Exercises solution

Question 1:

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

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

Answer 1:

(d) Bases turn red litmus blue and acids turn blue litmus red. Basic solution has a pH value more than 7. Since the 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) LiCl (d) KCl

Answer 2:

(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. 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

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

Answer 3:

(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

Answer 4:

(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.

Answer 5:

(a) Sulphuric acid + Zinc → Zinc sulphate + Hydrogen

$$H_2SO_{4(aq)} + Zn_{(s)} \longrightarrow ZnSO_{4(aq)} + H_{2(g)}$$

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

$$2HCl_{(aq)} + Mg_{(s)} \longrightarrow MgCl_{2(aq)} + H_{2(g)}$$

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

$$3H_2SO_{4(aq)} + 2Al_{(s)} \longrightarrow Al_2(SO_4)_{3(aq)} + 3H_{2(g)}$$

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

$$6HCl_{(aq)} + 2Fe_{(s)} \longrightarrow 2FeCl_{3(aq)} + 3H_{2(g)}$$

Question 6:

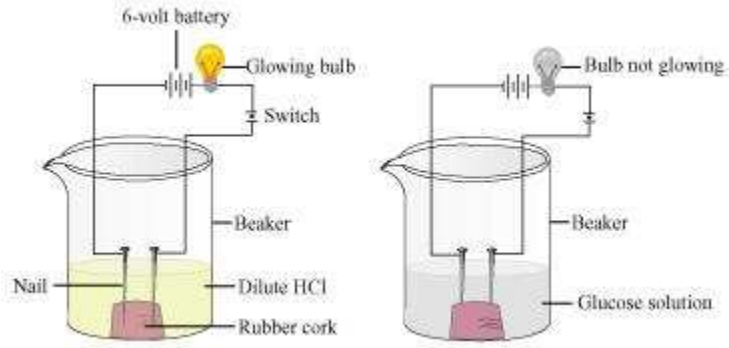
Compounds such as alcohols and glucose also contain hydrogen but are not categorized as acids. Describe an activity to prove it.

Answer 6:

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?

Answer 7:

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.

Question 8:

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

Answer 8:

Acids do not show acidic behaviour in the absence of water because the dissociation of hydrogen ions from an acid occurs in the presence of water only. It is the hydrogen ions that are responsible for the acidic behaviour.

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.

Answer 9:

(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:

$11 < 9 < 7 < 4 < 1$

Question 10:

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 (CH_3COOH) is added to test tube B. In which test tube will the fizzing occur more vigorously and why?

Answer 10:

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 CH_3COOH and therefore produces 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.

Answer 11:

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?

Answer 12:

(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?

Answer 13:

Plaster of Paris (POP) 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.

$$\underset{(\text{POP})}{CaSO_4.\frac{1}{2}H_2O} + 1\frac{1}{2}H_2O \longrightarrow \underset{\text{Gypsum}(\text{Hard solid})}{CaSO_4.2H_2O}$$

Question 14:

What is a neutralization reaction? Give two examples.

Answer 14:

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

For example:

(i) $\underset{(\text{Base})}{NaOH} + \underset{(\text{Acid})}{HCl} \longrightarrow \underset{(\text{Salt})}{NaCl} + \underset{(\text{Water})}{H_2O}$

(ii) During indigestion (caused due to the production of excess of hydrochloric acid in the stomach), we administer an antacid (generally milk of magnesia, $Mg(OH)_2$, which is

basic in nature). The antacid neutralizes the excess of acids and thus gives relief from indigestion.

$$Mg(OH)_2 + 2HCl \rightarrow MgCl_2 + 2H_2O$$

Question 15:

Give two important uses of washing soda and baking soda.

Answer 15:

Two important used 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 that makes bread or cake fluffy.

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

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?

Answer 1:

If the colour of red litmus paper gets changed to blue, then it is a base and if there is no colour change, then it is either acidic or neutral. Thus, basic solution can be easily identified.

Let us mark the 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 to blue, then it is basic. Therefore, out of three, one is eliminated. 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 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.

Page 22

Question 1:

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

Answer 1:

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.

$$Metal + Acid \rightarrow Salt + Hydrogen\ gas$$

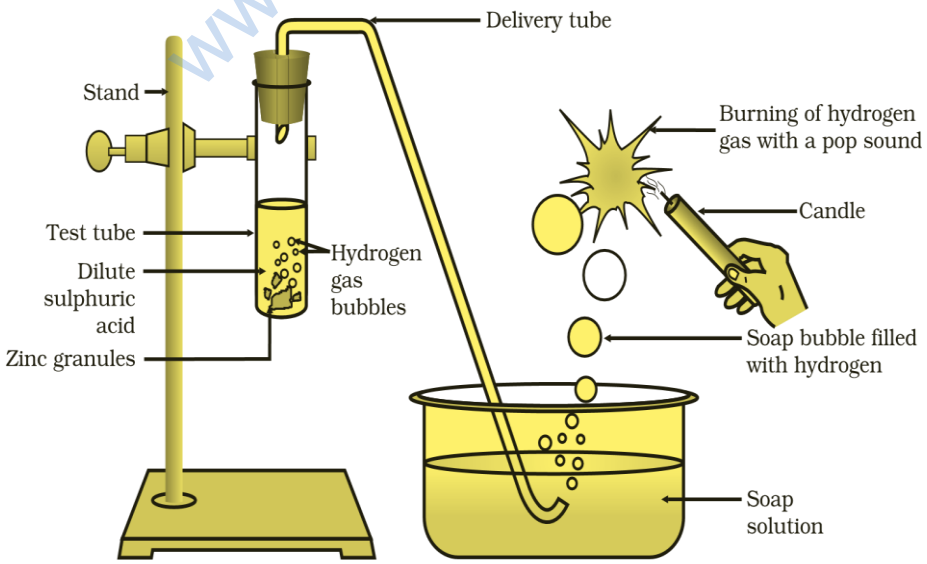
$$\underbrace{Zn}_{Metal} + \underbrace{2H_2SO_4}_{Acid} \longrightarrow \underbrace{Zn(SO_4)_2}_{Salt} + \underbrace{2H_2}_{Hydorgen}$$

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?

Answer 2:

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



Take few pieces of zinc granules and add 5 ml of dilute H_2SO_4. Shake it and pass the gas produced into a soap solution. The bubbles of the soap solution are formed. These soap bubbles contain hydrogen gas.

$$\underbrace{Zn}_{Zinc} + \underbrace{2H_2SO_4}_{Sulphuric\ Acid} \longrightarrow \underbrace{Zn(SO_4)_2}_{Sodium\ Hydroxide} + \underbrace{2H_2}_{Hydorgen}$$

We can test the evolved hydrogen 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.

Answer 3:

$$\underbrace{CaCO_3}_{Calcium\ Carbonate} + \underbrace{2HCl}_{Hydrochloric\ Acid} \longrightarrow \underbrace{CaCl_2}_{\text{Calcium Chloride}} + \underbrace{CO_2}_{Carbondioxide} + \underbrace{H_2O}_{Water}$$

Page 25

Question 1:

Why do HCl, HNO_3, etc., show acidic characters in aqueous solutions while solutions of compounds like alcohol and glucose do not show acidic character?

Answer 1:

The dissociation of HCl or HNO_3 to form hydrogen ions always occurs in the presence of water. Hydrogen ions (H^+) combine with H_2O to form hydronium ions (H_3O^+).

The reaction is as follows:

$$HCl + Water \rightarrow H^+ + Cl^-$$

$$H^+ + H_2O \rightarrow H_3O^+$$

Although aqueous solutions of glucose and alcohol contain hydrogen, these cannot dissociate in water to form hydrogen ions. Hence, they do not show acidic character.

Question 2:

Why does an aqueous solution of an acid conduct electricity?

Answer 2:

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

Question 3:

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

Answer 3:

Colour of the litmus paper is changed by the hydrogen ions. Dry HCl gas does not contain H^+ ions. It is only in the aqueous solution that an acid dissociates to give ions. Since in this case, neither HCl is in the aqueous form nor the litmus paper is wet, 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?

Answer 4:

The process of dissolving an acid or a base in water is a highly exothermic one. Care must be taken while mixing concentrated nitric acid or sulphuric acid with water. The acid must always be added slowly 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. The glass container may also break due to excessive local heating

Question 5:

How is the concentration of hydronium ions (H_3O^+) affected when a solution of an acid is diluted?

Answer 5:

When an acid is diluted, the concentration of hydronium ions (H_3O^+) per unit volume decreases. This means that the strength of the acid decreases.

Question 6:

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

Answer 6:

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

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 this is acidic and which one is basic?

Answer 1:

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.

Question 2:

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

nswer 2:

Concentration of $H^+(aq)$ can have a varied effect on the nature of the 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 $H^+(aq)$ ions? If yes, then why are these basic?

Answer 3:

Yes, basic solution also has $H^+(aq)$ ions. However, their concentration is less as compared to the concentration of OH^- ions that 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)?

Answer 4:

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

Page 33

Question 1:

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

Answer 1:

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

Question 2:

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

Answer 2:

Calcium hydroxide [$Ca(OH)_2$], on treatment with chlorine Cl_2, yields bleaching powder.

Question 3:

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

Answer 3:

Washing soda ($Na_2CO_3.10H_2O$) is used for softening hard water.

Question 4:

What will happen if a solution of sodium hydrocarbonate is heated? Give the equation of the reaction involved.

Answer 4:

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

$$2NaHCO_3 \xrightarrow{Heat} Na_2CO_3 + H_2O + CO_2$$

Question 5:

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

Answer 5:

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

$$\underbrace{CaSO_4.\frac{1}{2}H_2O}_{Plaster\ of\ Peris} + 1\underbrace{\frac{1}{2}H_2O}_{Water} \longrightarrow \underbrace{CaSO_4.2H_2O}_{\text{Gypsum}}$$