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CLASS X: SCIENCE  
Chapter 2: Acids, Bases and Salts

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**Q1.** You have been provided with three test tubes. One of them contains distilled water and the other two contain an acidic solution and a basic solution, respectively. If you are given only red litmus paper, how will you identify the contents of each test tube?

**Ans.** Step 1- Let us mark the three test tubes as A, B and C.

Step 2- A drop of the solution in test tube A is put on the red litmus paper. Same is repeated with solution B and C. If either of them changes colour to blue, then it is basic. Therefore, out of three, one is eliminated.

Step 3- Out of the remaining two, any one can be acidic or neutral. Now a drop of basic solution is mixed with a drop of each of the remaining two solutions separately and then a drop of each solution is put on the red litmus paper.

If the colour of red litmus turns blue, then that solution is neutral and if there is no change in colour, then that solution is acidic.

This is because acidic and basic solutions neutralise each other. Hence, we can distinguish between the three types of solutions.

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**Q1.** Why should curd and sour substances not be kept in brass and copper vessels?

**Ans.** Curd and other sour substances contain acids. Therefore, when they are kept in brass and copper vessels, the metal reacts with the acid to liberate hydrogen gas and harmful products, thereby spoiling the food.



**Q2.** Which gas is usually liberated when an acid reacts with a metal? Illustrate with an example. How will you test for the presence of this gas ?

**Ans.** Hydrogen gas is usually liberated when an acid reacts with a metal.

Example,

Step 1- Take few pieces of zinc granules and add 5 ml of dilute  $\text{H}_2\text{SO}_4$ .

Step 2 - Shake it and pass the gas produced into a soap solution. The bubbles are formed in the soap solution. These soap bubbles contain hydrogen gas.

Test for hydrogen gas. The evolved hydrogen gas can be tested by bringing a burning candle near the soap bubbles. Hydrogen gas burns with a pop sound. (Refer Active Chemistry 2.3).

**Q3.** Metal compound A reacts with dilute hydrochloric acid to produce effervescence. The gas evolved extinguishes a burning candle. Write a balanced chemical equation for the reaction if one of the compounds formed is calcium chloride.

**Ans.**  $\text{CaCO}_3(\text{s}) + 2\text{HCl}(\text{aq}) \rightarrow \text{CaCl}_2(\text{s}) + \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\ell)$

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**Q1.** Why do  $\text{HCl}$ ,  $\text{HNO}_3$ , etc., show acidic character in aqueous solution while solutions of compounds like alcohol and glucose do not show acidic character?

**Ans.**  $\text{HCl}$  and  $\text{HNO}_3$  dissociate in the presence of water to form hydrogen or hydronium ions. Although aqueous solutions of glucose and alcohol contain hydrogen, these cannot dissociate in water to form hydrogen or hydronium ions. Hence, they do not show acidic character.

**Q2.** Why does an aqueous solution of an acid conduct electricity?

**Ans.** Acids dissociate in aqueous solutions to form ions. These ions are responsible for conduction of electricity.

**Q3.** Why does dry  $\text{HCl}$  gas not change the colour of the dry litmus paper ?

**Ans.** Acid do not ionize in the absence of water to liberate  $\text{H}_3\text{O}^+$  which shows acidic nature of a solution. Therefore, dry  $\text{HCl}$  gas does not change the colour of the dry litmus paper because it does not contain  $\text{H}^+$  ions.



**Q4.** While diluting an acid, why is it recommended that the acid should be added to water and not water to the acid ?

**Ans.** It is recommended that the acid should be added to water and not water to the acid because the process of dissolving an acid in water is exothermic. If water is added to acid, since large amount of acid is present, a large amount of heat is generated, therefore, the mixture splashes out and causes burns.

**Q5.** How is the concentration of hydronium ions ( $\text{H}_3\text{O}^+$ ) affected when a solution of an acid is diluted ?

**Ans.** When an acid is diluted, the concentration of hydronium ions ( $\text{H}_3\text{O}^+$ ) per unit volume decreases. This means that the strength of the acid decreases.

**Q6.** How is the concentration of hydroxide ions ( $\text{OH}^-$ ) affected when excess base is dissolved in a solution of sodium hydroxide ?

**Ans.** The concentration of hydroxide ions ( $\text{OH}^-$ ) would increase when excess base is dissolved in a solution of sodium hydroxide.

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**Q1.** You have two solutions, A and B. The pH of solution A is 6 and pH of solution B is 8. Which solution has more hydrogen ion concentration? Which of this is acidic and which one is basic ?

**Ans.** A pH value of less than 7 indicates an acidic solution, while greater than 7 indicates a basic solution. Therefore, the solution with pH = 6 is acidic and has more hydrogen ion concentration than the solution of pH = 8 which is basic.

**Q2.** What effect does the concentration of  $\text{H}^+(\text{aq})$  ions have on the nature of the solution ?

**Ans.** If the concentration of  $\text{H}^+$  ions is increased, the solution becomes more acidic. If the concentration of  $\text{H}^+$  ions is decreased, the solution becomes less acidic or more basic.



**Q3.** Do basic solutions also have  $H^+(aq)$  ions ? If yes, then why are these basic ?

**Ans.** Yes, a basic solution also has  $H^+(aq)$  ions. However, their concentration is less as compared to the concentration of  $OH^-(aq)$  ions which makes the solution basic.

**Q4.** Under what soil condition do you think a farmer would treat the soil of his fields with quick lime (calcium oxide) or slaked lime (calcium hydroxide) or chalk (calcium carbonate) ?

**Ans.** If the soil is acidic and improper for cultivation, then to neutralise the acidity of the soil, the farmer would treat the soil with quick lime or slaked lime or chalk.

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**Q1.** What is the common name of the compound  $CaOCl_2$ ?

**Ans.** The common name of the compound  $CaOCl_2$  is bleaching powder.

**Q2.** Name the substance which on treatment with chlorine yields bleaching powder ?

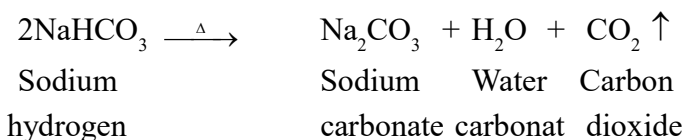
**Ans.** Calcium hydroxide [ $Ca(OH)_2$ ], on treatment with chlorine, yields bleaching powder.

**Q3.** Name the sodium compound which is used for softening hard water.

**Ans.** Washing soda ( $Na_2CO_3 \cdot 10 H_2O$ ) is used for softening hard water.

**Q4.** What will happen if a solution of sodium hydrogen carbonate is heated? Give the equation of the reaction involved.

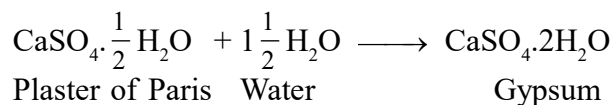
**Ans.** When a solution of sodium hydrogencarbonate is heated, sodium carbonate and water are formed with the evolution of carbon dioxide gas.





**Q5.** Write an equation to show the reaction between Plaster of Paris and water.

**Ans.** The chemical equation for the reaction of Plaster of Paris and water can be represented as-



## EXERCISES

**Q1.** A solution turns red litmus blue, its pH is likely to be  
 (1) 1                      (2) 4                      (3) 5                      (4) 10

**Ans.** (4) 10

**Q2.** A solution reacts with crushed egg-shells to give a gas that turns lime-water milky. The solution contains  
 (1) NaCl                      (2) HCl                      (3) LiCl                      (4) KCl

**Ans.** (2) HCl

**Q3.** 10 mL of a solution of NaOH is found to be completely neutralised by 8 mL of a given solution of HCl. If we take 20 mL of the same solution of NaOH, the amount of HCl solution (the same solution as before) required to neutralise it will be  
 (1) 4 mL                      (2) 8mL                      (3) 12 mL                      (4) 16 mL

**Ans.** (4) 16 mL

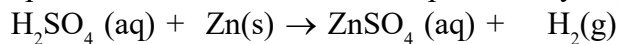
**Q4.** Which one of the following types of medicines is used for treating indigestion ?  
 (1) Antibiotic                      (2) Analgesic                      (3) Antacid                      (4) Antiseptic

**Ans.** (3) Antacid

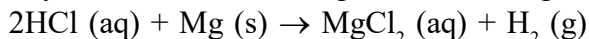
**Q5.** Write word equations and then balanced equations for the reaction taking place when -  
 (1) Dilute sulphuric acid reacts with zinc granules.  
 (2) Dilute hydrochloric acid reacts with magnesium ribbon.  
 (3) Dilute sulphuric acid reacts with aluminium powder.  
 (4) Dilute hydrochloric acid reacts with iron filings.



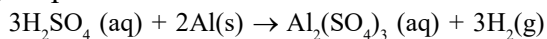
**Ans.** (1) Sulphuric acid + Zinc  $\rightarrow$  Zinc sulphate + Hydrogen



(2) Hydrochloric acid + Magnesium  $\rightarrow$  Magnesium chloride + Hydrogen



(3) Sulphuric acid + Aluminium  $\rightarrow$  Aluminium sulphate + Hydrogen



(4) Hydrochloric acid + Iron  $\rightarrow$  Ferric chloride + Hydrogen

**Q6.** Compounds such as alcohols and glucose also contain hydrogen but are not categorized as acids. Describe an activity to prove it.

**Ans.** Activity

Step 1- Two nails are fitted on a cork and are kept it in a 100 mL beaker.

Step 2- The nails are then connected to the two terminals of a 6-volt battery through a bulb and a switch.

Step 3- Some dilute HCl is poured in the beaker and the current is switched on.

Step 4- The same experiment is then performed with glucose solution and alcohol solution.

**Observations :** It will be observed that the bulb glows in the HCl solution and does not glow in the glucose solution and alcohol solution.

**Result :** HCl dissociates into  $\text{H}^+$  (aq) and  $\text{Cl}^-$  (aq) ions. These ions conduct electricity in the solution which results in the glowing of the bulb. On the other hand, the glucose solution and alcohol solution does not dissociate into ions. Therefore, it does not conduct electricity. (Refer Active Chemistry 3.8 for figure).

**Conclusion :** From this activity, it can be concluded that all acids contain hydrogen but not all compounds containing hydrogen are acids.

That is why, though alcohols and glucose contain hydrogen, they are not categorised as acids.

**Q7.** Why does distilled water not conduct electricity, whereas rain water does?

**Ans.** Distilled water is a pure form of water and is devoid of any ionic species. Therefore, it does not conduct electricity. Rain water, being an impure form of water, contains many ionic species such as acids and therefore it conducts electricity.

**Q8.** Why do acids not show acidic behaviour in the absence of water ?

**Ans.** Acids do not show acidic behaviour in the absence of water because there are no hydrogen ions available for conduction of electricity. Acids dissociate in the presence of water to give free hydrogen ions. It is the hydrogen ions that are responsible for the acidic behaviour.





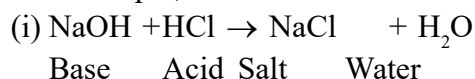
**Q13.** Plaster of Paris should be stored in a moisture-proof container. Explain why?

**Ans.** Plaster of Paris should be stored in a moisture-proof container because Plaster of Paris, a powdery mass, absorbs water (moisture) to form a hard solid known as gypsum.

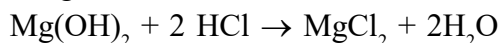
**Q14.** What is a neutralisation reaction? Give two examples.

**Ans.** A reaction in which an acid and base react with each other to give a salt and water is termed as neutralisation reaction. In this reaction, energy is evolved in the form of heat.

For example,



(ii) During indigestion (caused due to the production of excess of hydrochloric acid in the stomach), we administer an antacid (generally milk of magnesia,  $\text{Mg(OH)}_2$  which is basic in nature). The antacid neutralises the excess of acids and thus gives relief from indigestion.



**Q15.** Give two important uses of washing soda and baking soda.

**Ans.** Two important uses of washing soda and baking soda are as follows-

(1) Washing soda-

- (a) It is used in glass, soap, and paper industries.
- (b) It is used to remove permanent hardness of water.

(2) Baking soda-

- (a) It is used as baking powder. Baking powder is a mixture of baking soda and a mild acid known as tartaric acid. When it is heated or mixed in water, it releases  $\text{CO}_2$  gas that makes bread or cake fluffy.
- (b) It is used in soda-acid fire extinguishers.