Acids, Base & Salts

Check Point 01

Q. 1. Which type of chemical compound found in citrus fruits?

Answer: Citrus fruits contain an acid called citric acid. Lemon, orange are examples of citrus fruits. They also contain ascorbic acid which is commonly known as Vitamin C. In short, the chemical compound found in citrus fruits is acidic in nature.

Q. 2. What happens when CO_2 gas is passed through lime water?

Answer: Lime water is a solution of calcium hydroxide ($Ca(OH)_2$). When CO_2 gas is passed through lime water, the following reaction occurs.

$$Ca(OH)_2 + CO_2 \rightarrow \underset{\text{(white precipitate)}}{CaCO_3\downarrow} + H_2O$$

The solution of lime water turns milky due to the formation of calcium carbonate, which is a white precipitate insoluble in water.

If CO_2 gas is passed in excess amounts, then the above reaction occurs further.

$$CaCO_3\downarrow + H_2O + CO_2 \rightarrow \underset{\text{(soluble in water)}}{Ca(HCO_3)_2}$$

The product formed is calcium hydrogen carbonate, which is soluble in water. Hence the milky solution becomes a clear solution.

Q. 3. Bases should not be kept in active metal container. Why?

Answer: Containers should be selected such that they should not react with what is to be stored. Bases react with active metals (metals which are highly reactive) to form salt and hydrogen gas. Hence, metal containers cannot be used to store bases.

Q. 4. Give a chemical reaction to prove that non-metallic oxides are acidic in nature.

Answer: Consider the following reaction,

$$Ca(OH)_2 + \underset{\text{(non-metallic oxide)}}{CO_2} \rightarrow CaCO_3 + H_2O$$

Here, calcium hydroxide ($Ca(OH)_2$) is a base, and it reacts with carbon dioxide (CO_2) to give salt (calcium carbonate) and water. Comparing the above reaction with,

Base + Acid → Salt + Water

One can see that CO_2 acts as an acid. Hence, one can prove that non-metallic oxides are acidic in nature.

Q. 5. Name the reaction in which acid reacts with base.

Answer: The reaction between an acid and a base is called neutralization. Neutralization can be represented by the equation,

Acid + Base → Salt + Water

Where the nature of salt (acidic or basic) depends upon the nature of acid and base used.

Q. 6. How H_3O^+ ion is formed in water solution?

Answer: When acid is added to water, H^+ ions are formed in the solution. These ions cannot exist alone and hence they readily combine with water molecules to form the hydronium ion (H_3O^+).

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

Q. 7. What is the effect of dilution on an acid or base?

Answer: Dilution is the process of decreasing the strength of an acid or base. We know that acids and bases produce H_3O^+ and OH^- ions in water. When they are diluted (by having more amount of water), the concentration of H_3O^+ or OH^- ions per unit volume decreases. This results in decrease of the strength of the acid or base.

Check Point 02

Q. 1. Which indicator gives pink colour in basic solution?

Answer: Phenolphthalein is a colourless indicator which gives pink colour in basic solution. It does not give any colour for acidic solutions.

Q. 2. In which pH range our body works?

Answer: The human body works in a slightly basic nature. The pH range within which our body works is 7.0-7.8. A slight pH change from this range can cause severe effects to our body.

Q. 3. How toothpaste prevents tooth decay?

Answer: Tooth decay occurs when the pH of the mouth falls less than 5.5. The bacteria present in the mouth degrade the food remaining in the mouth after eating and produce acids. These acids lower the pH of the mouth, causing tooth decay.

Toothpastes are basic in nature, and therefore cleaning the teeth with toothpastes would result in neutralization of excess acids. Thus toothpaste prevents tooth decay.

Q. 4. Name the chemical which is injected into the skin of a person during wasp's sting and during the nettle leaf hair sting.

Answer: A wasp sting is alkaline in nature. The nettle leaf sting contains methanoic acid (or formic acid) which is acidic in nature.

Q. 5. How will you get relief if an insect bites?

Answer: The basic principle behind getting relief from an insect bite is neutralization. The insect sting/bite may produce a secretion which is acidic or basic in nature. Based on that, one can choose basic or acidic substance so as to neutralize the effect. This way, less pain is experienced. Apply an alkaline substance if the sting is acidic and an acidic substance if the sting is alkaline (basic).

For example, ant stings are acidic (methanoic acid). Hence it should be treated with an alkaline substance like baking soda.

Q. 6. Write the role of HCl present in the stomach.

Answer: HCl present in the stomach has multiple uses, and they are listed below.

● It provides an acidic medium for the enzymes present in the stomach to function properly. These enzymes are activated by the secretion of HCl.

● HCl in stomach is highly acidic (pH – 1 to 2) and helps in killing bacteria and other harmful microorganisms.

Check Point 03

Q. 1. Sea water contains many salts dissolved in it. How can the salt that we use in food is obtained?

Answer: First of all sea water is collected at a place having large surface area. Then it is left to let water evaporate due to heat of sunlight falling on it. And then the salts are left in place which are moved from there to other places.

The salt we use in our food is also obtained by same process.

Q. 2. What is 'chlor-alkali' process and what products are formed during this process?

Answer: The production of sodium hydroxide and chlorine from brine solution by through electricity is known as chlor-alkali process.

When electricity is passed through a highly concentrated solution of salt and water (Brine solution), the electrolysis of water takes place and we obtain three different products. We get chlorine gas on anode and hydrogen gas and sodium hydroxide solution on cathode.

Q. 3. Name the chemical compound which is used as a disinfectant for water.

Answer: Chlorine in form of tablets is used as disinfectant for water

Q. 4. When a sodium compound X which is also used in soda-fire extinguisher is heated, gives a sodium compound Y along with water and carbon dioxide. Y on crystallisation forms compound Z. Identify X, Y and Z.

Answer: The sodium compound X used in fire extinguisher is Sodium bicarbonate ($NaHCO_3$) and when it is heated it gives sodium carbonate (Na_2CO_3) as Y along with water (H_2O) and carbon dioxide (CO_2). Sodium carbonate on absorbs 10 molecules of water and crystallises into sodium decahydrate ($Na_2CO_3.10H_2O$).

Thus X is Sodium bicarbonate (NaHCO3), Y is sodium carbonate (Na_2CO_3) and Z is sodium decahydrate ($Na_2CO_3.10H_2O$).

Q. 5. Write the chemical formula of blue vitriol.

Answer: Blue vitriol is common name for Copper sulphate solution which has chemical formula as $CuSO_4$.

Chapter Exercise

Q. 1. Which acid is present in vinegar?

Answer: Acetic acid (CH_3COOH) is present in vinegar. In vinegar, about 5-20% acetic acid is present.

Q. 2. Which solution is more acidic, one with a pH of 4 or one with a pH of 1?

Answer: The solution which has pH of 1 is more acidic.

According to the pH scale, value less than 7 on the pH scale represents an acidic solution while value greater than 7 represents a basic solution. And pH value 7 represents a neutral solution. Also lesser pH indicates more acidic and more pH indicates more basic.

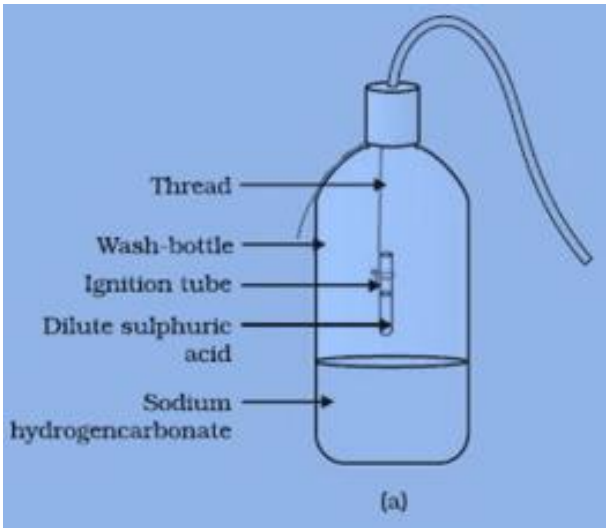
Q. 3. A student dipped pH paper in rain water. What would be the colour of the pH paper?

Answer: The colour of the pH paper would be red because rainwater is acidic in nature due to pollutant gases like Sulphur dioxide and nitrogen oxides. These gases react with water in clouds and form sulphuric acid and nitric acid.

Q. 4. Name the chemicals used in making fire extinguisher.

Answer: The chemicals used in making fire extinguisher are acid (Sulphuric acid) and Sodium hydrogen carbonate ($NaHCO_3$). This acid reacts with sodium hydrogen carbonate and CO_2 gas evolves. And this CO2 gas helps to put off the fire.

$H_2SO_4 + 2NaHCO_3 \rightarrow 2CO_2 + 2 H_2O + Na_2SO_4$



Q. 5. Why blue colour of copper sulphate crystals disappears on heating?

Answer: Copper sulphate crystals contain water of crystallisaton. Water of crystallization is the fixed number of water molecules present in one formula unit of a compound. Copper sulphate crystal contains five water molecules in one formula unit. When we heat the copper sulphate crystals then this water is removed and the colour of crystals turn white.

Q. 6. Name an acid which is present in baking powder

Answer: The acid which is present in baking powder is tartaric acid. Baking soda (sodium hydrogen carbonate) reacts to tartaric acid and forms CO_2 gas, water and sodium salt of acid. This CO_2 gas makes bread or cake soft and spongy.

$NaHCO_3$ + Acid $\rightarrow$ $CO_2 + H_2O$ + Sodium salt of acid

Q. 7. The pH of a sample of vegetable soup was found to be 6.5. How is this soup likely to taste?

Answer: Since the pH of a sample of vegetable soup is 6.5. So according to pH paper, it is acidic in nature. And acids are sour in taste. So vegetable soup will be sour in taste.

Q. 8. Write down the net ionic equation for the reaction of sodium hydroxide with hydrochloric add.

Answer: $H^+(aq) + Cl^-(aq) + Na^+(aq) + OH^-(aq) \rightarrow Na^+(aq) + Cl^-(aq) + H_2O$

Explanation- When acid reacts to base then salt is formed. This reaction is called neutralization reaction.

Q. 9. What happens when crystals of washing soda are kept open in the air for long time?

Answer: When crystals of washing soda ($Na_2SO_4.10H_2O$) are kept open in the air for long time then the water of crystallization will lose and the crystals will turn to white. This process of loosing water of crystallization when kept in air is called efflorescence.

$Na_2SO_4.10H_2O \rightarrow Na_2SO_4 + 10H_2O$

Q. 10. What is the use of common salt in soap industry?

Answer: The soap is washed with NaCl or brine solution to separate glycerin. Common salt is added to the neat soap after the saponification reaction. Common salt is added for precipitation to occur and to separate soap from aqueous solution. Salt is also used to separate glycerol from the water.

Q. 11. Complete the following equation:

NaOH + Zn → ___ **+**____

Answer: $2NaOH + Zn \rightarrow Na_2ZnO_2 + H_2$

Explanation- When metal react to base then metallic salt and hydrogen (H_2) gas are formed.

Balancing of chemical equation-

(i) Here one Na atom is in left side and 2 Na atom are in right side. So to equate the Na atoms, we will multiply in NaOH by 2.

$2NaOH + Zn \rightarrow Na_2ZnO_2 + H_2$

(ii) And we shall check that other atoms are equal or not. If the other atoms are equal to both side then the equation is balanced. If the other atoms are not equal then we shall make them equal.

Now Na atoms are equal, Zn atoms are equal, H atoms are equal and O atoms are also equal on both sides. So the chemical equation is balanced.

Q. 12. What happens when nitric acid is added to an egg shell?

Answer: Since egg shell is made of calcium carbonate. And we know that when calcium carbonate ($CaCO_3$) reacts with nitric acid (HNO_3) then carbon dioxide, calcium

nitrate and water are formed. So same reaction happens when nitric acid is added to an eggshell.

$CaCO_3 + 2HNO_3 \rightarrow Ca(NO_3)_2 + CO_2 + H_2O$

Q. 13. Which gas is evolved when hydrochloric acid is added in first test tube containing small pieces of marble and then in second test tube containing zinc granules?

Answer: We know that when calcium carbonate ($CaCO_3$) reacts with hydrochloric acid (HCl) then carbon dioxide, calcium chloride and water are formed. So when hydrochloric acid is added in first test tube containing small pieces of marble then CO_2 gas is evolved.

$CaCO_3 + 2HCl \rightarrow CO_2 + H_2O + CaCl_2$

And when acid reacts with metal then salt and hydrogen (H2) gas are formed. So when hydrochloric acid is added in second test tube containing zinc granules then H2 gas is evolved.

$Zn + 2HCl \rightarrow ZnCl_2 + H_2$

Q. 14. Name the gas evolved when potassium nitrate crystals are heated with concentrated sulphuric acid.

Answer: When potassium nitrate (KNO_3) crystals are heated with concentrated sulphuric acid (H_2SO_4) then vapours of nitric acid (HNO_3) are evolved and potassium bisulphate is also formed.

$KNO_3 + H_2SO_4 \rightarrow HNO_3 + KHSO_4$

Q. 15. What happens when an acid or a base is added to the water? Why does the beaker appear warm? Why should we always add acid or base to the water and not water to the acid or base?

Answer: When an acid or base is added to water:

i. When we add acid to the water, acid gives H^+ or H_3O^+ (hydronium ion) in water. For example: If we add HCl (an acid) to water, the reaction takes place is given as:

$$HCl + H_2O \rightarrow \underset{\text{Hydronium ion}}{H_3O^+} + Cl^-$$

ii. When we add base to the water, base produces OH^- (hydroxide ions) in water. For example: If we add NaOH to water, the reaction takes place is given as:

$$NaOH + H_2O \rightarrow Na^+ + \underset{\text{Hydroxyl ion}}{OH^-}$$

The beaker appears warm because the process of dissolving an acid or base in water is a highly exothermic one (releases energy)

We should always add acid or base to the water with constant stirring because if water is added to acid or base, the heat generated may cause the mixture to splash (a small blast) and cause harmful burns.

Q. 16. Give reasons:

(i) Use of a mild base like baking soda provides relief on the area stung by honeybee.
(ii) Baking powder is added to make the cakes spongy and soft.
(iii) The colour of blue copper sulphate crystals changes to white on heating.

Answer: (i) When a honeybee stings a person, this means it releases an acidic liquid (formic acid) into the body. This causes too much pain and irritation. As we know that baking soda (sodium hydrogen carbonate $NaHCO_3$) is a mild non-corrosive base. It can be used to neutralize an acid.

Hence, when it is applied to the stung area, it reduces the effect of acid by neutralizing the excess acid. As a result, the pain and irritation is reduced.

(ii) Baking powder, which is a mixture of baking soda and tartaric acid. When baking soda is heated or mixed in water, the reaction takes place is given as:

$$NaHCO_3 + \underset{\text{(releases from acid)}}{H^+} \rightarrow CO_2 + H_2O + \text{sodium salt of acid}$$

Carbon dioxide released during the reaction causes the bread or cake dough to rise which makes them soft and spongy.

(iii) The colour of blue copper sulphate crystals changes to white on heating because:

a. Blue copper sulphate crystals contain water of crystallization.
b. When we heat the crystals, the water is removed.
c. As a result, the salt turns white.

Q. 17. Among sulphurous acid and sulphuric acid, which is stronger and why?

Answer: Sulphuric acid (H_2SO_4) is much stronger than sulphurous acid (H_2SO_3) because when sulphuric acid dissociates, it gives more number of H^+ ions i.e. 2 whereas on dissociation, sulphurous acid gives less number of H^+ ions i.e. 1.

Q. 18. Acetic acid is a weak acid and ammonia is a weak base. Discuss the term weak.

Answer: The strength of acids and bases depends on the number of H^+ ions and OH^- ions produced.

i. Acids that give rise to more H^+ ions are said to be strong acids and acids that give less H^+ ions are said to be weak acids.

ii. Bases that give rise to more OH^- ions are said to be strong bases and bases that give less OH^- ions are said to be weak bases.

Q. 19. Give reason why solution of sulphuric acid conduct electricity whereas, alcohol does not.

Answer: Sulphuric acid conducts electricity because:

i. Sulphuric acid is a strong acid wheras alcohol is weak acid.

ii. When sulphuric acid is mixed with water, it produces more number of H^+ ions and when alcohol is mixed with water, it produces less number of H^+ ions.

iii. This means sulphuric acid has more number of free electrons or mobile ions than alcohol.

iv. More the number of free electrons or mobile ions present, more will be the electricity.

v. Hence, sulphuric acid conduct electricity whereas, alcohol does not.

Note: When an acid is dissolved in water, it produces number of ions. The presence of ions (free electrons) are mainly responsible for the conduction of electricity.

Q. 20. Answer the following:

(i) What happens when a concentrated solution of sodium chloride is electrolysed? Write the equation of the reaction involved.
(ii) Why is the electrolysis of a concentrated solution of sodium chloride known as chlor-alkali process?
(iii) Name three products of the chlor-alkali process. State two uses of each product.

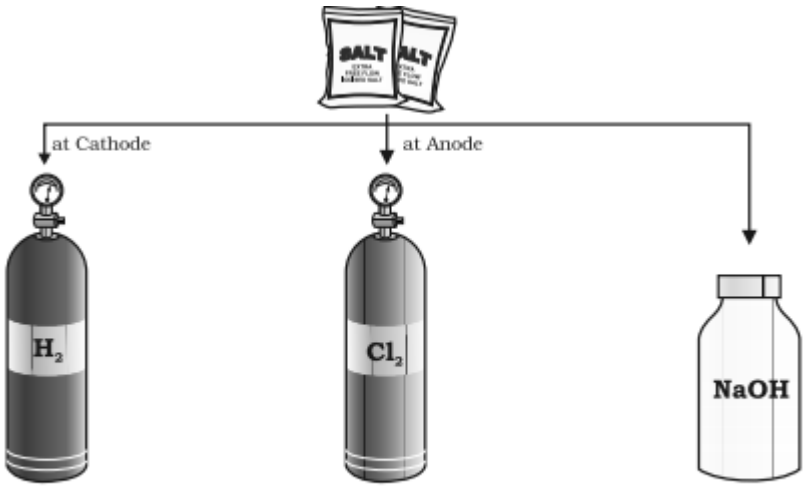
Answer: (i) When a concentrated solution of sodium chloride is electrolyzed, it forms sodium hydroxide (NaOH), chlorine gas and hydrogen gas.

Chlorine gas is formed at anode (positively charged) and hydrogen gas at cathode (negatively charged)

The reaction takes place is given as:

$2NaCl + 2H_2O \rightarrow 2NaOH + Cl_2 + H_2$

The above reaction is called chlor-alkali process.



Chlor-alkali process

(ii) The electrolysis of a concentrated solution of sodium chloride known as chlor-alkali process because of the products formed:

a. The products formed in this reaction are NaOH (a strong base/alkali), chlorine and hydrogen gas.

b. “Chlor” means chlorine and “alkali” means base i.e. NaOH.

(iii) The three products of thee chlor-alkali process are:

Sodium hydroxide (NaOH)

Uses:

a. It is mostly used in soaps and detergents.

b. It is also used to make papers and artificial fibers.

Chlorine gas

Uses:

a. It is mostly used in medicines and in fuels.

b. It is used with ammonia for fertilizers.

Hydrogen gas

Uses:

a. It is used in treatment of water in swimming pools.

b. It is used as disinfectants and pesticides.

Note: Water of crystallization is the fixed number of water molecules present in one formula unit of a salt. Five water molecules are present in one formal unit of copper sulphate, i.e., $CuSO_4.5H_2O$

Q. 21. Explain why is hydrochloric acid is called, a strong acid and acetic acid, a weak acid? How can it be verified?

Answer: The strength of acids and bases depends on the number of H^+ produced.

i. Acids that give rise to more H^+ ions are said to be strong acids and acids that give less H^+ ions are said to be weak acids.

ii. Hydrochloric acid (HCl) gives more number of H^+ on dissociation:

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

iii. On the other hand, acetic acid (CH_3COOH) gives H^+ ions but it is a reversible reaction and thus the ions formed gets to form acetic acid and reaction proceeds in backward direction through a reversible reaction. Due to reversibility, less number of H^+ ions are produced:

$CH_3COOH \leftrightarrow CH_3COO^- + H^+$

iv. Hence, hydrochloric acid is called strong acid and acetic acid is called a weak acid.

Q. 22. State in brief the method of preparation of bleaching powder. Write a balanced chemical equation for the reaction involved and state the uses of bleaching powder.

Answer: The method of preparation of bleaching powder is:

i. Chlorine gas is used for the manufacture of bleaching powder.

ii. When dry slaked lime is passed through chlorine gas, it forms bleaching powder.

iii. The reaction takes place is given as:

$$\underset{\text{Slaked lime}}{Ca(OH)_2} + Cl_2 \rightarrow \underset{\text{Bleaching powder}}{CaOCl_2} + H_2O$$

Uses of bleaching powder:

i. It is used for disinfecting drinking water to make it germfree.

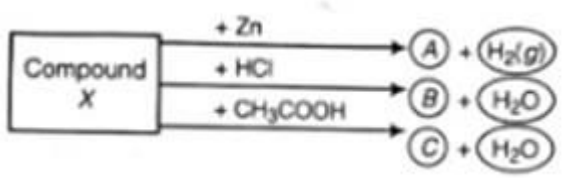
ii. It is used for bleaching cotton and linen in the textile industry.

iii. It is used to bleach dirty clothes in the laundry.

iv. It is used as an oxidizing agent in many chemical industries.

v. It is used for bleaching wood pulp in paper factories.

Q. 23. Identify the compound X on the basis of the reactions given below. Also, write the name and chemical formula of A, B and C.



Answer: The X must be sodium hydroxide (NaOH) because of the following reactions:

i. When NaOH reacts with zinc (a metal), it gives sodium zincate (a salt) and hydrogen gas:

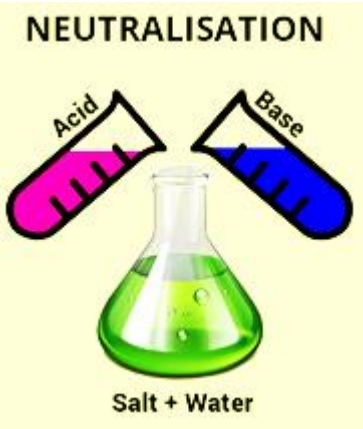
$$2NaOH + Zn \rightarrow \underset{\text{Sodium zincate}}{Na_2ZnO_2} + H_2$$

ii. When sodium hydroxide (a base) and HCl (an acid) reacts together, they form a common salt (NaCl) and water:

$NaOH + HCl \rightarrow NaCl + H_2O$

Note: The above reaction is a neutralization reaction. The reaction between an acid and a base to give a salt and water is called neutralization reaction.

Base + Acid → Salt + Water



iii. When NaOH and CH_3COOH (an acid) reacts together, they form a salt of sodium acetate and water:

$$NaOH + CH_3COOH \rightarrow \underset{\text{Sodium acetate}}{CH_3COONa} + H_2O$$

The above reaction is also an example of neutralization reaction.

Thus, X is NaOH.

A is sodium zincate (Na_2ZnO_2)

B is common salt (NaCl)

C is sodium acetate (CH_3COONa)

Q. 24. Fill in the missing data in the given table.

	Name of the salt	Formula	Salt obtained from	
			Base	Acid
(i)	Ammonium chloride	NH_4Cl		-
(ii)	Copper sulphate	-	-	H_2SO_4
(iii)	Sodium chloride	NaCl	NaOH	-
(iv)	Magnesium nitrate	$Mg(NO_3)_2$	-	HNO_3
(v)	Potassium sulphate	K_2SO4	-	-
(vi)	Calcium nitrate	$Ca(NO_3)_2$	$Ca(OH)_2$	-

Answer:

	Name of the salt	Formula	Salt obtained from	
			Base	Acid
(i)	Ammonium chloride	NH_4Cl	NH_3	HCl
(ii)	Copper sulphate	$CuSO_4$	$CuCO_3$	H_2SO_4
(iii)	Sodium chloride	NaCl	NaOH	HCl
(iv)	Magnesium nitrate	$Mg(NO_3)_2$	$Mg(OH)_2$	HNO_3
(v)	Potassium sulphate	K_2SO_4	KOH	H_2SO_4
(vi)	Calcium nitrate	$Ca(NO_3)_2$	$Ca(OH)_2$	HNO_3

(i)

$NH_3 + HCl \rightarrow NH_4Cl + H_2O$

Base Acid Ammonium chloride(salt)

When ammonia reacts with hydrochloric acid, it forms ammonium chloride and water.

(ii)

$CuCO_3 + H_2SO_4 \rightarrow CuSO_4 + CO_2 + H_2O$

Base Acid Copper sulphate(salt)

When copper carbonate reacts with sulphuric acid, it forms copper sulphate, carbon dioxide and water.

(iii)

$NaOH + HCl \rightarrow NaCl + H_2O$

Base Acid sodium chloride(salt)

When sodium hydroxide reacts with hydrochloric acid, it forms sodium chloride and water.

(iv)

$Mg(OH)_2 + 2HNO_3 \rightarrow Mg(NO_3)_2 + 2H_2O$

Base Acid Magnesium nitrate (salt)

When magnesium hydroxide (milk of magnesia) reacts with nitric acid, it forms magnesium nitrate and water.

(v)

$2KOH + H_2SO_4 \rightarrow K_2SO_4 + 2H_2O$

Base Acid Potassium sulphate(salt)

When potassium hydroxide reacts with sulphuric acid, it forms potassium sulphate and water.

(vi)

$Ca(OH)_2 + 2HNO_3 \rightarrow Ca(NO_3)_2 + 2H_2O$

Base Acid Calcium nitrate (salt)

When calcium hydroxide reacts with nitric acid, it forms calcium nitrate and water.

Q. 25. Rohan was very angry because of the oil spot on his favourite shirt. His mother want to make him happy and doesn't know what to do. Her neighbour Mrs Sharma advised him to use bleach (bleaching powder, $CaOCl_2$) to remove the oil spot. Read the above passage and answer the following questions.

(i) Would you suggest the same thing to remove oil spot? Why or why not? Justify your answer.

(ii) Which substance, is available in the market to remove such spots?
(iii) What values are associated with Mrs Sharma?

Answer: (i) No, we will not suggest to use bleach (bleaching powder, $CaOCl_2$) to remove oil spot. Bleaching powder will hide oil spot but cause a discolouration. It would not draw oil out of the clothing at all.

Bleach is not used to remove greasy things out of the clothes as it can damage the fine fabrics in it

(ii) Detergents are available in the market to remove such oil spots

They show instant results. They have a property to remove any kind of stain. These are used to remove greasy things out of the clothes.

(iii) Mrs. Sharma is not aware of the damages caused by using bleach on the clothes.

Q. 26. Enamel has calcium phosphate [$Ca_3(PO_4)_2$]. When we eat sweets, they form acid in our mouth which reacts and tooth decay starts. To avoid tooth decay, we should brush our teeth after every meal. Sonu brushes his teeth twice a day whereas Monu brushes once a day only. Answer the following questions.

(i) Is toothpaste acidic, basic or neutral? Give reason.
(ii) What values are associated by Sonu, who brushes his teeth twice a day?

Answer: (i) Toothpaste is basic.

a. Our tooth is made up of calcium phosphate.
b. It gets corroded and damaged when the pH in the mouth falls to 5.5 (acidic).
c. Bacteria present in the mouth produce acids from food particles which remains in the mouth after eating.
d. The best way to prevent this is to clean the mouth by using toothpastes which can neutralize the effect of excess acid.
e. Toothpaste prevents tooth decay.

(ii) Sonu is concern and aware of the mouth problems caused by tooth decay. He is a well-mannered and a hygienic person.

Q. 27. Dinesh is a farmer. He got pH of his soil tested and followed advice of Agricultural Scientists of 'Kissan Centre' in growing crops. He got better quality of crops this year. Answer the following questions.

(i) Why should we get our soil tested?
(ii) If soil has pH less than 7, how can we make it neutral?
(iii) What values are possessed by Dinesh?

Answer: (i) Plants need a specific pH test, so that we can regularly check the pH range of the soil which is very important for its healthy growth.

a. By knowing the pH range, we can determine the appropriate amount of fertilizers to use so that the production of crop may be occurred instantly.

b. The soil pH is important because it affects the presence of nutrients in the soil.

(ii) If the soil has pH less than 7, we can make it neutral by using calcium carbonate (limestone) It increases the pH of soil.

(iii) Dinesh is concern and aware.

Challengers

Q. 1. Aqueous solution of copper sulphate reacts with aqueous ammonium hydroxide solution to give.

A. brown precipitate
B. pale blue precipitate
C. white precipitate
D. green precipitate

Answer: When aqueous solution of copper sulphate reacts with aqueous ammonium hydroxide, it gives a precipitate of copper hydroxide which is pale blue in colour.

The reaction that takes place is:

$$CuSO_4 + 2NH_4OH \rightarrow Cu(OH)_2 + (NH_4)_2SO_4 + 4H_2O$$

Copper sulphate — Ammonium hydroxide — pale blue precipitate

Q. 2. Acetic acid was added to a solid X kept in a test tube. A colourless and odourless gas was evolved. The gas was passed through lime water which turned milky. It was concluded that.

A. Solid X is sodium hydroxide and the gas evolved is CO_2,

B. Solid X is sodium bicarbonate and the gas evolved is CO_2

C. Solid X is sodium acetate and the gas evolved is CO_2

D. Solid X is sodium chloride and the gas evolved is CO_2

Answer: When any acid reacts with metal hydrogencarbonate, the products formed are salt, carbon dioxide (CO_2) and water.

Metal hydrogencarbonate + Acid → Salt + Carbon dioxide + Water

Hence, when acetic acid reacts with sodium bicarbonate ($NaHCO_3$), a colourless and odourless of carbon dioxide gas is evolved.

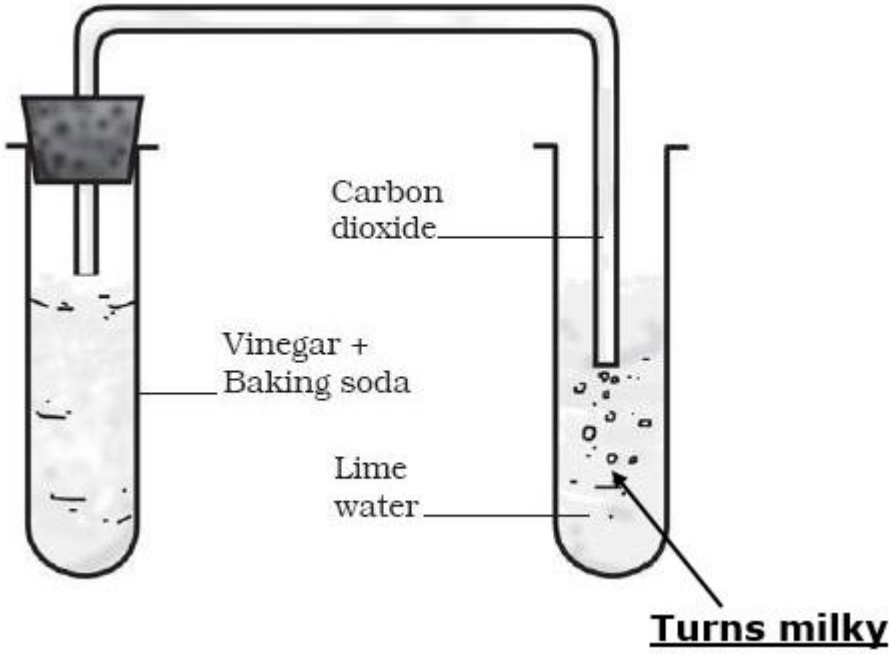
When carbon dioxide gas is passed through lime water [$(CaOH)_2$], the following reaction takes place:

$$(CaOH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$$

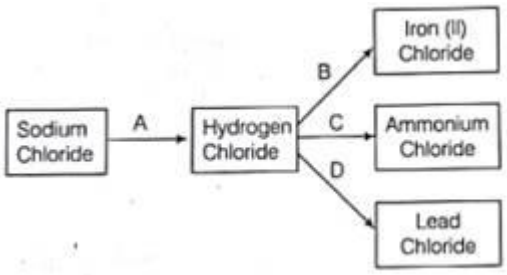
Limewater — Calcium Carbonate

i. In this reaction, when limewater comes in contact with the gas released in the form of an effervescence, it turns milky. This is a chemical test for carbon dioxide gas.

ii. When limewater turns milky, it is confirmed that the effervescence is of carbon dioxide.



Q. 3. Consider the following reaction:



Here, A, B, C and D respectively are:

A. A = Conc. HCl; B = Fe; C = NH_4OH; D = PbO

B. A = Conc. H_2SO_4; B = Fe; C = NH_4OH; D = $Pb(NO_3)_2$

C. A = Conc. H_2SO_4; B = Fe; C = NH_3; D= $Pb(NO_3)_2$

D. A = Conc. HCl; B = Fe; C = NH_3; D =PbO

Answer: Step 1: When sodium chloride reacts with conc. H_2SO_4, it forms hydrogen chloride (HCl) and sodium sulphate (Na_2SO_4).

The reaction that takes place is:

$2NaCl + \text{conc. } H_2SO_4 \rightarrow 2HCl + Na_2SO_4$

Thus, A is concentrated H_2SO_4

Step 2: When hydrogen chloride reacts with iron metal (Fe), it forms iron (II) chloride ($FeCl_2$) and hydrogen gas (H_2).

The reaction that takes place is:

$Fe + HCl \rightarrow FeCl_2 + H_2$

Thus, B is Fe.

Step 3: When hydrogen chloride reacts with ammonia (NH3), it forms ammonium chloride (NH_4Cl).

The reaction that takes place is:

$NH_3 + HCl \rightarrow NH_4Cl$

Thus, C is ammonia (NH_3).

Step 4: When hydrogen chloride reacts with lead nitrate [$Pb(NO_3)_2$], it forms lead chloride ($PbCl_2$) and nitric acid (HNO_3) .

The reaction that takes place is:

$Pb(NO_3)2 + HCl \rightarrow PbCl_2 + HNO_3$

Thus, D is lead nitrate [$Pb(NO_3)_2$]

Q. 4. In one of the industrial processes used for manufacture of sodium hydroxide, a gas X is formed as by-product. The gas X reacts with lime water to give a compound Y which is used as a bleaching agent in chemical industry. The compound X and Y could be

A. H_2 and $NaHCO_3$, respectively

B. CO_2 and $CaOCl_2$ respectively

C. Cl_2 and $CaOCl_2$ respectively

D. Cl_2 and $NaHCO_3$ respectively

Answer: The process includes the following steps:

Step 1: Preparation of sodium hydroxide:

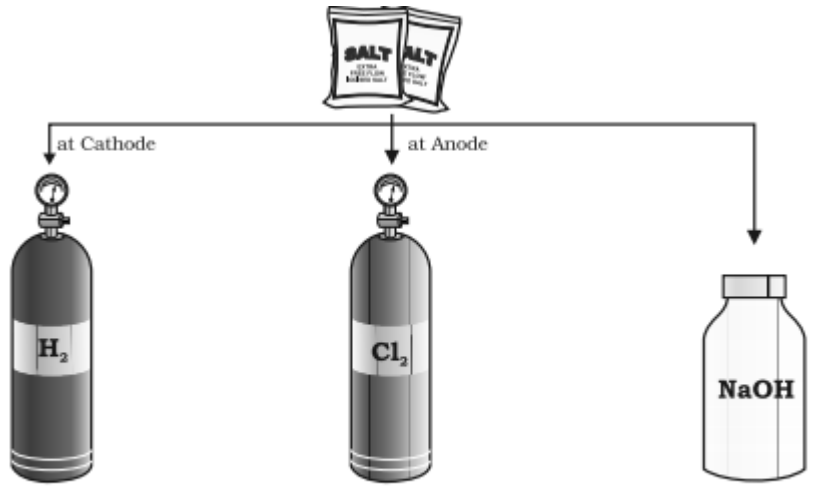
When a concentrated solution of sodium chloride is electrolyzed, it forms sodium hydroxide (NaOH), chlorine gas and hydrogen gas.

Chlorine gas (X) is formed at anode (positive charge) and hydrogen gas at cathode (negative charge)

The reaction takes place is given as:

$2NaCl + 2H_2O \rightarrow 2NaOH + Cl_2 + H_2$

Note: The above reaction is called chlor-alkali process.



Chlor-alkali process

Step 2: Now, chlorine gas (X) reacts with lime water [$Ca(OH)_2$] to form a compound (Y) that is bleaching powder which is used as bleaching agent in chemical industry.

The reaction that takes place is:

$Ca(OH)_2$ +	Cl_2	→	$CaOCl_2$
Limewater	Chlorine gas (X)		Bleaching powder (Y)

Thus, X is chlorine gas and Y is bleaching powder ($CaOCl_2$).

Q. 5. The organic acid present in tomato is

A. oxalic acid
B. lactic acid
C. malic acid
D. tartaric acid

Answer: The organic acid present in tomato is malic acid. Malic acid is the second organic acid present in tomato. The first organic acid is citric acid which is present in tomatoes.

Malic acid is responsible for the ripening of tomatoes. It plays an important role in the production of energy.

Q. 6. You are having five solutions A, B, C, D and E with pH values as follows:

A = 1.8, B = 7, C = 8.5, D = 8 and E = 5

Which solution would be most likely to liberate hydrogen with magnesium powder?

A. Solution A and B
B. Solution A
C. Solution C
D. All of the above

Answer: When magnesium powder reacts with HCl, it forms magnesium chloride and liberated hydrogen gas.

The reaction that takes place is:

$Mg + 2HCl \rightarrow MgCl_2 + H_2$

As we know that HCl is a strong acidic solution. The pH of acidic solution is less than 7. Being a strong acid, the pH of HCl is 1.8.

Q. 7. The reagent used to distinguish iron (II) chloride and iron (III) chloride is

A. distilled water
B. NaOH
C. dil. HCl
D. Warm water

Answer: We can distinguish between iron (II) chloride and iron (III) chloride by using NaOH.

When NaOH reacts with iron (II) chloride, it forms a dirty green precipitate whereas when NaOH reacts with iron (III) chloride, it forms a brown gelatinous precipitate.

Q. 8. An acid (A) with sodium hydrogencarbonate is used in making the cakes fluffy and spongy. It is due to the release of (B) gas in the reaction. Here, A and B are

A. A: Oxalic acid : B : CO2

B. A: Tartaric acid : B :O2

C. A : succinic acid : B : H2

D. A :Tartaric acid : B CO2:

Answer: Baking powder contains a mixture of baking soda and an acid, i.e., tartaric acid (A). When baking powder is heated or mixed in water, the following reaction takes place:

$$\underset{\text{Baking soda}}{NaHCO_3} + H^+ \rightarrow CO_2 + H_2O + \text{Sodium salt of acid}$$

Carbon dioxide gas (B) is produced during the reaction causes cake to rise making them soft, fluffy and spongy.

Thus, A is tartaric acid.

B is carbon dioxide (CO_2)

Q. 9. The pH of a solution is 4.0. What should be the change in the hydrogen ion concentration of the solution, if its pH is to be increased to 5.0.

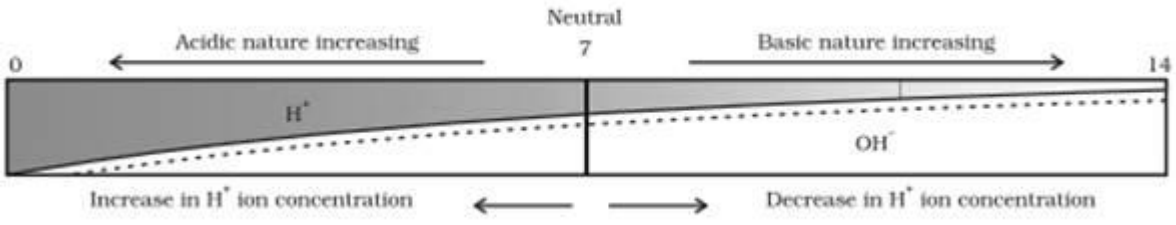
A. decreases to 1/10 of its original concentration
B. halved
C. doubled
D. increases by 10 times

Answer: As the pH value increases from 0 to 7, it represents a decrease in hydrogen ion concentration in the solution, that is, decrease in the strength of acid. Hence, when the pH = 4.0 is increased to 5.0, there is a decrease to 1/10 of its original concentration.

Q. 10. The pH of a solution is 5.0. Its hydrogen ion concentration is decreased by 100 times, the solution will be:

A. more acidic
B. basic
C. neutral
D. unaffected

Answer: The pH of a solution is 5.0 and if its hydrogen ion concentration is decreased by 100 times, the solution will be neutral because the decrease in hydrogen ion concentration represents an increase in the pH value.



Hence, if the hydrogen ion concentration is decreased by 100 times the solution will change its medium from acidic to neutral (5.0 to 7.0).