Chapter – 2
Acids, Bases and Salts

In Text Questions-Pg-18

Q.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:

We will first mark the three test tubes, A, B and C.

Now, we will divide the red litmus paper into three parts and put a drop from each test tube on the individual red litmus paper.

The test tube which has the base will turn the red litmus blue.

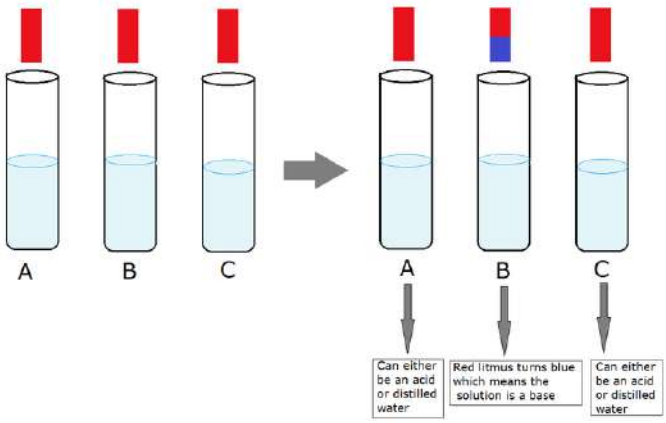
Now, both the acid and distilled water (which is neutral) will have no effect on the litmus paper so in both cases the red litmus will remain red.

To differentiate between the two, mix both the test tubes with the solution we have identified as the base and put a drop from these two solutions on red litmus again.

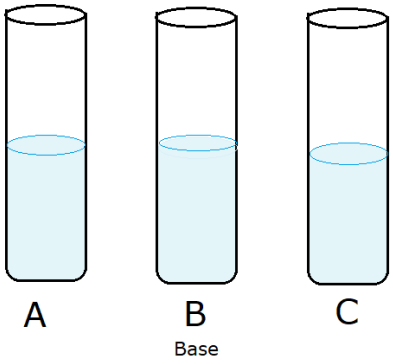
The solution which will have the acid + base won't change the colour of the litmus because acid and base neutralise each other.

The solution which will have the base _ distilled water will change the colour of red litmus to slightly blue.

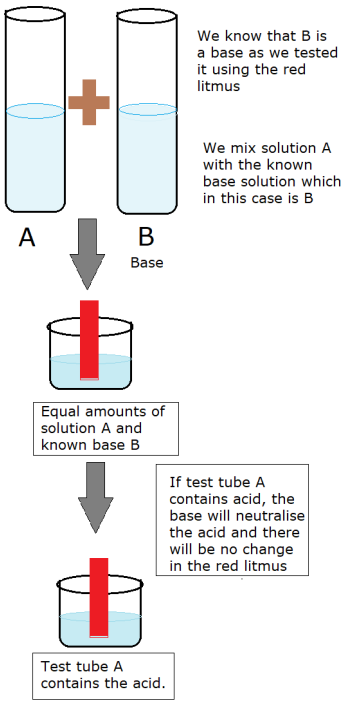
In this way, we can identify the three solutions.



Now, we know that the solution that turned the red litmus blue is the base. In this case, let's assume it is the solution in test tube B.



Now, to find out which solution is the acid and which one is the distilled water, we continue the experiment in the following way.



In Text Questions-Pg-22

Q. 1 Why should curd and sour substances not be kept in brass and copper vessels?

Answer: Curd and other sour substances contain acids. When these substances are kept in brass and copper vessels, the acid reacts with metal and liberated hydrogen gas and other harmful substances which may spoil these substances.

Q. 2 Which gas is usually liberated when an acid reacts with a metal? Illustrate with the help of an example. How will you test the presence of this gas?

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

For example: When zinc granules react with dilute sulphuric acid, then hydrogen gas is liberated and zinc sulphate solution is formed.

$Zn + H_2SO_4 \Longrightarrow ZnSO_4 + H_2$

The evolved hydrogen gas can be tested by taking a burning candle near gas filled bubbles. If candle burns with pop sound, it confirms the evolution of hydrogen gas.

Q. 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: During the chemical reaction, the evolved gas extinguishes a burning candle which means the gas is carbon dioxide. Carbon dioxide is formed when dilute hydrochloric acid reacts with a metal carbonate (or metal hydrogen carbonate) producing effervescence. Since, one of the compounds formed during this reaction is calcium chloride, it means the metal compound is calcium carbonate (It cannot be calcium hydrogen carbonate because calcium hydrogen carbonate is found only in solution, it is also unstable to exist as a solid). Hence, the compound A is calcium carbonate. The chemical reaction is written as follows

$CaCO_3$ (s) + 2HCL (aq) → $CaCl_2$ (aq) + CO_2 (g) + H_2O (I)

In Text Questions-Pg-25

Q. 1 Why do HCl, HNO_3 etc., show acidic character in aqueous solutions while solutions of compounds like alcohol and glucose do not show acidic character?

Answer: Acids form hydrogen ions [H^+ (aq) ions] in its aqueous solution which are responsible for their acidic characters. HCl and HNO_3 form hydrogen ions in aqueous solution hence, they show acidic characters in aqueous solution. While solutions of compounds like alcohol and glucose do not form hydrogen ions in the solution, hence, they do not show acidic character.

Q. 2 Why does an aqueous solution of an acid conduct electricity?

Answer: The presence of hydrogen ions (H^+) or hydronium ions (H_3O^+) in an aqueous solution of acid are responsible for conducting electricity. For example; hydrochloric acid (HCl) dissociates in aqueous solution and gives hydrogen ions [H^+(aq)] and chloride ions Cl^-(aq) which carry electric current. So, due to the presence of these ions, an aqueous solution of hydrochloric acid conducts electricity.

$H_2O(l) + HCl(l) \rightarrow H_3O^+(aq) + Cl^-(aq)$

Q. 3 Why does dry HCl gas not change the colour of dry litmus paper?

Answer: The colour of litmus paper changes only in the presence of ions like hydrogen (H^+) or hydronium (H_3O^+) ions.

HCl can produce these ions only in the form of an aqueous solution.

Hence dry HCl gas does not change the colour of dry litmus paper.

Q. 4 While diluting an acid, why is it recommended that the acid should be added to water and not water to the acid?

Answer: The process of dissolving an acid in water is a highly exothermic in which a large amount of heat is evolved. Care should be taken while mixing a concentrated acid with water. The acid must always be added slowly to water because evolved heat is easily

absorbed by the large amount of water. If water is added to concentrated acid, the heat generated my cause the mixture to splash out and cause burns.

Q. 5 How is the concentration of hydronium ions (H_3Q^+) affected when the solution of an acid is diluted?

Answer: When the solution of an acid is diluted, the concentration of hydronium ions (H3O+) per unit volume decreases.

Q. 6 How is the concentration of hydroxide ions (OH^-) affected when excess of base is dissolved in a solution of sodium hydroxide?

Answer: The concentration of hydroxide ions (OH^-) would increase, when excess of base is dissolved in a solution of sodium hydroxide.

In Text Questions-Pg-28

Q. 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 basic?

Answer: The pH value indicates the acidic and basic nature of a solution. The pH value of less than 7 indicates an acidic solution while greater than 7 indicates a basic solution. The pH value of a neutral solution is 7. Thus, in this case, the solution A with pH = 6 is acidic and has more hydrogen ion concentration than the solution B (pH=8) which is basic.

Q. 2 What effect does the concentration of $H^+(aq)$ ions have on the nature of the solution?

Answer: Higher the concentration of H^+(aq) ions in a solution, more acidic the solution will be.

Q. 3 Do basic solutions also have H^+(aq) ions? If yes, then why are these basic?

Answer: The basic solution also has hydrogen ions [H^+ (aq) ions]. However, they are basic because the concentration of hydrogen ions in them is less than the concentration of hydroxide ions [OH^- ions].

Q. 4 Under what soil condition do you think a farmer would treat the soil of his fields with quicklime (calcium oxide) or slaked lime (calcium hydroxide) or chalk (calcium carbonate)?

Answer: Quicklime, slaked lime and chalk are basic in nature. When they react with acids, neutralization reaction takes place. If the soil is too acidic and not good for cultivation, then to neutralize the acidity of soil, the farmer would treat the soil with these substances.

In Text Questions-Pg-33

Q. 1 What is the common name of the compound $CaOCl_2$?

Answer: The common name of compound $CaOCl_2$ is bleaching powder.

Q. 2 Name the substance which on treatment with chlorine yields bleaching powder.

Answer: Bleaching powder is produced by the action of chlorine on dry slaked lime.

Q. 3 Name the sodium compound which is used for softening hard water.

Answer: Sodium carbonate (Washing soda) is used for softening hard water.

Q. 4 What will happen if a solution of sodium hydrogen carbonate is heated? Give the equation of the reaction involved.

Answer: When a solution of sodium hydrogen carbonate is heated, it undergoes decomposition reaction to form sodium carbonate and carbon dioxide gas is liberated. The equation of the reaction involved is:

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

(Sodium hydrogencarbonate) (Sodium carbonate)

Q. 5 Write an equation to show the reaction between Plaster of Paris and water.

Answer:

$CaSo_4.\frac{1}{2}H_2O \rightarrow CaSO_4.2H_2O$

(Plaster of paris) (Gypsum)

Exercise-Pg-34

Q. 1 A solution turns red litmus blue, its pH is likely to be:

A. 1

B. 4

C. 5

D. 10

Answer: The solution which turns red litmus to blue is basic in nature. The pH value of base solution is greater than 7.

Q. 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: A solution reacts with crushed egg-shells to give a gas that turns lime water milky contains hydrochloric acid.

Q. 3 10 ml of a solution of NaOH is found to be completely neutralised by 8 ml of a given solution of HCI. If we take 20 ml of the same solution of NaOH, the amount of HCl solution (the same solution as before) required to neutralize it will be:

A. 4 ml

B. 8 ml

C. 12 ml

D. 16 ml

Answer: According to the Question, 10ml of NaOH neutralises 8ml Solution of HCl

$\therefore$ 1 ml of NaOH neutralises = $\frac{8}{10} ml\ HCl$

Therefore 20 ml of NaOH will neutralise = $\frac{8}{10} \times 20 = 16\ ml\ HCl$

16 ml of HCl solution will be required to neutralize the 20 ml of NaOH.

Q. 4 Which one of the following types medicines is used for treating indigestion?

A. Antibiotic

B. Analgesic

C. Antacid

D. Antiseptic

Answer: Antacids are a group of mild bases that have no toxic effects on the body. Being basic in nature, antacid reacts with excess of acid in the stomach and neutralizes it. This gives relief to the person concerned.

Q. 5 Write word equations and then balanced equations for the reactions 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:

(a) H_2SO_4 (aq) + Zn (s) → $ZnSO_4$ (aq) + H_2 (g)

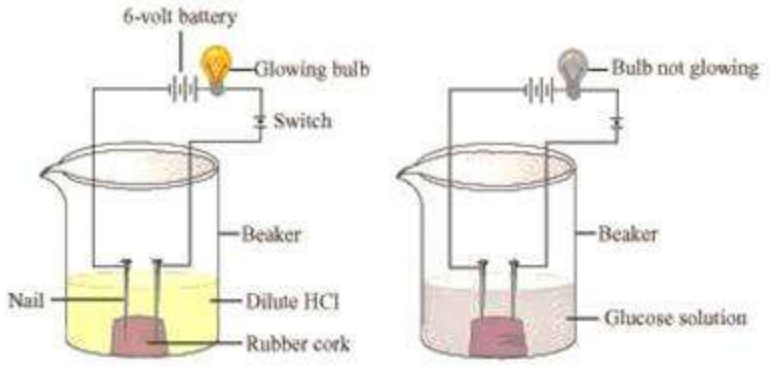
(b) 2HCl (aq) + Mg(s)→ $MgCl_2$ (aq) + H_2(g)

(c) $3H_2SO_4$ (aq) + 2Al (s) → $Al_2(SO_4)_3$ (aq) + $3H_2$ (g)

(d) 6HCl (aq) +2Fe (s) → $2FeCl_3$(aq) +$3H_2$(g)

Q. 6 Compounds such as alcohol and glucose also contain hydrogen but are not categorized as acids. Why? Describe an activity to prove it.

Answer:



(i) Take solution of dilute hydrochloric solution and glucose.

(ii) Two nails are fitted on a cork, and are placed it in a 100mL beaker.

(iii) Then nails are connected to the two terminals of a 6-volt battery through a bulb and a switch as shown in the figure.

(iv) Dilute HCl is poured in the beaker and current is switched on.

(v) Same experiment is performed with glucose solution.

(vi) It will be observed that the bulb glows in HCl solution and does not glow in the glucose solution.

HCl dissociate into H^+ (aq) and Cl^-(aq) ions which are responsible for conducting electricity. 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's why, though compounds like glucose and alcohol contain hydrogen, they are not categorized as acids.

Q. 7 Why does distilled water not conduct electricity whereas rain water does?

Answer: Distilled water is a pure form of water which does not contain ions, hence distilled water does not conduct electricity. Rain water, being an impure form of water, contains many ionic compounds like acids, hence it conducts electricity.

Q. 8 Why do acids not show acidic behaviour in the absence of water?

Answer: Acids form hydrogen ions [H^+ (aq) ions] in its aqueous solution which are responsible for their acidic characters. In the absence of water, acids do not produce hydrogen ions and hence do not show acidic behavior.

Q. 9 Five solutions A, B, C, D and E when tested with universal indicator showed pH as 4, 1, 11, 7 and 9 respectively.

(a) Which solution is (i) neutral (ii) strongly alkaline (iii) strongly acidic (iv) weakly acidic, and (v) weakly alkaline?

(b) Arrange the pH values in the increasing order of hydrogen ion concentration.

Answer: (a) (i) The pH of neutral solution is 7. Thus, the neutral solution is D with pH=7.

(ii) The pH value of greater than 7 indicates the basic solution. Higher pH value represents strong alkaline solution. Thus, strong alkaline solution is C with pH=11.

(iii) The pH value of less than 7 indicates the acidic solution. Lower pH value represents a strong acidic solution. Thus, a strong acidic solution is B with pH=1.

(iv) Weakly acidic: A (pH=4);

(v) Weakly alkaline: E (pH=9)

(b) pH scale quantifies the concentration of hydrogen ion in a solution. The pH value increases with a decrease in hydrogen ion concentration. The solution having pH 11 will have the minimum hydrogen ion concentration than the solution having pH 1. Thus, the arrangement of solutions in the increasing order of their hydrogen ion concentrations as follows:

C < E <D <A <B

(pH 11) < (pH 9) <(pH 7)< (pH 4)< (pH 1)

Q. 10 Equal lengths of magnesium ribbons are taken in test-tubes A and B. Hydrochloric acid (HCI) 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: When acid reacts with magnesium metal, hydrogen gas is produced which causes fizzing. Hydrochloric acid is a much stronger acid than acetic acid thus having greater number of hydrogen ions in it. Hence, during the chemical reaction with magnesium metal, hydrochloric acid will produce more hydrogen gas and the fizzing will be more vigorous in test-tube A.

Q. 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: The pH of fresh milk is 6. As milk turns into curd, lactic acid is formed due to which it become more acidic. Therefore, the pH of milk will reduce.

As the milk turns into curd, its pH will fall below 6 (it will become more acidic). This is because an acid (lactic acid) is produced when milk turns into curd.

Q. 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 longer time to set as curd?

Answer: (a) Since fresh milk is slightly acidic in nature, the milkman adds little baking soda to make the milk slightly alkaline. This will prevent the milk from getting sour due to lactic acid formation.

(b) For setting into a curd, the lactic acid, formed during curdling, needs to first neutralize the alkali present in the milk. Hence, the slightly alkaline milk takes longer time to set as curd.

Q. 13 Plaster of Paris should be stored in a moisture-proof container. Explain why?

Answer: Plaster of Paris should be stored in a moisture-proof container because it absorbs moisture (or water) to form a hard substance called gypsum which makes Plaster of Paris useless.

Q. 14 What is a neutralization reaction? Give two examples.

Answer: The reaction between an acid and a base to give a salt and water is known as neutralization reaction. That is:

Acid + Base → Salt + Water

For example:

(i) Sodium hydroxide (NaOH) reacts with hydrochloric acid (HCl) to form sodium chloride (NaCl) and water:

$NaOH + HCl \longrightarrow NaCl + H_2O$

(Base) (Acid) (Salt) (Water)

(ii) Magnesium hydroxide reacts with hydrochloric acid to form magnesium chloride and water:

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

Q. 15 Give two important uses each of washing soda and baking soda.

Answer: (a) Uses of Washing Soda:

(i) It is used for removing permanent hardness of water.

(ii) It is used in the manufacture of sodium compounds such as borax.

(b) Uses of Baking Soda:

(i) It is used in making baking powder. Baking powder is a mixture of baking soda and a mild edible acid called tartaric acid. When baking powder is heated or mixed in water, it releases CO_2 that makes cakes or bread fluffy.

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