Chapter - 7

Some compounds of Industrial Importance

Ammonia (NH_3)

Laboratory preperation of Ammonia

- ✓ In the laboratory, ammonia is produced by reacting ammonium chloride (NH_4Cl) with calcium hydroxide ($Ca(OH)_2$).

$$2NH_4Cl + Ca(OH)_2 \rightarrow CaCl_2 + 2H_2O + 2NH_3$$

- ✓ Ammonia gas formed is passed through a drying tower containing quick lime (CaO) to remove the moisture present in it.
- ✓ The density of ammonia gas is less than that of air, hence the gas jar used for collecting ammonia is kept inverted.

Features of Ammonia

Colour	Colourless
Odour	Pungent smell
Nature	Basic
Solubility in water	Very high
Density of ammonia	Less than that of air

Reaction of ammonia with water

- ✓ Ammonium hydroxide is the product obtained when ammonia dissolves in water (NH_4OH).

$$NH_3 + H_2O \rightarrow NH_4OH$$

Industrial preparation of ammonia (Haber process)

- ✓ Industrial preperation of ammonia is known as haber process.
- ✓ In haber process, nitrogen and hydrogen, in the ratio 1:3, are made to combine at very high pressure and temperature to produce ammonia.
- ✓ Sponge iron is used as the catalyst.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

Liquid ammonia

- Ammonia gas can be easily liquefied by applying pressure. Liquefied ammonia is known as liquid ammonia.

Liquor ammonia

- ✓ The Liquor ammonia is the concentrated aqueous solution of ammonia.

Uses of ammonia

- ✓ For the preparation of chemical fertilizers such as ammonium sulphate, ammonium phosphate and urea.
- ✓ As refrigerant.

- ✓ For the production of artificial fibres such as nylon and rayon.
- ✓ In the refining of petroleum.
- ✓ As the main raw material in the industrial preparation of **nitric acid** by **Ostwald process**.

Experiment 1:

Take some ammonium chloride in a test tube. Add a little sodium hydroxide solution to the test tube. Observe the colour and odour of the gas produced. Bring a moist red litmus paper to the mouth of the test tube. Heat the test tube gently. Then, introduce a glass rod dipped in con. hydrochloric acid to the mouth of the test tube.

Observations

Colour of the gas produced	Colourless
Odour of the gas produced	Pungent smell
The change in colour of the moist red litmus paper when shown to the mouth of the test tube.	Red litmus turned blue
Nature of the gas produced	Basic
The observation when the glass rod dipped in con. hydrochloric acid was shown to the mouth of the test tube.	Thick white fumes (NH_4Cl) are formed
The chemical equation of this reaction.	$NH_3 + HCl \rightarrow NH_4Cl$

Experimrnt 2 :

Place cotton dipped in HCl at one end and another piece of cotton dipped in ammonia solution at the other end of the glass tube, such that these are well inside the glass tube. Close both ends of the glass tube using cork. Observe the changes inside the glass tube.

Observations

- ✓ Thick white fumes are formed due to the formation of ammonium chloride (NH_4Cl) by the combination of HCl gas and NH_3 gas.

$$NH_3 + HCl \rightarrow NH_4Cl$$

- ✓ When the glass tube is heated, the ammonium chloride decomposes.

$$NH_4Cl \rightarrow NH_3 + HCl$$

Reversible reaction

- ✓ A reaction in which reactants are converted to products is called a **forward reaction**.
- ✓ A reaction in which products are converted to reactants is called **backward reaction**.
- ✓ Reactions taking place in both (forward and backward) directions simultaneously are called **reversible reactions**.

Example 1: $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

Forward reaction :

$$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$$

Backward reaction :

$$2NH_3(g) \rightarrow N_2(g) + 3H_2(g)$$

- ✓ The chemical reactions in which reactants give products, but the products do not give back the reactants are called irreversible reactions.

  Examples

  $C + O_2 \rightarrow CO_2$

  $NaOH + HCl \rightarrow NaCl + H_2O$

  $NaCl + AgNO_3 \rightarrow NaNO_3 + AgCl$

Chemical equilibrium

- ✓ The stage at which the rate of forward reaction becomes equal to the rate of backward reaction in a reversible reaction is called **chemical equilibrium**.

Characteristics of equilibrium

- At equilibrium, both the reactants and the products coexist.
- The rates of forward and backward reactions are equal at equilibrium.
- Chemical equilibrium is a dynamic equilibrium at the molecular level.
- Equilibrium is possible only in a closed system.

When nothing new is added to a system and nothing is removed from the system, such a system is called **a closed system**.

Le Chatelier's principle

- ✓ "When the concentration, pressure or temperature of a system at equilibrium is changed, the system will readjust itself so as to nullify the effect of that change and attain a new state of equilibrium." This is Le Chatelier's principle.

Influence of concentration on equilibrium

- ✓ According to Le Chatelier principle, if the concentration of reactants is increased in a system at equilibrium, the rate of forward reaction increases.
- ✓ If the concentration of product is increased, the rate of backward reaction increases.

Example : Consider the reaction

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

Action	Change in concentration	Change in rate
More hydrogen is added	Increases the concentration of reactant	Rate of forward reaction increases
More ammonia is added	Increases the concentration of product	Rate of backward reaction increases
Ammonia is removed	Concentration of product decreases	Rate of forward reaction increases
More nitrogen is added	Concentration of reactant increases	Rate of forward reaction increases
Nitrogen is removed	Concentration of reactant decreases	Rate of forward reaction decreases
Hydrogen is removed	Concentration of reactant decreases	Rate of forward reaction decreases

Pressure and chemical equilibrium

- ✓ According to Le Chatelier principle, when the pressure of a system at equilibrium is increased, the system will try to attain equilibrium by reducing the pressure.
- ✓ This is achieved by increasing the reaction in the direction where number of moles of molecules decreases.

Example : The influence of pressure in the production of ammonia

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

Total number of reactant molecules $= 1 + 3 = 4$

Total number of product molecules $= 2$

If pressure is **increased**, the rate of **forward reaction** increases

If pressure is **decreased**, the rate of **backward reaction** increases

- ✓ In a reversible reaction, if there is no change in the number of molecules of reactants and products in gaseous state, pressure will have no effect on the chemical equilibrium.

Example : $H_2 + I_2 \rightarrow 2\ HI$

Total number of reactant molecules $= 1 + 1 = 2$

Total number of product molecules $= 2$

Henc pressure has no influence

Temperature and equilibrium

- ✓ In a system at equilibrium, **increase in temperature** will increase the rate of **endothermic** reaction. **Decrease in temperature** will increase the rate of **exothermic** reaction.

Eg:

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) + \text{Heat}$$

If temperature is increased ⇒ Rate of endothermic reaction increases ⇒ Rate of backward reaction increases

If temperature is decreased ⇒ Rate of exothermic reaction increases ⇒ Rate of forward reaction increases

- ✓ But at low temperature, the number of molecules having threshold energy will be less. Therefore, the rates of forward and backward reactions get significantly reduced and hence the system will take more time to attain equilibrium. So, in the **manufacture** of **ammonia**, $\mathbf{450}$℃ is taken as the **optimum temperature**.

Catalyst and equilibrium

- ✓ In a reversible reaction, catalysts increases the rate of both forward and backward reactions to the same extent. As a result, the system reaches equilibrium very fast.
- ✓ A catalyst does not change the concentration of reactants and products at equilibrium.
- ✓ Iron (Fe) is the catalyst used in the manufacture of ammonia

Sulphuric acid (H_2SO_4)

- ✓ Sulphuric acid is often called the 'King of Chemicals' because it is an industrially important chemical.
- ✓ Sulphuric acid is manufactured by Contact process.

Important steps in Contact process

Step – 1

- ✓ Molten sulphur is burnt in purified and moisture free atmospheric air and converted to sulphur dioxide.

$$S\,(s) + O_2\,(g) \rightarrow SO_2\,(g)$$

Step – 2

Sulphur dioxide formed in the first step combines with oxygen, in presence of the catalyst **vanadium pentoxide** ($\mathbf{V_2O_5}$), to form sulphur trioxide.

$$2SO_2(g) + O_2(g) \overset{V_2O_5}{\rightleftharpoons} 2SO_3(g)$$

Step – 3

SO_3 is dissolved in concentrated sulphuric acid to produce oleum ($H_2S_2O_7$)

$$SO_3 + H_2SO_4 \rightarrow H_2S_2O_7$$

Step – 4

The oleum thus obtained is dissolved in water to produce sulphuric acid.

$$H_2S_2O_7 + H_2O \rightarrow 2H_2SO_4$$

Question : Why is sulphur trioxide not dissolved directly in water in the industrial production of sulphuric acid?

Answer :

Since the dissolution of SO_3 in water is an exothermic process, the sulphuric acid initially formed turns into fog like particles (smog) which will hinder further dissolution.

$$SO_3 + H_2O \rightarrow H_2SO_4$$

Physical properties of sulphuric acid

- ✓ Colourless
- ✓ Viscosity is higher than that of water.
- ✓ Denser than water.
- ✓ Dissolves in water.

Solubility of sulphuric acid in water

- ✓ Sulphuric acid is highly soluble in water.
- ✓ The dissolution of sulphuric acid in water is highly exothermic.
- ✓ While diluting sulphuric acid, the acid has to be added to water in very small quantities by stirring. If dilution is done by adding water to acid, the chance of splashing out of acid leading to accident is very high.

Chemical properties of sulphuric acid

1. Dehydrating property

- ✓ Dehydration is the process of absorbing chemically combined water, or hydrogen and oxygen in the same ratio as in water from substances.
- ✓ **Concentrated sulphuric acid** is a strong **dehydrating agent**.

Experiment : Take a little sugar in a watch glass and add a few drops of concentrated sulphuric acid.

Observation : A black colour substance is rises up from the watch glass (sulphuric acid absorbed the elements hydrogen and oxygen from sugar in the same ratio as in water.)

Chemical equation :

$$C_{12}H_{22}O_{11} \xrightarrow{con.H_2SO_4} 12C + 11H_2O$$

Here, sulphuric acid absorbed the elements hydrogen and oxygen from sugar in the same ratio as in water.

Activity	Observation
Add a little con. sulphuric acid to glucose taken in a beaker.	The white glucose turn black
Add con. sulphuric acid drop by drop to blue copper sulphate taken in a watch glass.	The blue crystals turn into a white substance

2. Drying property

- ✓ Drying agents are substances capable of absorbing the moisture present in a substance.
- ✓ Concentrated sulphuric acid is used as a drying agent in the preparation of CO_2, SO_2 and HCl.

Question : Concentrated H_2SO_4 is not used as a drying agent in the preparation of NH_3. Why?

Answer : Concentrated sulphuric acid reacts with basic ammonia gas forming ammonium sulphate.

3. Reaction with salts

- ✓ Concentrated sulphuric acid can displace acids from their salts.
- ✓ Concentrated sulphuric acid reacts with chlorides to form hydrogen chloride and with nitrates to form nitric acid.

$$NaCl + H_2SO_4 \rightarrow NaHSO_4 + HCl$$

$$KNO_3 + H_2SO_4 \rightarrow KHSO_4 + HNO_3$$

4. Oxidising nature

- ✓ Concentrated sulphuric acid reacts with metals as well as non metals and oxidise them.
- ✓ Concentrated sulphuric acid is a good oxidising agent.

Example 1

$$C + 2\,H_2SO_4 \rightarrow CO_2 + 2\,SO_2 + 2\,H_2O$$

Oxidation state of elemental carbon (C) $= 0$

Oxidation state of carbon in $CO_2 = +4$

Oxidised atom = Carbon (C)

Oxidising agent = Sulphuric acid (H_2SO_4)

Example 2

$$Cu + 2\,H_2SO_4 \rightarrow CuSO_4 + SO_2 + 2\,H_2O$$

Oxidation state of elemental copper (Cu) $= 0$

Oxidation state of copper in $CuSO_4 = +2$

Oxidised atom = Copper (Cu)

Oxidising agent = Sulphuric acid (H_2SO_4)

Basicity of Acids

- ✓ The basicity of an acid is the number of hydrogen ions that the molecule of the acid can donate.

- ✓ If **basicity** is **1**, the acid is called **monobasic** acid.

Acid	Equation of ionisation	Basicity
HCl	$HCl \rightarrow H^+ + Cl^-$	1
HBr	$HBr \rightarrow H^+ + Br^-$	1
HF	$HF \rightarrow H^+ + F^-$	1
HNO_3	$HNO_3 \rightarrow H^+ + {NO_3}^-$	1

- ✓ If the **basicity** of an acid is **2**, it is called **dibasic acid**.

Acid	Equation of ionisation	Basicity
H_2SO_4	$H_2SO_4 \rightarrow 2\,H^+ + {SO_4}^{2-}$	2
H_2CO_3	$H_2CO_3 \rightarrow 2\,H^+ + {CO_3}^{2-}$	2
$H_2C_2O_4$	$H_2C_2O_4 \rightarrow 2\,H^+ + {C_2O_4}^{2-}$	2

- ✓ If the basicity of an acid is 3, it is called tribasic acid.

Example : Phosphoric acid (H_3PO_4)

$$H_3PO_4 \rightarrow 3\,H^+ + {PO_4}^{3-}$$

Alakali

- ✓ Alkalies are bases that dissolve in water.
- ✓ Alkalies are substances which increase the concentration of hydroxide ions in aqueous solutions.

Chemical name of alkali	Chemical formula	Equation of ionisation in water
Sodium hydroxide	$NaOH$	$NaOH \rightarrow Na^+ + OH^-$
Calcium hydroxide	$Ca(OH)_2$	$Ca(OH)_2 \rightarrow Ca^+ + 2OH^-$
Ammonium hydroxide	NH_4OH	$NH_4OH \rightarrow {NH_4}^+ + OH^-$

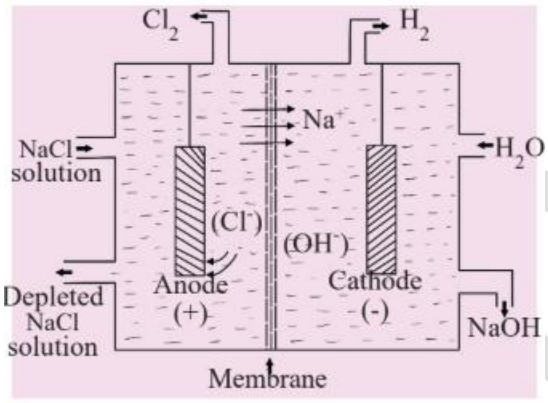
Arrhenius theory

- ✓ Arrhenius stated that when acids and bases dissolve in water, they dissociate into ions.

- ✓ According to **Arrhenius theory**, **acids** are substances which liberate $\mathbf{H^+}$ ions and **bases** are substances which liberate $\mathbf{OH^-}$ ions in **aqueous solutions**.

Sodium hydroxide(NaOH)

- ✓ Sodium hydroxide is industrially produced by chlor-alkali process.
- ✓ In this, concentrated aqueous solution of sodium chloride (brine) is subjected to electrolysis.
- ✓ In modern industries, membrane cell is used for the electrolysis of brine.



- ✓ In membrane cell, the two chambers are separated using a membrane which allows the passage of specific ions only.
- ✓ Na^+ ions in the left chamber move to the right chamber through the membrane.
- ✓ Water molecules undergo reduction at the cathode in the right chamber.

$$2H_2O + 2e^- \rightarrow H_2 + 2OH^-$$

Hydrogen gas is liberated here

- ✓ Sodium hydroxide is formed in the right chamber by the combination of Na^+ions and OH^- ions.

$$Na^+ + OH^- \rightarrow NaOH$$

- ✓ Chemical reaction taking place at

Anode **Cathode**

$2Cl^- \rightarrow Cl_2 + 2e^-$ $2H_2O + 2e^- \rightarrow H_2 + 2OH^-$

- ✓ In this process, hydrogen and chlorine are also formed in addition to sodium hydroxide.
- ✓ Sodium hydroxide is also known as caustic soda.

Uses of sodium hydroxide

- ✓ For the preparation of soaps and detergents.
- ✓ For the purification of bauxite in the manufacture of aluminium.
- ✓ To produce paper.
- ✓ For the production of rayon.
- ✓ To manufacture medicines like aspirin.

Hydrochloric acid (HCl)

- ✓ Hydrogen chloride is manufactured by the direct combination of hydrogen and chlorine.
- ✓ Since it is an exothermic process, the reactor where the process takes place will always be hot. Hence the reactor is known as 'HCl oven' or 'HCl burner'.
- ✓ The hydrogen chloride formed in the HCl burner is dissolved in deionised water to produce concentrated hydrochloric acid.

Uses of hydrochloric acid

- ✓ To refine table salt.
- ✓ To prepare dyes.
- ✓ For manufacturing PVC.
- ✓ To prepare aquaregia which is used to dissolve metals like gold and platinum.
- ✓ For preparing organic and inorganic compounds.
- ✓ To produce fertilizers.
- ✓ For refining metals.

Salts

- ✓ Acids and bases react to form **salt** and water through neutralization reaction.
- ✓ Salt is formed by the combination of negative ions of acids and the positive ions of bases.
- ✓ Salt hydrolysis is the process by which the anions, cations or both of a salt react with water to form a solution that has acidic or basic nature.

Acidic Salts

- ✓ Salts that undergo hydrolysis when dissolved in water to give an acidic solution are called acid salts.
- ✓ The **salt** formed from **strong acid** and **weak base** will be **acidic**.

Examples

Salt	Strong acid	Weak base
NH_4Cl	HCl	NH_4OH
$(NH_4)_2SO_4$	H_2SO_4	NH_4OH

Basic Salts

- ✓ Salts that undergo hydrolysis when dissolved in water to give a basic solution are called basic salts.
- ✓ The salt formed from weak acid and strong base will be basic.

Salt	Weak acid	Strong base
Na_2CO_3	H_2CO_3	$NaOH$
CH_3COONa	CH_3COOH	$NaOH$

Neutral Salts

- ✓ Certain salts when dissolved in water do not exhibit acidic or basic nature. Such salts are called neutral salts.
- ✓ The salt formed by the reaction of a strong acid and a strong base will be neutral.

Salt	Strong acid	Strong base
$NaCl$	HCl	$NaOH$

Fertilizers

- ✓ Natural or artificial substances that provide nutrients to plants are called fertilizers.
- ✓ The elements **carbon, hydrogen** and **oxygen** can be absorbed from air and water. These three elements are called **natural nutrients**.

- ✓ Nitrogen (**N**), phosphorus (**P**) and potassium (**K**) are the three elements that plants need in **large quantities**. These are called **primary nutrients**.
- ✓ The soil contains low amounts of calcium (**Ca**), magnesium (**Mg**) and sulphur (**S**). Plants need these only in **small amounts**. These three elements are called **secondary nutrients**.
- ✓ Some elements (**Iron, manganese**) are needed to plants only in **very small amounts**. Hence they are called **micro nutrients**.

Essential qualities of fertilizers

- ✓ The elements present in the compounds in fertilizer should be easily available to plants.
- ✓ The fertilizer should be soluble in water.
- ✓ The compounds in fertilizer must be stable and remain in the soil for a long time, making them available to plants
- ✓ They should not cause significant variations to the pH of the soil.
- ✓ They should not be toxic to plants.

Chemical fertilizers

- ✓ Chemical fertilizers are used to make the primary nutrients available to plants in the right quantities.
- ✓ Such fertilizers are classified as nitrogenous feritlizers, phosphate fertilizers and potash fertilizers.
- ✓ These are **combined** to produce **mixed fertilizers**. These are also called **NPK mixed fertilizers**.

Types of fertilizers	Effect of fertilizer on plants	Examples
Nitrogenous fertilizers	Accelerates the growth of plants.	Ammonium sulphate, calcium cyanamide, urea, sodium nitrate, calcium nitrate, potassium nitrate
Phosphate fertilizers	i.Increases productivity ii.Helps the growth of plants	Ammonium phosphate, triple super phosphate
Potash fertilizers	i.Helps the growth of plants ii.Increases productivity iii.Boosts immunity	Potassium chloride (Muriate of potash), potassium sulphate, Potassium–magnesium sulphate

Let us assess

1. Chemical formula of certain salts are given below.

KCl, $(NH_4)_2SO_4$, $AlCl_3$, CH_3COONa

Choose the correct ones from the given statements related to them and write it down.

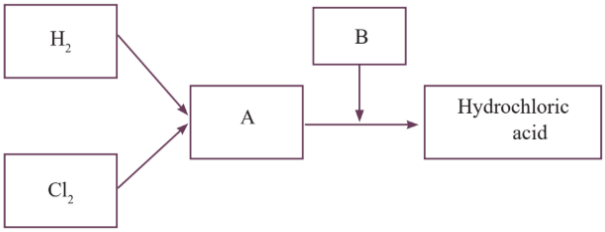
(i) KCl does not undergo hydrolysis.

(ii) $(NH_4)_2SO_4$ is an acidic salt.

(iii) $AlCl_3$ is a basic salt.

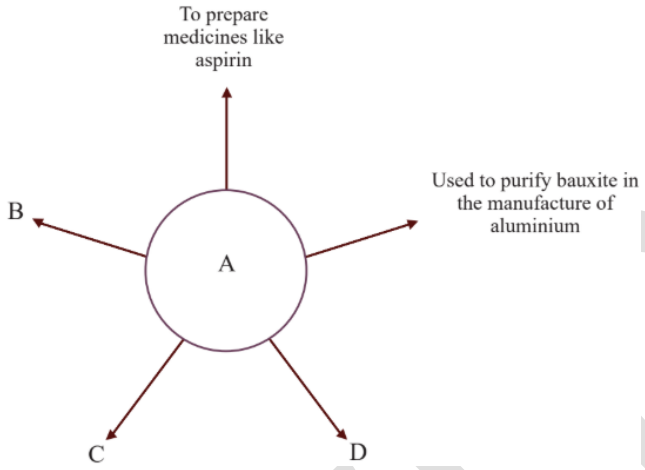
(iv) CH_3COONa is used to increase the basicity of an aqueous solution.

2. A flow chart of the industrial production of hydrochloric acid is given below.



What is A and B?

3. A word web indicating the uses of a compound is given. Complete it by adding A, B, C and D.



4. Explain with chemical equations of the chemical reactions that take place in the left and right chambers of the membrane cell during the chlor-alkali process.

(Hint : Type of reaction, chemical equation, the gas liberated, compound formed)

5. The basicity of phosphoric acid (H_3PO_4) 3.

(i) Write the ionisation equations of phosphoric acid.

(ii) Write the possible salts that can be formed when phosphoric acid react with sodium hydroxide.

6. Explain the effect of pressure on the following reversible reactions.

(i) $H_2(g) + I_2(g) \rightarrow 2\ HI(g)$

(ii) $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

7. $2\ NO(g) + O_2(g) \rightleftharpoons 2\ NO_2(g) + heat$

Complete the table given below by indicating the possible measures to increase the amount of NO_2 in this chemical reaction.

Temperature	-------(Increase/decrease)
Pressure	-------(Increase/decrease)
Amount of oxygen	-------(Increase/decrease)
Amount of NO	-------(Increase/decrease)

8. Haber process is an exothermic process. What changes can be done in the system to increase the amount of the product?

9. Complete the table.

Chemical name of the compound present in fertilizer	Calcium nitrate	Ammonium sulphate	Calcium phosphate	Potassium sulphate
Primary nutrient in the fertilizer				
Secondary nutrient in the fertilizer				

10. Examine the following statements related to Contact process. Write which among A, B, C or D is correct.

(i) Contact process is the process used for the industrial production of sulphuric acid.

(ii) In Contact process, the reaction between SO_2 and O_2 is endothermic.

(iii) Increasing the pressure will produce more SO_3.

(iv) Increasing the amount of oxygen will decrease the amount of the product.

(v) Increasing or decreasing the amount of SO_2 does not change the amount of SO_3

(vi) V_2O_5 is used as a catalyst.

(vii) Here, the catalyst does not affect the chemical equilibrium.

A. (i), (ii), (iv) and (vi) are right and (iii), (v) and (vii) are wrong.

B. (i), (iii), (vi) and (vii) are right and (ii), (iv) and (v) are wrong.

C. (i), (ii), (iii) and (iv) are right and (v), (vi) and (vii) are wrong .

D. (i), (iii) and (vi) are right and (ii), (iv), (v) and (vii) are wrong.

11. (i) Which substance is used as the drying agent in the laboratory preparation of ammonia?

(ii) Can concentrated sulphuric acid be used as a drying agent in this process? Write the chemical equation that occurs if it is used.

12. Certain fertilizers are given.

Urea, sodium nitrate, ammonium phosphate, potassium chloride

Complete the table.

Function in plants	Fertilizers that can be used
To accelerate plant growth.	
To increase productivity.	
To boost immunity of plants.	

Answers

1. (i) KCl does not undergo hydrolysis.

(ii) $(NH_4)_2SO_4$ is an acidic salt.

(iv) CH_3COONa is used to increase the basicity of an aqueous solution.

2. A – HCl

B – Deionised water

3. A – S odium hydroxide (NaOH)

B – To produce paper.

C – For the production of rayon.

D – For the preparation of soaps and detergents.

4.

Left Chamber	Right Chamber
Oxidation takes place	Reduction takes place
$2Cl^- \rightarrow Cl_2 + 2e^-$	$2H_2O + 2e^- \rightarrow H_2 + 2OH^-$
Chlorine(Cl_2) gas is liberated	Hydrogen (H_2) gas is liberated
	Sodium hydroxide is formed by the combination of Na^+ions and OH^- ions. $Na^+ + OH^- \rightarrow NaOH$

5. (i) $H_3PO_4 \rightarrow H^+ + H_2PO_4^-$

$H_2PO_4^- \rightarrow H^+ + HPO_4^{2-}$

$HPO_4^{2-} \rightarrow H^+ + PO_4^{3-}$

(ii) Sodium dihydrogen phosphate (NaH_2PO_4)

Disodium hydrogen phosphate (Na_2HPO_4)

Sodium phosphate (Na_3PO_4)

6. (i) The pressure has no effect since the reactant and product sides have the same number of gaseous molecules.

(ii) Since the number of gaseous molecules on the product side is less than on the reactant side, increasing the pressure increases the rate of the forward reaction.

7.

Temperature	Decrease
Pressure	Increase
Amount of oxygen	Increase
Amount of NO	Increase

8. i. By increasing the pressure.

ii. By increasing the concentration of reactants.

iii. By removing the product formed.

iv. By decreasing the temperature.

9.

Calcium nitrate	**Ammonium sulphate**	**Calcium phosphate**	**Potassium sulphate**
Nitrogen	Nitrogen	Phosphorous	Potassium
Calcium	Sulphur	Calcium	Sulphur

10. B. (i), (iii), (vi) and (vii) are right and (ii), (iv) and (v) are wrong.

11. (i) Quick lime (CaO)

(ii) Concentrated sulphuric acid cannot be used as a drying agent in the laboratory preperation of ammonia. Because Concentrated sulphuric acid reacts with basic ammonia gas forming ammonium sulphate

$$2NH_3 + H_2SO_4 \rightarrow (NH_4)_2SO_4$$

12.

Function in plants	Fertilizers that can be used
To accelerate plant growth.	Urea, sodium nitrate, ammonium phosphate, potassium chloride
To increase productivity.	Ammonium phosphate, potassium chloride
To boost immunity of plants.	Potassium chloride

Question Bank with Answers

1. Some statements related to the manufacture of aluminium are given.

(i) The ore is treated with hot NaOH solution.

(ii) Electricity is used as the reducing agent to extract the meal.

(iii) As a result of electrolysis, aluminium is obtained at the anode.

Which of the following is **correct**?

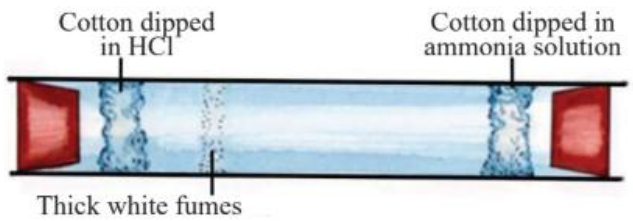
(a) Statements (i) and (iii) are correct, but (ii) is not correct.

(b) Statements (i) and (ii) are correct, but (iii) is not correct.

(c) Statements (ii) and (iii) are correct, but (i) is not correct.

(d) Statements (i), (ii) and (iii) are correct.

2. Observe the picture and answer the questions given below.



a. Which substance is responsible for the thick white fumes?

b. Write the chemical equation of formation this substance.

3. Some hints are given about the compound X.

(i) Known as the king of chemicals

(ii) It is prepared industrially through the contact process.

Write the answers to the questions given below.

(a) Write the ionisation equation of X.

(b) Write the name of the acid formed when X reacts with NaCl.

(c) What is the nature of the salt formed when X reacts with ammonium hydroxide? Write the reason.

4. The chemical formula of calcium chloride is $CaCl_2$.

a. Which alkali should be used to form this salt?

b. Write the ionisation equation of this alkali.

c. Will calcium chloride undergo salt hydrolysis? Why?

5. Choose the incorrect statement from the following statements related to some salts.

(a) Na_2CO_3 is basic salt

(b) NH_4Cl is an acidic salt

(c) NaCl undergoes salt hydrolysis

(d) KCl is a neutral salt

6. A few data related to a gas is given below.

- Used for the production of nitrogen fertilizers required for plant growth.
- Has a basic nature.
- Its density is less than that of air .

(a) Which are the chemicals required to prepare this gas in the laboratory?

(b) By what name is the concentrated aqueous solution of this gas known?

7. reversible reaction in equilibrium is given

$$2\,NO(g) + O_2(g) \rightleftharpoons 2\,NO_2(g) + heat$$

(a) Write any two characteristics of equilibrium.

(b) How do the following changes affect the rate of forward reaction?

i. Adding more oxygen
ii. Increasing pressure

Answers

1. (b) Statements (i) and (ii) are correct, but (iii) is not correct.

2. a. Ammonium chloride (NH_4Cl)

b. $NH_3 + HCl \rightarrow NH_4Cl$

3. a. $H_2SO_4 \rightarrow 2\,H^+ + {SO_4}^{2-}$

b. $NaCl + H_2SO_4 \rightarrow NaHSO_4 + HCl$

Name of the acid formed = Hydrochloric acid (HCl)

c. Nature of the salt formed = Acidic salt

Reason : The salt formed from strong acid and weak base will be acidic. [Sulphuric acid is a strong acid and ammonium hydroxide is a weak base]

4. a. Calcium hydroxide ($Ca(OH)_2$)

b. $Ca(OH)_2 \rightarrow Ca^{2+} + 2OH^-$

c. Calcium chloride does not undergo salt hydrolysis. Because calcium chloride is a neutral salt.

5. (c) NaCl undergoes salt hydrolysis

6. a. Ammonium chloride (NH_4Cl) and calcium hydroxide ($Ca(OH)_2$)

b. Liqour ammonia

7. a.

- At equilibrium, both the reactants and the products coexist.
- The rates of forward and backward reactions are equal at equilibrium.

b. i. Rate of forward reaction increases

ii. Rate of forward reaction increases