Book Name: Selina concise

EXERCISE

Question 1:

Draw a labelled diagram and give balanced equation for the lab. Preparation of ammonia. Also state physical properties of ammonia.

Solution 1:

Physical properties of ammonia
are: Color : Colourless

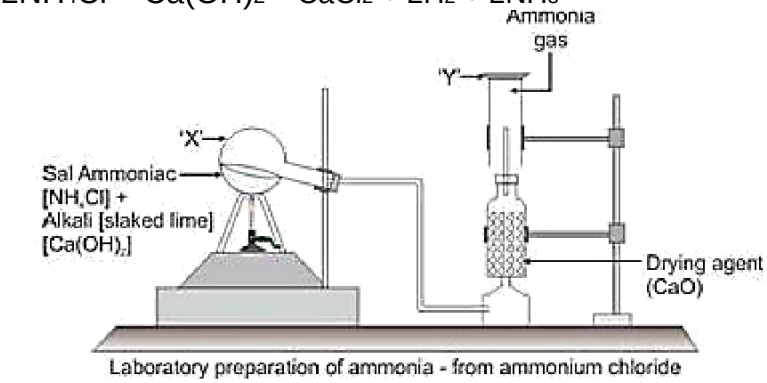
Odour : Strong, Pungent chocking
smell Taste: Slightly bitter (alkaline)
taste Physiological action: Non-
Poisonous Density: V.D = 8.5
Lighter than air Nature: Alkaline

Liquefaction: easily liquefied at 10^oC by compressing it at 6 atm. Pressure Boiling Point: Liquid ammonia boils at -33.5^oC
Freezing Point: Solid NH_3 melts at -77.7^oC

Solubility: Highly soluble in water, 1vol of water dissolves about 702 vols. of ammonia at 20^oC and 1 atm. pressure.

Reaction :

$2NH_4Cl + Ca(OH)_2 \quad CaCl_2 + 2H_2 + 2NH_3$



Laboratory preparation of ammonia - from ammonium chloride

Question 2:

(a) Is ammonia more dense or less dense than air?

(b) What property of ammonia is demonstrated by the fountain experiment?

(c) Write the balanced equation for the reaction between ammonia and sulphuric acid.

Solution 2:

Ammonia is less dense than air. By Fountain Experiment we demonstrate the high solubility of ammonia gas in water.

Balanced equation for the reaction between ammonia and sulphuric acid is: $2NH_3 + H_2SO_4 \; (NH_4)_2SO_4$

Question 3:

Pick the odd member from the list giving reasons:

(a) Ammonia, sulphur dioxide, hydrogen chloride, carbon dioxide.

(b) Copper oxide, aluminium oxide, sodium oxide, magnesium oxide.

Solution 3:

(a) Ammonia is basic in nature.

(b) Copper oxide because CuO is less reactive can be reduced by C, CO or by hydrogen whereas Al_2O_3, Na_2O, MgO are reduced by electrolysis.

Question 4:

The following reactions are carried out:

A: Nitrogen + metal compound X.

B: X + water ammonia + another compound

C: Ammonia + metal oxide metal + water + N_2

One metal that can be used for reaction A is magnesium.

(a) write the formula of the compound X formed

(b) write the correctly balanced equation for reaction B where X is the compound formed.

(c) what property of ammonia is demonstrated by reaction C?

Solution 4:

(a) The formula of the compound is Mg_3N_2.

(b) Balanced equation :

$Mg_3N_2 + 6\ H_2O\ 3\ Mg(OH)_2 + 2\ NH_3$

(c) Ammonia is a reducing agent and reduces less active metal oxide to its respective metal.

Question 5:

Ammonium salts decompose on heating. What other property do ammonium salts have in common?

Solution 5:

Reducing property.

Question 6:

State what you observe when a piece of moist red litmus paper is placed in a gas jar of ammonia.

Solution 6:

When a piece of moist red litmus paper is placed in a gas jar of ammonia it turns blue.

Question 7:

A gas 'P' gives dense white fumes with chlorine. Its aqueous solution gives a blue colour with copper (II) hydroxide (a) Name the gas P. (b) Give its formula (c) Give three uses of P.

Solution 7:

(a) The gas is ammonia.
(b) The formula is NH_3.
(c) Uses of ammonia:
It is used in the industrial preparation of nitric acid by Ostwald process.
It is used in the manufacture of fertilizers such as ammonium sulphate, ammonium nitrate, ammonium phosphate.
It is used in the manufacture sodium carbonate by Solvay process. $NaCl + NH_3 + CO_2 + H_2O$ $NaHCO_3 + NH_4Cl$

Question 8:

Ammonia solution in water gives a blue precipitate when it combines with a solution of copper salt. The blue precipitate further dissolves in excess of ammonia solution to give azure blue solution. Explain with equation.

Solution 8:

Equation:

$CuSO_4 + 2NH_4OH$ $Cu(OH)_2 +$ $[NH_4]2SO_4$ pale blue

Ammonia solution in water gives a blue precipitate when it combines with a solution of copper salt.

The pale blue precipitate of copper hydroxide dissolves in excess of ammonium hydroxide forming tetraamine copper[II] sulphate, an azure blue (deep blue)soluble complex salt. $Cu(OH)_2 + (NH_4)_2SO_4 + 2NH_4OH$ $[Cu(NH_3)_4]SO_4 + 4H_2O$

Question 9:

How do you prove that NH_3 contains nitrogen and hydrogen?

Solution 9:

Ammonia dissociates into nitrogen and hydrogen at high temperature or by electric sparks.

$$2NH_3 \xrightleftharpoons{N_2} 3H_2$$

Question 10:

Give reasons for the following:

(a) Liquid ammonia is used as a refrigerant in ice plants.

(b) Aqueous solution of ammonia is used for removing grease stains from woolen clothes

(c) Aqueous solution of ammonia gives a pungent smell

(d) Aqueous solution of ammonia conducts electricity

Solution 10:

(a) Liquid ammonia takes a lot of energy to vaporize. This heat is taken from the surrounding bodies which are consequently cooled down. Thus it is used as a refrigerant in ice plant.

(b) Ammonia emulsifies or dissolves fats, grease so it is used to remove grease from woolen clothes.

(c) Aqueous solution of ammonia gives pungent smell because of the presence of ammonia.

(d) Aqueous ammonia when dissolved in water breaks into ions which help in the conductance of electricity.

$$NH_3 + H_2O \qquad NH_4OH \rightleftharpoons NH_4^+ + OH^-$$

Question 11:

Copy and complete the following equations.

(a) $AlN + H_2O$

(b) $2NH_3 + 3PbO$

(c) $NH_3 + 3Cl_2$

(d) $NH_3 + CO_2$

(i) which property of ammonia is illustrated by equation (c) ?

(ii) what important fertilizer is prepared from equation (d) ?

Solution 11:

(a) $AlN + 3H_2O \rightarrow Al(OH)_3 + NH_3$

(b) $2NH_3 + 3PbO \rightarrow 3Pb + 3H_2O + N_2$

(c) $8NH_3 + 3Cl_2 \rightarrow N_2 + 6NH_4Cl$

(d) $2NH_3 + CO_2 \rightarrow NH_2CONH_2 + H_2O$

(i) Ammonia act as reducing agent is explained by equation (c).

(ii) Urea the nitrogenous fertilizer is prepared from equation (d).

Question 12:

Correct the following:

(a) A reddish brown precipitate is obtained when ammonium hydroxide is added to ferrous sulphate.

(b) Liquid ammonia is a solution of NH_3

(c) Finely divided platinum is used in Haber process

(d) Conc. H_2SO_4 is a drying agent for NH_3

(e) Ammonium salts, on heating, decompose to give ammonia.

Solution 12:

(a) A Dirty green precipitate of $Fe(OH)_2$ is obtained when ammonium hydroxide is added to ferrous sulphate.
(b) Liquid ammonia is liquefied ammonia.
(c) Finely divided Iron is used in Haber process.
(d) Quicklime is a drying agent for NH_3.
(e) Ammonium salts when heated with caustic alkali.

Question 13:

What do you observe when ammonium hydroxide is added to the aqueous solution of:

(a) $FeSO_4$ (b) Iron (III) chloride, (c) Lead nitrate (d) Zinc nitrate?

Solution 13:

(a) Dirty green ppt. of Ferrous hydroxide is formed which is insoluble in excess of NH_4OH. $FeSO_4 + 2NH_4OH$ $[NH_4]_2SO_4 + Fe(OH)_2$

(b) Reddish brown ppt. of ferric hydroxide is formed which is insoluble in ammonium hydroxide.

$FeCl_3 + 3NH_4OH$ $3NH_4Cl + Fe(OH)_3$

(c) White ppt. of lead hydroxide is formed which is insoluble in NH_4OH. $Pb(NO_3)_2 + 2NH_4OH$ $2NH_4NO_3 + Pb(OH)_2$

(d) White gelatinous ppt. of Zinc hydroxide is formed which is soluble in NH_4OH. $Zn(NO_3)_2 + 2NH_4OH$ $2NH_4NO_3 + Zn(OH)_2$

Question 14:

Why is ammonium hydroxide used in qualitative analysis? Give two equations to justify your answer

Solution 14:

When correct amount of ammonium hydroxide is added drop wise to solutions of the metallic salts, ppts. (coloured generally) are formed. They help us to identify their metal ions.

Two equations:

$FeSO_4 + 2NH_4OH$ $(NH_4)_2SO_4 + Fe(OH)_2$

(Green) (Dirty green)
shows the presence of Fe^{+2} ion.

$FeCl_3 + 3NH_4OH \; 3NH_4Cl + Fe(OH)_3$ (Brown) (Reddish brown)

shows the presence of Fe^{+3} ion.

Question 15:

Give a chemical test to distinguish between the following:

(a) Ammonium chloride and sodium chloride

(b) Ferric salt and ferrous salt

(c) Sodium sulphate and ammonium sulphate

Solution 15:

(a) $NH_4Cl \xrightleftharpoons{Heat} NH_3 + HCl$

NH_4Cl on strong heating sublimes to form dense white fumes which condense to white powdery mass on cooler parts of the tube whereas no white fumes on heating NaCl.

(b) When ammonium hydroxide is added drop wise to solution to be tested. Ferrous salt gives dirty green ppt.
Ferric salt gives reddish brown ppt of their hydroxides.

(c) $(NH_4)_2SO_4$ on warming with NaOH sol. gives NH_3 gas. Sodium sulphate does not liberate NH_3 gas.

Question 16:

Give balanced equations for the following conversation:

(a) Ammonia to nitrogen using an acidic gas,

(b) Ammonia to brown gas,

(c) Ammonia to nitrogen trichloride

(d) Ammonia solution to an amphoteric hydroxide

(e) A nitride of a trivalent metal to ammonia

(f) Lead oxide to lead.

Solution 16:

Balanced equations :

(a) $8NH_3 + 3Cl_2 \; 6NH_4Cl + N_2$

(b) $4NH_3 + 5O_2 \xrightarrow[800^0 C]{Pt} 4NO + 6H_2O + Heat$

$2NO + O_2 \; 2NO_2$
Brown gas

(c) $NH_3 + 3Cl_2 \; 3HCl + NCl_3$

(d) $AlCl_3 + 3NH_4OH \; 3NH_4Cl + Al(OH)_3$

(e) $AlN + 3H_2O \; Al(OH)_3 + NH_3$

(f) $3PbO + 2NH_3 \rightarrow 3Pb + 3H_2O + N_2$

Question 17:

(a) explain catalytic oxidation of ammonia

(b) Give two reactions to show reducing property of ammonia.

Solution 17:

(a) In the presence of Platinum at 800^oC, ammonia reacts with oxygen to give nitric oxide and water vapour.

Procedure:

Pass dry ammonia gas and oxygen gas through inlets over heated platinum placed in the combustion tube, which in the heated state emits reddish glow.

Reaction:

$4NH_3 + 5O_2 \xrightarrow[800^0 C]{Pt} 4NO + 6H_2O + Heat$

$2NO + O_2 \rightarrow 2NO_2$ Brown gas

Observation:

Reddish brown vapours of nitrogen dioxide are seen in the flask due to the oxidation of nitric oxide.

The platinum continues to glow even after the heating is discontinued since the catalytic oxidation of ammonia is exothermic.

(b) Two reactions to show reducing property of ammonia are: $8NH_3 + 3Cl_2 \rightarrow N_2 + 6NH_4Cl$

$2NH_3 + 3CuO \rightarrow 3Cu + 3H_2O + N_2$

Question 18:

Choose the correct word or phrase from the brackets to complete the following sentences and write balanced equations for the same.

(i) ammonium chloride is a soluble salt prepared by ……. [precipitation, neutralization]

(ii) when ammonium chloride is heated, it undergoes …….. [thermal decomposition/ dissociation].

(iii) Heating ammonium chloride with sodium hydroxide produces ……. [ammonia, nitrogen].

Solution 18:

(i) Neutralization

$NH_3 + HCl \rightarrow NH_4Cl$

(ii) Thermal dissociation $NH_4Cl \rightarrow NH_3 + HCl$

(iii) Ammonia
$NH_4Cl + NaOH$ $NH_3 + NaCl + H_2O$

Question 19:

Name:
(a) the gas which is prepared by Haber process,
(b) two gases which give dense white fumes with ammonia,
(c) one salt of ammonia in each case which is used in: (i) dry cell (ii) explosive (iii) medicine.
(d) an acidic gas which reacts with a basic gas liberating a neutral gas,
(e) a metallic chloride soluble in ammonium hydroxide,
(f) the gas obtained when ammonia burns in an atmosphere of oxygen without any catalyst
(g) a nitride of a divalent metal which reacts with warm water liberating ammonia
(h) an amphoteric oxide reduced by the basic gas.
(i) a white salt produced by an acid gas and a basic gas.

Solution 19:

(a) Ammonia
(b) Hydrogen chloride and chlorine gas.
(c) (i) Ammonium chloride
(ii) Ammonium nitrate
(iii) Ammonium carbonate
(d) Acidic gas: HCl
Basic gas: Ammonia
Neutral gas: NH_4Cl
(e) Silver chloride
(f) Nitrogen
(g) Magnesium nitride
(h) Lead oxide
(i) Ammonium chloride

Question 20:

When ammonium hydroxide is added to solution B, a pale blue precipitate is formed. This pale blue precipitate dissolves in excess ammonium hydroxide giving an inky blue solution. What is the cation [positive ion] present in solution B? what is the probable colour of solution B.

Solution 20:

$CuSO_4 + 2NH_4OH$ $(NH_4)_2SO_4 + Cu(OH)_2$ [Pale blue] The cation present in solution B is Copper (Cu^{+2}).
The colour of solution B is Blue.

The pale blue precipitate of copper hydroxide dissolves in excess of ammonium hydroxide forming tetraamine copper [II] sulphate, an azure blue(deep blue) soluble complex salt. $Cu(OH)_2 + (NH_4)_2SO_4 + 2NH_4OH$ $[Cu(NH_3)_4]SO_4 + 4H_2O$

Question 21:

When an ammonium salt is warmed with sodium hydroxide solution, ammonia gas is evolved. State three ways in which you could identify this gas.

Solution 21:

Three ways in which ammonia gas can be identified is: It has a sharp characteristic odour

When a glass rod dipped in HCl is brought in contact with the gas white colour fumes of ammonium chloride are formed

It turns moist red litmus blue, moist turmeric paper brown and phenolphthalein solution pink.

Question 22:

Complete the following equations. What property of ammonia is illustrated by the reaction in (b)?

(a) $Mg_3N_2 + 6H_2O$

(b) $2NH_3 + 3CuO$

(c) $8NH_3 + 3Cl_2$

(d) $4\ NH_3 + 5O_2$

What important process starts with the reaction in (d) above? Name the catalyst used.

Solution 22:

(a) $Mg_3N_2 + 6H_2O$ $3Mg(OH)_2 + 2NH_3$

(b) $2NH_3 + 3CuO$ $3Cu + 3H_2O + N_2$

Ammonia acts as a reducing agent. It reduces metallic oxide to give metals, water vapour and nitrogen.

(c) $8NH_3 + 3Cl_2$ $N_2 + 6NH_4Cl$

(d) $4\ NH_3 + 5O_2$ $6H_2O + 4NO$ +Heat

Ostwald process starts with the catalytic oxidation of ammonia to manufacture nitric acid in the presence of catalyst platinum.

Question 23:

A gas ‘A’ reacts with another gas ‘B’ in the presence of a catalyst to give a colourless gas ‘C’. the gas ‘C’ when comes in contact with air produces a brown gas ‘D’. The solution of ‘A’ in water turns red litmus blue. Explain the observations.

Solution 23:

As the 'A' turns red litmus blue it is a base. Now the gas 'A' combines with 'B' in presence of Catalyst to give colourless gas Nitrogen monoxide. It reacts with oxygen to give brown gas which is Nitrogen dioxide.

A = NH_3

B = O_2

C = NO

D = NO_2

Reactions:

$4NH_3 + 5O_2 \xrightarrow[800^0 C]{PL} 4NO + 6H_2O + Heat$

$2NO + O_2 \quad 2NO_2$

NH_3 in water forms NH_4OH which turns red litmus blue.

Question 24:

Name the common refrigerant. How does it deplete ozone layer?

Solution 24:

Hydroxide ion.

The alkaline behavior of aqueous solution of ammonia is due to the hydroxyl ion. $NH_3 + H_2O$ NH_4OH

NH_4OH $NH_4^+ + OH^-$

An aqueous solution of ammonia turns moist red litmus paper blue.

Question 25:

(a) What is the alternative of chlorofluoro carbon?

(b) State the advantages of using ammonia as refrigerant?

Solution 25:

(a) The main refrigerants used are Freon chlorofluorocarbons (CFC). They deplete ozone layer. The chlorofluorocarbons are decomposed by ultraviolet rays to highly reactive chlorine which is produced in the atomic form.

$CF_2Cl_2(g) \xrightarrow{ultraviolet} CF_2Cl(g) \quad (g)$

free radical

The free radical [Cl] reacts with ozone and chlorine monoxide is formed. $Cl(g)\ O_3(g)\ ClO(g)\ O_2(g)$

This causes depletion of ozone layer and chlorine monoxide so formed reacts with atomic oxygen and produces more chlorine free radicals.

$ClO + O$ $Cl + O_2$

Again this free radical destroys ozone and the process continues thereby giving rise to ozone depletion.

(b) Liquid ammonia can be used as a refrigerant, as an alternative for chlorofluorocarbons.
(c) Advantages of ammonia as refrigerant:

(i) Ammonia is environmentally compatible. It does not deplete ozone layer and does not contribute towards global warming.

(ii) It has superior thermodynamic qualities as a result ammonia refrigeration systems use less electricity.

Ammonia has a recognizable odour and so leaks are not likely to escape.

Question 26:

Ammonia is a good refrigerant but it shows some disadvantages when used as refrigerant. State the disadvantages.

Solution 26:

Disadvantages of ammonia as a refrigerant are as follows:

(i) It is not compatible with copper, so it cannot be used in any system with copper pipes.

(ii) It is poisonous in high concentration although it is easily detectable due to its peculiar smell and since it is less dense than air it goes up in the atmosphere not affecting the life too much on earth.

Question 27:

Name a compound prepared by ammonia and is used as:

(a) Explosive, (b) fertilizers

(c) Medicine (d) laboratory reagent

Solution 27:

(a) Explosive: ammonium nitrate
(b) Medicine: ammonium carbonate
(c) Fertilizers: ammonium sulphate
(d) Laboratory reagent: ammonia solution

Question 28:

Ammonia is used in the Ostwald process,

(a) Give the sources of reactants used in this process.

(b) Name the catalyst used in the process

(c) Name the oxidizing agent used in this process

(d) What is the ratio of ammonia and air taken in this process?

(e) Why is quartz used in this process?

Solution 28:

(a) Dry air free from carbon dioxide and dry ammonia from Habers process.
(b) The catalyst used in the process is Platinum.
(c) The oxidizing agent used in the process is oxygen.
(d) Ratio of ammonia and air is 1:10.
(e) Quartz is acid resistant and when packed in layers help in dissolving nitrogen dioxide uniformly in water.

Question 29:

Write the equation for the action of heat on:

(a) Ammonium chloride (b) Ammonium nitrate

State whether each reaction is an example of thermal decomposition or thermal dissociation.

Solution 29:

(a) Ammonium chloride

$NH_4Cl \xrightleftharpoons{} NH_3 + HCl$

(b) Ammonium nitrate

$NH_4NO_3 \xrightleftharpoons{} N_2O + 2H_2O$

Both are examples of Thermal dissociation.

Question 1(2003):

1. (a) Write the equation for the formation of ammonia by the action of water on magnesium nitride

(b) H**ow** is ammonia collected?

(c) why is ammonia not collected over water?

(d) Which compound is normally used as a drying agent for ammonia?

Solution 1(2003):

(a) $Mg_3N_2 + 6H_2O \; 3Mg(OH)_2 + 2NH_3$

(b) Ammonia gas is collected in inverted gas jars by the downward displacement of air.
(c) Ammonia is not collected over water because it is highly soluble in water.
(d) Quicklime is used as a drying agent for ammonia.

Question 1(2004):

(a) Write the equation for the reaction in Haber process that forms ammonia.

(b) state the purpose of liquefying the ammonia produced in the process.

Solution 1(2004):

(a) Equation:

$$2NH_3 \xrightleftharpoons[200atm]{450-500^0 C} N_2 + 3H_2$$

(b) Compared to nitrogen and hydrogen, ammonia is easily liquefiable and to increase the forward reaction.

Question 1(2005):

(a) which feature of ammonia molecule leads to the formation of the ammonium ion when ammonia dissolves in water?

(b) Name the other ion formed when ammonia dissolves in water.

(c) Give one test that can be used to detect the presence of the ion produced in (b)

Solution 1(2005):

(a)It is the basic nature of ammonia molecule.

(b)Hydroxyl ion ($NH_3 + H_2O \; NH_4^+ + OH^-$)

(c) The red litmus paper turns blue in the solution.

Question 2(2005):

Write the equations for the following reactions which result in the formation of ammonia.

(a) A mixture of ammonium choride and slaked lime is heated.

(b) Aluminium nitride and water.

Solution 2(2005):

Equations are:

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

(b) $AlN + 3H_2O \; Al(OH)_3 + NH_3$

Question 1(2006)

State what is observed when:

Excess of ammonia is passed through an aqueous solution of lead nitrate.

Solution 1(2006):

$Pb(NO_3)_2 + NH_4OH \; 2NH_4NO_3 + Pb(OH)_2$ The chalky white ppt. of lead hydroxide is formed.

Question 1(2007):

(a) Of the two gases, ammonia and hydrogen chloride which is more dense? Name the method of collection of this gas.

(b) Give one example of a reaction between the above two gases which produces a solid compound.

Solution 1(2007):

(a) HCl gas is more dense [V.D.=18.25, V.D. of ammonia = 8.5] and it is collected by the upward displacement of air.

(b) $NH_3 + HCl$ NH_4Cl

Question 2(2007):

Write a balanced equation for a reaction in which ammonia is oxidized by:

(a) a metal oxide

(b) a gas which is not oxygen

Solution 2(2007):

Balanced equation:

(a) $2NH_3 + 3CuO$ $3Cu + 3H_2O + N_2$

(b) $2NH_3 + 3Cl_2$ $N_2 + 6HCl$

Question 1(2008):

Write equation for the following:

Aluminum nitride and water.

Solution 1(2008):

Equation:

$AlN + 3H_2O$ $Al(OH)_3 + NH_3$

Question 2(2008):

Choose the correct from the following:

Ammonia can be obtained by adding water to

A : Ammonium chloride

B : Ammonium nitrite,

C : Magnesium nitride

D : Magnesium nitrate

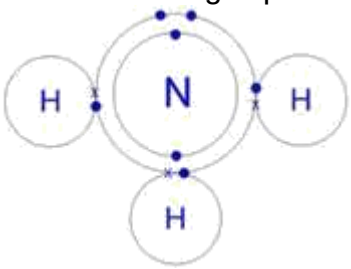
Solution 2(2008):

Magnesium Nitride

INTEXT 1

Question 1:
State the type of bonding present in ammonia, show by a diagram.

Solution 1:
Covalent bonding is present in ammonia.



Question 2:
Name the different forms of ammonia.

Solution 2:
The different forms of ammonia:
Gaseous ammonia(dry ammonia gas)
Liquid ammonia
Liquor ammonia fortis
Laboratory bench reagent

Question 3:
What is the formula of liquid ammonia? Account for the basic nature of this compound.

Solution 3:
Formula of liquid ammonia is: NH_3.
Liquid ammonia is liquefied ammonia and is basic in nature. It dissolves in water to give ammonium hydroxide which ionizes to give hydroxyl ions.

$NH_3 + H_2O \rightleftharpoons NH_4OH \rightleftharpoons NH_4^+ + OH^-$

Therefore it turns red litmus blue and phenolphthalein solution pink.

Question 4:
Ammonia gas can be prepared by warming an ammonium salt with caustic alkali. Give two equations.

Solution 4:

Ammonia gas can be prepared by warming an ammonium salt with caustic alkali. The two equations are:

$(NH_4)_2SO_4 + 2NaOH\ Na_2SO_4 + 2H_2O + 2NH_3$

$(NH_4)_2SO_4 + 2NaOH\ K_2SO_4 + 2H_2O + 2NH_3$

Question 5:

(a) Write a balanced chemical equation for the lab preparation of ammonia.

(b) How is ammonia dried and collected in the laboratory?

(c) Ammonia cannot be collected over water. Give reason.

Solution 5:

(a) Lab preparation of ammonia:

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

(b) The ammonia gas is dried by passing through a drying tower containing lumps of quicklime (CaO).

(c) Ammonia is highly soluble in water and therefore it cannot be collected over water.

Question 6:

Name a drying agent for ammonia. Why are other drying agents such as P_2O_5 and $CaCl_2$ are not used?

Solution 6:

The drying agent used is CaO in case of ammonia.

Other drying agents like P_2O_5 and $CaCl_2$ are not used. As ammonia being basic reacts with them. $6NH_3 + P_2O_5 + 3H_2O\ 2(NH_4)_3PO_4$

$CaCl_2 + 4NH_3 \quad CaCl_2.4NH_3$

Question 7:

A substance ‘A’ was heated with slaked lime and a gas ‘B’ with a pungent smell was obtained. Name the substances A and B and give a balanced equation.

Solution 7:

The substance A is Ammonium chloride and 'B' is Ammonia. Reaction:

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

Question 8:

Ammonia is manufactured by Haber process.

(a) Under what condition do the reactants combine to form ammonia? Give a balanced equation for the reaction.

(b) In what ration by volume, are the above gases used?

(c) state one possible source of each reactant used in haber process.

(d) state whether the formation of ammonia is promoted by the use of high pressure or low pressure?

(e) Mention two possible ways by which ammonia produced is removed from unchanged gases

(f) What is the function of:

(i) finely divided iron

(ii) molybdenum in the above process?

Solution 8:

(a) Conditions for reactants to combine :

Optimum temperature is 450°-$500^{o}C$

Above 200 atm pressure

Finely divided iron as catalyst

Traces of molybdenum or Al_2O_3 as promoters.

Reaction: $N_2 + 3H_2 \rightleftharpoons 2NH_3 + heat$

(b) Dry nitrogen and dry hydrogen in the ratio of 1:3 by volume is made to combine.

(c) Source of Hydrogen: Hydrogen is generally obtained from water gas by Bosch process.

$$(CO + H_2) + H_2O \xrightarrow[500^0\,C]{Fe/Fe_2O_3} CO_2 + 2H_2$$

Source of Nitrogen: It is obtained from fractional distillation of liquid air.

(d) High pressure favours the forward reaction i.e. formation of ammonia.

(e) Two possible ways by which NH_3 produced is removed from unreacted N_2 and H_2 by: (i) Liquefaction: NH_3 is easily liquefiable.

(ii) Absorbing in water: As ammonia is highly soluble in water.

(f)

(i) Finely divided iron increases the rate of reaction.

(ii) Molybdenum acts as a promoter to increase the efficiency of the catalyst.

(g) 15%

(h) The unchanged nitrogen and hydrogen are recirculated through the plant to get more ammonia. By recirculating in this way, an eventual yield of 98% can be achieved.

Question 9:

Given reasons:

(a) Ammonium compounds do not occur as minerals

(b) Ammonium nitrate is not used in the preparation of ammonia

(c) Conc H_2SO_4 is a good drying agent, yet it is not used to dry NH_3.

Solution 9:

(a) Ammonium compounds being highly soluble in water do not occur as minerals.

(b) Ammonium nitrate is not used in the preparation of ammonia as it is explosive in nature and it decomposes forming nitrous oxide and water vapours.

(c) Conc. H_2SO_4 is not used to dry ammonia, as ammonia being basic reacts with them.

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

Question 10:

Explain with a diagram the preparation of aqueous ammonia.

Solution 10:

Preparation of Aqueous Ammonia: An aqueous solution of ammonia is prepared by dissolving ammonia in water. The rate of dissolution of ammonia in water is very high; therefore, back suction of water is possible. To avoid this, a funnel is attached to the outer end of the delivery tube with rubber tubing.

Procedure: Water is taken in a container and only a small portion of the mouth of funnel is dipped in water.

As ammonia dissolves in water at a higher rate than its production in the flask, the pressure in the funnel above water level decreases for a moment and water rushes into the funnel. As a result, the rim of the funnel loses its contact with water. Since, ammonia produced pushes the water down, the funnel comes in contact with water again. In this way, ammonia dissolves in water without back suction of water.