



## Acids, Bases & Salts

**Learning Outcomes:** Acids, bases and salts and their properties. Classification of substances into acidic, basic and neutral. Acid Base indicators.

**Acids:** The word acid comes from the Latin word “acere” which means sour. Substances that are sour to taste are acidic in nature. **Examples:** Curd, lemon juice, orange juice, vinegar etc.

### Properties of Acids

1. Acids have a sour taste. Lemons, vinegar, and sour candies all contain acids.
2. Acids change the color of certain acid-base indicators. Two common indicators are litmus and phenolphthalein. Blue litmus turns red in the presence of an acid, while phenolphthalein turns colorless.
3. Aqueous solutions of acids conduct electrical current.
4. Acids react with bases to produce a salt and water.

**Bases:** Substances that are bitter in taste and feel soapy on touching are known as bases. **Examples:** Soaps, Shampoo, ammonia & sodium bicarbonate etc.

### Properties of Bases

1. Bases have a bitter taste and are slippery to the touch.
2. Bases also change the color of indicators. Litmus turns blue in the presence of a base while phenolphthalein turns pink.
3. Aqueous solutions of Bases conduct electrical current.
4. Bases react with Acids to produce a salt and water.

**Indicators:** Some Acids & Bases are weak & some are strong and we cannot taste every substance to find its nature. Special type of substances are used to test whether a substance is acidic or basic. These substances are known as indicators. The indicators change their colour when added to a solution containing an acidic or a basic substance. **Examples:** Turmeric, litmus, China rose petals, etc., are some of the naturally occurring indicators. Phenolphthalein is also an Acid & Base indicator.



Litmus Papers

### Litmus: A natural dye

The most commonly used natural indicator is litmus. It is extracted from lichens (Fig. 5.1a). It has a mauve (purple) colour in distilled water. When added to an acidic solution, it turns red and when added to a basic solution, it turns blue. It is available in the form of a solution, or in the form of strips of paper, known as litmus paper. Generally, it is available as red and blue litmus paper.

**Neutral Substances:** Substances that are neither acidic nor basic in nature are called neutral substances. Neutral substances do not affect the colour of indicators.

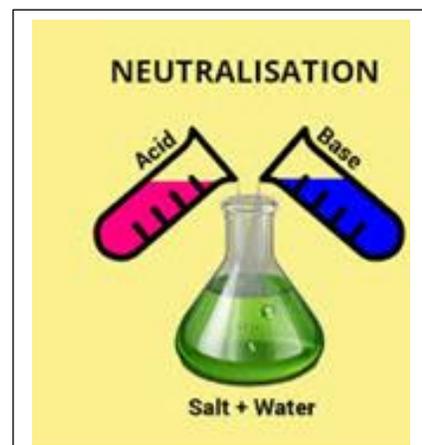
### NEUTRALISATION

When an acid is mixed with a base, they neutralize the effect of each other. This is called **Neutralization**. Water and salt are produced as products during the Neutralization. Heat is also produced during the neutralization reaction.



#### Some Basic Facts

1. **Ant- Sting:** Ant sting contains formic acid. The effect of this acid is neutralized by rubbing moist baking soda.
2. **Indigestion:** Milk of Magnesia (magnesium hydroxide) is an antacid used to neutralise the effect of the acid produced in our stomach.
3. **Factory wastes:** The wastes of many factories contain acids which are



neutralised by adding basic substances.

### Acid Rain

Are you familiar with the term acid rain? Have you ever heard about damaging effect of acid rain? As the name indicates the rain containing excess of acids is called an acid rain. Where do these acids come from? The rain becomes acidic because carbon dioxide, sulphur dioxide and nitrogen dioxide (which are released into the air as pollutants) dissolve in rain drops to form carbonic acid, sulphuric acid and nitric acid respectively. Acid rain can cause damage to buildings, historical monuments, plants and animals.

## EXERCISES

**Question.1 State differences between acids and bases.**

**Answer.**

Acids	Bases
1.Acids are sour in taste.	2.Bases are bitter in taste
2.Acids are non-soapy to touch.	2.Bases are soapy to touch.
3.Acids turn blue litmus red.	3.Bases do not change colour of blue litmus.
4.Examples of acids are citric acid, lactic acid, tartaric acid, etc.	4.Examples of bases are sodium hydroxide, magnesium hydroxide, calcium hydroxide, etc.

**Question.2 Ammonia is found in many household products, such as window cleaners. It turns red litmus blue. What is its nature?**

**Answer.** Ammonia is basic in nature as it turns red litmus blue.

**Question.3 Name the source from which litmus solution is obtained. What is the use of this solution?**

**Answer.** Litmus is obtained from Lichens. Litmus solution is used as an indicator. It is used to find the nature (acidic/basic /neutral) of the solution.

**Question.4 Is the distilled water acidic/basic/neutral? How would you verify it?**

**Answer.** Distilled water is neutral in nature. The same can be tested by using red and blue litmus paper. Acidic solution turns blue litmus paper red while basic solution turns red litmus paper blue. Distilled water neither turns blue litmus paper red nor red litmus paper blue. Therefore, distilled water is a neutral.

**Question.5 Describe the process of neutralisation with the help of an example:**

**Answer.** The reaction between the acid and base is known as the neutralisation reaction. In the neutralisation reaction, salt and water are produced with the evolution of heat.



**Example:** Hydrochloric acid (acid) reacts with sodium hydroxide (base) to form sodium chloride (salt) and water. Heat is evolved in this process.

**Question.6 Mark 'T' if the statement is true and 'F' if it is false:**

- (i) Nitric acid turns red litmus blue. (T/F)
- (ii) Sodium hydroxide turns blue litmus red. (T/F)
- (iii) Sodium hydroxide and hydrochloric acid neutralise each other and form salt and water. (T/F)
- (iv) Indicator is a substance which shows different colours in acidic and basic solutions. (T/F)
- (v) Tooth decay is caused by the presence of a base. (T/F).

**Answer.**

- (i) Nitric acid turns red litmus blue. (F)
- (ii) Sodium hydroxide turns blue litmus red. (F)
- (iii) Sodium hydroxide and hydrochloric acid neutralise each other and form salt and water. (T)
- (iv) Indicator is a substance which shows different colours in acidic and basic solutions. (T)

(v) Tooth decay is caused by the presence of a base. (F)

**Question.7** Dorji has a few bottles of soft drink in his restaurant. But unfortunately, these are not labelled. He has to serve the drink on the demand of customers. One customer wants acidic drink, another wants basic and third one wants neutral drink. How will Dorji decide which drink is to be served to whom?

**Answer.** Since, soft drinks are edible; Dorji can decide acidic, basic and neutral soft drinks by tasting them. Acidic soft drink will be sour in taste whereas basic soft drink will be bitter in taste. Neutral soft drink will have neither sour taste nor bitter. Acidic, basic and neutral soft drinks can also be decided by using blue and red litmus paper. Dorji can pour a few drops of one soft drink on red and blue litmus paper. If red litmus turns blue, then it will be a basic soft drink and if blue litmus changes to red, then it will be an acidic soft drink. If colour of both the litmus papers remains same, then it will be a soft drink. The same process can be repeated with the other soft drinks also.

**Question.8** Explain why.

- (a) An antacid tablet is taken when you suffer from acidity.
- (b) Calamine solution is applied on the skin when an ant bites.
- (c) Factory waste is neutralised before disposing it into the water bodies.

**Answer.** (a) Hydrochloric acid present in our stomach helps in the digestion of food. But excess of it causes acidity. To relieve from acidity, antacid tablets are taken as it contains base such as magnesium hydroxide that neutralises the acid present in the stomach.

(b) Formic acid is present in ant's sting. When an ant bites, it injects the solution of formic acid into skin. The effect of sting can be neutralised by rubbing calamine solution on the stung area. Calamine solution being basic in nature neutralises the formic acid.

(c) The factory wastes contain acids. If such water is released into a water body, it can harm aquatic animals like fishes. Factory wastes should be treated with calcium hydroxide to neutralise acid before it is disposed off in water.

**Question.9** The three liquids are given to you. One is hydrochloric acid, another is sodium hydroxide and third is a sugar solution. How will you identify them? You have only turmeric indicator.

**Answer.** Put a drop each of hydrochloric acid, sodium hydroxide and sugar solution on the turmeric indicator. The solution which changes the colour of turmeric indicator to red will be basic that is sodium hydroxide. Now add a few drops of sodium hydroxide solution in remaining two solutions i.e. both in hydrochloric acid and sugar solution. After that, put some drops of these mixtures on turmeric indicator separately. Drop that changes the colour of turmeric indicator will be neutral in nature i.e. sugar solution. Mixture of basic solution and neutral solution will be basic in nature and change the colour of turmeric indicator to red. Drop that does not change the colour of turmeric indicator will be acidic in nature i.e. hydrochloric acid. This is because hydrochloric acid being acidic in nature neutralises the sodium hydroxide solution.

**Question.10** Blue litmus paper is dipped in a solution. It remains blue. What is the nature of the solution? Explain.

**Answer.** The nature of the solution will be either basic or neutral. This is because both basic solution and neutral solution do not change the colour of blue litmus paper.

**Question.11** Consider the following statements:

- (a) Both acids and bases change colour of all indicators.
- (b) If an indicator gives a colour change with an acid, it does not change colour with a base.
- (c) If an indicator changes colour with a base, it does not change colour with an acid.
- (d) Change of colour in an acid and a base depends on the type of the indicator.

Which of these statements are correct?

- (i) All four                      (ii) a and d                      (iii) b and c                      (iv) only d

**Answer.**

The correct option is (iv) only d.

#### CAUTION

Great care should be taken while handling laboratory acids and bases because these are corrosive in nature, irritating and harmful to skin.