(iv) It forms hydronium ion in the solution due to the combination of hydrogen ion with water molecule
(1) (i) only (2) (iii) only
(3) (ii) and (iv) (4) (iii) and (iv)

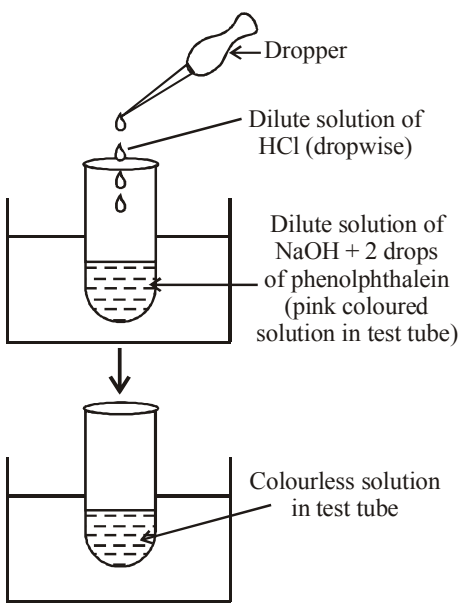
72. Identify the correct representation of reaction occurring during chloralkali process
(1) $2NaCl(l) + 2H_2O(l) \rightarrow 2NaOH(l) + Cl_2(g) + H_2(g)$
(2) $2NaCl(aq) + 2H_2O(aq) \rightarrow 2NaOH(aq) + Cl_2(g) + H_2(g)$
(3) $2NaCl(aq) + 2H_2O(l) \rightarrow 2NaOH(aq) + Cl_2(aq) + H_2(aq)$
(4) $2NaCl\ (aq) + 2H_2O\ (l) \rightarrow 2NaOH\ (aq) + Cl_2(g) + H_2(g)$

73. Which one observations is correct according to effect of acids and bases on some indicators

| | Test Sample | Red litmus | Blue litmus | Phenol-phthalein | Methyl orange |
|---|---|---|---|---|---|
| I | Dil. HCl | No effect | Turn red | No effect | Turn red |
| II | Dil $H_2SO_4$ | Turn blue | No effect | Turn pink | Turn red |
| III | $Ca(OH)_2$ | No effect | Turn red | Turn pink | Turn red |
| IV | $Mg(OH)_2$ | Turn blue | Turn red | No effect | No effect |

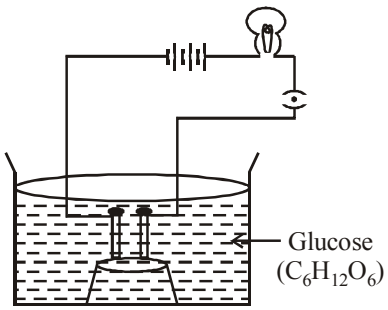
(1) I observation is correct
(2) II observation is correct
(3) III observation is correct
(4) IV observation is correct

74. Observe the experimental setup carefully

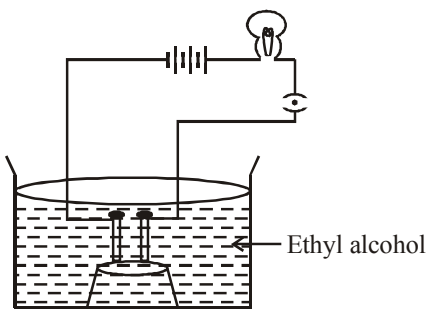



Which type of reaction is this ?
(1) Isomerisation (2) Neutralisation
(3) Saponification (4) Both (2) & (3)

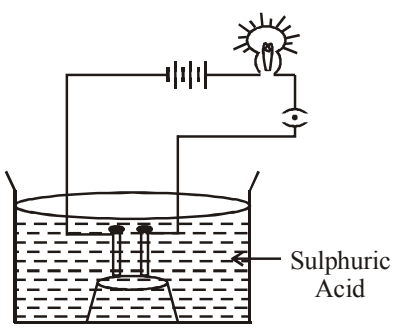
75. Carefully observe the experimental setup shown below :




(A)




(B)




(C)

The above figure indicates –

(1) Glucose is sweet in taste

(2) Ethyl alcohol gives $OH^-$ ions

(3) $H_2SO_4$ releases $H^+$ ions which is responsible for conduction of electric current

(4) Both ethyl alcohol and $H_2SO_4$ are acids.

76. When electricity is passed through an aqueous solution of sodium chloride (called brine) :

$$NaCl\,(aq) \xrightarrow{\text{electricity}} NaOH\,(aq) + X + Y$$

What is X, Y & where it will produced :

(1) $X = O_2$ at cathode $Y = Cl_2$ at anode

(2) $X = O_2$ at anode $Y = Cl_2$ at cathode

(3) $X = H_2$ at cathode $Y = Cl_2$ at anode

(4) $X = H_2$ at anode $Y = Cl_2$ at cathode

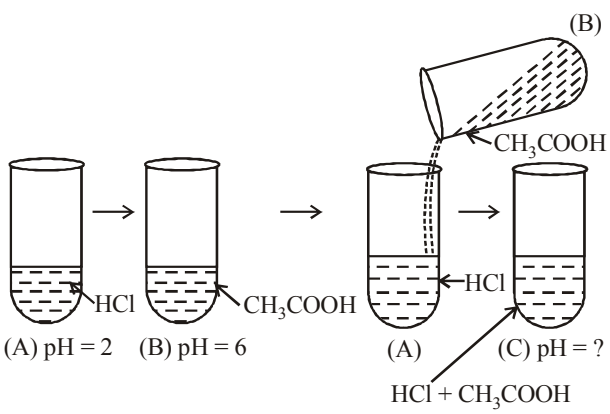
77. Which one of the combination is completely correct

| | (A) Name of contents | (B) Chemical formula | (C) Use |
|---|---|---|---|
| 1) | Lactic acid | $CH_3-\underset{\displaystyle OH}{\underset{\vert}{CH}}-COOH$ | Used as a food preservative |
| 2) | Citric acid | $C_6H_8O_7$ | Present in lemon, orange etc |
| 3) | Sulphuric acid | $H_2SO_4$ | Commonly used in automobile batteries |
| 4) | Sodium hydroxide | NaOH | Used for manufacturing of soaps |
| 5) | Potassium hydroxide | KOH | Used for manufacturing of fertilizers |

(1) 1, 4, 3 (2) 2, 3, 4

(3) 2, 4, 5 (4) 1, 3, 5

78. If we have 2 test tubes (A & B) containing HCl and $CH_3COOH$. On mixing both acids, which are having pH = 2 (HCl) and pH = 6 ($CH_3COOH$), pH of resultant solution will be




(1) The pH will be less than 2

(2) The pH will be more than 6

(3) The pH will be between 2 to 6

(4) The pH will be 7

79. What is correct for following ?

(i) Lemon Juice (ii) Solution of washing soda

(iii) Toothphaste (iv) Stomach Juices

(v) Vinegar

(1) i, iv, v are acids and ii, iii are bases

(2) ii, iii are acids i, iv, v are bases

(3) i, iii, iv, v are acids and ii is a base

(4) i, ii, iii are acids and iv, v are bases

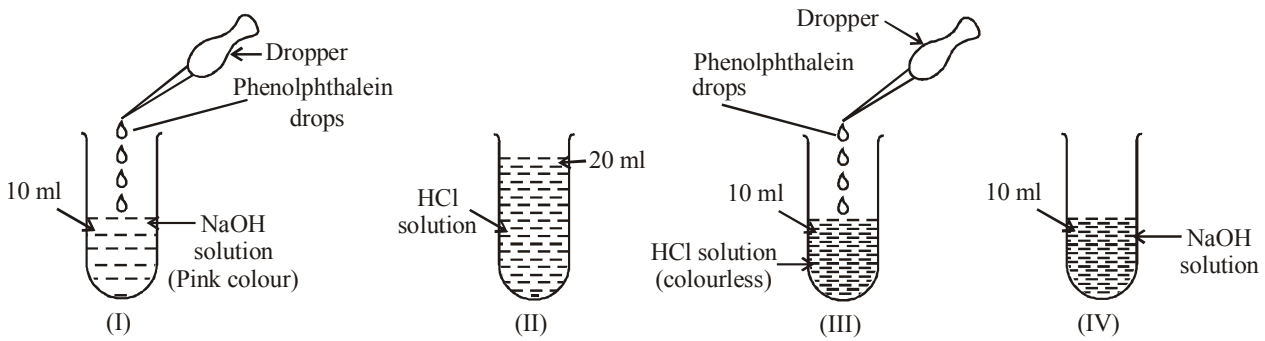
80. A student collected the samples of acids such as : hydrochloric acid, acetic acid and bases such as sodium hydroxide and magnesium hydroxide from the science laboratory. He put 10 drops of each of the above sample solution on a watch glass and tested with a 1–2 drops of the following indicators as given below; and recorded his observations :

| Sample solution | Red litmus solution | Blue litmus solution | Phenolphthalein solution | Methyl orange solution |
|---|---|---|---|---|
| A. HCl solution | No colour change | Changes to red | Colourless | Changes to red |
| B. $CH_3COOH$ solution | No colour change | Changes to red | Changes tor red | Colourless |
| C. NaOH solution | Changes to blue | No colour change | Changes to light pink | remains as it is |
| D. $Mg(OH)_2$ solution | No colour change | Changes to red | Changes to light pink | Colourless |

The correct observation is made by a student :

(1) A & B (2) A & C (3) B & C (4) B & D

81. Observe the following experimental set-up




**Statement – I :** When (I) test tube and (II) test tube containing NaOH & HCl solution respectively are mixed together completely the colour of the solution changed to colourless.

**Statement -II :** When test tube (III) & (IV) are mixed together completely, the resultant solution remains colourless.

(1) Only (I) is correct

(2) Only (II) is correct

(3) Both (I) and (II) are correct

(4) None of these

# Exercise 2

## Matching Based MCQ

**DIRECTIONS (Qs. 1 to 8) :** Match Column-I with Column-II and select the correct answer using the codes given below the columns.

1.

| | Column I | | Column II |
|---|---|---|---|
| (A) | Acetic acid | (p) | Tomato |
| (B) | Citric acid | (q) | Tamarind |
| (C) | Tartaric acid | (r) | Orange |
| (D) | Oxalic acid | (s) | Vinegar |
| (E) | Lactic acid | (t) | Milk |

(1) A → (s); B → (r); C → (q); D → (p); E → (t)

(2) A → (r); B → (s); C → (q); D → (t); E → (p)

(3) A → (s); B → (r); C → (p); D → (q); E → (t)

(4) A → (s); B → (q); C → (r); D → (p); E → (t)

2.

| | Column I | | Column II |
|---|---|---|---|
| (A) | HCl | (p) | strong acid |
| (B) | HCN | (q) | weak acid |
| (C) | NaOH | (r) | weak base |
| (D) | $NH_4OH$ | (s) | strong base |
| (E) | Distilled water | (t) | neutral |

(1) A → (s); B → (r); C → (q); D → (p); E → (t)

(2) A → (p); B → (q); C → (s); D → (r); E → (t)

(3) A → (s); B → (r); C → (p); D → (q); E → (t)

(4) A → (s); B → (q); C → (r); D → (p); E → (t)

3.

| | Column I | | Column II |
|---|---|---|---|
| (A) | $KNO_3$ | (p) | Nitric acid silver hydroxide |
| (B) | $AgNO_3$ | (q) | Hydrochloric acid, Magnesium hydroxide |
| (C) | $MgCl_2$ | (r) | Carbonic acid, Ammonium hydroxide |
| (D) | $(NH_4)_2CO_3$ | (s) | Nitric acid, potassium hydroxide |
| (E) | NaCl | (t) | Hydrochloric acid and sodium hydroxide |

(1) A → (s); B → (r); C → (q); D → (p); E → (t)

(2) A → (p); B → (q); C → (s); D → (r); E → (t)

(3) A → (s); B → (r); C → (p); D → (q); E → (t)

(4) A → (s); B → (p); C → (q); D → (r); E → (t)

4. **List-I (Chemical)** **List-II (Formula)**
(A) Quick lime (p) $NaHCO_3$
(B) Caustic Soda (q) $Na_2CO_3$
(C) Washing Soda (r) NaOH
(D) Baking Soda (s) CaO
(1) A → (s), B → (r), C → (q), D → (p)
(2) A → (r), B → (s), C → (p), D → (q)
(3) A → (p), B → (r), C → (q), D → (s)
(4) A → (s), B → (p), C → (r), D → (p)

5. **Column -I** **Column -II**
(A) Bleaching powder (p) Constituent of glass
(B) Baking soda (q) Production of $H_2$ and $Cl_2$
(C) Borax (r) Decolourisation
(D) Sodium chloride (s) Antacid
(1) A → (q), B → (p), C → (s), D → (r)
(2) A → (r), B → (q), C → (s), D → (p)
(3) A → (r), B → (s), C → (p), D → (q)
(4) A → (q), B → (s), C → (p), D → (r)

6. **Column -I** **Column -II**
(1) Plaster of Paris (p) $Ca(OH)_2$
(2) Gypsum (q) $CaSO_4.1/2\,H_2O$
(3) Bleaching Powder (r) $CaSO_4.2H_2O$
(4) Lime Water (s) $CaOCl_2$
(1) A → (q), B → (r), C → (s), D → (p)
(2) A → (s), B → (q), C → (r), D → (p)
(3) A → (p), B → (s), C → (r), D → (q)
(4) A → (q), B → (r), C → (p), D → (s)

7. **Column -I** **Column -II**
(A) $H_2SO_4$ (*aq*) (p) turns red litmus blue
(B) NaOH (*aq*) (q) turns blue litmus red
(C) $CuSO_4.5H_2O$ (*aq*) (r) turns phenolphthalein pink
(D) $Na_2CO_3$ (*aq*) (s) pH paper becomes red
(E) $NaNO_3$(*aq*) (t) pH paper becomes blue
(v) pH paper becomes green
(1) A → (q, s); B → (p, r, t); C → (q, s); D → (p, r, t); E (v)
(2) A → (q, v); B → (p, r); C → (q, s); D → (t, r); E (s)
(3) A → (q, s); B → (p, r, t); C → (q, s); D → (p, r); E (v)
(4) A → (s); B → (p, q, t); C → (r, s); D → (p, r, t); E (v)

8. **Column-I** **Column-II**
(A) Caustic soda (p) Manufacture of antacid
(B) Sulphuric acid (q) Preservation of food
(C) Calcium hydroxide (r) Manufacturing of soap
(D) Acetic acid (s) Automobile batteries
(1) A – (r); B – (s); C – (p); D – (q)
(2) A – (q); B – (s); C – (p); D – (r)
(3) A – (r); B – (p); C – (s); D – (q)
(4) A – (s); B – (r); C – (p); D – (q)

## Statement Based MCQ

9. Consider the following statements :
(a) Whether water acts as an acid or as a base depends on the other species present.
(b) Every liquid is either an acid or a base.
Which of these statement(s) is/are correct ?
(1) (a) only (2) (b) only
(3) Both (a) and (b) (4) Neither (a) nor (b)

10. Consider the following statements :
(a) The hydronium ion ($H_3O^+$) is the strongest acid that can exist in aqueous solution.
(b) Mixing concentrated acid or bases with water is a highly endothermic reaction.
Which of these statement(s) is/are correct ?
(1) (a) only (2) (b) only
(3) Both (a) and (b) (4) Neither (a) nor (b)

11. Consider the following statements :
(a) Bee stings contain ethanoic acid.
(b) The white enamel on our teeth is made up of calcium sulphate.
(c) Acidic nature of a substance is due to the formation of $H^+$(aq) ions in solution.
Which of these statement(s) is/are correct ?
(1) (a) and (b) (2) (a) and (c)
(3) Only (c) (4) Only (b)

12. Consider the following statements :
(a) Living beings carry out their metabolic activities with in an optimal pH range.
(b) There are a variety of strengths when you study acids and base.
Which of these statement(s) is/are correct ?
(1) (a) only (2) (b) only
(3) Both (a) and (b) (4) Neither (a) nor (b)

13. Consider the following statements :
(a) Washing soda on strong heating gives sodium oxide and carbon dioxide.
(b) Plaster of Paris is obtained by heating gypsum at 373 K.
(c) Bleaching powder is used for disinfecting drinking water.
Which of these statement(s) is/are correct ?
(1) (a) and (b) (2) (b) and (c)
(3) (a) and (c) (4) All are correct

14. Consider the following statements :
(a) Hydrogen chloride gas turns the red litmus blue.
(b) Lactic acid is one of the mineral acids.
(c) Milk of magnesia is a type of milk.
Which of these statement(s) is/are correct ?
(1) (a) and (b) (2) (a) and (c)
(3) All are correct (4) All are incorrect

15. Consider the following statements :
(a) Solution of sodium hydrogen carbonate is alkaline in nature.
(b) Sodium hydrogen carbonate is used in fire extinguisher.
Which of these statement(s) is/are correct ?
(1) (a) only (2) (b) only
(3) Both (a) and (b) (4) Neither (a) nor (b)

16. Consider the following statements :
(a) When a base reacts with a metal, along with the evolution of hydrogen gas a salt is formed which has a positive ion composed of the metal and oxygen.
(b) Acidic and basic solution in water conduct electricity because they produce hydrogen and hydroxide ions respectively.
(c) Acids and bases neutralise each other to form corresponding salts and water.
Which of these statement(s) is/are correct ?
(1) (a) and (b) (2) (b) and (c)
(3) (a) and (c) (4) All are correct

17. Consider the following statements :
(a) We can determine the pH of a solution using a litmus paper.
(b) The colour of caustic soda solution turns pink when phenolphthalein is added.
Which of these statement(s) is/are correct ?
(1) (a) only (2) (b) only
(3) Both (a) and (b) (4) Neither (a) nor (b)

18. Consider the following statements :
(a) Tamarind contains tartaric acid.
(b) Guava contains citric acid.
(c) amla is rich source of vitamin B.
Which of these statement(s) is/are correct ?
(1) (a) and (c) (2) (a) and (b)
(3) (b) and (c) (4) All are correct

## Passage Based MCQ

**DIRECTIONS (Qs. 19 to 33) :** Read the passage(s) given below and answer the questions that follow.

### PASSAGE - 1

The strength of an acid depends on the concentration of the hydronium ions present in a solution. Greater the number of hydronium ion present. Greater is the strength of acid. However some acids do not dissociate to any appreciable extent in water. Therefore these acids will have a low concentration of hydronium ions. Those acids which dissociate to give two or more than two hydronium are called polybasic acids.

19. Which of the following is not the characteristics of an acid?
(1) Turns blue litmus to red.
(2) Turns phenolpthalein pink from colourless.
(3) Decompose carbonates
(4) Oxy compounds of non-metals.

20. Strength of an acid can be explained on the basis of
(1) its concentration in solution
(2) its degree of ionisation
(3) (1) and (2) both required
(4) it is an inherent property of acid.

21. The basicity of phosphorous acid (polybasic) is -
(1) 1 (2) 2
(3) 3 (4) 4

### PASSAGE - 2

If chlorine is passed for a considerable time over solid **slaked lime** , the product formed is bleaching power. Bleaching powder is represented as $CaOCl_2$,

$$Ca(OH)_2 + Cl_2 \longrightarrow CaOCl_2 + H_2O$$

It has greater available chlorine than sodium hypochlorite, NaClO (liquid bleach). It contains about 36% of available chlorine.

Bleaching powder deteriorates if left in contact with the air and smells of chlorine because of action of $CO_2$ in atmosphere.

It is widely used as a bleaching agent for bleaching clothes. It is used for disinfection of drinking water or swimming pool water. For use in outdoor swimming pools, $CaOCl_2$ can be used as a sanitizer in combination, with cyanuric acid stabilizer. Two stabilizer will reduce the loss of chlorine because of u.v. radiation.

22. How is bleaching powder prepared ?
(1) Reaction of $Cl_2$ with $Ca(OH)_2$
(2) Reaction of $Cl_2$ with CaO
(3) Reaction of Ca with HOCl
(4) Reaction of Ca with $Cl_2/H_2O$

23. How much amount of available chlorine is present in bleaching powder ?
(1) 32% (2) 36%
(3) 35% (4) 38%

24. Why bleaching powder smells of chlorine ?
(1) by action of $H_2O$ in atmosphere on bleaching powder
(2) by action of $O_2$ in atmosphere on bleaching powder
(3) by action of $SO_2$ in atmosphere on bleaching powder
(4) by action of $CO_2$ in atmosphere on bleaching powder

### PASSAGE - 3

Types of salts. There are three types of salts.

(i) Neutral salts are those salts which when dissolved in water form a neutral solution. These are formed by the reaction of strong acids with strong bases. Sodium chloride (NaCl) and sodium sulphate ($Na_2SO_4$) are two examples of neutral salt. The solutions of a neutral salt has no effect on litmus.

(ii) Acidic salts are those salts which when dissolved in water form an acidic solution. These are formed by the neutralisation reaction of a strong acid with a weak base. The solution of an acidic salt turns blue litmus to red. Two examples of acidic salts are ammonium chloride ($NH_4Cl$) and ammonium sulphate $(NH_4)_2SO_4$.

(iii) Basic salts are those salts which when dissolved in water form a basic solution. These are formed by the neutralisation reaction of a weak acid with a strong base. The solution of a basic salt turns red litmus to blue. Two examples of basic salts are sodium carbonate ($Na_2CO_3$) and sodium hydrogen carbonate ($NaHCO_3$).

25. Common salt (NaCl) is
(1) normal salt (2) acidic salt
(3) basic salt (4) None of these

26. Which of the following is an acidic salt?
(1) $ZnSO_4$ (2) $Zn(NO_3)_2$
(3) NaCl (4) $NaHSO_4$

27. Which of the following is a basic salt?
(1) $MgCl_2$ (2) NaCl
(3) Pb(OH)Cl (4) $CaCl_2$

28.

| | **Column I** **Name of salt** | | **Column II** **Nature of the salt** |
|---|---|---|---|
| (A) | Sodium carbonate ($NaHCO_3$) | (p) | Basic |
| (B) | Sodium sulphate ($Na_2SO_4$) | (q) | Neutral |
| (C) | Ammonium sulphate $(NH_4)_2SO_4$ | (r) | Acidic |

(1) A – (p), B – (q), C – (r)
(2) A – (r), B – (q), C – (p)
(3) A – (q), B – (p), C – (r)
(4) A – (p), B – (r), C – (q)

**PASSAGE - 4**

Three different substances were taken and tested with litmus paper. The results are given below. Based on the results answer the questions 29 to 33.

| Type of Litmus | X | Y | Z |
|---|---|---|---|
| Red litmus | turns blue | no change | no change |
| Blue litmus | no change | turns red | no change |

29. What could be the substance X?
(1) An acid (2) A base
(3) Water (4) Salt

30. What could be the substance Y?
(1) An acid (2) A base
(3) Water (4) Salt

31. What could be the substance Z?
(1) Water (2) Salt
(3) Either A or B (4) Either an acid or a base

32. How can you obtain the substance Z?
(1) By the reaction of X and Y
(2) By dissolving X in water
(3) By dissolving Y in water
(4) Cannot be said

33. How will the substance X behave with phenolphthalein?
(1) It turns pink (2) It remains colourless
(3) It turns blue (4) It turns red

## Assertion Reason Based MCQ

**DIRECTIONS (Qs. 34 to 43) :** Following questions consist of two statements, one labelled as the **'Assertion'** and the other as **'Reason'**. You are to examine these two statements carefully and select the answer to these items using the code given below.

**Code :**

(1) Both A and R are individually true and R is the correct explanation of A:

(2) Both A and R are individually true but R is not the correct explanation of A.

(3) A is true but R is false

(4) A is false but R is true.

34. **Assertion :** Acetic acid is weak acid
**Reason :** Acetic acid gets partially ionized in aqueous solutions

35. **Assertion :** Formic acid is present in Ant's sting.
**Reason :** The portion of body where ant bite is nibbed with dry baking soda.

36. **Assertion :** Many factories wastes are acidic in nature
**Reason :** Generally bases are added to all factory wastes before discharging into the water bodies

37. **Assertion :** Tooth decay starts when the pH in the mouth is below 5.5.
**Reason :** The strength of an acid or an alkali is measured by a scale called the pH scale.

38. **Assertion :** In an acidic solution, the indicator phenolphthalein remains colourless.
**Reason :** Phenolphthalein is an acid base indicator.

39. **Assertion :** Concentrated sulphuric acid can be diluted by adding water dropwise to acid.
**Reason :** Concentrated sulphuric acid has a strong affinity for water.

40. **Assertion :** An aqueous solution of $Na_2CO_3$ is basic in nature.
**Reason :** In aqueous solution, $Na_2CO_3$ gives $Na^+$ ions which behave as base.

41. **Assertion :** A solution of $NH_3$ in water turns blue litmus red.
**Reason :** In water, ammonia forms $NH_4OH$ which dissociates to give $NH_4^+$ and $OH^-$ ions.

42. **Assertion :** In summer season, a milk man adds a very small amount of baking soda to fresh milk.
**Reason :** Sodium hydrogen carbonate ($NaHCO_3$) present in baking soda neutralises lactic acid formed in the milk.

43. **Assertion** : $H_3PO_4$ and $H_2SO_4$ are strong acids.
**Reason** : They ionises completely in a aqueous solution to give $H^+$ ions.

## Correct Definition Based MCQ

44. Which of the following is correct definition of Indicators?
(1) Indicators are substances used to determine the acidic or basic nature of a particular substance as they change their physical state in different media
(2) Indicators are substances used to determine the acidic or basic nature of a particular substance as they change their color in different media.
(3) Indicators are substances used to determine exact pH of particular substance.
(4) Indicators are substances obtained by plants used to determine acidic or basic nature of a particular substance.

45. Which of the following is correct definition of neutral substances?
(1) The substances which are amphoteric in nature
(2) The substances which are neither acidic nor basic in nature
(3) The substances obtained by neutralisation reaction between acid and base
(4) The substances which are only slightly acidic in nature.

46. Which of the following is correct definition of strong bases?
(1) They give only small number of hydroxide ions when dissolved in water
(2) They give large number of hydrogen ions when dissolved in water
(3) They give large number of hydroxide ions when dissolved in water
(4) They give small number of hydrogen ions when dissolved in water

47. Which of the following is correct definition of Aqua regia?
(1) It is a mixture of three parts hydrochloric acid and one part nitric acid
(2) It is a mixture of three parts nitric acid and one part hydrochloric acid
(3) It is a mixture of three parts sulphuric acid and one part hydrochloric acid
(4) It is a mixture of three parts hydrochloric acid and one part sulphuric acid

## Feature Based MCQ

48. On the basis of following features identify the correct group of materials
(I) They are corrosive in nature
(II) They have wide industrial applications
(III) They have sour toste
(IV) They furnish hydrogen or hydronium ions in aqueous solutions
(1) Acids (2) Bases
(3) Salts (4) Metals

49. On the basis of following features identify the correct substance
(I) It is sour in taste
(II) It occurs in vinegar solution
(III) It is used in food items like pickles, jams, sauces etc
(1) Formic acid (2) Acetic acid
(3) Lactic acid (4) Tartaric acid

50. On the basis of following features identify the correct substance
(I) It is sour in taste
(II) It occurs naturally in grapes, tamarind etc.
(III) It is a constituent of baking powder.
(1) Formic acid (2) Acetic acid
(3) Lactic acid (4) Tartaric acid

51. On the basis of following featues identify the correct base
(I) It is non metal containing compound.
(II) It ionized only partially in aqueous solution
(1) $B(OH)_3$ (2) $NH_4OH$
(3) NaOH (4) $Ba(OH)_2$

# Hints & SOLUTIONS

## Exercise 1

**1. (2)** **2. (3)** **3. (2)**
**4. (2)** Alkali is a base which are water soluble.
**5. (3)** Sodium hydroxide being a base neturalises the acid.
**6. (3)**
**7. (1)** NaCl solution in water is neutral i.e., pH = 7, the same as that of distilled water as NaCl is a salt of strong acid and strong base.
**8. (3)** The blue colour of pH paper indicates basic nature of solution. Only sodium hydrogen carbonate solution show basic nature, all others are acidic.
**9. (2)** Litmus paper does not give any information about the pH values.
**10. (3)** It can be for entire pH range.
**11. (3)** Gastric juice is acidic.
**12. (4)**
**13. (3)** $NH_4OH$ as it is not get completely ionized in aqueous solution.
**14. (1)** **15. (4)** **16. (3)** **17. (2)**
**18. (3)** **19. (1)** **20. (1)**
**21. (1)** $NaNO_3$ as it is a salt of strong acid and strong base. $Ca(OH)_2$ is a base $CuSO_4.5H_2O$ is a salt of weak base and strong acid while $NaHCO_3$ is a salt of strong base and weak acid so they all effects litmus.
**22. (1)**
**23. (2)** $Na_2CO_3$ when react with water form strong base and weak acid. So its aqueous solution is highly basic and thus it has highest pH.
**24. (4)** Less the pH, more acidic is the solution. The pH of acid B is 2.5 which is minimum.
**25. (3)** **26. (2)** **27. (2)** **28. (4)**
**29. (1)** **30. (1)** **31. (2)** **32. (2)**
**33. (3)**
**34. (2)** It gives $H^+$ ions which combine with water to produce $H_3O^+$ ions and $Cl^-$ ions
**35. (4)** Phenolphthalein gives color in basic media. It gives pink colour.
**36. (3)**
**37. (3)** As $HNO_3$ is a mineral acid.
**38. (4)**
**39. (3)** When lemon juice is mixed with milk the milk turns sour and changes into 'paneer'. The properties of milk are completely different from that of 'paneer'.
**40. (2)** Sodium hydroxide (NaOH) is a strong base while ammonium hydroxide ($NH_4OH$) is a weak base. Water is neutral in nature, neither acidic nor basic.
**41. (4)** All acids are sour in taste, like tartaric acid in tamarind and acetic acid in vinegar while all bases are bitter in taste like baking soda.
**42. (2)** Bases soluble in water are called alkalis. Only the oxides of sodium, potassium, and calcium are soluble in water, so these form sodium hydroxide potassium hydroxide and calcium hydroxide. These are the strongest bases.
**43. (3)** The third statement is wrong because acid reacts with metal carbonates to form metallic salt, carbon dioxide gas and water
**44. (4)** Acid rain is caused due to increased pollution in the air. The poisonous gases like sulphur dioxide, carbon dioxide and nitrogen dioxide react with water to form sulphuric acid, carbonic acid and nitric acid respectively.
**45. (2)** Acidic soil is harmful for the plants as the plants cannot grow well in it. So the soil is neutralized by adding a base, calcium oxide (CaO)
**46. (2)** The sting of an ant contains formic acid. Its effect can be neutralized by rubbing moist baking soda on the affected part.
**47. (1)** Natural indicator is obtained from lichens and is purple in colour. It turns acidic solution red and basic solution blue.
**48. (1)** Usually the factory wastes are acidic in nature and are neutralized by adding basic substances. The acidic waste can kill fishes when released in water bodies.

**49.** **(3)** Vinegar is acetic acid and baking soda is sodium hydrogen carbonate (a base). Whenever an acid reacts with a metal carbonate it produces carbon dioxide gas.

$$CH_3COOH + NaHCO_3 \longrightarrow CH_3COONa + H_2O + CO_2$$

**50.** **(3)** Bases turn red litmus to blue, magnesium hydroxide is also a base which turns red litmus blue.

**51.** **(1)** Due to the corrosive nature of concentrated acid, dilute acid is used. As the concentrated sulphuric acid can cause severe burns because it can get splashed while boiling.

**52.** **(3)** Acids on reaction with sulphites and bisulphites produces sulphur dioxide.

$$\underset{\text{Sodium sulphite}}{Na_2SO_3\,(aq)} + \underset{\text{hydrochloric acid}}{2HCl\,(aq)} \longrightarrow$$

$$\underset{\text{sodiumchloride}}{2NaCl\,(aq)} + \underset{\text{water}}{H_2O\,(l)} + \underset{\text{sulphuri dioxide}}{SO_2\,(g)}\uparrow$$

**53.** **(4)** Acid rain effects all of them. Acid rain corrodes historical monuments and marble structures. Acid rain alter the pH of water bodies by making it more acidic thus affects acquatic plants and animals.

**54.** **(4)** Sodium bisulphate ($NaHSO_4$) and potassium bisulphite ($KHSO_3$) both are acidic salts.

**55.** **(3)** **56.** **(2)** **57.** **(3)**

**58.** **(4)** Basic solutions are conducting in nature. Conduction depends on the number of hydroxide ions produced when dissolved in water.

**59.** **(3)** This reaction is exothermic i.e. Heat is evolved

$$HCl + NaOH \rightarrow NaCl + H_2O + Heat$$

**60.** **(3)** Ant or bee sting contains formic acid

**61.** **(2)**

**62.** **(4)** $HCl + NaOH \longrightarrow NaCl + H_2O + Heat$

**63.** **(3)** **64.** **(4)**

**65.** **(2)** Acid burns should be neutralised with mild bases like $NaHCO_3$. Neutralizing acid spills with strong bases, such as NaOH can cause a violent exothermic reaction, and the base itself can cause just as much damage as the original acid spill.

**66.** **(2)**

**67.** **(3)** $NaCl + H_2O + CO_2 + NH_3 \longrightarrow \underset{\text{Baking soda}}{NH_4Cl} + NaHCO_3$

$$2NaHCO_3 \xrightarrow{\text{heat}} Na_2CO_3 + H_2O + CO_2$$

$$\underset{\text{Sodium carbonate}}{Na_2CO_3} + 10\,H_2O \longrightarrow \underset{\substack{\text{Hydrated sodium}\\ \text{carbonate}\\ \text{(washing soda)}}}{Na_2CO_3.10\,H_2O}$$

**68.** **(3)**

**69.** **(3)** NaOH being strong base furnish $OH^-$ ions in solution. Which are responsible for electrolytic condition

**70.** **(2)**

**71.** **(3)** Though HCl gas is a covalent compound, in the aqueous solution it ionizes to form $H^+$ (aq) and $Cl^-$ (aq) ions.

**72.** **(4)** **73.** **(1)**

**74.** **(2)** $HCl + NaOH \longrightarrow NaCl + H_2O$

**75.** **(3)** $H^+$ ions here responsible for electrolytic conductance and completes the circuit.

**76.** **(3)** **77.** **(2)** **78.** **(3)**

**79.** **(1)** Lemon juice contains citric acid. Stomach juice contains HCl vinegar contains $CH_3COOH$. Washing soda solution and toothpaste are basic.

**80.** **(2)**

**81.** **(3)** Neutralisation reaction results into formation of salt and water which are neutral.

$$NaOH + HCl \longrightarrow NaCl + H_2O$$

## Exercise 2

**1.** **(1)**

**2.** **(2)** HCl and NaOH are strong acid and strong base respectively as they get completely dissociated in aqueous solution. HCN and $NH_4OH$ are weak acid and weak base respectively as they get only partially ionized in aqueous solution. Distilled water is neutral.

**3.** **(4)** **4.** **(1)** **5.** **(3)**

**6.** **(1)** **7.** **(1)** **8.** **(1)**

**9.** **(1)** $KNO_3$ solution is neutral.

**10.** **(1)** Acid or base dilution is exothermic in nature.

**11.** **(3)** Bee sting contains formic acid white enamel on our teeth is made up of calcium phosphate.

**12.** **(3)** **13.** **(2)**

**14.** **(4)** HCl is acid thus will not change colour of red litmus. Lactic acid is organic acid and milk of magnesia is antacid.

**15.** **(3)** **16.** **(2)**

**17.** **(2)** Phenolphthalein turns pink in basic media.

**18.** **(2)**

**19.** **(2)** It is a characteristic of bases.

**20.** **(3)** Since for strong acids (Completely ionised) only concentration is the measure of strength but for weak (incompletely ionised) acids both degree of ionisation and concentration will be required.

**21.** **(2)** Phosphorous acid is $H_3PO_3$ which has two replaceable $H^+$ ions.

**22.** **(1)** It is prepared by passing chlorine gas over slaked lime.

$$Ca(OH)_2 + Cl_2 \longrightarrow CaOCl_2 + H_2O$$

**23.** **(2)** It contains about 36% of available chlorine.

**24.** **(4)** It is because of action of $CO_2$ in atmosphere

$$2CaOCl_2 + 2CO_2 \longrightarrow 2CaCO_3 + 2Cl_2 + O_2$$

**25.** **(1)** **26.** **(4)** **27.** **(3)** **28.** **(1)**

**29.** **(2)** As base turns red litmus blue.

**30.** **(1)** Acid turns blue litmus red.

**31.** **(3)** Both salt and water are neutral towards litmus.

**32.** **(1)** Z is either water or salt, both of which can be obtained from the reaction between acid and a base. Since X is a base and Y is an acid, Z can be obtained from the reaction between X and Y.

**33.** **(1)** In basic medium phenolphthalein turns pink.

**34.** **(1)** Strength of an acid depends upon the number of hydrogen ions they furnish in aqueous solutions. Since acetic acid furnish only small amount of hydrogen ion in aqueous solutions this is considered as weak acid.

**35.** **(3)** The portion of body where ant bite is nibbed with moist baking soda.

**36.** **(1)** As factory wastes are acidic in nature there direct dischare into water bodies results into damage of aquatic life. Therefore before discharging of acidic waste is neutralised with addition of bases.

**37.** **(2)**

**38.** **(1)**

**39.** **(4)** Concentrated sulphuric acid can be diluted by adding acid dropwise to water. This will minimise the heat evolved during the reaction.

**40.** **(3)** In aqueous solution $Na_2CO_3$ forms NaOH (strong base) and carbonic acid ($H_2CO_3$). Therefore, it is basic in nature.

$$Na_2CO_3 + 2H_2O \longrightarrow \underset{\text{(Strong base)}}{2NaOH} + \underset{\text{(Weak acid)}}{H_2CO_3}$$

**41.** **(4)** A solution of $NH_3$ in water turns red litmus blue since it is of basic nature.

**42.** **(1)** **43.** **(1)** **44.** **(2)** **45.** **(2)**

**46.** **(3)** **47.** **(1)** **48.** **(1)** **49.** **(2)**

**50.** **(4)** **51.** **(2)**