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In text Questions and Answers

NCERT Questions and Answers 2011 to 2018

NCERT Solved Question Papers

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10

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Contents

1 Chemical Reactions and Equations

Blue Print

A	B	C

NCERT Intext Questions

Pg.No. 6

1. Why should a magnesium ribbon be cleaned before burning in air?

1. Magnesium reacts with oxygen present in the moist air to form ***magnesium oxide***.
2. The ***magnesium oxide*** is a ***white powder***.
3. The white powder of ***magnesium oxide*** forms a ***coating*** over the ***magnesium ribbon***.
4. It is ***inert*** and ***hinders*** the burning of magnesium.
5. So, the ***magnesium ribbon*** should be ***cleaned*** with ***sand paper*** to remove the ***inert*** magnesium oxide.

2. Write the balanced equation for the following chemical reactions.
   (i) Hydrogen + Chlorine → Hydrogen chloride
   (ii) Barium chloride + Aluminium sulphate → Barium sulphate + Aluminium chloride
   (iii) Sodium + Water → Sodium hydroxide + Hydrogen

(i) $H_2(g) + Cl_2(g) \rightarrow 2HCl(aq)$

(ii) $3BaCl_2(aq) + Al_2(SO_4)_3(aq) \rightarrow 3BaSO_4(s) + 2AlCl_3(aq)$

(iii) $2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g)$

3. Write a balanced chemical equation with state symbols for the following reactions.

(i) Solutions of barium chloride and sodium sulphate in water react to give insoluble barium sulphate and the solution of sodium chloride.

(ii) Sodium hydroxide solution (in water) reacts with hydrochloric acid solution (in water) to produce sodium chloride solution and water.

(i) $BaCl_2$ (aq) + Na_2SO_4 (aq) $\rightarrow$ $BaSO_4$ (s) + 2NaCl (aq)

(ii) NaOH (aq) + HCl (l) $\rightarrow$ NaCl (aq) + H_2O (l)

Pg.No. 10

1. A solution of a substance 'X' is used for white washing.

(i) Name the substance 'X' and write its formula.

(ii) Write the reaction of the substance 'X' named in (i) above with water.

(i) The substance ***'X'*** which is used for ***white washing*** is ***Calcium oxide*** or ***quick lime.***

Formula

The formula of calcium oxide is ***CaO***.

(ii) CaO (s) + H_2O (l) $\rightarrow$ $Ca(OH)_2$ (aq)

Quick lime Water Slaked lime (Calcium hydroxide)

2. Why is the amount of gas collected in one of the test tubes in Activity 1.7 double of the amount collected in the other? Name this gas.

Reason

1. Water is electrolysed to give ***hydrogen*** gas at one electrode and ***oxygen*** gas at the other electrode.

$2H_2O$ (l) $\rightarrow$ 2 H_2(g) + O_2

2. The molar ratio of hydrogen and oxygen is 2:1.
3. When water is electrically decomposed, the constituent gases ***hydrogen*** and ***oxygen*** are produced in the ***molar ratio 2:1.***
4. So, the volume of ***hydrogen*** produced is ***double*** than that of ***oxygen***.

Name of the Gas

The gas is ***hydrogen***.

Pg.No. 13

1. Why does the colour of copper sulphate solution change when an iron nail is dipped in it?

1. ***Copper sulphate*** solution is ***blue*** in colour.
2. When an ***iron nail*** is dipped in it, its blue colour ***fades.***
3. This is due to the formation of ***green*** coloured ***ferrous sulphate*** and ***brown*** coloured copper.

4. Ferrous sulphate is formed by ***displacement*** reaction.
5. Iron has displaced copper from ***copper sulphate***.

$Fe\ (s) + CuSO_4\ (aq) \rightarrow FeSO_4\ (aq) + Cu\ (s)$

Grey Blue Green Brown

2. Give an example of a double displacement reaction other than the one given in Activity 1.10.

The following reaction is an example of a double displacement reaction:

$AgNO_3\ (aq) + NaCl\ (aq) \rightarrow AgCl(s) + NaNO_3\ (aq)$

Silver nitrate Sodium chloride Silver chloride Sodium nitrate

3. Identify the substances that are oxidised and the substances that are reduced in the following reactions.

(i) $4Na\ (s) + O_2\ (g) \rightarrow 2Na_2O\ (s)$

(ii) $CuO\ (s) + H_2\ (g) \rightarrow Cu\ (s) + H_2O\ (l)$

(i) In the reaction, $4Na\ (s) + O_2\ (g) \rightarrow 2Na_2O\ (s)$, ***Sodium metal*** is ***oxidised*** to sodium oxide and ***oxygen*** is ***reduced*** by sodium.

(ii) In the reaction, $CuO\ (s) + H_2\ (g) \rightarrow Cu\ (s) + H_2O\ (l)$ ***Copper oxide*** is ***reduced*** to copper and ***hydrogen*** is ***oxidised to water.***

Pg.No. 14

1. Which of the statements about the reaction below are incorrect?

$2PbO\ (s) + C\ (s) \rightarrow 2Pb\ (s) + CO_2\ (g)$

(a) Lead is getting reduced.
(b) Carbon dioxide is getting oxidised.
(c) Carbon is getting oxidised.
(d) Lead oxide is getting reduced.

(i) (a) and (b) (iv) all
(ii) (a) and (c)
(iii) (a), (b) and (c)

Ans ***: (i) (a) and (b)***

2. $Fe_2O_3 + 2Al \rightarrow Al_2O_3 + 2Fe$

The above reaction is an example of a

(a) combination reaction.
(b) double displacement reaction.
(c) decomposition reaction.
(d) displacement reaction.

Ans : ***(d) Displacement reaction.***

3.What happens when dilute hydrochloric acid is added to iron fillings? Tick the correct answer.

(a) Hydrogen gas and iron chloride are produced.
(b) Chlorine gas and iron hydroxide are produced.
(c) No reaction takes place.
(d) Iron salt and water are produced.

Ans : ***(a) Hydrogen gas and iron chloride are produced.***

4. What is a balanced chemical equation? Why should chemical equations be balanced?

Balanced Chemical Equation

In a ***balanced chemical equation***, the total number of ***atoms*** of each element is ***same*** in the ***reactants*** and the ***products***.

Mass of reactants = Mass of product.

Chemical Equations Should Be Balanced

1. An equation should be balanced in order to satisfy the ***'law of conservation of mass'***.
2. (i) According to the ***law of conservation of mass,*** mass can neither be created nor destroyed in a chemical reaction.
   (ii) The total ***mass of reactants*** should be equal to the total ***mass of products*** i.e., Mass of reactants = Mass of product.
3. Hence, in a chemical reaction, the ***number of atoms*** of various elements on both sides ***should be equal***.
4. Therefore, a ***chemical equation*** is to be ***balanced*** in accordance with the ***'law of conservation of mass'***.

5. Translate the following statements into chemical equations and then balance them.
   (a) Hydrogen gas combines with nitrogen to form ammonia.
   (b) Hydrogen sulphide gas burns in air to give water and sulphur dioxide.
   (c) Barium chloride reacts with aluminium sulphate to give aluminium chloride and a precipitate of barium sulphate.
   (d) Potassium metal reacts with water to give potassium hydroxide and hydrogen gas.

(a) $3H_2\,(g) + N_2\,(g) \rightarrow 2NH_3\,(g)$
(b) $2H_2S\,(g) + 3O_2\,(g) \rightarrow 2H_2O\,(l) + 2SO_2\,(g)$

(c) $3BaCl_2\,(aq) + Al_2(SO_4)_3\,(aq) \rightarrow 2AlCl_3\,(aq) + 3BaSO_4\,(s)$
(d) $2K\,(s) + 2H_2O\,(l) \rightarrow 2KOH\,(aq) + H_2\,(g)$

6. Balance the following chemical equations.
(a) $HNO_3\,(aq) + Ca(OH)_2\,(aq) \rightarrow Ca(NO_3)_2\,(aq) + H_2O\,(l)$
(b) $NaOH + H_2SO_4 \rightarrow Na_2SO_4 + H_2O$
(c) $NaCl + AgNO_3 \rightarrow AgCl + NaNO_3$
(d) $BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + HCl$

(a) $2HNO_3\,(aq) + Ca(OH)_2\,(aq) \rightarrow Ca(NO_3)_2\,(aq) + 2H_2O\,(l)$
Nitric acid; Calcium hydroxide; Calcium nitrate; Water

(b) $2NaOH\,(aq) + H_2SO_4\,(aq) \rightarrow Na_2SO_4\,(aq) + 2H_2O\,(l)$
Sodium hydroxide; Sulphuric acid; Sodium sulphate; Water

(c) $NaCl\,(aq) + AgNO_3\,(aq) \rightarrow AgCl\,(s) + NaNO_3\,(aq)$
Sodium chloride; Silver nitrate; Silver chloride; Sodium nitrate

(d) $BaCl_2\,(aq) + H_2SO_4\,(aq) \rightarrow BaSO_4\,(s) + 2HCl\,(aq)$
Barium chloride; Sulphuric acid; Barium sulphate; Hydrochloric acid

7. Write the balanced chemical equations for the following reactions.
(a) Calcium hydroxide + Carbon dioxide → Calcium carbonate + Water
(b) Zinc + Silver nitrate → Zinc nitrate + Silver
(c) Aluminium + Copper chloride → Aluminium chloride + Copper
(d) Barium chloride + Potassium sulphate → Barium sulphate + Potassium chloride

(a) $Ca(OH)_2\,(aq) + CO_2\,(g) \rightarrow CaCO_3\,(s) + H_2O\,(l)$
(b) $Zn\,(s) + 2AgNO_3\,(aq) \rightarrow Zn(NO_3)_2\,(aq) + 2Ag\,(s)$
(c) $2Al\,(s) + 3CuCl_2\,(aq) \rightarrow 2AlCl_3\,(aq) + 3Cu\,(s)$
(d) $BaCl_2\,(aq) + K_2SO_4\,(aq) \rightarrow BaSO_4\,(s) + 2KCl\,(aq)$

8. Write the balanced chemical equation for the following and identify the type of reaction in each case.
(a) Potassium bromide (aq) + Barium iodide (aq) → Potassium iodide (aq) + Barium bromide (s)

(b) Zinc carbonate (s) → Zinc oxide (s) + Carbon dioxide (g)
(c) Hydrogen (g) + Chlorine (g) → Hydrogen chloride (g)
(d) Magnesium (s) + Hydrochloric acid (aq) → Magnesium chloride (aq) + Hydrogen (g)

(a) $2KBr + BaI_2\ (aq) \rightarrow 2KI\ (aq) + BaBr_2\ (s)$

Type of Reaction

It is a double displacement reaction.

(b) $ZnCO_3\ (s) \rightarrow ZnO\ (s) + CO_2\ (g)$

Type of Reaction

It is a decomposition reaction.

(c) $H_2\ (g) + Cl_2\ (g) \rightarrow 2HCl\ (g)$

Type of Reaction

It is a combination reaction.

(d) $Mg\ (s) + 2HCl\ (aq) \rightarrow MgCl_2\ (aq) + H_2\ (g)$

Type of Reaction

It is a displacement reaction.

9. What does one mean by exothermic and endothermic reactions? Give examples.

Exothermic Reaction

Chemical reaction which ***releases*** heat along with the of ***products*** is called exothermic reaction.

Examples

1. $H_2SO_4\ (aq) \xrightarrow{\text{Water}} 2H + SO_4^{2-} + \text{Heat}$
   Sulphuric acid
2. $CH_4\ (g) + 2O_2\ (g) \longrightarrow CO_2\ (g) + 2H_2O\ (l) + \text{Heat}$
   Methane Oxygen Carbon dioxide Water
3. $C_6H_{12}O_6\ (s) + 6O_2\ (g) \xrightarrow{\text{Water}} 6CO_2\ (g) + 6H_2O\ (l) + \text{Heat}$
   Glucose Oxygen Carbon dioxide Water

Endothermic Reaction

Chemical reaction which ***requires*** heat for the reaction to proceed is called ***endothermic reaction.***

The heat required is usually absorbed from the surroundings.

Examples

1. $2HgO\ (s) + \text{Heat} \longrightarrow 2Hg\ (l) + O_2\ (g)$
   Mercuric oxide Mercury Oxygen

2. NH_4Cl (s) + H_2O (l) $\xrightarrow{Heat}$ NH_4Cl (aq)
Ammonium chloride Water Ammonium chloride

3. N_2 (g) + O_2(g) + Heat $\longrightarrow$ 2NO (g)
Nitrogen Oxygen Nitric oxide

10. Why is respiration considered an exothermic reaction? Explain.

1. In ***respiration,*** glucose gets oxidized to form ***Carbon-dioxide***, ***water*** and ***heat***.
2. As heat energy is released during respiration, it is regarded as ***exothermic reaction***.

11. Why are decomposition reactions called the opposite of combination reactions? Write equations for these reactions.

Decomposition Reaction	***Combination Reaction***
1. The ***reactants*** are ***complex*** and the ***products*** are ***simpler***.	1.The ***reactants*** are ***simpler*** and the ***products*** are ***complex***.
2. A ***complex*** compound is ***broken*** down into ***simpler compounds***.	2. ***Simple*** compounds combine to form ***complex compounds***.
3. A ***compound*** is ***broken*** down into ***two*** or ***more*** compounds.	3. ***One*** or ***two*** compounds combine to form a ***single*** compound.
4. ***Heat, light*** or ***electricity*** is absorbed.	4. ***Heat*** is evolved.
5. Eg. $2NH_3$+Heat$\rightarrow N_2+3H_2$	Eg. $N_2+3H_2\rightarrow 2NH_3$+Heat

12. Write one equation each for decomposition reactions where energy is supplied in the form of heat, light or electricity.

Decomposition reactions require ***energy*** either in the form of ***heat, light*** or ***electricity*** for breaking down the reactants.

Energy in the Form of Heat

(i) $CaCO_3$ (s) $\xrightarrow{Heat}$ CaO (s) + CO_2 (g)
Lime stone Calcium oxide Carbon di oxide

Energy in the Form of Sunlight

(ii) 2 AgCl (s) $\xrightarrow{Sunlight}$ 2Ag(s) + Cl_2 (g)
Silver chloride Silver Chlorine

Energy in the Form of Electricity

(iii) $2H_2O\,(l) \xrightarrow{\text{Electricity (acid)}} 2H_2\,(g) + O_2\,(g)$
Water — Hydrogen — Oxygen

13. What is the difference between displacement and double displacement reactions? Write equations for these reactions.

Displacement Reaction

In displacement reaction, ***more reactive metal displaces less reactive metal*** from its ***salt solution***.

$Zn\,(s) + CuSO_4\,(aq) \rightarrow ZnSO_4\,(aq) + Cu\,(s)$
Zinc — Copper sulphate — Zinc sulphate — Copper

Hence, ***Zn*** displaces ***Cu*** from its salt solution ($CuSO_4$)

Double Displacement Reaction

In double displacement reaction, ***two compounds exchange*** their ***ions*** to form ***two new compounds***.

$BaCl_2\,(aq) + K_2SO_4\,(aq) \rightarrow BaSO_4\,(s) + 2KCl\,(aq)$
Barium chloride — Potassium sulphate — Barium sulphate — Potassium chloride

Here, ***Ba*** and ***K*** displace each other.

14. In the refining of silver, the recovery of silver from silver nitrate solution involved displacement by copper metal. Write down the reaction involved.

$2AgNO_3\,(aq) + Cu\,(s) \rightarrow Cu\,(NO_3)_2\,(aq) + 2Ag\,(s)$
Silver nitrate — Copper — Copper nitrate — Silver metal

15. What do you mean by a precipitation reaction? Explain by giving examples.

1. In precipitation reaction, ***two soluble salts*** combine to form ***insoluble*** salts called ***precipitates***.
2. It is a ***double displacement*** reaction.

Explanation with Examples

1. $AgNO_3\,(aq) + NaCl\,(aq) \rightarrow AgCl\,(s) + NaNO_3\,(aq)$
White precipitate

When ***silver nitrate*** is added to an aqueous solution of ***sodium chloride***, a ***white precipitate*** of ***silver chloride (AgCl),*** is obtained.

2. $Pb(NO_3)_2 + 2KI \rightarrow PbI_2 + 2KNO_3$
Yellow precipitate

Lead nitrate reacts with potassium iodide to form lead iodide and potassium nitrate. Lead iodide is a yellow precipitate.

16. Explain the following in terms of gain or loss of oxygen with two examples each.
    (a) Oxidation
    (b) Reduction

(a). Oxidation

Oxidation is a chemical reaction in which a substance ***gains oxygen*** or ***loses hydrogen***.

Examples

1. $2Mg\ (s) + O_2\ (g) \longrightarrow 2MgO\ (s)$
   Magnesium Oxygen Magnesium oxide

Here, ***Mg*** has ***gained oxygen*** to form ***MgO***. Hence, Mg has been oxidised to Magnesium oxide (MgO)

2. $2Cu\ (s) + O_2\ (g) \xrightarrow{Heat} 2CuO\ (s)$
   Copper Oxygen Copper oxide

In this reaction, ***Cu*** has ***gained oxygen*** to form ***CuO***. Thus Cu is oxidised to Copper oxide (CuO).

(b). Reduction

Reduction is a chemical reaction in which a substance ***loses*** of ***oxygen*** or ***gains hydrogen***.

Examples

1. $CuO + H_2 \xrightarrow{Heat} Cu + H_2O$
   Copper oxide Hydrogen Copper Water

In this reaction, Copper oxide has lost oxygen. So, it is reduced to copper.

2. $ZnO + C \xrightarrow{Heat} Zn + CO$
   Zinc oxide Carbon Zinc Carbon monoxide

In this reaction, ***Zinc oxide*** has ***lost oxygen***. So, it is reduced to zinc.

17. A shiny brown coloured element 'X' on heating in air becomes black in colour. Name the element 'X' and the black coloured compound formed.

Name of the Element 'X'

The element 'X' is ***Copper.***

Name of the Black Coloured Compound

The black coloured compound is ***Copper oxide*** (CuO).

Key :

Shiny brown element **X** + Air $\xrightarrow{\text{Heat}}$ Black coloured compound

$$2Cu + O_2 \xrightarrow{\text{Heat}} 2CuO$$

Copper (***brown***) + Oxygen → Copper oxide (***black***)

18. Why do we apply paint on iron articles?

1. Painting on iron is done to prevent ***rusting***.
2. Paint forms a ***protective coating*** on the surface of ***iron*** articles.
3. So, ***oxygen*** and ***moisture*** present in the air cannot come in contact with iron.
4. ***Paint*** acts as an ***antioxidant***.
5. It saves iron articles from damage due to ***corrosion***.
6. ***Paint*** also acts as a ***buffer*** between iron articles and moist air.

19. Oil and fat containing food items are flushed with nitrogen. Why?

1. Oil and fat containing foods, on exposure to ***air*** undergoes ***oxidation***.
2. When ***fats*** and ***oils*** are ***oxidised*** or ***hydrolysed,*** they become ***rancid***.
3. ***Rancid*** foods result due to the ***deterioration*** of the ***fat*** or ***oil*** portion of the food.
4. The ***rancid*** food has ***bad smell*** and ***taste***.
5. When oil and fat containing food items are flushed with nitrogen, ***nitrogen*** forms a ***protective coat*** around the food.
6. ***Nitrogen prevents*** the ***contact*** of food with ***oxygen***.
7. ***Nitrogen*** acts as an ***antioxidant***.
8. Nitrogen ***prevents oxidation***.
9. ***Chips manufacturers*** usually ***flush*** bags of ***chips*** with ***nitrogen*** to prevent the chips from getting oxidised.

20. Explain the following terms with one example each.
(a) Corrosion (b) Rancidity

(a) Corrosion

- Corrosion is a process in which metals are slowly eaten up by the action of ***air***, ***moisture*** or ***chemicals***.
- It is due to the ***deterioration*** of a ***metal*** as a result of ***chemical reaction*** between the ***metal*** and ***environment***.

- Corrosion leads to the formation of ***reddish brown*** coating on ***iron***, ***black coating*** on ***silver*** and ***green coating*** on ***copper***.

Example

Rusting of iron is a form of ***corrosion***. It occurs due to the formation of a reddish brown coating of ***iron oxide***.

$$4Fe + 3O_2 \rightarrow 2Fe_2O_3$$

Iron Oxygen Iron oxide

(b) Rancidity

- Rancidity is the ***natural process*** of ***decomposition*** of ***fats*** or ***oils***.
- It occurs either by ***oxidation*** or ***hydrolysis***, or ***both***.
- Due to fat ***deterioration, food materials*** become ***rancid***.
- The food materials develop ***undesirable smell*** and ***flavour***, making the food ***unfit*** for ***consumption***.
- The ***factors*** which lead to rancidity are the following:
  1. *Exposure to air for a long duration*
  2. *Heat*
  3. *Light*
  4. *Water*
  5. *Long duration*

Example

Butter, when exposed to air for a long duration, leads to ***change*** in ***smell*** and ***taste***.

Board Exam
Solved Questions

1. What is the difference between displacement and double displacement reactions? Write equations for these reactions (2012, 2011, 2010).

Refer Q.No. 13 , Pg.No.8

2. Oil and fat containing food items are flushed with nitrogen. Why? (2014).

Refer Q.No. 19 , Pg.No.10

3. Balance the following chemical equations and state whether they are exothermic or endothermic?

   (i) $Na + H_2O \rightarrow NaOH + H_2$

   (ii) $FeSO_4 \rightarrow Fe_2O_3 + SO_2 + SO_3$ (2016)

(i) $2Na + 2H_2O \longrightarrow 2NaOH + H_2$ (Heat)

As heat is evolved in this reaction, it is an exothermic reaction.

(ii) $2FeSO_4 \xrightarrow{Heat} Fe_2O_3 + SO_2 + SO_3$

As this chemical reaction utilizes heat, it is an endothermic reaction.

4. State the type of chemical reactions with chemical equations that take place in the following:
   (i) Magnesium wire is burnt in air
   (ii) Electric current is passed through water
   (iii) Ammonia and hydrogen chloride gases are mixed (2016)

(i) When Magnesium wire is burnt in air, it produces ***magnesium oxide*** and ***heat***.

$2Mg\ (s) + O_2\ (g) \rightarrow 2MgO\ (s) + Heat$

As a single product is formed by the combination of two reactants, it is a combination reaction.

(ii) When electric current is passed through water, hydrogen and oxygen gases are evolved.

$2H_2O\ (l) \xrightarrow{Electric\ current} 2H_2\ (g) + O_2\ (g)$

In this reaction, a ***single reactant*** is broken down to give simpler products. So, it is a decomposition reaction.

(iii) Ammonia and hydrogen chloride gases are mixed to form ***ammonium chloride***.

NH_3 + HCl $\longrightarrow$ NH_4Cl

Ammonia Hydrochloric acid Ammonium chloride

In this reaction, a ***single*** product is formed from ***two reactants***. So, it is a ***combination*** reaction.

5. What is a reduction reaction? Identify the substances that are oxidised and the substances that are reduced in the following reactions.
   (i) $Fe_2O_3 + 2Al \rightarrow Al_2O_3 + 2Fe$
   (ii) $2PbO + C \rightarrow 2Pb + CO_2$ (2014)

Reduction Reaction

Reduction reaction is a chemical reaction in which a substance loses ***oxygen*** or gains ***hydrogen*** or ***electrons.***

(i) 1. In the reaction, $Fe_2O_3 + 2Al \rightarrow Al_2O_3 + 2Fe$, ***Aluminium metal*** is ***oxidised.***

2. Ferric oxide (***Fe_2O_3***) is ***reduced*** to iron.

(ii) 1. In the reaction, $2PbO + C \rightarrow 2Pb + CO_2$, ***Carbon*** is ***oxidised.***
2. ***Lead oxide*** (***PbO***) is ***reduced.***

6. In a school laboratory, a student wants to study the effect of heat on ferrous sulphate crystals in a boiling tube. State the conclusion he is likely to draw on the basis of his observation.

Conclusion

1. This reaction is a ***decomposition reaction.***
2. A ***single reactant*** is decomposed to form ***three products.***

Observations Made by the Student

1. On gentle heating, ferrous sulphate crystals ***lose water*** and form anhydrous ferrous sulphate.
2. So, the colour of ferrous sulphate, first changes from light green to ***white.***
3. On ***strong heating***, anhydrous ferrous sulphate decomposes to form ferric oxide, sulphur dioxide and sulphur trioxide.
4. So, the colour of ferrous sulphate changes to ***brown.***
5. A brown gas having a ***smell*** of ***burning sulphur*** is evolved.

$$2FeSO_4(s) \rightarrow Fe_2O_3(s) + SO_2(g) + SO_3(g)$$

Ferrous sulphate — Ferric oxide — Sulphur dioxide — Sulphur trioxide

7. Translate the following statements into chemical equations and then balance them.
(a) Hydrogen gas combines with nitrogen to form ammonia
(b) Hydrogen sulphide gas burns in air to give water and sulphur dioxide
(c) Barium chloride reacts with aluminium sulphate to give aluminium chloride and a precipitate of barium sulphate
(d) Potassium metal reacts with water to give potassium hydroxide and hydrogen gas (2012)

Refer Q.No.5 , Pg.No.4

8. Why are decomposition reactions called the opposite of combination reactions? Write equations for these reactions (2012)

Refer Q.No.11, Pg.No.7

9. State one basic difference between a physical change and a chemical change. (2011)

Physical Change	Chemical Change
1. No new substance is formed. 2. Physical change is ***reversible.*** 3. Original substance can be ***recovered.*** 4. ***Only physical*** properties are changed. 5. ***Very little*** amount of energy is absorbed or given out.	1. A new substance is formed. 2. Chemical change is ***not reversible.*** 3. Original substance ***cannot*** be recovered. 4. Both ***physical*** and ***chemical*** properties are changed. 5. ***Large amount*** of energy is absorbed or given out.

10. What is meant by chemical reaction? (2011)

1. Chemical reaction is a ***process*** by which, chemicals interact to form ***new chemicals*** with ***different composition***.
2. The ***chemicals*** that interact are called ***reactants*** and the ***chemicals*** that are ***produced*** are called ***products***.
3. In chemical reactions, ***one*** or ***more reactants*** are ***converted*** into ***one*** or ***more products***.
4. This reaction can be ***represented*** by ***chemical equation***.

11. $AgNO_3$ (aq) + NaCl (aq) $\rightarrow$ AgCl (s) $\downarrow$ + $NaNO_3$ (aq)
$FeS + H_2SO_4 \rightarrow FeSO_4 + H_2S \uparrow$
Consider the above mentioned two chemical reactions with two different kinds of arrows and along with product. What do these two different arrows indicate? (2011)

* $\uparrow$ - shows the ***gas evolved.***
* $\downarrow$ - shows the ***precipitate*** formed.

12. What happens chemically when quick lime is added to water filled in a bucket? (2010)

1. When quick lime is added to water, ***slaked lime*** is formed.
2. The reaction produces lot of ***heat*** and ***hissing sound***.

$CaO (s) + H_2O (l) \rightarrow Ca(OH)_2 (s)$ + Heat + Hissing sound
Quick lime (Calcium oxide) Water Slaked lime (Calcium hydroxide)

3. It is an ***exothermic reaction.***

13. On what basis is a chemical equation balanced?

A chemical equation is balanced on the basis of law of ***conservation of mass.***

According to this law, ***total mass*** of the ***elements*** of the ***products*** should be ***equal*** to that present in the ***reactant***.

So, the ***number of atoms*** of each element is ***same*** before and after the reaction, both in the reactants and products.

14. What change in colour is observed when silver chloride is left exposed to sunlight? State the type of chemical reaction in this change. (2010)

Exposure of Silver Chloride in Sunlight

1. When ***silver chloride*** is left ***exposed*** to ***sunlight***, the colour of ***silver chloride*** turns into ***grey*** from ***white.***
2. The ***grey colour*** is due to the formation of ***silver***.

Type of Reaction

Conversion of silver chloride is a ***photochemical decomposition*** reaction

$$\underset{\text{(White colour)}}{2AgCl} \rightarrow \underset{\text{(Grey colour)}}{2Ag} + \underset{\text{Chlorine}}{Cl_2}$$

15. Write balanced chemical equations for the following reactions:
    (a) Silver bromide on exposure to sunlight decomposes into silver and bromine.
    (b) Sodium metal reacts with water to form sodium hydroxide and hydrogen gas (2012)

(a) $2AgBr\,(s) \xrightarrow{\text{sunlight}} 2Ag\,(s) + Br_2\,(g)$

(b) $2Na\,(s) + 2H_2O \longrightarrow 2NaOH\,(aq) + H_2\,(g)$

16. Write the balanced equation for the following reactions and identify the type of reaction in each case.
    (a) Potassium bromide + Barium iodide $\rightarrow$ Potassium iodide + Barium bromide
    (b) Hydrogen (g) + Chlorine (g) $\rightarrow$ Hydrogen chloride (g) (2011)

Refer (a) and (c) from Q.No.8, Pg.No.5-6

17. A Zinc plate was put into a solution of copper sulphate kept in a glass container. It was found that blue colour of the solution gets fader

and fader with the passage of time. After a few days when zinc plate was taken out of the solution, a number of holes were observed in it.

(a) State the reason for changes observed on the zinc plate

(b) Write the chemical equation for the reaction involved (2011)

(a) Reason for Changes Observed on Zinc Plate

1. Zinc is ***more reactive*** than copper.
2. So, ***Zinc*** displaces ***copper*** from copper sulphate solution to form ***Zinc sulphate***.
3. ***Zinc*** of the Zinc plate has been ***used*** to form ***zinc sulphate***.
4. On ***prolonged exposure*** to the solution, ***zinc*** dissolves here and there, causing holes in the plate.

(b) $Zn\ (s) + CuSO_4\ (aq) \rightarrow ZnSO_4\ (aq) + Cu\ (s)$

Zinc Copper sulphate Zinc sulphate Copper

18. What is observed when a solution of potassium iodide is added to a solution of lead nitrate? Name the type of reaction. Write a balanced chemical equation to represent the above chemical reaction. (2014, 2013)

Observation

1. When a solution of potassium iodide is added to a solution of lead nitrate, ***lead iodide*** and potassium nitrate are formed.
2. Lead iodide formed is a ***yellow precipitate***, which ***deposits*** at the ***bottom*** of the tube.
3. ***Potassium nitrate*** is formed as a colourless solution.

Type of Reaction

- This reaction is a ***double displacement*** reaction .
- As this reaction results in the formation of precipitates, it is also called ***precipitation reaction.***

Balanced Chemical Equation

$Pb(NO_3)_2\ (aq) + 2KI\ (aq) \rightarrow PbI_2\ (s) + 2\ KNO_3\ (aq)$

Lead nitrate Potassium iodide Lead iodide (Yellow precipitate) Potassium nitrate

19. Consider the following chemical reaction

X + Barium chloride $\rightarrow$ Y (white precipitate) + Sodium chloride

(a) Identify 'X' and 'Y'

(b) Type of reaction. (2015)

(a) The ***element 'X'*** in the reaction is ***Na_2SO_4***.
The product '***Y***' formed is ***$BaSO_4$***.

(b) 1. The reaction is a ***double displacement reaction.***
2. It is also a ***precipitation*** reaction.
3. $Na_2SO_4 + BaCl_2 \rightarrow BaSO_4 + 2NaCl$
X Y
4. ***Barium sulphate*** formed is a ***white precipitate.***

20. Name the reducing agent in the following reaction
$3MnO_2 + 4Al \rightarrow 3Mn + 2Al_2O_3$
State which is more reactive, Mn or Al and why? (2015)

Name of the Reducing Agent

Aluminium is the ***reducing*** agent, as Al is getting oxidised.

More Reactive Element

Aluminium is ***more reactive*** than Mn.

Reason

1. ***Aluminium*** is more reactive than Mn, on the basis of the ***reactivity series order***.
2. According to 'reactivity series order of the Elements', ***Al*** has a ***lower*** first ionization energy ***than Mn***.
3. When the ionisation energy is lower, the ***reactivity*** of the element is ***more***.
4. As ***Al*** has ***lower*** ionization energy ***than Mn***, it is ***more reactive*** than ***Mn***.

21. Write the chemical equation of the reaction in which the following changes have taken place with an example of each
(a) Change in colour
(b) Change in temperature
(c) Formation of precipitate. (2015, 2014, 2011)

(a) Change in Colour

(a) $Cu\ (s) + 2AgNO_3\ (aq) \rightarrow Cu(NO_3)_2\ (aq) + 2Ag$
Reddish Brown Yellow Blue colour

1. The solution will become ***blue*** in colour.
2. ***Shiny silver metal*** will be deposited.

(b) Change in Temperature

$NaOH + HCl \rightarrow NaCl + H_2O + Heat$

The ***temperature*** will ***increase*** because ***heat*** will be evolved.

(c) Formation of Precipitate

$$Pb(NO_3)_2\,(aq) + 2KI\,(aq) \rightarrow \underset{\text{Yellow precipitate}}{PbI_2\,(s)} + 2KNO_3\,(aq)$$

Yellow precipitate of ***PbI_2*** will be formed.

22. Write the balanced equation for the following, mention the type of reaction involved

(a) Aluminium + Bromine → Aluminium bromide

(b) Calcium carbonate → Calcium oxide + Carbon dioxide

(c) Silver chloride → Silver+ Chlorine. (2011)

(a) Balanced Equation

$$2Al\,(s) + 3Br_2\,(g) \rightarrow 2AlBr_3\,(s)$$

Types of Reaction

The above reaction is a combination reaction.

(b) Balanced Equation

$$CaCO_3\,(s) \xrightarrow{\text{Heat}} CaO\,(s) + CO_2\,(g)$$

Types of Reaction

The above reaction is a thermal decomposition reaction.

(c) Balanced Equation

$$2AgCl\,(s) \xrightarrow{\text{Sunlight}} 2Ag\,(s) + Cl_2\,(g)$$

Types of Reaction

The above reaction is a photo decomposition reaction.

23. Write the type of chemical reaction represented by the following equation.

(a) $CaO + H_2O \rightarrow Ca(OH)_2$

(b) $3BaCl_2 + Al_2(SO_4)_3 \rightarrow 3BaSO_4 + 2AlCl_3$

(c) $2FeSO_4 \xrightarrow{\text{Heat}} Fe_2O_3 + SO_2 + SO_3$

(a) ***Combination reaction***

(b) ***Double displacement reaction*** (***Precipitation reaction***)

(c) ***Decomposition reaction***

24. What is redox reaction? Identify the substance oxidised and the substance reduced in the following reactions?

(a) $2PbO + C \rightarrow Pb + CO_2$

(b) $MnO_2 + 4HCl \rightarrow MnCl_2 + 2H_2O + Cl_2$ (2012)

Redox Reaction

1. Redox reaction is a chemical reaction in which ***oxidation*** of ***one reactant*** is coupled with the ***reduction*** of ***another reactant***.
2. Redox reaction is the abbreviation of ***'Oxidation - reduction reaction'.***
3. ***Gain*** and ***transfer*** of electrons occur when ***two dissimilar atoms*** interact.
4. ***One*** atom ***loses*** an ***electron*** and the ***other*** atom ***gains*** an ***electron***.
5. The ***atom*** that ***loses*** an ***electron*** is said to be ***oxidised***; the ***atom*** that ***gains*** an ***electron*** is reduced.
6. Oxidation and reduction occur ***simultaneously***.

Substance Oxidised and Reduced

(a) PbO is reduced due to loss of oxygen.
Carbon is oxidised due to gain of oxygen.

(b) MnO_2 is reduced due to the loss of oxygen.
HCl is oxidised due to gain of oxygen.

25. What is rancidity? Mention any two ways by which rancidity can be prevented (2012, 2015).

Refer part (b) in Q.No.20 , Pg.No.11

Prevention of Rancidity

1. ***Refrigeration*** of ***cooked food.***
2. ***Packing*** of food ***materials*** in ***air tight containers***.
3. ***Addition*** of ***antioxidnts*** to foods. (Eg) Nitrogen.
4. ***Storage*** of oil in ***coloured glass*** containers.
5. ***Vacuum*** packaging of foods, so that oxygen is eliminated.

26. Discuss the importance of decomposition reaction in metal industry with three points (2015).

In decomposition reaction, a ***single compound*** breaks down into ***two*** or ***more elements*** or ***new compounds***.

Importance

1. Decomposition reaction occurs during the ***refining*** of ***metals***.

Example :

- ***Copper*** is refined by electrolysis of aqueous copper sulphate solution using ***carbon electrodes***. Copper is deposited on the carbon electrodes.

2. ***Metals*** are ***extracted*** from their naturally occurring ores using ***heat*** and ***electricity*** by ***decomposition***.

Example :

- ***Sodium metal*** is extracted from molten ***Sodium chloride*** by ***electrolytic decomposition***.
- ***Aluminium*** metal is extracted from ***bauxite*** ore mixed with cryolite by ***electrolytic decomposition***.
- ***Copper*** metal is extracted from its ore, ***malachite*** by thermal decomposition.

3. Thermite Welding

- In thermite welding, ***metal*** to ***metal joint*** is created by ***melting*** base material (iron).
- ***Molten*** state of ***iron oxide*** undergoes ***decomposition*** to produce ***liquid Fe*** at 1600^{o}.
- This ***liquid state Fe*** is used for ***welding***.

27. On adding dilute hydrochloric acid to copper oxide powder, the solution formed is blue-green. Predict the new compound formed which imparts a blue-green colour to the solution. (2013)

- The new compound formed is ***Copper (II) chloride*** ($CuCl_2$).
- It imparts a blue-green colour to the solution.

$$\underset{\text{Hydrochloric acid}}{HCl} + \underset{\text{Copper oxide}}{CuO} \longrightarrow \underset{\text{Copper (II) chloride}}{CuCl_2} + \underset{\text{Water}}{H_2O}$$

28. What type of coating is formed on copper articles when they get corroded? (2013)

1. The copper articles form ***green coating*** of ***basic copper carbonate*** [$CuCO_3Cu(OH)_2$].
2. This is due to the ***corrosion*** of copper articles on ***exposure*** to ***moist air***.
3. This is formed when ***copper*** reacts with oxygen, water and carbon dioxide.

$$2Cu + H_2O + CO_2 + O_2 \longrightarrow Cu(OH)_2 + CuCO_3$$

29. What is meant by skeletal equation? (2013)

- ***Unbalanced chemical equation*** is called a skeletal equation.
- The ***number*** of ***atoms*** of each ***element*** in the ***reactants*** and products are ***not equal***.

Example:

$Mg + HCl \rightarrow MgCl_2 + H_2$

Magnesium — Hydrochloric acid — Magnesium chloride — Hydrogen

30. State what happens when
    (a) Hydrated Copper sulphate is heated
    (b) Gypsum is heated at 373K
    (c) Chlorine gas is passed through dry slaked lime
    Also write the chemical equation in each case. (2015)

(a)
- When hydrated copper sulphate is heated, ***five molecules*** of ***water*** are removed by crystallisation.
- ***Blue colour*** of copper sulphate turns into white.
- The ***white colour*** is due to the formation of ***anhydrous copper sulphate***.

$CuSO_4 . 5H_2O\ (s) \xrightarrow{Heat} CuSO_4 + 5H_2O\ (W)$

Hydrated Copper sulphate — Copper sulphate (White colour) — Water

(b)
- When gypsum is heated at 373K, ***plaster of paris*** is formed.
- Plaster of paris is otherwise called ***Calcium sulphate hemihydrate***.

$CaSO_4 . 2H_2O \xrightarrow{373K} CaSO_4 . ½\ H_2O + 1½\ H_2O$

Calcium sulphate hemihydrate

(c)
- When chlorine gas is passed through dry slaked lime ***bleaching powder*** is formed.
- Bleaching powder is otherwise called ***Calcium oxychloride.***

$Ca(OH)_2 + Cl_2 \longrightarrow CaOCl_2 + H_2O$

Dry slaked lime — Chlorine — Bleaching powder — Water

31. State reason for the following:
    (a) Potato chips manufacturers usually flush bags of chips with nitrogen gas.
    (b) Iron articles lose their shine gradually.
    (c) Foods should be kept in air tight containers. (2015)

(a) 1. Nitrogen gas is flushed into potato chips packets to prevent ***rancidity***.
2. Nitrogen gas acts as an ***antioxidant***.
3. Potato chips, if ***not*** treated with ***nitrogen***, will undergo ***deterioration***, when exposed to air.
4. Deterioration causes change in smell and taste (rancid) of the food.
5. It makes ***food undesirable*** for consumption.

(b) 1. Iron articles lose their shine due to ***rusting***.
2. ***Rust*** is formed on the ***iron articles*** as ***reddish brown powder***.
3. Rusting occurs when the iron articles are exposed to ***moist air***.

(c) 1. Foods should be kept in air tight containers to ***avoid rancidity***.
2. Due to exposure of ***food to air***, the foods ***deteriorate***.
3. This brings about change in the smell and taste of the food (rancid).
4. Thus, foods become ***unfit*** for ***consumption***.

32. What happens when a piece of
(i) Aluminium metal is added to dilute hydrochloric acid.
(ii) Zinc metal is added to Copper sulphate solution.
(iii) Silver metal is added to Copper sulphate solution
Also write balanced chemical equation, if the reaction occurs (2016).

(i) ❖ ***Aluminium displaces hydrogen*** from ***dil. HCl*** solution.
❖ It produces aqueous aluminium chloride and ***hydrogen gas.***

Balanced Equation

$$2Al\ (s) + 6HCl\ (aq) \rightarrow 2AlCl_3\ (aq) + 3H_2\ (g)$$

(ii) ❖ Zinc displaces Cu from Copper sulphate solution
❖ It produces Zinc sulphate and Copper.

Balanced Equation

$$Zn\ (s) + \underset{\text{Blue colour}}{CuSO_4\ (aq)} \rightarrow \underset{\text{Colourless}}{ZnSO_4\ (aq)} + Cu\ (s)$$

(iii) 1. No reaction occurs when silver metal is added to Copper sulphate solution.
2. Silver is less reactive than Copper.
3. ***Silver cannot displace copper*** from its solution.

33. Complete and balance the following chemical equations.

(i) $CaCO_3 + HCl \rightarrow$
(ii) $Al + HCl \rightarrow$
(iii) $MnO_2 + HCl \rightarrow$ (2016)

(i) $CaCO_3 + 2HCl \rightarrow \boldsymbol{CaCl_2 + H_2O + CO_2}$
(ii) $2Al + 6HCl \rightarrow \boldsymbol{2AlCl_3 + 3H_2}$
(iii) $MnO_2 + 4HCl \rightarrow \boldsymbol{MnCl_2 + Cl_2 + 2H_2O}$

34. Explain the type of reactions represented by the following equations:
(i) $CaO + CO_2 \rightarrow CaCO_3$
(ii) $2Na + H_2O \rightarrow 2NaOH + H_2$
(iii) $Mg + CuSO_4 \rightarrow MgSO_4 + Cu$
(iv) $NH_4NO_2 \rightarrow N_2 + 2H_2O$
(v) $CuSO_4 + 2NaOH \rightarrow Cu(OH)_2 + Na_2 + SO_4$ (2016)

(i) ♣ The reaction, $CaO + CO_2 \rightarrow CaCO_3$ is a ***combination reaction.***
♣ ***Two*** or ***more*** substances combine to form ***single*** substance.

(ii) ♣ The reaction, $2Na + H_2O \rightarrow 2NaOH + H_2$ is a ***displacement reaction.***
♣ One element displaces another element in a compound.

(iii) ♣ The reaction, $Mg + CuSO_4 \rightarrow MgSO_4 + Cu$ is a ***displacement reaction.***
♣ More reactive metal displaces less reactive metal from its salt solution.

(iv) ♣ The reaction, $NH_4NO_2 \rightarrow N_2 + 2H_2O$ is a ***decomposition reaction.***
♣ A compound has split into two or more simpler substances.

(v) ♣ The reaction, $CuSO_4 + 2NaOH \rightarrow Cu(OH)_2 + Na_2 + SO_4$ is a ***double displacement reaction.***
♣ Two compounds react by the exchange of ions to form two new compounds.

35. Complete the following chemical equations:
(i) $C_2H_5OH + O_2 \rightarrow$
(ii) $C_2H_5OH \xrightarrow[443K]{\text{conc. } H_2SO_4}$
(iii) $CH_3COOH + NaHCO_3$ (2017)

(i) $C_2H_5OH + 7O_2 \longrightarrow \boldsymbol{2CO_2} + \boldsymbol{3H_2O} + \boldsymbol{Energy}$
Ethanol Oxygen Carbon dioxide Water

(ii) $C_2H_5OH \longrightarrow \underset{\text{Ethylene}}{\boldsymbol{C_2H_4}} + \underset{\text{Water}}{\boldsymbol{H_2O}}$
Ethanol

(iii) $CH_3COOH + NaHCO_3 \rightarrow \underset{\text{Sodium acetate}}{CH_3COONa} + \underset{\text{Water}}{H_2O} + \underset{\text{Carbon dioxide}}{CO_2}$
Acetic acid Sodium bicarbonate

36. State whether the following chemical reactions will take place or not, giving suitable reason for each.
(a) $Zn\ (s) + CuSO_4\ (aq) \rightarrow ZnSO_4\ (aq) + Cu\ (s)$
(b) $Fe\ (s) + ZnSO_4\ (aq) \rightarrow FeSO_4\ (aq) + Zn\ (s)$
(c) $Zn\ (s) + FeSO_4\ (aq) \rightarrow ZnSO_4\ (aq) + Fe\ (s)$

Reason

(a)
- This reaction will take place. It is a ***displacement reaction.***
- Zinc is more ***reactive*** than ***Copper.***
- ***Zinc displaces Copper*** from ***Copper sulphate solution***.

Reason

(b)
- This reaction will not take place.
- ***Iron*** is ***less*** reactive than ***Zinc.***
- ***Iron*** is ***unable*** to ***displace Zinc***.

Reason

(c)
- This reaction occurs. It is a ***displacement reaction.***
- Zinc is ***more reactive*** than ***iron***.
- Zinc ***displaces*** iron from ***iron sulphate*** solution.

37. When you add a few drops of acetic acid to a test tube containing Sodium bicarbonate powder, which one of the following is your observation?
(a) No reaction takes place.
(b) A colourless gas with pungent smell is released with brisk effervescence.
(c) A brown coloured gas is released with brisk effervescence.
(d) Formation of bubbles of a colourless and odourless gas.
(2017)

Ans : ***(d) Formation of bubbles of a odourless and colourless gas.***

Key:

$CH_3COOH + NaHCO_3 \rightarrow NaC_2H_3O_2 + \underset{\text{Water}}{H_2O} + \underset{\text{(Colourless gas)}}{CO_2\,(g)}$

38. What happens when, (write chemical equation in each case)
    (a) ethanol is burnt in air?
    (b) ethanol is heated with excess con. H_2SO_4 at 443K?
    (c) a piece of Sodium is dropped into ethanol?

(a) 1. When ***ethanol*** is burnt in ***air,*** it evolves ***heat*** and ***light***.

2. The reaction produces ***Carbon dioxide*** gas and ***water vapour***.

$$CH_3CH_2OH + 3O_2 \rightarrow 2CO_2 + 3H_2O + \text{Heat} + \text{Light}$$

Ethanol Oxygen Carbon dioxide Water

(b) 1. When ethanol is heated with excess Con. H_2SO_4 at 443K, dehydration takes place.

2. Ethylene and water are formed.

$$CH_3CH_2OH \xrightarrow[443K]{\text{Con. } H_2SO_4} CH_2 = CH_2 + H_2O$$

Ethanol Ethylene Water

(c) When a piece of sodium is dropped into ethanol, ***Sodium*** reacts with ***ethanol*** to give off ***bubbles*** of ***hydrogen*** gas and leaves a colourless solution of ***Sodium ethoxide.***

$$2CH_3CH_2OH\ (l) + 2Na\ (s) \rightarrow 2CH_3CH_2ONa + H_2$$

Ethanol Sodium Sodium ethoxide Hydrogen gas

39. Complete the following chemical equations:
    (i) $CH_3COOC_2H_5 + NaOH \rightarrow$
    (ii) $CH_3COOH + NaOH \rightarrow$
    (iii) $C_2H_5OH + CH_3COOH \xrightarrow{\text{con. } H_2SO_4}$ (2017)

(i) $CH_3COOC_2H_5 + NaOH \rightarrow CH_3COONa + C_2H_5OH$

Ethyl acetate Sodium hydroxide Sodium acetate Ethanol

(ii) $CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$

Acetic acid Sodium hydroxide Ethyl acetate Water

(iii) $C_2H_5OH + CH_3COOH \rightarrow CH_3COOC_2H_5 + H_2O$

Ethanol Acetic acid Ethyl acetate Water

40. A gas is liberated immediately with a brisk effervescence, when you add acetic acid to Sodium hydrogen carbonate powder in a test tube. Name the gas and describe the test that confirms the identify of the gas.

Name of the Gas

The gas liberated is ***Carbon dioxide***.

Test to Confirm CO_2

CO_2 liberated can be tested by the following tests:

1. When a burning splinter is brought near the mouth of the test tube containing Carbon dioxide, the flame gets ***extinguished***.
2. If this ***gas*** is passed through ***lime water***, the lime water turns ***milky*** due to the formation of insoluble $CaCO_3$.

$Ca(OH)_2$ + CO_2 → $CaCO_3$ + H_2O
Calcium hydroxide — Carbon dioxide — Calcium carbonate — Water

41. Complete the following chemical equations:
(i) $CH_3COOH + Na_2CO_3 \rightarrow$
(ii) $CH_4 + O_2 \rightarrow$
(iii) $2C_2H_5OH + Na \rightarrow$ (2017)

(i) $2CH_3COOH + Na_2CO_3 \rightarrow CH_3COONa + H_2O + CO_2$
Acetic acid — Sodium carbonate — Sodium acetate — Water — Carbon dioxide

(ii) $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$
Methane — Oxygen — Carbon dioxide — Water

(iii) $2C_2H_5OH + Na \rightarrow C_2H_5ONa + H_2$
Ethanol — Sodium — Sodium ethoxide — Hydrogen

42. (a) Name any one metal each which can be extracted by:
(i) reduction with carbon
(ii) electrolytic reduction
(iii) reduction with aluminium
(iv) reduction with heat alone

(b) Write a chemical equation for any of the above four parts. (2016)

(a) (i) **Reduction with Carbon**

Zn metal is extracted from Zinc oxide by reduction with Carbon.

$2ZnO + C \longrightarrow 2Zn + CO_2$
Zinc Oxide — Carbon — Zinc metal — Carbon dioxide

(a) (ii) **Electrolytic Reduction**

Aluminium metal is extracted by electrolytic reduction of ***molten alumina*** (aluminium oxide).

$$\underset{\text{Aluminium oxide}}{2Al_2O_3} \xrightarrow[\text{reduction}]{\text{Electrolytic}} \underset{\text{Aluminium}}{4Al} + \underset{\text{Oxygen}}{3O_2}$$

(a) (iii) **Reduction with Aluminium**

Magnesium oxide, when reduced by aluminum gives ***magnesium*** and ***aluminium oxide***.

(iv) **Reduction with Heat Alone**

Mercury oxide can be reduced to ***mercury*** metal by the action of heat alone.

$$\underset{\text{Mercury Oxide}}{2HgO} \xrightarrow{\Delta} \underset{\text{Mercury}}{2Hg} + \underset{\text{Oxygen}}{O_2}$$

(b) $\underset{\text{Zinc oxide}}{2ZnO} + \underset{\text{Carbon}}{C} \longrightarrow \underset{\text{Zinc metal}}{2Zn} + \underset{\text{Carbon dioxide.}}{CO_2}$

43. Write chemical equation of the reaction of ethanoic acid with the following:
    (a) Sodium
    (b) Sodium hydroxide
    (c) Ethanol

    Write the name of one main product of each reaction.

(a) $\underset{\text{Ethanoic acid}}{2CH_3COOH} + \underset{\text{Sodium}}{2Na} \longrightarrow \underset{\text{Sodium ethanoate}}{2CH_3COONa} + \underset{\text{Water}}{H_2O}$

(b) $\underset{\text{Ethanoic acid}}{CH_3COOH} + \underset{\text{Sodium hydroxide}}{NaOH} \longrightarrow \underset{\text{Sodium ethanoate}}{CH_3COONa} + \underset{\text{Hydrogen}}{H_2}$

(c) $\underset{\text{Ethanoic acid}}{CH_3COOH} + \underset{\text{Ethyl alcohol}}{CH_3CH_2OH} \longrightarrow \underset{\text{Ethyl ethanoate}}{CH_3COOC_2H_5} + \underset{\text{Water}}{H_2O}$

44. Write three different chemical reactions showing the conversion of ethanoic acid to sodium ethanoate. Write balanced chemical equation in each case. Write the name of the reactants and the products other than ethanoic acid and sodium ethanoate in each case. (2016)

1. $\underset{\text{Ethanoic acid}}{2CH_3COOH} + \underset{\text{Sodium carbonate}}{Na_2CO_3} \rightarrow \underset{\text{Sodium ethanoate}}{2CH_3COONa} + \underset{\text{Water}}{H_2O} + \underset{\text{Carbon dioxide}}{CO_2}$

2. $\underset{\text{Ethanoic acid}}{CH_3COOH} + \underset{\text{Sodium hydroxide}}{NaOH} \rightarrow \underset{\text{Sodium ethanoate}}{CH_3COONa} + \underset{\text{Water}}{H_2O}$

3. $CH_3COOH + NaHCO_3 \rightarrow CH_3COONa + H_2O + CO_2$

Ethanoic acid	Sodium bicarbonate	Sodium ethanoate	Water	Carbon dioxide

45. What is an oxidising agent? What happens when an oxidising agent is added to propanol? Explain with the help of a chemical equation. (2016)

Oxidising Agent

Oxidising agent is a chemical substance that ***oxidizes another substance***, by ***getting*** itself ***reduced*** in the process.

Addition to Propanol

When an oxidising agent, alk. $KMnO_4$ is added to propanol, it is oxidised to propanoic acid.

Chemical Equation

$$\underset{\text{Propanol}}{CH_3CH_2CH_2OH} \xrightarrow[\Delta]{\text{alk.}KMnO_4} \underset{\text{Propanoic acid}}{CH_3CH_2COOH}$$

Key

1. Propanol gets oxidised to propionaldehyde first and then is oxidised to propanoic acid.

2. $CH_3CH_2CH_2OH \rightarrow CH_3CH_2CHO \rightarrow CH_3CH_2COOH$

Propanol	Propionaldehyde	Propanoic acid

46. Reverse of the following chemical reaction is not possible:

$$Zn\,(s) + CuSO_4\,(aq) \longrightarrow ZnSO_4\,(aq) + Cu\,(s)$$

Justify this statement with reason: (2015)

Reason

1. ***Most reactive*** metal ***displaces less reactive*** metal.
2. ***Copper*** is ***less reactive*** than ***Zn***.
3. ***Copper*** is ***unable*** to ***displace Zn*** from Zinc sulphate.
4. So, the reaction is ***not reversible***.

47. Name the substance oxidised and the substance reduced, and also identify the oxidising agent and reducing agent in the following reaction:

(a) $3MnO_2 + 4Al \rightarrow 3Mn + 2Al_2O_3$

(b) $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

(c) $SO_2 + 2H_2S \rightarrow 3S + 2H_2O$ (2015)

(a) In the chemical reaction,

$3MnO_2 + 4Al \rightarrow 3Mn + 2Al_2O_3$

- Substance ***oxidised*** is ***Al***
- Substance ***reduced*** is ***MnO_2***
- ***Oxidising agent*** is ***MnO_2***
- ***Reducing agent*** is ***Al***

Key: Substance oxidised is a reducing agent.
Substance reduced is a oxidising agent.

(b) In the chemical equation,

$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

- Substance ***oxidised*** is ***CO***
- Substance ***reduced*** is ***Fe_2O_3***
- ***Oxidising agent*** is ***Fe_2O_3***
- ***Reducing agent*** is ***CO***

Key: Substance oxidised is a reducing agent.
Substance reduced is a oxidising agent.

(c) In the chemical equation,

$SO_2 + 2H_2S \rightarrow 3S + 2H_2O$

- Substance ***oxidised*** is ***H_2S***
- Substance ***reduced*** is ***SO_2***
- ***Oxidising agent*** is ***SO_2***
- ***Reducing agent*** is ***H_2S***

Key: Substance oxidised is a reducing agent.
Substance reduced is a oxidising agent.

48. You are given samples of three metals - sodium, magnesium and copper. Suggest any two activities to arrange them in order of their decreasing reactivity. (2015)

Activity 1

* When the three metals are added to magnesium chloride solution, taken in test tubes separately, the following changes will be observed

- ***Displacement reaction*** is seen with ***Na.***
- ***No reaction*** is seen with ***Mg*** and ***Cu***.

* So, ***Na*** is the ***most reactive element***.

Activity 2

* When Na, Mg and Cu are taken in separate test tubes and Cu SO4 solution is added, the following changes are observed.
  - ***Displacement*** reaction is seen with ***Na*** and ***Mg***.
  - ***No reaction*** is seen with ***Cu***.
* So, copper is the ***least reactive*** element.

Order of Decreasing Reactivity

Order of ***decreasing reactivity*** of the elements is ***Na>Mg> Cu***.

49. (i) While studying the combination reaction on adding water to quick lime, name the product formed and write its colour.
(ii) While studying the decomposition reaction by heating ferrous sulphate crystals in a test tube, a product is formed in the test tube. Name the product and write its colour. (2015)

(i) Name of the product

The product formed is ***slaked lime - Calcium hydroxide***.

(i) Colour of the product

Calcium hydroxide is ***white*** in colour

$$\underset{\text{Calcium oxide}}{C_aO\,(s)} + \underset{\text{Water}}{H_2O\,(l)} \longrightarrow \underset{\text{Calcium hydroxide}}{Ca(OH)_2\,(aq)}$$

Key

* When water is added to quick lime, ***calcium oxide*** (quick lime) reacts with ***water*** to produce ***slaked lime*** (Calcium hydroxide)

(ii) Name of the product

* The ***product*** formed by the decomposition of ferrous sulphate is ***ferric oxide***.

(ii) Colour of the product

* ***Ferric oxide*** is ***brown*** in colour.

Key

$$\underset{\text{Ferrous sulphate}}{2Fe_2SO_4\,(s)} \xrightarrow{\Delta} \underset{\text{Ferric oxide}}{Fe_2O_3\,(s)} + \underset{\text{Sulphur dioxide}}{SO_2\,(g)} + \underset{\text{Sulphur trioxide}}{SO_3\,(g)}$$

* ***Ferrous sulphate***, on decomposition loses water and produces ferric oxide.

2 Acids, Bases and Salts

Blue Print

A	B	C

NCERT Intext Questions

Pg.No.18

1. You have been provided with three test tubes. One of them contains distilled water and the other two contain an acidic solution and a basic solution respectively. If you are given only red litmus paper, how will you identify the contents of each test tube?

1. The given litmus paper is cut into three parts.
2. These papers are dipped, one in each test tube.
3. The test tube in which red litmus paper turns into ***blue*** contains ***basic*** solution.
4. The litmus paper that turned blue is then cut into 2 halves and dipped into the remaining two solutions.
5. The one which turns blue litmus into ***red*** is the ***acidic*** solution.
6. The third test tube, in which there is ***no change*** contains ***water***.

Pg.No.22

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

Acids in these substances are also ***corrosive*** with metals like ***brass*** and ***copper***.

Curd and sour substances should not be kept in brass and copper vessels as they ***produce toxic substances.***

Acids present in curd and sour substances react with metals forming respective ***metal oxides***, which are ***toxic.***

These toxic substances make ***food toxic.***

These foods cause ***health issues*** due to the presence of ***toxins.***

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

Gas Liberated

When an acid reacts with a metal, H_2 gas is liberated.

Example

Zinc reacts with HCl giving $ZnCl_2$ and H_2.

$$Zn + 2HCl \longrightarrow ZnCl_2 + H_2$$

Zinc — Hydrochloric acid — Zinc chloride — Hydrogen

Experiment to Test the Presence of H_2

1. When this gas is passed through soap solution, ***soap bubble*** filled with ***hydrogen*** is formed.

2. When a burning candle is taken near a gas filled bubble, it burns with a ***pop*** sound.

3. It shows the presence of hydrogen.

3. Metal compound A reacts with dilute hydrochloric acid to produce effervescence. The gas evolved extinguishes a burning candle. Write a balanced chemical equation for the reaction if one of the compounds formed is calcium chloride.

Balanced Equation

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

Calcium carbonate — Hydrochloric acid — Calcium chloride — Carbon dioxide — Water

Key

$\boxed{A}$ + dil. HCl $\rightarrow$ $CaCl_2$ + gas

Gas evolved produces ***effervescence*** and ***extinguishes*** a burning candle.

So the gas will be ***CO_2***.

As one of the products is $CaCl_2$, the reactant must be $CaCO_3$. The metal compound 'A' is $CaCO_3$.

Pg.No.25

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

HCl and HNO_3 ionise completely in aqueous solutions to produce H^+ ions.

These ions are responsible for the ***acidic character.***

Solutions of compounds like alcohol and glucose ***do not*** ionise in the aqueous solution.

So, they do not ***generate*** H^+ ions.

Hence, they do not show acidic character.

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

1. Aqueous solution of an acid ***generates ions.***
2. Current is carried ***only through ions***.
3. So, aqueous solution of an acid ***conducts*** electricity.

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

Dry HCl gas ***does not contain*** any ***hydrogen ions.***

So, it does not show acidic behaviour and so, no change of colour of litmus paper.

Key

H^+ ions are derived by ***ionisation.***

Ionisation is facilitated only when ***HCl*** is ***dissolved*** in ***water.***

Ionisation leads to the ***formation*** of ***H^+*** and ***Cl^-*** ions.

Further, ***H^+*** ions are hydrated in water to form hydronium ions (H_3O^+).

Hydronium ions (H_3O^+) are responsible for acidic behaviour, which brings about change of ***colour of litmus paper.***

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

⋆ Acid should always be ***diluted*** by adding ***acid to water*** to prevent the following hazards :

* *Splashes*
* *Burns*
* *Breakage of glass container*

⋆ If water is added to acid, vigorous ***exothermic*** reaction takes place.

⋆ It releases ***large amount*** of heat.

⋆ The ***water boils*** violently and the ***acid*** may ***splash***.

⋆ Adding acid slowly to water will dilute the acid quickly due to large volume of water.

Hence, ***small amount*** of ***heat*** will be released.

5. How is the concentration of hydronium ions (H_3O^+) affected when a solution of an acid is diluted?

When a solution of an acid is diluted, the concentration of hydronium ion decreases.

In an acid, a fixed number of hydronium ions per unit volume is present.

When a solution of an acid is diluted, the number of ***hydronium ions per unit volume decreases.***

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

When excess base is dissolved in a solution of sodium hydroxide, the concentration of hydroxide ions will also increase.

This is due to the increase in amount of hydroxide ions per unit volume.

Pg.No.28

1. You have two solutions, A and B. The pH of solution A is 6 and pH of solution B is 8. Which solution has more hydrogen ion concentration? Which of this is acidic and which one is basic?

Solution A has more ***hydrogen ion*** concentration
Solution A is acidic as the ***pH is 6***
Solution B is basic as its ***pH is 8***.

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

As the concentration of H^+ (aq) ions increases, the ***acidic*** nature of the solution also increases.

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

Yes, basic solutions also have ***H^+ (aq)*** ions along with OH^- ions.

Reason

The number of H^+ ions is ***lesser than OH^- ions***.

The ***higher*** concentration of ***OH^- ions*** is responsible for the basic nature of the solutions.

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

Farmer would treat the soil with quick lime slaked lime or chalk if the ***pH*** of soil is ***acidic.***

Plants grow well in the soil of pH 6-8.

If the soil is ***acidic***, the soil should be treated with bases like ***quick lime*** or ***slaked lime*** or ***chalk.***

It brings ***optimum*** pH of the soil.

Pg.No.33

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

The common name of $CaOCl_2$ is ***bleaching powder.***

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

Dry slaked lime [$Ca(OH)_2$], on treatment with chlorine yields bleaching powder.

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

Sodium carbonate is used for softening hard water.

It permanently ***removes*** the ***hardness*** of water.

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

Heating Sodium Hydrocarbonate

When sodium hydrocarbonate is heated, ***sodium carbonate***, ***carbon dioxide*** and ***water*** are formed.

Equation

$$\underset{\text{Sodium hydro-carbonate}}{2NaHCO_3} \xrightarrow{\text{Heat}} \underset{\text{Sodium carbonate}}{Na_2CO_3} + \underset{\text{carbon dioxide}}{CO_2} + \underset{\text{Water}}{H_2O}$$

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

$$\ast \quad CaSO_4.\frac{1}{2}H_2O + \frac{3}{2}H_2O \rightarrow CaSO_4.2H_2O$$

Plaster of Paris Water Gypsum

Pg.No.34

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

(a) 1 (b) 4 (c) 5 (d) 10

Ans: (d) 10

2. A solution reacts with crushed egg-shells to give a gas that turns lime-water milky. The solution contains

(a) NaCl (b) HCl (c) LiCl (d) KCl

Ans: (b) HCl

Key

1. Crushed egg-shells contain ***calcium carbonate.***
2. Calcium carbonate produces ***carbon dioxide*** on reaction with ***HCl***
3. CO_2 turns ***lime-water milky.***

$$Ca(OH)_2(aq) + CO_2(g) \longrightarrow CaCO_3(s) + H_2O(l)$$

Lime water | Carbon dioxide | Calcium carbonate (White precipitate)

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

(a) 4 ml (b) 8 ml (c) 12 ml (d) 16 ml

Ans: (d) 16 ml

Key

1. 10 ml NaOH will be neutralized by 8 ml HCl.
2. Hence, 20 ml NaOH requires $8/10 \times 20 = 16$ ml of HCl.

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

(a) Antibiotic (b) Analgesic (c) Antacid (d) Antiseptic

Ans: (c) Antacid

5. Write word equations and then balanced equations for the reaction taking place when

(a) dilute sulphuric acid reacts with zinc granules.
(b) dilute hydrochloric acid reacts with magnesium ribbon.
(c) dilute sulphuric acid reacts with aluminium powder.
(d) dilute hydrochloric acid reacts with iron filings.

(a) Zinc + dil. Sulphuric acid → Zinc sulphate + Hydrogen

$$Zn + H_2SO_4 \rightarrow ZnSO_4(aq) + H_2\uparrow$$

(b) Magnesium + dil. Hydrochloric acid → Magnesium chloride + Hydrogen

$$Mg + 2HCl \rightarrow MgCl_2 + H_2\uparrow$$

(c) Aluminium + dil. Sulphuric acid → Aluminium sulphate + Hydrogen

$$2Al + 3H_2SO_4 \rightarrow Al_2(SO_4)_3 + 3H_2\uparrow$$

(d) Iron + dil. Hydrochloric acid → Iron (III) chloride + Hydrogen

$2Fe + 6\ HCl \rightarrow 2FeCl_3 + 3H_2\uparrow$

6. Compounds such as alcohols and glucose also contain hydrogen but are not categorised as acids. Describe an activity to prove it.

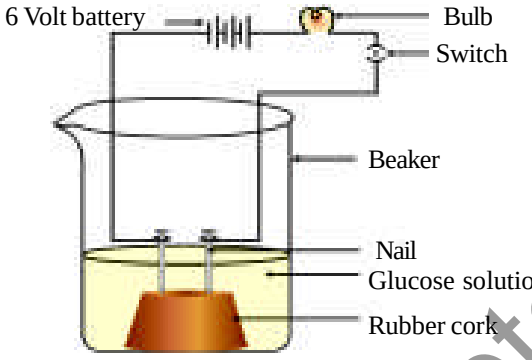


Fig.2.1: Activity to Show Acid Solution in Water Conducts Electricity

* Acids contain ***hydrogen***.

* In a aqueous solution, acids ***ionise***.

* Hence, they are ***capable*** of conducting ***electricity***.

* Like acids, ***glucose*** and ***alcohol*** also contain hydrogen.

* But, ***glucose*** and ***alcohol do not*** ionise in aqueous solution. Hence they ***do not conduct*** electricity.

* This can be proved by the following activity

1. Fix ***two nails*** on a ***cork*** and place the cork in a ***beaker.***

2. ***Connect*** the ***nails*** to the ***two terminals*** of a 6 volt ***battery*** through a ***bulb*** and ***switch.***

3. Pour ***dil HCl*** in the ***beaker*** and ***switch on*** the current.

4. The ***bulb glows*** as acids ***conduct*** electricity.

5. Repeat the experiment with ***sulphuric acid***, ***glucose*** and ***alcohol.***

6. It is observed that the ***bulb glows*** only with ***acids*** and ***not*** with ***glucose*** and ***alcohol***.

7. The bulb does ***not glow*** in case of ***glucose*** and ***alcohol***, as electricity is not conducted.

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

Distilled water is ***pure water*** and is ***free of ions.***

So, distilled water does not conduct electricity.

Rain water contains ***ions*** because ***acidic gases*** of atmosphere dissolve in rain water, forming ***acids.***

The acids ***dissociate*** easily into ***ions.***
So, ***rain water*** conducts ***electricity.***

8. Why do acids not show acidic behaviour in the absence of water?
   1. ***H^+ ions*** exhibit ***acidic*** behaviour.
   2. In the absence of water, ***acids do not ionize.***
   3. ***H^+ ions*** are ***not*** produced.
   4. So, ***acids do not show*** acidic behaviour.

9. Five solutions A,B,C,D and E when tested with universal indicator showed pH as 4,1,11,7 and 9 respectively. Which solution is
   (a) neutral? *(d) weakly acidic?*
   (b) strongly alkaline? *(e) weakly alkaline?*
   (c) strongly acidic?
   Arrange the pH in increasing order of hydrogen-ion concentration.

   (a) ***Solution D*** with pH 7 is neutral.
   (b) ***Solution C*** with pH 11 is strongly alkaline.
   (c) ***Solution B*** with pH 1 is strongly acidic.
   (d) ***Solution A*** with pH 4 is weakly acidic.
   (e) **Solution E** with pH 9 is weakly alkaline.
   pH in increasing order of hydrogen ion concentration is

   $11 < 9 < 7 < 4 < 1$
   C E D A B

10. Equal lengths of magnesium ribbons are taken in test tubes A and B. Hydrochloric acid (HCl) is added to test tube A, while acetic acid (CH_3COOH) is added to test tube B. In which test tube will the fizzing occur more vigorously and why?

More Vigorous Fizzing

- ***Fizzing*** occur more vigorously in ***test tube A***.

Reason

1. Hydrochloric acid is a ***strong*** acid.
2. Acetic acid is a weak acid.
3. Reaction occurs at a ***faster rate in hydrochloric acid*** than in acetic acid.

11. Fresh milk has a pH of 6. How do you think the pH will change as it turns into curd? Explain your answer.

Change in pH

* The ***pH*** of fresh milk falls ***below 6*** as it turns into ***curd.***

Explanation

* As milk turns into ***curd, lactic acid*** is produced
* Thus, milk becomes more ***acidic*** and the ***pH reduces below 6.***

12. A milkman adds a very small amount of baking soda to fresh milk.
(a) Why does he shift the pH of the fresh milk from 6 to slightly alkaline?
(b) Why does this milk take a long time to set as curd?

(a) The milkman shifts the pH of fresh milk from 6 to slightly alkaline to ***delay curdling.***

(b) 1. During curdling, ***lactic acid*** is produced.
2. ***Lactic acid,*** produced, ***neutralises*** the alkali (baking soda)
3. As long as ***alkali*** is ***present***, ***milk cannot*** set as ***curd.***

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

1. Plaster of Paris should be stored in a moisture-proof container to prevent the ***formation*** of ***gypsum*** again.
2. Plaster of Paris is ***Calcium sulphate hemihydrate-$CaSO_4$.1/2 H_2O.***
3. It readily absorbs moisture.
4. When it is exposed to moisture, it mixes with water and becomes ***gypsum ($CaSO_4$.2 H_2O)***

14. What is a neutralisation reaction? Give two examples.

Neutralisation Reaction

Reaction between an ***acid and a base*** to give salt and water is called ***neutralisation*** reaction.

Acid + Base $\rightarrow$ Salt + water

Examples

1. HCl + $NaOH$ $\rightarrow$ $NaCl$ + H_2O
Hydrochloric acid (Acid) | Sodium hydroxide (Base) | Sodium chloride (Salt) | Water

2. CH_3COOH + $NaOH$ $\rightarrow$ CH_3COONa + H_2O
Acetic acid (Acid) | Sodium hydroxide (Base) | Sodium acetate (Salt) | Water

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

Uses of Washing Soda (Sodium Carbonate)

1. Washing soda is used to remove stubborn ***stains*** in laundry.
2. It is used to remove ***permanent hardness*** of water.
3. It is used in ***glass, soap*** and ***paper*** industry.
4. It is used in the ***manufacture*** of ***sodium compounds*** such as borax.
5. It is used as a ***cleaning agent*** for ***domestic purposes.***

Uses of Baking Soda (Sodium Hydrogen Carbonate)

1. Baking soda is used for making baking ***powder***.
2. It is used in ***bakery.***
3. It is used as an ***ingredient*** in ***antacids.***
4. It is used for faster cooking.
5. It is used in ***soda-acid fire extinguisher.***

Board Exam
Solved Questions

1. On adding acetic acid to sodium carbonate in a test tube, a student observes

(A) no reaction
(B) a colourless gas with pungent smell
(C) bubbles of a colourless and odourless gas
(D) a strong smell of vinegar (2012)

Ans: (C) bubbles of a colourless and odourless gas.

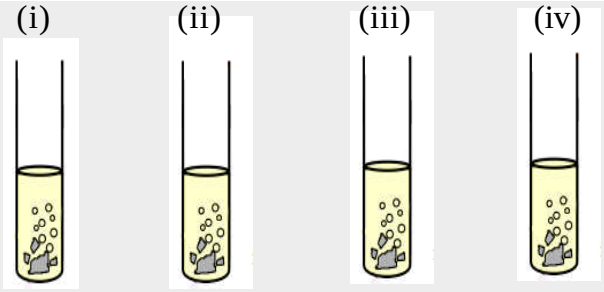
2. A student prepared 20% NaOH solution in a beaker containing water. The observations noted by him are given below:

(i) Sodium hydroxide is in the form of pellets
(ii) It dissolves in water readily
(iii) The beaker appears cold when touched from outside
(iv) Red litmus paper turns blue when dipped with the solution

The correct observations are

(a) (i), (ii) and (iii)
(b) (ii), (iii) and (iv)
(c) (iii), (iv) and (i)
(d) (i), (ii) and (iv) ***Ans: (d) (i), (ii) and (iv)***

3. Four test tubes containing solutions I, II, III and IV are shown below along with their colours. Zinc sulphate is contained in



(a) (i) *(c) (iii)*
(b) (ii) *(d) (iv)* ***Ans: (d) (iv)***

4. A knife, which is used to cut a fruit was immediately dipped into water containing drops of blue litmus solution. If the colour of the solution is changed to red, what inference can be drawn about the nature of the fruit and why? (2011)

Nature of the Fruit

The fruit is acidic.

Reason

The acids have the property of changing blue litmus to red.

5. What is neutralisation reaction? Give some examples (2011)
Ref. Q.No.14 , Pg.No. 39

6. Equal lengths of magnesium ribbons are taken in test tubes A and B. Hydrochloric acid (HCl) is added to test tube A, while acetic acid (CH_3COOH) is added to test tube B. Amount and concentration taken for both the acids are same. In which test tube will the fizzing occur more vigorously and why? (2011)
Ref. Q.No.10 , Pg.No. 38

7. A milkman adds a very small amount of baking soda to fresh milk.
   (a) Why does he shift the pH of the fresh milk from 6 to slightly alkaline?
   (b) Why does this milk take a long time to set as curd? (2011)
Ref. Q.No.12 , Pg.No. 39

8. You have been provided with three test tubes. One of them contains distilled water and the other two contain an acidic solution and a

basic solution respectively. If you are given only red litmus paper, how will you identify the contents of each test tube? (2011) (2012) (2015)

Ref. Q.No.1 , Pg.No.31

9. Under what soil condition do you think a farmer would treat the soil of his fields with quick lime (calcium oxide) or slaked lime (calcium hydroxide) or chalk (calcium carbonate)? (2012)

Ref. Q.No.4 , Pg.No.34-35

10. Compounds such as alcohols and glucose also contain hydrogen but are not categoried as acids. Describe an activity to prove it. (2011)

Ref. Q.No.6 , Pg.No.37

11. Fresh milk has a pH of 6. How do you think the pH will change as it turns into curd? Explain your answer. (2011) (2012)

Ref. Q.No.11, Pg.No. 38-39

12. A compound of X of Sodium is commonly used in kitchen for making crispy pakoras. It is also used for curing acidity in the stomach. Identify X. What is its chemical formula? State the reaction which takes place when it is heated during cooking. (2015)

Name of the Compound 'X'

X is Sodium bicarbonate or Sodium hydrogen carbonate.

Chemical Formula

Chemical formula of sodium hydrogen carbonate is ***$NaHCO_3$***.

Reaction on Heating

$$\underset{\text{Sodium bi-carbonate}}{2\,NaHCO_3} \xrightarrow{Heating} \underset{\text{Sodium carbonate}}{Na_2CO_3} + \underset{\text{Water}}{H_2O} + \underset{\text{Carbon dioxide}}{CO_2}$$

13. The aqueous solutions of copper sulphate and zinc sulphate appear

(A) blue and green respectively
(B) green and colourless respectively
(C) Blue and brown respectively
(D) Blue and colourless respectively.

Ans: (D) Blue and colourless respectively

14. On adding 2 ml acetic acid to 2 ml of water in a test tube, it was observed that

(A) a clear and transparent solution is formed.
(B) a white precipitate is formed almost immediately
(C) two separate layers were formed
(D) a colourless, odourless gas is evolved.

Ans: (A) a clear and transparent solution is formed.

15. Hard water required for an experiment is not available in a school laboratory. However, following salts are available in the laboratory. Select the salts which may be dissolved in water to make it hard for the experiment.
    1. Calcium sulphate
    2. Sodium sulphate
    3. Calcium chloride
    4. Potassium sulphate
    5. Sodium hydrogen carbonate
    6. Magnesium chloride.

(a) 1, 2 and 4 *(c) 2, 5 and 6*
(b) 1, 3 and 6 *(d) 1,4 and 6* ***Ans: (b) 1, 3 and 6***

16. Write the balanced equation for the following reactions.
    (A) Zinc + Silver nitrate → Zinc nitrate + Silver
    (B) Aluminium + Copper chloride → Aluminium chloride + Copper
    (C) Barium chloride + Potassium sulphate → Barium sulphate + Potassium chloride

(A) $Zn + 2AgNO_3 \rightarrow 2Ag + Zn(NO_3)_2$
(B) $2Al + 3CuCl_2 \rightarrow 3Cu + 2\ AlCl_3$
(C) $BaCl_2 + K_2SO_4 \rightarrow BaSO_4 + 2\ KCl$

17. You have two solutions A and B. The pH of solution A is 6 and pH of solution B is 8.
    (a) Which solution is acidic and which solution is basic?
    (b) Which solution has more H^+ ion concentration?
    (c) Why is HCl a stronger acid than acetic acid?

(a) ***Solution A*** is acidic. ***Solution B*** is basic.
(b) ***Solution A*** has more H^+ ion concentration.
(c) HCl is a stronger acid because ***hydronium ions per unit volume is more*** in HCl than acetic acid.

18. Answer the following:

(i) Name the compound which is obtained from baking soda and is used to remove permanent hardness of water.
(ii) Write its chemical formula.
(iii) What happens when it is recrystallised from its aqueous solution?
(iv) Plaster of Paris should be stored in moisture proof container. Explain why?

(i) Washing soda is used to remove permanent hardness of water.
(ii) Its chemical formula is ***$Na_2CO_3.10H_2O$***
(iii) When it is recrystallised from its aqueous solution, anhydrous sodium carbonate becomes ***hydrated***.
(iv) 1. Plaster of Paris should be stored in a moisture-proof container to prevent the formation of gypsum again.
2. Plaster of Pairs is ***Calcium sulphate hemihydrate $CaSO_4.1/2\ H_2O$***
3. It readily ***absorbs moisture.***
4. When it is exposed to moisture, it absorbs water and becomes ***gypsum ($CaSO_4.2\ H_2O$)***

19. For preparing soap in the laboratory, we require an oil and a base. Which of the following combination of an oil and a base would be best suited for the preparation of soap?
(a) Castor oil and calcium hydroxide
(b) Turpentine oil and sodium hydroxide
(c) Castor oil and sodium hydroxide
(d) Mustard oil and calcium hydroxide (2016)
Ans: (c) Castor oil and sodium hydroxide

20. A student puts a drop of reaction mixture of a saponification reaction first on a blue litmus paper and then on a red litmus paper. He may observe that
(a) there is no change in the blue litmus paper and the red litmus paper turns white.
(b) there is no change in the red litmus paper and the blue litmus paper turns red.
(c) there is no change in the blue litmus paper and the red litmus paper turns blue.
(d) no change in the colour is observed in both the litmus paper.
Ans: (c) there is no change in the blue litmus paper and the red litmus paper turns blue.

21. In the neighbourhood of your school, hard water required for an experiment is not available. From the following groups of salts available in your school, select a group of salts, each member of which, when dissolved in water, will make it hard. (2016)

(a) Sodium chloride, calcium chloride
(b) Potassium chloride, sodium chloride
(c) Sodium chloride, magnesium chloride
(d) Calcium chloride, magnesium chloride

Ans: (d) Calcium chloride, magnesium chloride

22. A student adds a spoonful of powdered sodium hydrogen carbonate to a flask containing ethanoic acid. List two main observations that he/she must note in his/her note book about the reaction that takes place. Also write chemical equation for the reaction.(2016)

Observations

1. Brisk ***effervescence*** is formed.
2. Colourless and odourless gas, CO_2 is formed.
3. Sodium acetate salt is formed.

Chemical Equation

$$\underset{\text{Ethanoic acid}}{CH_3COOH} + \underset{\text{Sodium hydrogen carbonate}}{NaHCO_3} \rightarrow \underset{\text{Sodium acetate}}{CH_3COONa} + \underset{\text{Water}}{H_2O} + \underset{\text{Carbon dioxide}}{CO_2}$$

23. What do we observe on pouring acetic acid on red and blue litmus papers?

(A) Red litmus remains red and blue litmus turns red.
(B) Red litmus turns blue and blue litmus remains blue.
(C) Red litmus turns blue and blue litmus turns red.
(D) Red litmus becomes colourless and blue litmus remains blue.

Ans: (A) Red litmus remains red and blue litmus turns red.

24. While preparing soap, a small quantity of common salt is generally added to the reaction mixture of vegetable oil and sodium hydroxide. Which one of the following may be the purpose of adding common salt?

(A) To reduce the basic nature of the soap.
(B) To make the soap neutral.

(C) To enhance the cleaning power of the soap.
(D) To favour the precipitation of the soap (2015)

Ans: (D) To favour the precipitation of the soap

25. A student takes about 4 ml of distilled water in four test tubes marked P, Q, R and S. He then dissolves in each test tube, an equal amount of the following salts, namely Sodium sulphate in P, Potassium sulphate in Q, Calcium sulphate in R and Magnesium sulphate in S. After that, he adds an equal amount of soap solution in each test tube. On shaking each of these test tubes well, he observes a good amount of lather (foam) in the test tubes marked. (2015)

(A) P and Q *(C) P, Q and S*
(B) Q and R *(D) R, Q and S* ***Ans: (A) P and Q***

26. When you add sodium hydrogen carbonate to acetic acid in a test tube, a gas liberates immediately with a brisk effervescence. Name the gas. Describe the method of testing this gas. (2015)

Name of the Gas

The gas liberated due to the reaction of sodium hydrogen carbonate with acetic acid is ***carbondioxide.***

$NaHCO_3 + CH_3COOH \rightarrow CH_3COONa + H_2O + CO_2$

Sodium hydrogen carbonate | Acetic acid | Sodium acetate | Water | Carbon dioxide

Test for CO_2

If CO_2 is passed through lime water, it turns lime water ***milky***.

$Ca(OH)_2 + CO_2 \longrightarrow CaCO_3 + H_2O$

Lime water | Carbondioxide | Calcium carbonate | Water

27. What happens when bases react with non-metal oxide? What does this reaction tell us about the nature of non metal oxides? Write a chemical reaction to support your answer. (2015)

Reaction of Base with Non Metal Oxide

When bases react with non-metal oxides, both ***neutralise*** each other and their ***respective salt*** and ***water*** are formed.

Nature of Non-metal Oxides

Non-metal oxides are ***acidic*** in nature.

Chemical Reaction

Calcium hydroxide reacts with ***carbon dioxide*** to give ***calcium carbonate*** and ***water***.

$$Ca(OH)_2 + CO_2 \longrightarrow CaCO_3 + H_2O$$

28. Sahil is suffering from toothache. His friend Tavi has suggested him to brush his teeth properly with tooth paste after having food and sugary substance. What is the reason behind it ? Write any two values depicted by Tavi.

Reason

1. Brushing with tooth paste that are basic will ***neutralise*** the ***excess acid*** and ***prevents tooth decay.***
2. The enamel is corroded due to the low pH in the mouth.
3. Low pH is due to the production of acids by the degradation of sugar and food particles remaining in the mouth after eating.

Values Depicted by Tavi

1. Concern towards his friend
2. Helping tendency

29. What happens when carbon dioxide gas is passed through lime water
(a) for a short time?
(b) for a considerable period of time?
Write chemical reactions to support your answer. (2015)

(a) When carbon dioxide gas is passed through lime water for a short time, the ***lime water*** turns ***milky*** due to the formation of ***Calcium carbonate.***

Chemical Reaction

$$Ca(OH)_2 + CO_2 \longrightarrow CaCO_3 + H_2O$$

Lime water Carbon dioxide Calcium carbonate Water

(b) 1. When CO_2 is passed through lime water for a considerable period of time, ***calcium bicarbonate*** is formed.
2. It is soluble in water.
3. So, ***milkiness disappears.***

Chemical Reaction

$$CaCO_3 + H_2O + CO_2 \longrightarrow Ca(HCO_3)_2$$

Calcium carbonate Water Carbon dioxide Calcium bicarbonate

30. Fill in the missing data in the following table.

	Name of the Salt	Formula	Salt Obtained from	
			Base	Acid
i.	Ammonium chloride	NH_4Cl	NH_4OH	.....

ii.	Sodium chloride	NaCl	NaOH	.....
iii.	Magnesium nitrate	$Mg(NO_3)_2$	.....	.....
iv.	Potassium sulphate	K_2SO_4	.....	H_2SO_4
v.	Calcium nitrate	$Ca(NO_3)_2$	$Ca(OH)_2$	HNO_3

(2016)

	Name of the Salt	Formula	Salt Obtained From	
			Base	Acid
i.	Ammonium chloride	NH_4Cl	NH_4OH	***HCl***
ii.	Sodium chloride	NaCl	NaOH	***HCl***
iii.	Magnesium nitrate	$Mg(NO_3)_2$	***$Mg(OH)_2$***	***HNO_3***
iv.	Potassium sulphate	K_2SO_4	***KOH***	H_2SO_4
v.	Calcium nitrate	$Ca(NO_3)_2$	$Ca(OH)_2$	HNO_3

31. A student adds a few drops of the universal indicator to a solution of dilute hydrochloric acid. He would observe that the colour of the solution changes from colourless to (2016)

(a) Red *(c) Violet*
(b) Yellow *(d) Green* ***Ans: (a) Red***

32. A student requires hard water for an experiment in his laboratory, which is not available in the neighbouring area. In the laboratory, there are some salts, which when dissolved in distilled water can convert it into hard water. Select from the following groups of salts, a group, each salt of which when dissolved in distilled water will make it hard.

(a) Sodium chloride, potassium chloride.
(b) Sodium sulphate, potassium sulphate
(c) Sodium sulphate, calcium sulphate.
(d) Calcium sulphate, calcium chloride. (2017)

Ans: (d) Calcium sulphate, calcium chloride.

33. Two solutions A and B have pH values of 3.0 and 10.5 respectively. Which of these will turn:
(i) Blue litmus solution to red
(ii) Phenolphthalein from colourless to pink?
Justify your answer in each case. (2016)

(i) ***Solution A*** will turn blue litmus solution to red.

(ii) ***Solution B*** will turn ***phenolphthalein*** from colourless to ***pink***.

Justification

1. ***Solution A*** is acidic in nature, as its pH is 3.0.
2. Hence, it will turn ***blue litmus to red.***
3. ***Solution B*** is alkaline, as its pH is 10.5
4. Hence, it will turn ***phenolphthalein*** (colourless in acidic solution) to ***'pink'*** in basic solution.

34. Write one point of difference between each of the following:
(i) A hydrated salt and an anhydrous salt.
(ii) Washing soda and soda ash.
(iii) Baking soda and Baking powder (2016)

(i) Difference betweeen hydrated salt and an anhydrated salt.

Hydrated Salt	**Anhydrous Salt**
1. Hydrated salt contains free water molecules	1. Anhydrous salt does not contain any free water molecules

(ii) Difference between washing soda and soda ash.

Washing Soda	**Soda Ash**
1. Washing soda is the ***hydrated*** form of ***sodium carbonate*** (contains 10 molecules of water).	1. Soda Ash is ***anhydrous*** form of sodium carbonate.
2. Its chemical formula is $Na_2CO_3.10H_2O$	2. Its chemical formula is Na_2CO_3

(iii) Difference between baking soda and baking powder

Baking Soda	**Baking Powder**
1. Baking soda is ***Sodium bicarbonate*** ($NAHCO_3$).	1. Baking powder is a mixture of ***baking soda*** and ***tartaric acid.***

35.(a) Define indicator. Name two indicators obtained from plants.
(b) Write balanced chemical equation for the reaction that takes place when sodium oxide reacts with water. How will this solution behave towards phenolphthalein and red litmus paper?
(c) State what happens when sodium hydroxide solution reacts with dilute hydrochloric acid. What is this reaction called? (2016)

(a) Indicator

- ***Materials,*** which ***indicate*** the ***presence*** of ***acid*** or ***base*** in a solution are called indicators.
- They are normally called ***acid-base indicators.***

(a) Indicators Obtained from Plants

1. *Litmus*
2. *Turmeric*
3. *Methyl orange*
4. *Phenolphthalein*

(b) Balanced Chemical Equation

$$\underset{\text{Sodium oxide}}{Na_2O} + \underset{\text{Water}}{H_2O} \longrightarrow \underset{\text{Sodium hydroxide}}{2NaOH}$$

(b) Action of NaOH on Phenolphthalein and Red Litmus Paper

- NaOH solution shows ***pink colour*** with ***phenolphthalein.***
- NaOH solution turns red ***litmus paper*** to blue.

(c) Action of NaOH with dil HCl

When sodium hydroxide solution reacts with dil. hydrochloric acid, the ***effect*** of the ***base*** (NaOH) is ***nullified*** by the ***acid*** (HCl).

$$NaOH\ (aq) + HCl\ (aq) \rightarrow NaCl\ (aq) + H_2O\ (l)$$

Name of the Reaction

- This reaction is called ***neutralisation reaction.***
- In neutralisation reaction, ***acid*** and ***base*** react to give ***salt*** and ***water.***

36. The two colours seen at the extreme ends of the pH chart are:

(*a) Red and blue* *(b) Red and green*
(c) Green and blue *(d) Orange and green* (2016)

Ans: (a) Red and blue

37. Four students A, B, C and D determined the pH of water, lemon juice and dil. sodium bicarbonate solution. They recorded their observations and arranged them in descending order of pH values as follows:

Student	Solutions
A	Water, lemon juice, sodium bicarbonate solution
B	Water, sodium bicarbonate solution, lemon juice
C	Lemon juice, water, sodium bicarbonate solution
D	Sodium bicarbonate solution, water, lemon juice

Ans: (D) Sodium bicarbonate solution, water, lemon juice

38. A student puts a drop of reaction mixture of a saponification reaction first on a blue litmus paper and then on a red litmus paper. He may observe that:
    (a) There is no change in the blue litmus paper and the red litmus paper turns white
    (b) There is no change in the red litmus paper and the blue litmus paper turns red.
    (c) There is no change in the blue litmus paper and the red litmus paper turns blue
    (d) No change in colour is observed in both the litmus papers (2016)

    Ans: ***(c) There is no change in the blue litmus paper and the red litmus paper turns blue***

39. What do you observe when you drop a few drops of acetic acid to a test tube containing:
    (i) phenolphthalein
    (ii) distilled water
    (iii) universal indicator
    (iv) sodium hydrogen carbonate powder (2016)

    (i) ***No colour*** change occurs when few drops of ***acetic acid*** is added to ***phenolphthalein.***
    (ii) When few drops of acetic acid is added to distilled water, ***acetic*** acid ***dissolves*** in ***water,*** with the release of heat.
    (iii) ***Yellowish pink*** colour is observed when few drops of ***acetic acid*** is added to ***universal indicator.***
    (iv) ◦ When ***acetic acid*** is added to ***sodium hydrogen carbonate*** (baking soda), CO_2 is released.
    ◦ The gas released is a ***colourless, odourless gas*** with brisk effervescence.

40. (a) Define universal indicator. Mention its one use
    (b) Solution A gives pink colour when a drop of phenolphthalein indicator is added to it. Solution B gives red colour when a drop of methyl orange is added to it. What type of solutions are A and B, and which one of the solutions A and B will have a higher pH value?

(c) Name one salt whose solution has pH more than 7 and one salt, whose solution has pH less than 7. (2015)

(a) Universal Indicator

A universal indicator is a ***mixture*** of ***several indicators,*** which undergoes ***several colour change*** over a wide range of pH.

(a) Use of Universal indicator

1. Universal indicator is used to find the ***amount*** of H^+ ***and*** OH^- ions in solutions.
2. It is used to ***judge*** how ***strong*** the given ***acid*** or ***base*** is.

(b) Type of Solutions

- ***Solution A*** is a base, as it gives pink colour when phenolphthalein indicator is added to it.
- ***Solution B*** is an acid, as it gives red colour, when a drop of methyl orange is added to it

(b) Solution having Higher pH

Solution A has higher pH, as it is a ***base***.

(c) Name of the Salt

- ***Salts*** that have pH more than 7 are ***Sodium carbonate, Ammonium nitrate*** etc.
- Salts that have pH less than 7 are ***Ammonium chloride, Zinc chloride*** etc.

41. The pH value of a sample of hydrochloric acid is 2. pH of this sample, when diluted by adding water will be:

(a) less than 2 but more than 0
(b) more than 2 but less than 7
(c) more than 7
(d) no change in pH ***Ans: (b) more than 2 but less than 7***

42. A student added a drop of universal indicator to one ml of the given solution and found that a green colour is produced. pH value of the solution will be in the range of: (2015)

(a) 0-3 (b) 4-6 (c) 7-9 (d) 10-12

Ans: (c) 7-9

Key

When pH is 7 to 8 the colour is green.

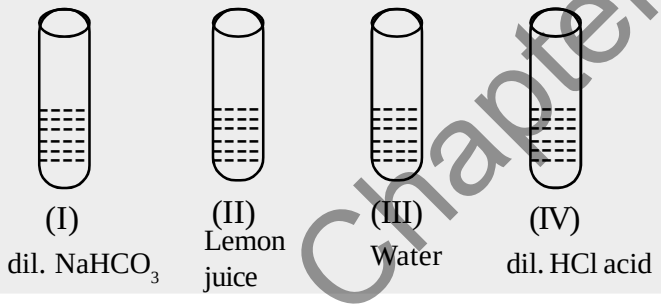
43. A student was given a solution to find its pH. His teacher declared his recorded pH as wrong. Student explained to his teacher, all the

steps done by him while finding the pH of sample. Mark the step taken by student in which he committed mistake.

(a) Collection of apparatus
(b) Clearing of all apparatus
(c) Making pH paper wet and then dip it in sample
(d) Recording observation (2015)

Ans: (c) Making pH paper wet and then dip it in sample.

44. A student was provided with four samples of solutions as shown in figures (I), (II), (III), and (IV). He determined pH value of each solution by using pH paper. The correct sequence of colour change of pH paper observed by the student will be:



(a) indigo light red green red
(b) red indigo green light red
(c) indigo red green yellow
(d) green red yellow indigo (2015)

Ans: (a) indigo light red green red

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