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H₂O

Class - 10th

NCERT Solution



science



NCERT Class 10 Science

CHAPTER 2 ACID, BASES AND SALTS : DETAILED SOLUTIONS

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?

Ans. (i) Put the red litmus paper in all the test tubes, turn by turn. The solution which turns red litmus to blue will be a basic solution. The blue litmus paper formed here can now be used to test the acidic solution.

(ii) Put the blue litmus paper obtained above in the remaining two test tubes, turn by turn. The solution which turns the blue litmus paper to red will be the acidic solution.

(iii) The solution which has no effect on any litmus paper will be neutral and hence it will be distilled water.

2. 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.

3. 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.

For example,

Step 1 - Take few pieces of zinc granules and add 5 mL of dilute H_2SO_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 3).

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

5. Why do HCl, HNO₃, etc., show acidic character in aqueous solution while solutions of compounds like alcohol and glucose do not show acidic character?

Ans. HCl and HNO₃ 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.

6. 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.

7. Why does dry HCl gas not change the colour of the dry litmus paper?

Ans. Acids do not ionize in the absence of water to liberate H₃O⁺ which shows acidic nature of a solution. Therefore, dry HCl gas does not change the colour of the dry litmus paper because it does not contain H⁺ ions.

8. 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 a large amount of acid is present, a large amount of heat is generated. Therefore, the mixture splashes out and causes burns.

9. How is the concentration of hydronium ions (H₃O⁺) affected when a solution of an acid is diluted?

Ans. When an acid is diluted, the concentration of hydronium ions (H₃O⁺) per unit volume decreases. This means that the strength of the acid decreases.

10. How is the concentration of hydroxide ions (OH⁻) affected when excess base is dissolved in a solution of sodium hydroxide?

Ans. The concentration of hydroxide ions (OH⁻) would increase when excess base is dissolved in a solution of sodium hydroxide.

11. 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.

12. What effect does the concentration of $H^+(aq)$ ions have on the nature of the solution?

Ans. If the concentration of H^+ ions is increased, the solution becomes more acidic. If the concentration of H^+ ions is decreased, the solution becomes less acidic or more basic.

13. 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.

14. 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.

15. What is the common name of the compound $CaOCl_2$?

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

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

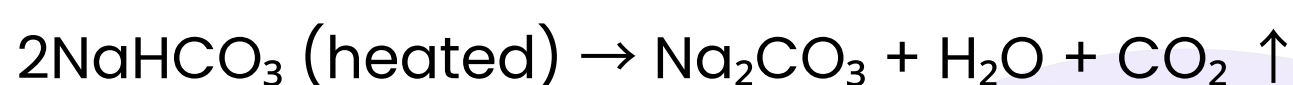
Ans. Calcium hydroxide [$Ca(OH)_2$], on treatment with chlorine, yields bleaching powder.

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

Ans. Washing soda ($\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$) is used for softening hard water.

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

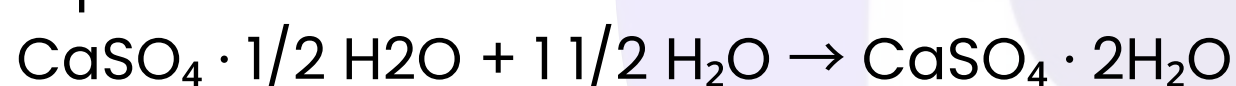
Ans. When a solution of sodium hydrogen carbonate is heated, sodium carbonate and water are formed with the evolution of carbon dioxide gas.



Sodium Hydrogen Carbonate \rightarrow Sodium Carbonate + Water + Carbon Dioxide

19. **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-



Plaster of Paris + Water \rightarrow Gypsum

20. **A solution turns red litmus blue, its pH is likely to be**

(1) 1

(2) 4

(3) 5

(4) 10

Ans. (4) 10

21. **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

22. **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) 8 mL
- (3) 12 mL
- (4) 16 mL

Ans. (4) 16 mL

23. Which one of the following types of medicines is used for treating indigestion?

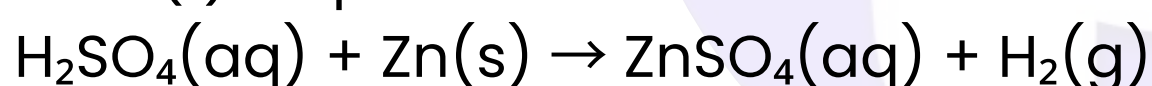
- (1) Antibiotic
- (2) Analgesic
- (3) Antacid
- (4) Antiseptic

Ans. (3) Antacid

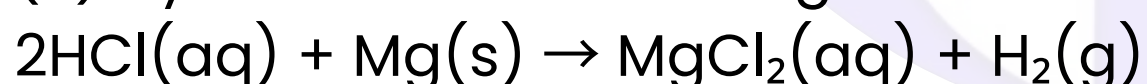
24. Write word equations and then balanced equations for the reaction taking place when -

- (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.

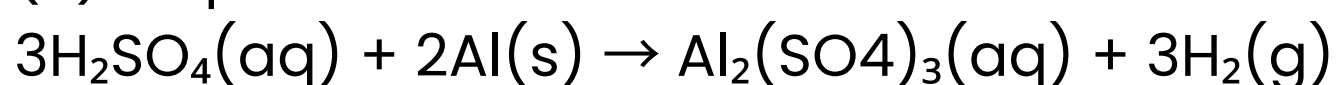
Ans. (1) Sulphuric acid + Zinc → Zinc sulphate + Hydrogen



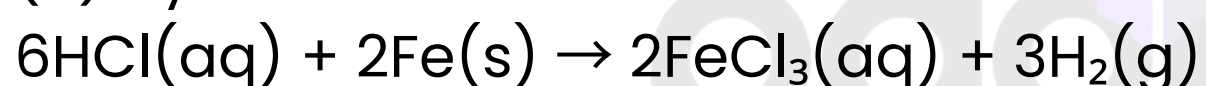
(2) Hydrochloric acid + Magnesium → Magnesium chloride + Hydrogen



(3) Sulphuric acid + Aluminium → Aluminium sulphate + Hydrogen



(4) Hydrochloric acid + Iron → Ferric chloride + Hydrogen



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

Ans. Activity

Method

Step 1- Two nails are fitted on a cork and are kept 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 into the beaker and the current is switched on.

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

Observations:

Observations:

It is observed that the bulb glows in the HCl solution but does not glow in the glucose solution and alcohol solution.

Result: HCl dissociates into $\text{H}^+(\text{aq})$ and $\text{Cl}^-(\text{aq})$ 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 do not dissociate into ions. Therefore, it does not conduct electricity. (Refer to Active Chemistry 8 for figure).

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

Though alcohols and glucose contain hydrogen, they are not categorised as acids.

26. 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.

27. 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.

28. 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

- Ans.** (a) Neutral – Solution D with pH 7
 (b) Strongly alkaline – Solution C with pH 11
 (c) Strongly acidic – Solution B with pH 1
 (d) Weakly acidic – Solution A with pH 4
 (e) Weakly alkaline – Solution E with pH 9

The pH can be arranged in the increasing order of the concentration of hydrogen ions as $11 < 9 < 7 < 4 < 1$.

29. **Equal lengths of magnesium ribbons are taken in test tubes A and B. Hydrochloric acid (HCl) is added to test tube A, while acetic acid (CH₃COOH) is added to test tube B. In which test tube will the fizzing occur more vigorously and why?**

Ans. The fizzing will occur strongly in test tube A, in which hydrochloric acid (HCl) is added. This is because HCl is a stronger acid than CH₃COOH and therefore, produces hydrogen gas at a faster speed due to which fizzing occurs.

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

Ans. 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.

31. **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?

Ans. (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 neutralised by the base. Therefore, it takes a longer time for the curd to set.

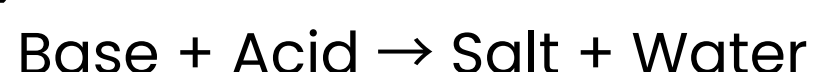
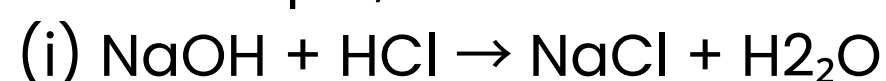
32. **Plaster of Paris should be stored in a moisture-proof container. Explain why?**

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.

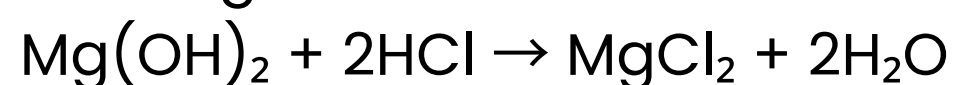
33. **What is a neutralisation reaction? Give two examples.**

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



34. 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 CO_2 gas that makes bread or cake fluffy.

(b) It is used in soda-acid fire extinguishers.

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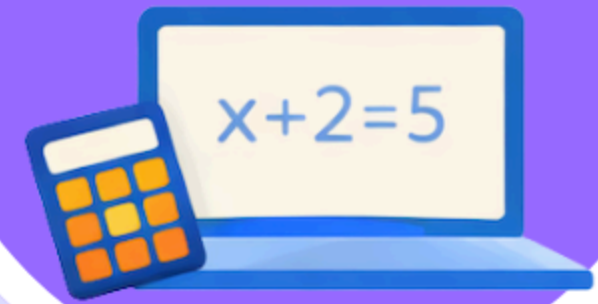
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