

## Chapter 2

# Acids, Bases and Salts

### Intext Questions

#### On Page 18

**Question 1:** 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?

**Solution:**

Basic solution changes the colour of red litmus paper to blue. Acid & other neutral compounds have no effect on red litmus. Thus, basic solution can be easily identified.

Let us take three test tubes as A, B, and c. A drop of the solution in A is put on the red litmus paper. Same is repeated with solution B and C. If either of them changes colour of red litmus to blue, then it is basic. Thus, we can identify basic solution. Now, we are left with two solutions. Now a drop of basic solution is mixed with a drop of each of the remaining two solutions separately and then the nature of the drops of the mixtures is checked. If the colour of red litmus turns blue, then the second solution is neutral and if there is no change in colour, then the second solution is acidic. This is because acidic and basic solutions neutralize each other. Hence, we can distinguish between the three types of solutions.

#### On Page 22

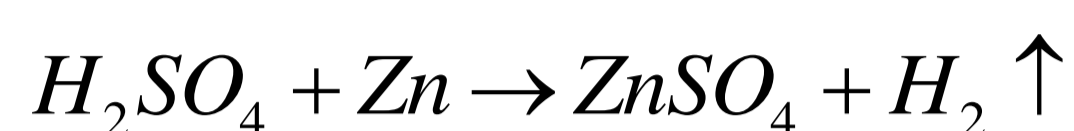
**Question 1:** Why should curd and sour substances not be kept in brass and copper vessels?

**Solution:** Curd and sour substances are acidic in nature. If we keep them in brass and copper vessels, metal of their container reacts with the acid and liberates hydrogen gas and harmful products. This results in spoiling of food.

**Question 2:** 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?

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

For example- if we allow zinc granules to react with dilute H<sub>2</sub>SO<sub>4</sub> and pass the gas produced into a soap solution. The bubbles of the soap solution are formed. These soap bubbles contain hydrogen gas.



We can test the evolved gas by its burning with a pop sound when a candle is brought near the soap bubbles.

**Question 3:** 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.



### On Page 25

**Question 1:** Why do HCl, HNO<sub>3</sub>, etc show acidic characters in aqueous solutions while solutions of compounds like alcohol and glucose do not show acidic character?

**Solution:** The dissociation of HCl or HNO<sub>3</sub> to form hydrogen ions always occurs in the presence of water



Aqueous solutions of glucose and alcohol contain hydrogen atoms but they cannot dissociate hydrogen in water. Thus, they do not form hydrogen ions. Hence, they do not show acidic character.

**Question 2:** Why does an aqueous solution of acid conduct electricity.

**Solution:** Acidic compounds dissociate in aqueous solutions to form ions. The ions formed are responsible for conduction of electricity.

**Question 3:** Why does dry HCl gas not change the colour of the dry litmus paper?

**Solution:** We know that, colour of the litmus paper is changed by the hydrogen ions and hydrogen ions can be generated in aqueous solution only. Dry HCl gas does not contain  $H^+$  ions. Therefore, the colour of the litmus paper does not change.

**Question 4:** While diluting an acid why is it recommended that the acid should be added to water and not water to the acid?

**Solution:** The process of dissolving an acid into water is exothermic. Thus, acid should be added to water. If we add water in acid, it can be dangerous as it is possible that because of the large amount of heat generated, the mixture splashes out and causes burns.

**Question 5:** How is the concentration of hydronium ions affected when a solution of an acid is diluted?

**Solution:** When an acid is diluted, the concentration of hydronium ions per unit volume decreases. Hence, we can say that, strength of the acid decreases.

**Question 6:** How is the concentration of hydroxide ions affected when excess base is dissolved in a solution of sodium hydroxide?

**Solution:** The concentration of hydroxide ions would increase when excess base is dissolved in a solution of sodium hydroxide.

### On Page 28

**Question 1:** 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 these is acidic and which one is basic?

**Solution:** A solution having pH value less than 7 indicates an acidic solution, while greater than 7 indicates a basic solution. Hence, the solution with  $pH = 6$  is acidic and has more hydrogen ion concentration. The solution of  $pH = 8$  will be basic.

**Question 2:** What effect does the concentration of  $H^+$  ions have on the nature of the solution?

**Solution:** Concentration of  $H^+$  decides the acidic and basic nature of solution. With an increase in  $H$  ion concentration; the solution becomes more acidic, while a decrease of  $H$  Ion causes an Increase in the basicity of the solution

**Question 3:** Do basic solutions also have  $H^+$  ions? If yes, then why are these basic?

**Solution:** Yes, basic solution also has  $H^+$  ions but their concentration is less as compared to the concentration of  $OH$  ions. Thus, presence of more  $OH$  ions makes the solution basic.

**Question 4:** 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?)

**Solution:** If the soil is acidic and improper for cultivation, and then to increase the basicity of soil, the farmer would treat the soil with quick lime or slaked lime or chalk.

### On Page 33

**Question 1:** What is the common name of the compound  $CaOCl_2$ ?

**Solution:** Bleaching powder

**Question 2:** Name the substance which on treatment with chlorine yields bleaching powder?

**Solution:** Calcium hydroxide

**Question 3:** Name the sodium compound which is used for softening hard water.

**Solution:** Washing soda

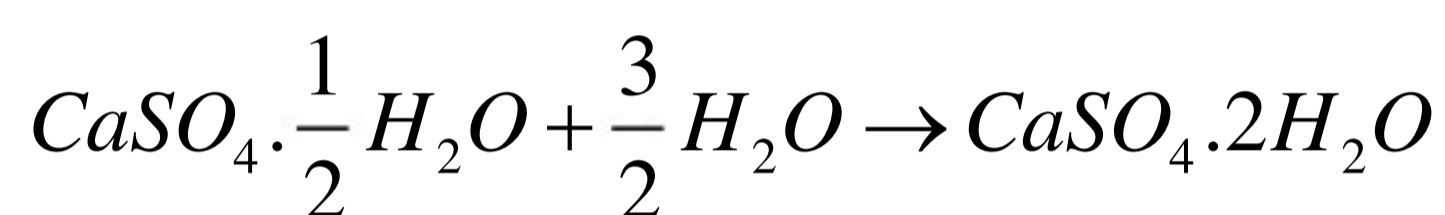
**Question 4:** What will happen if a solution of sodium hydrocarbonate is heated? Give the equation of the reaction involved

**Solution:** When a solution of sodium hydrocarbonate is heated, sodium carbonate and water are formed with the evolution of carbon dioxide gas



**Question 5:** Write an equation to show the reaction between Plaster of Paris and water.

**Solution:** The chemical equation for the reaction of Plaster of Paris and water can be represented as



Plaster of paris

Gypsum

### Exercises

**Question 1:** A solution turns red litmus blue; its pH is likely to be

- a) 1
- b) 4
- c) 5
- d) 10

**Solution:** (d) Solution turns red litmus blue; its pH is likely to be 10.

**Question 2:** A solution reacts with crushed egg-shells to give a gas that turns lime-water milky. The solution contains:

- (a) NaCl
- (b) HCl
- (c) LiC
- (d) KCl

**Solution:** (b) The solution contains HCl.

**Question 3:** 10 mL of a solution of NaOH is found to be completely neutralised by 8 mL of a given solution of HCl. We take 20 mL of the same solution of NaOH, the amount of HCl solution (the same solution as that required to neutralise it) will be?

- (a) 4 mL
- (b) 8 mL
- (c) 12 mL
- (d) 16 mL

**Solution:** (d) 16 mL of HCl solution will be required

**Question 4:** Which one of the following types of medicines is used for treating indigestion?

- (a) Antibiotic
- (b) Analgesic
- (c) Antacid
- (d) Antiseptic

**Solution:** (c) Antacid is used for treating indigestion

**Question 5:** Write word equations and then balanced equations for the reaction taking place when:

- (a) Dilute sulphuric acid reacts with zinc granules.
- (b) Dilute hydrochloric acid reacts with magnesium ribbon.
- (c) Dilute sulphuric acid reacts with aluminium powder.
- (d) Dilute hydrochloric acid reacts with iron filings.

### Solution:

- (a)  $H_2SO_4 + Zn \rightarrow ZnSO_4 + H_2$   
(b)  $2HCl + Mg \rightarrow MgCl_2 + H_2$   
(c)  $3H_2SO_4 + 2Al \rightarrow Al_2(SO_4)_3 + 3H_2$   
(d)  $6HCl + 2Fe \rightarrow 2FeCl_3 + 3H_2$

**Question 6:** Compounds such as alcohols and glucose also contain hydrogen but are not characterized as acids. Describe an activity to prove it.

**Solution:** Two nails are fitted on a cork and are kept it in a 100 mL beaker. The nails are then connected to the two terminals of a 6-volt battery through a bulb and a switch. Some dilute HCl is poured in the beaker and the current is switched on. 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.

**Result:** HCl dissociates into H and Cl ions. These ions conduct electricity in the solution resulting in the glowing of the bulb. On the other hand, the glucose solution does not dissociate into ions Therefore, it does not conduct electricity.

**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.

**Question 7:** Why does distilled water not conduct electricity, whereas rain water does?

**Solution:** Distilled water is a pure form of water and is free of any ionic species. Thus, it does not conduct electricity. Rain water is an impure form of water. It contains many ionic species such as acids and therefore it conducts electricity.

**Question 8:** Why do acids not show acidic behaviour in the absence of water?

**Solution:** It happens because in presence of water, acids dissociate into hydrogen ions. Hydrogen ions are responsible for the acidic behaviour. In absence of water, no dissociation of acid takes place.

**Question 9:** Five solutions A, B, C, D and E, when tested with universal indicator showed pH as 4, 1, 11, 7 and 9; respectively. Which solution is:

- (a) Neutral?
- (b) Strongly alkaline?
- (c) Strongly acidic?
- (d) Weakly acidic?
- (e) Weakly alkaline?

Arrange the pH in increasing order of hydrogen-ion concentration

**Solution:**

- (a) Neutral → Solution D
- (b) Strongly alkaline → Solution C
- (c) Strongly acidic → Solution B
- (d) Weakly acidic → Solution A
- (e) Weakly alkaline → Solution E

Order of pH value:

$$11 < 9 < 7 < 4 < 1$$

**Question 10:** Equal lengths of magnesium ribbons are taken in test tubes A and B. HCl is added to test tube A, while acetic acid is added to test tube B. In which test tube will the fizzing occur more vigorously and why?

**Solution:** The fizzing will occur strongly in test tube A. This is because HCl is a stronger acid than acetic acid and thus, produce hydrogen gas at a faster speed due to which fizzing occurs.

**Question 11:** Fresh milk has a pH of 6. How do you think the pH will change as it turns into curd? Explain your answer.

**Solution:** The pH of milk is 6. As it changes to curd, the pH will reduce because curd is acidic in nature. The acids present in it decrease the pH.



**Question 12:** A milkman adds a very small amount of baking soda to fresh milk:

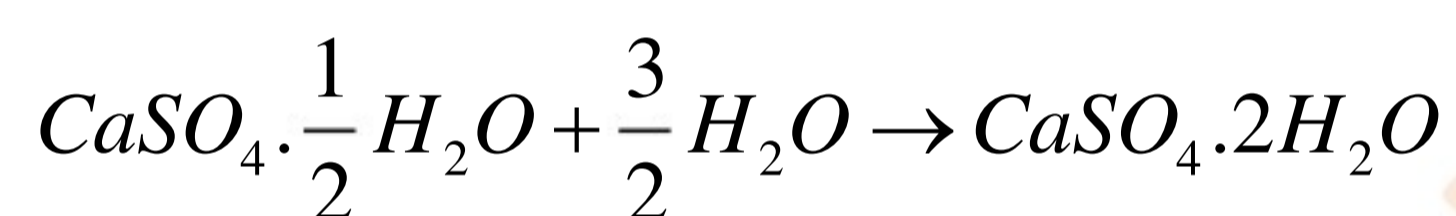
- (a) Why does he shift the pH of the fresh milk from 6 to slightly alkaline?
- (b) Why does this milk take a long time to set as curd'?

**Solution:**

- (a) The milkman shifts the pH of the fresh milk from 6 to slightly alkaline because in alkaline condition, milk does not set as curd easily.
- (b) Since this milk is slightly basic than usual milk, acids produced to set the curd are neutralized by the base. Therefore, it takes a longer time for the curd to set

**Question 13:** Plaster of Paris should be stored in a moisture-proof container Explain why?

**Solution:** Plaster of Paris should be stored in a moisture-proof container because it is a powdery mass which can absorb water to form a hard solid known as gypsum.



Plaster of paris

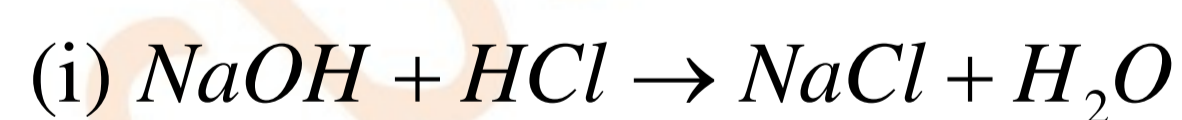
Gypsum

**Question 14:** What is a neutralization reaction? Give two examples.

**Solution:**

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

For example:



Base      acid      salt      water



Base      acid      salt      water

**Question 15:** Give two important uses of washing soda and baking soda.

**Solution:** Two important uses of washing soda and baking soda are:

- (1) (a) Washing soda
  - (b) It is used in glass, soap, and paper industries
  - (c) It is used to remove permanent hardness of water
- (2) (a) Baking soda
  - (b) It is used as baking powder
  - (c) It is used in soda-acid fire extinguishers

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