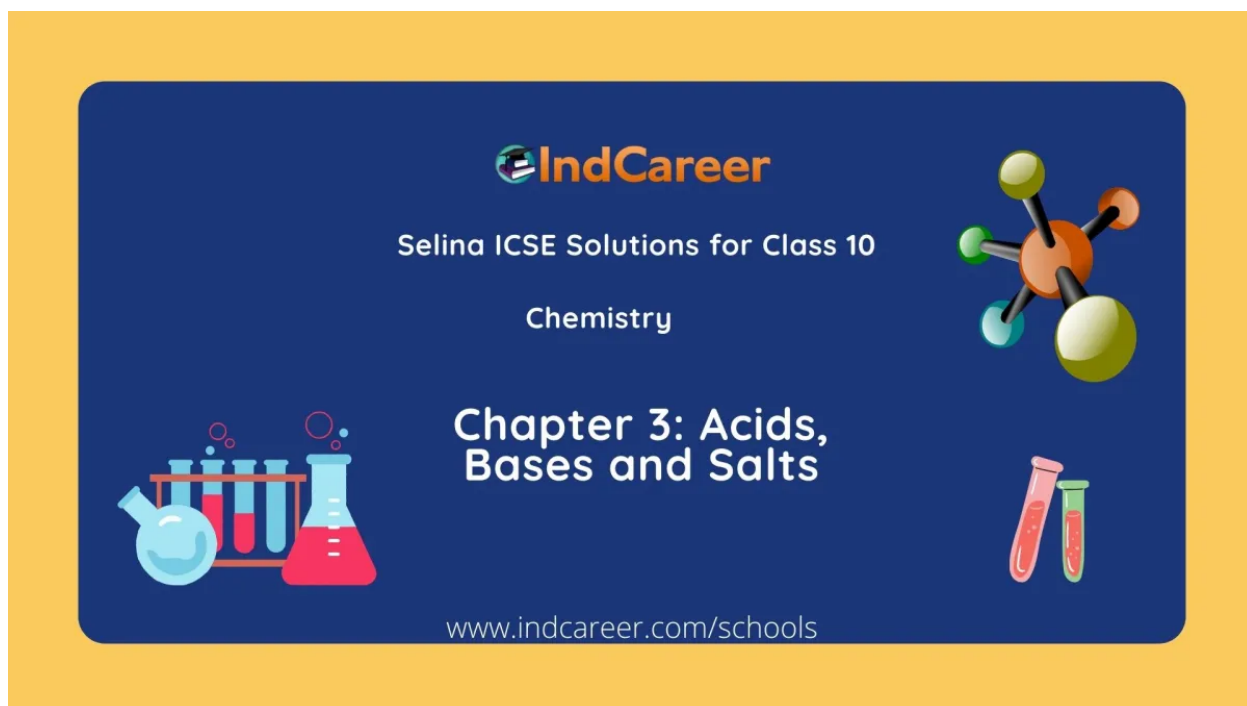


Selina Class 10 ICSE Solutions Chemistry :

Chapter 3- Acids, Bases and Salts



For any clarifications or questions you can write to **info@indcareer.com**

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Selina Class 10 ICSE Solutions Chemistry :

Chapter 3- Acids, Bases and Salts

Class 10: Chemistry Chapter 3 solutions. Complete Class 10 Chemistry Chapter 3 Notes.

Selina Class 10 ICSE Solutions Chemistry : Chapter 3- Acids, Bases and Salts

Selina 10th Chemistry Chapter 3, Class 10 Chemistry Chapter 3 solutions

Exercise Intext 1

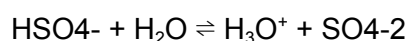
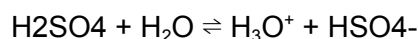
Solution 1.

(a) Acids are defined as compounds which contain one or more hydrogen atoms, and when dissolved in water, they produce hydronium ions (H_3O^+), the only positively charged ions.

(b) Hydronium ion

(c) H_3O^+

Solution 2.



Solution 3.

If water is added to a concentrated acid, the heat generated causes the mixture to splash out and cause severe burns. Thus, water is never added to acid in order to dilute it.

Solution 4.

Basicity: The basicity of an acid is defined as the number of hydronium ions (H_3O^+) that can be produced by the ionization of one molecule of that acid in aqueous solution.

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The basicity of following compounds are:

Nitric acid: Basicity= 1

Sulphuric acid: Basicity=2

Phosphoric acid: Basicity=3

Solution 5.

(a) Oxyacids: – HNO_3 , H_2SO_4

(b) Hydracid:- HCl , HBr

(c) Tribasic acid:- H_3PO_4 , H_3PO_3

(d) Dibasic acid: – H_2SO_4 , H_2CO_3

Solution 6.

(a) The anhydride of following acids are:

1. **Sulphurous acid:** SO_2
2. **Nitric acid:** N_2O_5
3. **Phosphoric acid:** P_2O_5
4. **Carbonic acid :** CO_2

(b) Acids present in following are:

Vinegar: Acetic acid

Grapes: Tartaric acid and Malic acid

Lemon: Citric acid

(c)

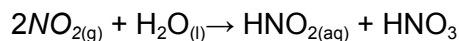
1. H^+ ion turns blue litmus red.
2. OH^- ion turns red litmus blue.

Solution 7.

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Acetic acid is a monobasic acid which on ionization in water produce one hydronium ion per molecule of the acid.

Solution 8.



Solution 9.

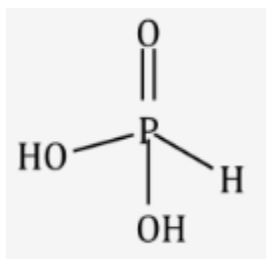
The strength of an acid is the extent to which the acid ionizes or dissociates in water. The strength of an acid depends on the degree of ionization and concentration of hydronium ions $[\text{H}_3\text{O}^+]$ produced by that acid in aqueous solution.

Solution 10.

(a) Carbonic acid is a dibasic acid with two replaceable hydrogen ions; therefore it forms one acid salt or one normal salt. Hydrochloric acid is a monobasic acid with one replaceable hydrogen ion and so forms only one normal salt.

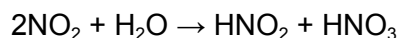
(b) Strength of an acid is the measure of concentration of hydronium ions it produces in its aqueous solution. Dil. HCl produces high concentration of hydronium ion compared to that of concentrated acetic acid. Thus, dil. HCl is stronger acid than highly concentrated acetic acid.

(c) H_3PO_3 is not a tribasic acid because in oxyacids of phosphorus, hydrogen atoms which are attached to oxygen atoms are replaceable. Hydrogen atoms directly bonded to phosphorus atoms are not replaceable.



(d) The salt produced is insoluble in the solution so the reaction does not proceed. Hence, we do not expect lead carbonate to react with hydrochloric acid.

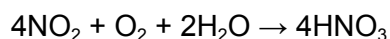
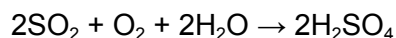
(e) NO_2 is called double acid anhydride because two acids – nitrous acid and nitric acid – are formed when it reacts with water.



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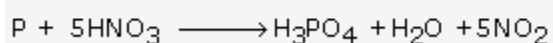
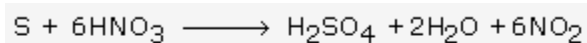
Solution 11.

Acid rain is a by-product of a variety of human activities which release oxides of sulphur and nitrogen in the atmosphere. Burning of fossil fuels, coal, oil, petrol and diesel produces sulphur dioxide and nitrogen oxide which pollute the air. Polluted air also contains many oxidising agents which produce oxygen because of excessive heat. This oxygen combines with the oxides of sulphur and nitrogen and rain water to form acids.

**Solution 12.**

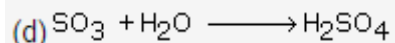
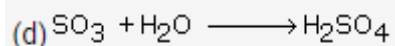
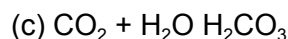
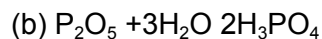
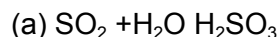
(a) Acids are prepared from non-metals by their oxidation. For example :

Sulphur or phosphorus is oxidized by conc. Nitric acid to form sulphuric acid or phosphoric acid.



(b) Acids are prepared from salt by the displacement reaction. For example :

Nitric acid is prepared by using H_2SO_4 and sodium chloride.

**Solution 13.****Solution 14.**

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- 4(a) Citric acid
- (b) Carbonic acid
- (c) Oxalic acid
- (d) Boric acid

Exercise Intext 2

Solution 1.

An alkali is a basic hydroxide which when dissolved in water produces hydroxyl ions (OH^-) as the only negatively charged ions.

(a) Strong alkalis: Sodium hydroxide , Potassium hydroxide

(b) Weak alkalis: Calcium hydroxide , Ammonium hydroxide

Solution 2.

(a) An alkali and a base:

1. Alkalis are soluble in water whereas bases may be or may not be soluble in water.
2. All alkalis are bases but all bases are not alkalis.

(b) The chemical nature of an aqueous solution of HCl and an aqueous solution of NH_3

1. The aqueous solution of HCl is acidic in nature. It can turn blue litmus to red.
2. The aqueous solution of NH_3 is basic in nature. It can turn red litmus to blue.

Solution 3.

(a) Hydroxyl ion (OH^-)

(b) H^+

Solution 4.

(a) Barium oxide

(b) Sodium hydroxide

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- (c) Manganese oxide
- (d) Cupper hydroxide
- (e) Carbonic acid
- (f) Ferric hydroxide
- (g) Copper oxide
- (h) Ammonia
- (i) Ammonium hydroxide

Solution 5.

The test tube containing distilled water does not affect the red litmus paper.

The test tube containing acidic solution does not change the red litmus paper.

But the test tube containing basic solution turns red litmus paper blue.

Solution 6.

It is because HCl and HNO₃ ionize in aqueous solution whereas ethanol and glucose do not ionize in aqueous solution.

Solution 7.

(a) Dry HCl gas does not contain any hydrogen ions in it, so it does not show acidic behaviour. Hence, dry HCl gas does not change the colour of dry litmus paper.

(b) Lead oxide is a metallic oxide which reacts with hydrochloric acid to produce lead chloride and water, but it is excluded from the class of bases, because chlorine is also produced.



Thus, lead oxide is not a base.

(c) Yes, basic solutions have H⁺ ions, but the concentration of OH⁻ ions is more than the H⁺ ions which makes the solution basic in nature.

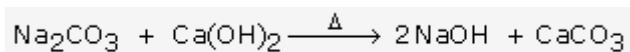
Solution 8.

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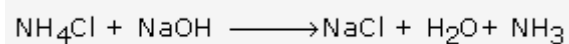
(a) We can obtain a base from another base by double decomposition. The aqueous solution of salts with base precipitates the respective metallic hydroxide.



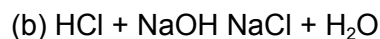
(b) An alkali from a base



(c) Salt from another salt



Solution 9.



Solution 10.

As we know that alkalis react with oil to form soap. As our skin contains oil so when we touch strong alkalis, a reaction takes place and soapy solution is formed. Hence we should wear gloves.

Solution 11.

Indicator	Neutral	Acidic	Alkaline
Litmus	Purple	Blue to red	Red to blue
Phenolphthalein	Colourless	Colourless	Pink

Solution 12.

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pH represents the strength of acids and alkalis expressed in terms of hydrogen ion concentration. The solution with pH value 10 will give pink colour with phenolphthalein indicator.

Solution 13.

A = Strongly acidic

B= neutral

C=Weakly alkaline

D= Strongly alkaline

E= Weakly acidic

(a) Solution A (acidic solution) + MgH_2 + Mg salt

(b) SolutionA (acidic solution) + ZnH_2 + Zn salt

Solution 14.

(a) A common acid-base indicator and a universal indicator:

An acid-base indicator like litmus tells us only whether a given substance is an acid or a base. The universal indicator gives an idea as to how acidic or basic a substance is universal indicator gives different colours with solutions of different pH values.

(b) The acidity of bases and basicity of acids

The acidity of bases: The number of hydroxyl ions which can be produced per molecule of the base in aqueous solution.

Basicity of acid: The basicity of an acid is defined as the number of hydronium ions that can be produced by the ionization of one molecule of that acid in aqueous solution.

(c) Acid and alkali:

An acid is that substance which gives H^+ ions when dissolved in water.

An alkali is that substance which gives OH^- ions when dissolved in water.

Solution 15.

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Substances like chocolates and sweets are degraded by bacteria present in our mouth. When the pH falls to 5.5 tooth decay starts. Tooth enamel is the hardest substance in our body and it gets corroded. The saliva produced by salivary glands is slightly alkaline, it helps to increase the pH, to some extent, but toothpaste which contains basic substance is used to neutralize excess acid in the mouth.

Solution 16.

A universal indicator is a mixture of dyes which identify a gradual change of various colours over a wide range of pH, depending on the strength of the acid. When we use a universal indicator, we see solutions of different acids produce different colours. Indeed, solutions of the same acid with different concentration give different colours.

The more acidic solutions turn universal indicator bright red. A less acidic solution will only turn it orange-yellow. Colour differences can also be observed in case of vinegar which is less acidic and battery acid which is more acidic.

Solution 17.

(a)

1. The pH can be increased by adding a basic solution.
2. The pH can be increased by adding an acidic solution.

(a) The solution is basic in nature and the pH value will be more than 7.

(b) Less than 7

Solution 18.

(a) Solution P

(b) Solution R

(c) Solution Q

Exercise Intext 3

Solution 1.

(a) A normal salt: Normal salts are the salts formed by the complete replacement of the ionizable hydrogen atoms of an acid by a metallic or an ammonium ion.

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(b) An acidic salt: Acid salts are formed by the partial replacement of the ionizable hydrogen atoms of a polybasic acid by a metal or an ammonium ion.

(c) A mixed salt: Mixed salts are those salts that contain more than one basic or acid radical.

Examples:

(a) A Normal salt: Na_2SO_4 , NaCl

(b) An acid salt: NaHSO_4 , Na_2HPO_4

(c) A mixed salt: NaKCO_3 , CaOCl_2

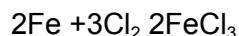
Solution 2.

(a) Salt is a compound formed by the partial or total replacement of the ionizable hydrogen atoms of an acid by a metallic ion or an ammonium ion.

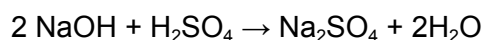
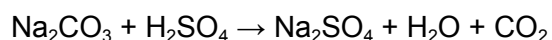
(b) An insoluble salt can be prepared by precipitation.

(c) A salt prepared by direct combination is Iron(III) chloride.

Reaction:



(d) By neutralizing sodium carbonate or sodium hydroxide with dilute sulphuric acid:



Solution 3.

(a) Copper sulphate crystals from a mixture of charcoal and black copper oxide:

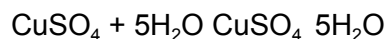
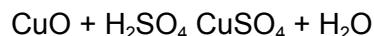
The carbon in the charcoal reduces the black copper oxide to reddish-brown copper. The lid must not be removed until the crucible is cool or the hot copper will be re-oxidized by air.

Take dilute sulphuric acid in a beaker and heat it on wire gauze. Add cupric oxide in small quantities at a time, with stirring till no more of it dissolves and the excess compound settles to the bottom.

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Filter it hot and collect the filtrate in a china dish. Evaporate the filtrate by heating to the point of crystallization and then allow it to cool and collect the crystals of copper sulphate pentahydrate.

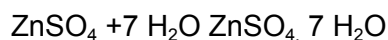
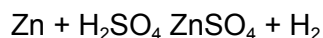
Reaction:



(b) Zinc sulphate crystals from Zinc dust:

Take dilute sulphuric acid in a beaker and heat it on wire gauze. Add some granulated zinc pieces with constant stirring. Add till the Zinc settles at the base of the beaker. Effervescences take place because of the liberation of hydrogen gas. When effervescence stops, it indicates that all the acid has been used up. The excess of zinc is filtered off. Collect the solution in a china dish and evaporate the solution to get crystals. Filter, wash them with water and dry them between the folds of paper. The white needle crystals are of hydrated Zinc sulphate.

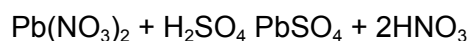
Reaction:



(c) Lead sulphate from metallic lead:

Metallic lead is converted to lead oxide by oxidation. Then lead sulphate is prepared from insoluble lead oxide, by first converting it into soluble lead nitrate. Then the lead nitrate solution is treated with sulphuric acid to obtain white ppt. of Lead sulphate.

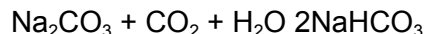
Reaction:



(d) Sodium hydrogen carbonate crystals:

Dissolve 5 grams of anhydrous sodium carbonate in about 25 ml of distilled water in a flask. Cool the solution by keeping the flask in a freezing mixture. Pass carbon dioxide gas in the solution. Crystals of sodium bicarbonate will precipitate out after some time. Filter the crystals and dry it in folds of filter paper.

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Reaction:**Solution 4.**

1. **Anhydrous ferric chloride:** -A (Direct combination of two elements)
 $2\text{Fe} + 3\text{Cl}_2 \rightarrow 2\text{FeCl}_3$
2. **Lead chloride:** -E (Reaction of two solutions of salts to form a precipitate)
 $\text{Pb}(\text{NO}_3)_2 + 2\text{HCl} \rightarrow \text{PbCl}_2 + 2\text{HNO}_3$
3. **Sodium sulphate:** – D(Titration of dilute acid with a solution of soluble base)
 $2\text{NaOH} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$
4. **Coppersulphate:**– C (reaction of dilute acid with an insoluble base)
 $\text{Cu}(\text{OH})_2 + \text{H}_2\text{SO}_4 \rightarrow \text{CuSO}_4 + 2\text{H}_2\text{O}$

Solution 5.

- (a) Lead chloride
- (b) Silver chloride
- (c) Barium sulphate and lead sulphate
- (d) Basic lead chloride
- (e) Sodium hydrogen sulphate
- (f) Sodium potassium carbonate
- (g) Sodium argentocyanide
- (h) Potash alum
- (i) Potassium bromide and potassium chloride
- (j) Calcium sulphate

Solution 6.

An acid is a compound which when dissolved in water forms hydronium ions as the only positively charged ions. A base is a compound which is soluble in water and contains hydroxide

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ions. A base reacts with an acid to form a salt and water only. This type of reaction is known as neutralisation.

Solution 7.

- (a) Blue litmus will turn into red which will indicate the solution to be acidic.
- (b) No change will be observed.
- (c) Red litmus will turn into blue will indicate the solution to be basic.

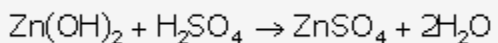
Solution 8.

- (a) Since sodium hydroxide and sulphuric acid are both soluble, an excess of either of them cannot be removed by filtration. Therefore it is necessary to find out on small scale, the ratio of solutions of the two reactants.
- (b) As iron chloride is highly deliquescent, so it is kept dry with the help of fused calcium chloride.
- (c) On heating the hydrate, HCl acid is released and basic salt (FeOCl) or ferric oxide remains. Hence, anhydrous ferric chloride cannot be prepared by heating the hydrate.

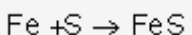
Solution 9.

Zinc Sulphate – Displacement

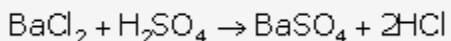
Ferrous sulphide – synthesis



Barium sulphate – Precipitation

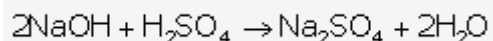


Ferric Sulphate- Oxidation



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Sodium sulphate – Neutralisation



Solution 10.

(a) pH of pure water is 7 at 25°C. No, the pH does not change when common salt is added.

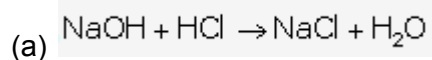
(b) Acids: H_2SO_4 and HNO_3

Bases: Ammonium hydroxide and sodium hydroxide.

Salts: Barium chloride and sodium chloride.

Solution 11.

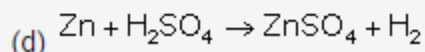
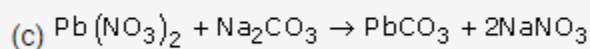
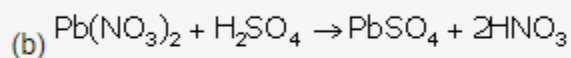
Neutralization is the process by which H^+ ions of an acid react completely with the $[\text{OH}]^-$ ions of a base to give salt and water only.



(b) Neutralization is simply a reaction between H^+ ions given by strong acid and OH^- ions given by strong base. In case of all

strong acids and strong bases, the number of H^+ and OH^- ions produced by one mole of a strong acid or strong base is always same. Hence the heat of neutralization of a strong acid with strong base is always same.

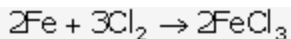
Solution 12.



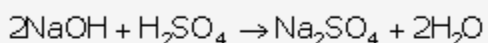
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Solution 13.

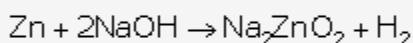
(a) Iron (III) Chloride: Iron chloride is formed by direct combination of elements.



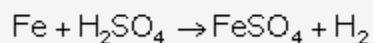
(b) Sodium sulphate: By neutralization of caustic soda with dilute sulphuric acid



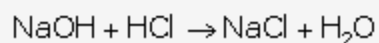
(c) Sodium zincate: By the action of metals with alkalis



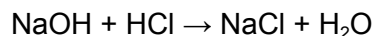
(d) Iron (II) sulphate: Iron sulphate is prepared by the action of dilute acid on an active metal.



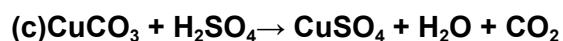
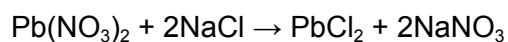
(e) Sodium chloride: By the neutralization reaction of strong acid with strong base

**Solution 14.**

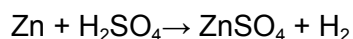
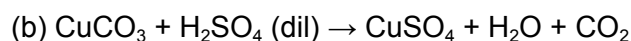
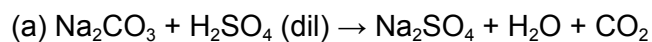
(a) By neutralisation:



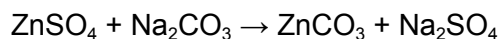
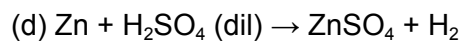
(b) By precipitation:



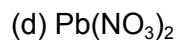
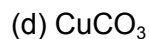
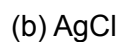
(d) Simple displacement:

**Solution 15.**

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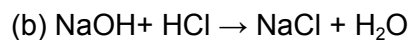


Solution 16.



Solution 17.

(a) acid salt



Solution 18.

(a) Alkali

(b) Precipitate

(c) Weak acid

Solution 19.

1. Copper (II) chloride – B
2. Iron (II) chloride – A
3. Iron (III) chloride – C
4. Lead (II) chloride – E
5. Sodium chloride – D

Solution 20.

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Reactants	Products	Method
Soluble base + Acid (dil)	Salt + water	Neutralisation Titration
Metal + Non-metal	Salt (soluble/insoluble)	Direct Combination
Insoluble base +	Salt (soluble) + water	
Active metal + Acid (dil)	Salt + Hydrogen	Displacement
Soluble salt solution (A) + Soluble salt solution (B)	Precipitated salt + Soluble salt	Precipitation
Carbonate /bicarbonate + Acid (dil)	Salt + Water+ Carbon dioxide	Decomposition of carbonate
Chlorides/nitrates + Acid (conc)	Acid salt + HCl/HNO ₃	Decomposition of chlorides and nitrates

Exercise Intext 4

Solution 1.

It is the amount of water molecules which enter into loose chemical combination with one molecule of the substance on crystallisation from its aqueous solution.

Common name	Chemical name	Formula
Washing soda	Sodium carbonate decahydrate	Na ₂ CO ₃ .10H ₂ O
Epsom salt	Magnesium sulphate heptahydrate	MgSO ₄ . 7H ₂ O
Potash alum	Hydrated potassium aluminium sulphate	K ₂ SO ₄ .Al(SO ₄) ₃ .24H ₂ O
Gypsum	Hydrated calcium sulphate	CaSO ₄ .2H ₂ O

Solution 2.

(a) Crystalline hydrated salts which on exposure to the atmosphere lose their water of crystallisation partly or completely and change into a powder. This phenomenon is called efflorescent and the salts are called efflorescent.

Examples: CuSO₄.5H₂O, MgSO₄.7H₂O, Na₂CO₃.10H₂O

(b) Water-soluble salts which on exposure to the atmosphere absorb moisture from the atmosphere and dissolve in the same and change into a solution. The phenomenon is called deliquescence and the salts are called deliquescent.

Examples: CaCl₂, MgCl₂, ZnCl₂

Solution 3.

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Drying agents	Dehydrating agents
They remove moisture from other substances.	They remove chemically combined elements of water in the ratio of 2:1 (hydrogen:oxygen) from a compound.
They are used to dry gases like chlorine, sulphur dioxide and hydrogen chloride. They are also used in dessicators to keep substances dry.	They prepare substances such as carbon monoxide and sugar charcoal.
They represent a physical change.	They represent a chemical change.

Solution 4.

Conc. sulphuric acid is hygroscopic in nature and can remove moisture from other substances; therefore, it is used as a drying agent. It is also used as a dehydrating agent because it has a strong affinity for water and thus absorbs water quickly from compounds.

Solution 5.

1. blue
2. red
3. hydrogen gas
4. basic, alkaline
5. graphite

Solution 6.

(a) Sodium hydrogensulphate [NaHSO_4] is an acid salt and is formed by the partial replacement of the replaceable hydrogen ion in a dibasic acid [H_2SO_4]. The [H] atom in NaHSO_4 makes it behave like an acid.

So, on dissolving in water, it gives hydrogen ions.

(b) Desiccating agents are used to absorb moisture. Anhydrous calcium chloride (CaCl_2) has the capacity of absorbing moisture as it is hygroscopic in nature. So, it is used in a desiccator.

Solution 7.

- (a) Increase
- (b) Increase
- (c) Decrease
- (d) Increase

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(e) Increase

Solution 8.

(a) Table salt turns moist and ultimately forms a solution on exposure to air especially during the rainy season. Although pure sodium chloride is not deliquescent, the commercial version of the salt contains impurities (such as magnesium chloride) which are deliquescent substances.

(b) The impurity can be removed by passing a current of dry hydrogen chloride gas through a saturated solution of the affected salt. Pure sodium chloride is produced as a precipitate which can be recovered by filtering and washing first with a little water and finally with alcohol.

(c) Conc. sulphuric acid

(d) Common salt and sugar

Solution 9.

(a) Water of crystallization

(b) White

(c) By heating with any dehydrating agent

(d) Anhydrous calcium chloride



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- Chapter 5- Mole Concept and Stoichiometry
- Chapter 6- Electrolysis
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- Chapter 8- Study of Compounds - Hydrogen Chloride
- Chapter 9- Study of Compounds - Study of Compounds - Ammonia
- Chapter 10- Study of Compounds - Nitric Acid
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