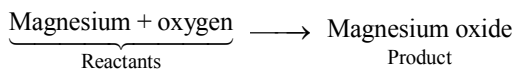


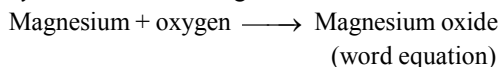
# Chemical Reactions and their various types

- **Chemical Reaction** : The process in which a substance undergoes change to produce new substances with new properties are known as chemical reaction.
- **Chemical Equation** : The qualitative representation of a chemical reaction in a short hand or concise form in term of symbols and formulae, is called a chemical equation. For example. The burning of magnesium wire in oxygen(air) to produce magnesium oxide can be written as under in the form of a *word equation*.



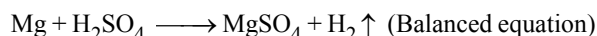
Word equations represent simply change of reactants into products. They do not give the true picture of the chemical reactions.

- **Skeletal Chemical Equation or Symbol Equation** : A chemical equation written in the form of symbols and formulae is called a skeletal chemical equation. *Such a chemical equation may or may not be balanced* e.g.



In the skeletal equation given above there are two oxygen atoms ( $\text{O}_2 = 2$  atoms of oxygen) in the reactants and only one oxygen atom in products so it is not a balanced equation.

- **Balanced Chemical Equation** : A chemical equation in which number of atoms of each elements on L.H.S. (i.e. reactants) and R.H.S. (i.e. products) is equal is called a balanced chemical equation for example, magnesium reacts with sulfuric acid to form magnesium sulphate and hydrogen, can be represented as follows.

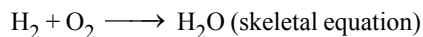
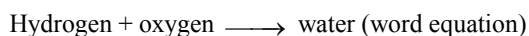


The balancing of a chemical equation is essential or necessary to fulfill the requirement of the **Law of Conservation of Mass**.

- **Balancing of Chemical Equations** :

The process of making the number of different elements on both side of the equation equal is known as balancing of chemical equation.

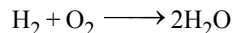
**Hit and Trial Method** : The reaction between hydrogen and oxygen to form water can be represented as under :-



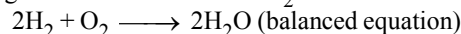
This equation is **unbalanced** and can be balanced by hit and trial method as follows :-

Oxygen will be balanced if 2 is written before  $\text{H}_2\text{O}$  (product).

It will give us the following equation.



In doing so the number of hydrogen atoms becomes unbalanced. On the L.H.S. there are only 2 atoms of hydrogen while on RHS we have 4 atoms of hydrogen. To balance hydrogen atoms write 2 before  $\text{H}_2$ .



In a balanced chemical equation, homoatomic gases with atomicity two or more are always written in molecular form e.g.  $\text{H}_2$ ,  $\text{O}_2$ ,  $\text{N}_2$ ,  $\text{Cl}_2$ ,  $\text{O}_3$  etc. Atomicity may be defined as the number of atoms in one molecule of the gas.

- **Essential of a Chemical Equation** :

A chemical equation-

- should represent an actual chemical change
- should be balanced, and
- should be molecular, i.e., all the substances should be in the form of molecules.

- **Implications of a Chemical Equation or Information by a Chemical Equation** :

A chemical equation conveys a large number of informations as described below-

- It tells us about the names of the reactants and products.
- It expresses the number of molecules of reactants and products.
- It expresses the relative weight of the reactants and the products.
- It expresses the volume of the gaseous reactants and products.

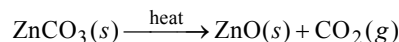
**Types of chemical reactions** :

- **Decomposition reactions** : Decomposition reactions are those reactions in which a compound breaks down into simpler compounds (or substances). This type of reaction is simply the reverse of combination reactions. These reactions require energy in the form of heat, light, electricity etc.

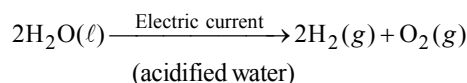
**Kinds of decomposition reactions** :

Various kinds of decomposition reactions are :

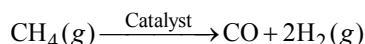
- Thermal decomposition** : This type of reaction takes place on heating a substance. For example,



- Electrolytic decomposition** : This type of reaction takes place on passing electric current for example



- Catalytic decompositions** : This type of reaction takes place in presence of a catalyst. For example



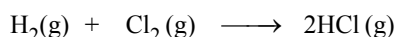


coal, charcoal, wood etc, burn in air and thus undergo combustion. All substances acting as fuels undergo combustion reactions. These are highly exothermic and are accompanied by release of energy which is quite useful in our daily life. All combustion reactions are not accompanied by flame. Combustion accompanied by release of energy.

- **Homogeneous reactions** : In case all the reactants and products of a chemical reaction are in the same physical state then such a reaction is known as **homogeneous reactions**.

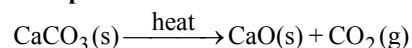
For representation of a physical state of reactants/products we write (g) for gases, (ℓ) for liquids and (s) for solids state.

**Example :**



- **Heterogeneous reaction** : If in a chemical reaction, all the products and reactants are *not* in the same physical state then such a reaction is known as **heterogeneous reaction**.

**Example :**



- **Corrosion (Erosion by chemical action)** : Corrosion is the degradation of metals and generally called rust. Corrosion causes damage to car bodies, iron railings, ships and to all objects made of metals, specially those of iron. Corrosion of iron is a serious problem. Corrosion is the primary means by which metals deteriorate. Most metal corrode on contact with water (and moisture in the air), acids, bases, salts, oils, aggressive metals polishes, and other solid and liquid chemicals. To minimize corrosion, protective coatings are applied to prevent the direct contact of moisture and oxygen with that metal.

- **Rancidity** : The most important cause of deterioration in fats and fatty foods is oxidation of fats. What we perceive is an unpleasant change in the flavour and odour of a food, called rancidity. Factors which accelerate fat oxidation include trace metals (iron, zinc, etc.), salt, light, water, bacteria, and moulds. Fat oxidation can be retarded by use of antioxidants by use of spices such as sage and rosemary, and by use of light and or air tight wrapping.

## Exercise

# 1

**DIRECTIONS** : This section contains multiple choice questions. Each question has 4 choices (1), (2), (3) and (4) out of which only one is correct.

- A student added dilute HCl to a test tube containing zinc granules and made following observations :
  - The zinc surface became dull and black.
  - A gas evolved which burnt with a pop sound.
  - The solution remained colourless.
 Correct observations are -
  - I and II
  - I and III
  - II and III
  - I, II and III
- A balanced chemical equation is accordance with-
  - Law of multiple proportion
  - Law of conservation of mass
  - Both (1) and (2)
  - Neither (1) nor (2)
- A change is said to be a chemical change when-
  - Energy change occurs
  - New substances are formed
  - The change cannot be easily reversed
  - All statements are correct
- Which of the following are chemical changes ?
  - Digestion of food
  - Liquefaction of air
  - Ripening of fruit
  - Dissolution of sulphur in carbon disulphide
  - Freezing of water
  - Electrolysis of water
  - (i) to (iv) all
  - (i), (iii) and (v)
  - (i), (iii) and (vi)
  - (iii), (iv) and (vi)
- Which of the following statements is true?
  - The total mass of the substance remains same in chemical change
  - Chemical change is permanent and irreversible
  - Physical change is temporary and reversible
  - All of these
- Which of the following statements is not correct?
  - A chemical equation tells us about the substances involved in a reaction.
  - A chemical equation informs us about the symbols and formula of substances involved in a reaction
  - A chemical equation tells us about the atom or molecules of the reactants and products involved in a reaction
  - All are correct
- Which one is not a balanced equation?
  - $\text{Fe} + \text{Cl}_2 \longrightarrow \text{FeCl}_3$
  - $\text{Mg} + \text{CuSO}_4 \longrightarrow \text{MgSO}_4 + \text{Cu}$
  - $\text{Zn} + \text{S} \longrightarrow \text{ZnS}$
  - $2\text{NaOH} + \text{H}_2\text{SO}_4 \longrightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$
- Which of the following reactions involved the combination of two element ?
  - $\text{CaO} + \text{CO}_2 \longrightarrow \text{CaCO}_3$
  - $4\text{Na} + \text{O}_2 \longrightarrow 2\text{Na}_2\text{O}$
  - $\text{SO}_2 + \frac{1}{2}\text{O}_2 \longrightarrow \text{SO}_3$
  - $\text{NH}_3 + \text{HCl} \longrightarrow \text{NH}_4\text{Cl}$

9. Consider the reaction  

$$\text{Fe}_2\text{O}_3 + 2\text{Al} \longrightarrow \text{Al}_2\text{O}_3 + 2\text{Fe}$$
 The above reaction is an example of  
 (1) combination reaction  
 (2) double displacement reaction  
 (3) decomposition reaction  
 (4) simple displacement reaction
10. What happens when dilute hydrochloric acid is added to iron filings? Tick the correct answer.  
 (1) Hydrogen gas and iron chloride are formed.  
 (2) Chlorine gas and iron chloride are formed.  
 (3) No reaction takes place.  
 (4) Iron salts and water are produced.
11. What happens when copper rod is dipped in iron sulphate solution?  
 (1) Copper displaces iron  
 (2) Blue colour of copper sulphate solution is obtained  
 (3) No reaction takes place  
 (4) Reaction is exothermic
12. Which of the following is a decomposition reaction?  
 (1)  $2\text{HgO} \xrightarrow{\text{Heat}} 2\text{Hg} + \text{O}_2$   
 (2)  $\text{CaCO}_3 \xrightarrow{\text{Heat}} \text{CaO} + \text{CO}_2$   
 (3)  $2\text{H}_2\text{O} \xrightarrow{\text{Electrolysis}} \text{H}_2 + \text{O}_2$   
 (4) All of these
13.  $\text{AgNO}_3(\text{aq}) + \text{NaCl}(\text{aq}) \longrightarrow \text{AgCl}(\text{s}) + \text{NaNO}_3(\text{aq})$   
 Above reaction is -  
 (1) precipitation reaction  
 (2) double displacement reaction  
 (3) combination reaction  
 (4) (1) and (2) Both
14. The reaction in which two compounds exchange their ions to form two new compounds is -  
 (1) a displacement reaction  
 (2) a decomposition reaction  
 (3) an isomerization reaction  
 (4) a double displacement reaction
15. When the gases sulphur dioxide and hydrogen sulphide mix in the presence of water, the reaction is  

$$\text{SO}_2 + 2\text{H}_2\text{S} \longrightarrow 2\text{H}_2\text{O} + 3\text{S}$$
 Here hydrogen sulphide is acting as  
 (1) an oxidising agent (2) a reducing agent  
 (3) a dehydrating agent (4) a catalyst
16.  $\text{CuO} + \text{H}_2 \longrightarrow \text{H}_2\text{O} + \text{Cu}$  reaction is an example of -  
 (1) redox reaction (2) synthesis reaction  
 (3) neutralisation (4) analysis reaction
17. A substance which oxidises itself and reduces other is known as -  
 (1) oxidising agent (2) reducing agent  
 (3) Both of these (4) None of these
18. In the reaction  $\text{PbO} + \text{C} \longrightarrow \text{Pb} + \text{CO}$   
 (1) PbO is oxidising agent  
 (2) C acts as a oxidising agent  
 (3) C acts as a reducing agent  
 (4) This reaction does not represent redox reaction
19. A redox reaction is one in which -  
 (1) both the substance are reduced  
 (2) both the substance are oxidised  
 (3) an acid is neutralised by the base  
 (4) one substance is oxidised while the other is reduced
20. In the equation,  $\text{NaOH} + \text{HNO}_3 \longrightarrow \text{NaNO}_3 + \text{H}_2\text{O}$   
 nitric acid is acting as -  
 (1) an oxidising agent (2) an acid  
 (3) a nitrating agent (4) a dehydrating agent
21. Which of the statement about the following reaction is correct ?  

$$2\text{PbO}(\text{s}) + \text{C}(\text{s}) \longrightarrow 2\text{Pb}(\text{s}) + \text{CO}_2(\text{s})$$
  
 (i) Lead is getting reduced  
 (ii) Carbon dioxide is getting oxidised  
 (iii) Carbon is getting oxidised  
 (iv) Lead oxide is getting reduced.  
 (1) (i) and (ii) (2) (i) and (iii)  
 (3) (i), (ii) and (iii) (4) All are correct
22. Slow eating away of iron articles in the presence of moist air is called  
 (1) galvanisation (2) crystallisation  
 (3) rusting (4) neutralisation
23. An oxidation reaction involves  
 (1) addition of hydrogen or removal of oxygen  
 (2) addition of oxygen or removal of hydrogen  
 (3) addition of oxygen only  
 (4) addition of hydrogen only
24. A neutralization reaction is a  
 (1) decomposition reaction.  
 (2) displacement reaction.  
 (3) combination reaction.  
 (4) double displacement reaction.
25. In a combination reaction, how many products are formed?  
 (1) Only one (2) Only two  
 (3) One or two only (4) Many
26. Which of the following reaction is based on activity series of metals?  
 (1) Decomposition reaction  
 (2) Displacement reaction  
 (3) Double displacement reaction  
 (4) Synthesis reaction
27. Which of the following reaction is endothermic?  
 (1)  $\text{C} + \text{O}_2 \longrightarrow \text{CO}_2$   
 (2)  $\text{CaCO}_3 \longrightarrow \text{CaO} + \text{CO}_2$   
 (3)  $\text{CH}_4 + 2\text{O}_2 \longrightarrow \text{CO}_2 + 2\text{H}_2\text{O}$   
 (4)  $\text{CaO} + \text{H}_2\text{O} \longrightarrow \text{Ca}(\text{OH})_2$
28. Which of the following is a homogeneous reaction?  
 (1)  $\text{C}(\text{s}) + \text{O}_2(\text{g}) \longrightarrow \text{CO}_2(\text{g})$   
 (2)  $2\text{Mg}(\text{s}) + \text{O}_2(\text{g}) \longrightarrow 2\text{MgO}(\text{s})$   
 (3)  $\text{N}_2(\text{g}) + \text{O}_2(\text{g}) \longrightarrow 2\text{NO}(\text{g})$   
 (4)  $\text{CaO}(\text{s}) + \text{H}_2\text{O}(\text{l}) \longrightarrow \text{Ca}(\text{OH})_2(\text{aq})$

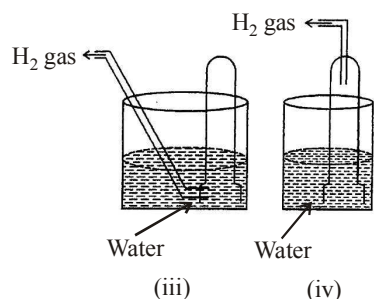
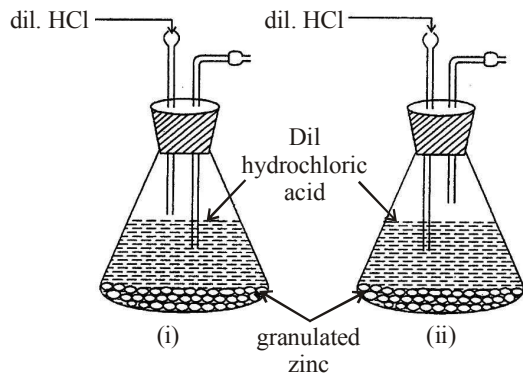
29. The conversion of  $\text{Fe}^{++}$  to  $\text{Fe}^{+++}$  is :
- oxidation
  - reduction
  - ionisation
  - nuclear reaction
30. Consider the following reactions :
- $\text{Cu} + \text{I}_2 \rightarrow \text{CuI}_2$
  - $\text{Fe} + \text{S} \rightarrow \text{FeS}$
- Which of the above reactions is/are redox reactions ?
- Only (a)
  - Only (b)
  - Both (a) and (b)
  - Neither (a) nor (b)
31. Which one of the following statements is correct ?  
In the reaction
- $$2\text{FeCl}_2 + \text{Cl}_2 \rightleftharpoons 2\text{FeCl}_3$$
- $\text{FeCl}_2$  is an oxidizing agent
  - $\text{Cl}_2$  is an oxidizing agent
  - $\text{FeCl}_3$  is an oxidising agent
  - $\text{Cl}_2$  is a reducing agent
32. The following reaction is an example of a
- $$4\text{NH}_3(\text{g}) + 5\text{O}_2(\text{g}) \rightarrow 4\text{NO}(\text{g}) + 6\text{H}_2\text{O}(\text{g})$$
- displacement reaction
  - combination reaction
  - redox reaction
  - neutralisation reaction
- (i) and (iv)
  - (iii) and (iii)
  - (i) and (iii)
  - (iii) and (iv)
33. Which of the following statements about the given reaction are correct ?
- $$3\text{Fe}(\text{s}) + 4\text{H}_2\text{O}(\text{g}) \rightarrow \text{Fe}_3\text{O}_4(\text{s}) + 4\text{H}_2(\text{g})$$
- Iron metal is getting oxidised
  - Water is getting reduced
  - Water is acting as reducing agent
  - Water is acting as oxidising agent
- (i), (ii) and (iii)
  - (iii) and (iv)
  - (i), (ii) and (iv)
  - (ii) and (iv)
34. Three beakers labelled as A, B and C each containing 25 mL of water were taken. A small amount of NaOH, anhydrous  $\text{CuSO}_4$  and NaCl were added to the beakers A, B and C respectively. It was observed that there was an increase in the temperature of the solutions contained in beakers A and B, whereas in case of beaker C, the temperature of the solution falls. Which one of the following statement(s) is (are) correct?
- In beakers A and B, exothermic process has occurred.
  - In beakers A and B, endothermic process has occurred.
  - In beaker C exothermic process has occurred.
  - In beaker C endothermic process has occurred.
- (i) only
  - (ii) only
  - (i) and (iv)
  - (ii) and (iii)
35. Which among the following statement(s) is(are) true? Exposure of silver chloride to sunlight for a long duration turns grey due to
- the formation of silver by decomposition of silver chloride
  - sublimation of silver chloride
  - decomposition of chlorine gas from silver chloride
  - oxidation of silver chloride
- (i) only
  - (i) and (iii)
  - (ii) and (iii)
  - (iv) only
36. Solid calcium oxide reacts vigorously with water to form calcium hydroxide accompanied by liberation of heat. This process is called slaking of lime. Calcium hydroxide dissolves in water to form its solution called lime water. Which among the following is (are) true about slaking of lime and the solution formed?
- It is an endothermic reaction
  - It is an exothermic reaction
  - The pH of the resulting solution will be more than seven
  - The pH of the resulting solution will be less than seven
- (i) and (ii)
  - (ii) and (iii)
  - (i) and (iv)
  - (iii) and (iv)
37. Barium chloride on reacting with ammonium sulphate forms barium sulphate and ammonium chloride. Which of the following correctly represents the type of the reaction involved?
- Displacement reaction
  - Precipitation reaction
  - Combination reaction
  - Double displacement reaction
- (i) only
  - (ii) only
  - (iv) only
  - (ii) and (iv)
38. In the double displacement reaction between aqueous potassium iodide and aqueous lead nitrate, a yellow precipitate of lead iodide is formed. While performing the activity if lead nitrate is not available, which of the following can be used in place of lead nitrate?
- Lead sulphate (insoluble)
  - Lead acetate
  - Ammonium nitrate
  - Potassium sulphate
39. In which of the following chemical equations, the abbreviations represent the correct states of the reactants and products involved at reaction temperature?
- $2\text{H}_2(\text{l}) + \text{O}_2(\text{l}) \rightarrow 2\text{H}_2\text{O}(\text{g})$
  - $2\text{H}_2(\text{g}) + \text{O}_2(\text{l}) \rightarrow 2\text{H}_2\text{O}(\text{l})$
  - $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{H}_2\text{O}(\text{l})$
  - $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{H}_2\text{O}(\text{g})$
40. The following reaction is used for the preparation of oxygen gas in the laboratory
- $$2\text{KClO}_3(\text{s}) \xrightarrow[\text{Catalyst}]{\text{Heat}} 2\text{KCl}(\text{s}) + 3\text{O}_2(\text{g})$$
- Which of the following statement(s) is (are) correct about the reaction?
- It is a decomposition reaction and endothermic in nature
  - It is a combination reaction
  - It is a decomposition reaction and accompanied by release of heat
  - It is a photochemical decomposition reaction and exothermic in nature

41. A magnesium ribbon (X) about 2 cm long and a piece of coal (Y) were taken in a watch-glass by four students P, Q, R and S. On burning of these two 'X' and 'Y' by using burner following observation were recorded in the form of table as given below:

Observation by	Item	Flame's colour	Residue obtained
P	X	Dazzling white flame	Greyish Ash
	Y	Yellowish flame	Black ash
Q	X	Dazzling white flame	White powder
	Y	Sooty flame	Blackish grey ash
R	X	White flame	Grey powder
	Y	White flame	Black coke
S	X	Yellowish flame	Greyish Ash
	Y	Sooty flame	Black Ash

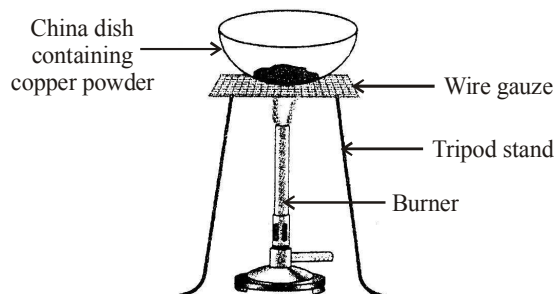
The correct observation was made by the student.

- (1) P (2) Q  
(3) R (4) S
42. Which two experimental set-up would you choose to prepare and collect hydrogen gas in the laboratory ?



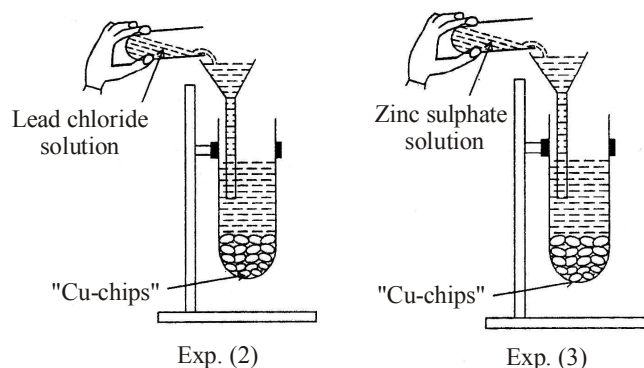
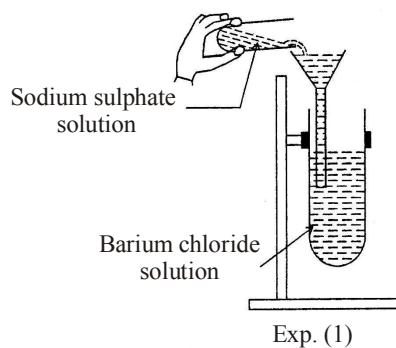
- (1) (i) and (iii) (2) (i) and (iv)  
(3) (ii) and (iv) (4) (ii) and (iii)

43. Observe this experiment carefully :



In above experiment copper powder turned to black coloured product on heating. It is due to the reason that:

- (1) Copper has absorbed heat  
(2) Copper (ii) oxide is formed  
(3) Copper (i) oxide is formed  
(4) Both (1) & (3) are correct
44. Observe the experiment set-up carefully:



In which experiment an insoluble precipitate is formed and of which substance ?

- (1) Exp 1,  $\text{Na}_2\text{SO}_4$  (2) Exp 2,  $\text{CuCl}_2$   
(3) Exp 3,  $\text{CuSO}_4$  (4) Exp 1,  $\text{BaSO}_4$
45. Two test tubes 'A' and 'B' contain aqueous solution of potassium iodide and lead nitrate separately. When these two test-tubes 'A' and 'B' are mixed together, results into 'X' and 'Y'. The 'X' and 'Y' are:
- (1) Yellow ppt, yellow solution  
(2) Yellow ppt, colourless solution  
(3) White ppt, yellow solution  
(4) White ppt, colourless solution



46. Oily and fatty food items are flushed with nitrogen gas because :
- (1) Nitrogen reacts with oils and fats and thus prevents rancidity.
  - (2) Nitrogen is inert gas and prevent a direct contact of air with oily and fatty food items
  - (3) Nitrogen helps in the decomposition of food items and makes them tasty
  - (4) All given statements are wrong
47. In an experiment to prepare a compound using iron filings and sulphur powder, the teacher instructed the students not to heat the mixture or iron and sulphur without test-tube holder because :
- (1) the reaction between iron and sulphur is exothermic
  - (2) the reaction between iron and sulphur is endothermic
  - (3) the test-tube is likely to melt
  - (4) the reaction is explosive
48. In order to study the reaction between barium chloride and sodium sulphate, the two compounds are mixed in the form of:
- (1) aqueous solutions
  - (2) dry powders
  - (3) molten liquids
  - (4) gases
49. The equation  $\text{Cu} + x\text{HNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + y\text{NO}_2 + 2\text{H}_2\text{O}$   
The values of x and y are –
- (1) 3 and 5
  - (2) 8 and 6
  - (3) 4 and 2
  - (4) 7 and 1
50. A dilute solution of sodium carbonate was added to two test-tubes – one containing dil HCl (1) and the other containing dilute NaOH (2). The correct observation was –
- (1) a brown coloured gas liberated in test-tube A
  - (2) a brown coloured gas liberated in test-tube B
  - (3) a colourless gas liberated in test-tube A
  - (4) a colourless gas liberated in test-tube B
51. Write the physical states of reactants and products denoted by 'x', 'y', 'z' and 'w'.
- $$\text{CH}_4(x) + 2\text{O}_2(y) \longrightarrow \text{CO}_2(z) + \text{H}_2\text{O}(w)$$
- (1) g, g, g, l
  - (2) g, g, g, g
  - (3) g, g, l, l
  - (4) l, g, g, g

## Exercise

## 2

### Matching Based MCQ

**DIRECTIONS (Qs. 1 to 5) :** Match Column-I with Column-II and select the correct answer using the codes given below the columns.

1. **Column I** **Column II**
- (A)  $\text{C} + \text{O}_2 \rightarrow \text{CO}_2$  (p) Displacement
- (B)  $2\text{AgBr} \xrightarrow{\text{Light}} 2\text{Ag} + \text{Br}_2$  (q) Combination
- (C)  $\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$  (r) Decomposition
- (D)  $2\text{Ca} + \text{O}_2 \rightarrow 2\text{CaO}$  (s) Oxidation
- (E)  $\text{BaCl}_2 + \text{H}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + 2\text{HCl}$  (t) Double displacement reaction
- (1) A – (r), B – (q), C – (p), D – (s) E – (t)
- (2) A – (q), B – (r), C – (p), D – (s) E – (t)
- (3) A – (q), B – (r), C – (s), D – (p) E – (t)
- (4) A – (q), B – (r), C – (p), D – (t) E – (s)
2. **Column I** **Column II**
- (A)  $2\text{Ca} + \text{O}_2 \rightarrow$  (p) 2HCl
- (B)  $4\text{Fe} + 3\text{O}_2 \xrightarrow{\text{moisture}}$  (q) 2CaO
- (C)  $\text{H}_2 + \text{Cl}_2 \xrightarrow{h\nu}$  (r) 2Fe<sub>2</sub>O<sub>3</sub>
- (D)  $2\text{Fe} + 3\text{Cl}_2 \longrightarrow$  (s) 2FeCl<sub>3</sub>
- (E)  $4\text{NO}_2 + \text{O}_2 + 2\text{H}_2\text{O} \longrightarrow$  (t) 4HNO<sub>3</sub>
- (1) A – (r), B – (q), C – (p), D – (s) E – (t)
- (2) A – (q), B – (r), C – (p), D – (t) E – (s)
- (3) A – (q), B – (r), C – (s), D – (p) E – (t)
- (4) A – (q), B – (r), C – (p), D – (s) E – (t)
3. **Column I** **Column II**
- (A)  $\text{H}_2(\text{g}) + \text{S}(\text{l}) \xrightarrow{\text{(boiling)}} \text{H}_2\text{S}(\text{g})$  (p) Displacement reaction
- (B)  $\text{Zn} + 2\text{HCl} \longrightarrow \text{ZnCl}_2 + \text{H}_2$  (q) Neutralisation reaction
- (C)  $2\text{NaOH} + \text{H}_2\text{SO}_4 \longrightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$  (r) Decomposition reaction
- (D)  $2\text{Cu}(\text{NO}_3)_2 \longrightarrow 2\text{CuO} + 4\text{NO}_2 + \text{O}_2$  (s) Combination reaction
- (1) A – (s), B – (p), C – (r), D – (q)
- (2) A – (p), B – (s), C – (q), D – (r)
- (3) A – (s), B – (p), C – (q), D – (r)
- (4) A – (s), B – (q), C – (p), D – (r)
4. **Column I** **Column II**
- (A)  $2\text{C}_4\text{H}_{10} + 13\text{O}_2 \longrightarrow 8\text{CO}_2 + 5\text{H}_2\text{O}$  (p) Combustion
- (B)  $2\text{AgBr} \longrightarrow 2\text{Ag} + \text{Br}_2$  (q) Exothermic
- (C)  $\text{BaCl}_2(\text{aq}) + \text{H}_2\text{SO}_4(\text{aq}) \longrightarrow \text{BaSO}_4(\text{s}) + 2\text{HCl}(\text{aq})$  (r) Endothermic
- (s) Decomposition
- (t) Double displacement
- (u) Precipitation
- (1) A – (p, r), B – (q, s), C – (t, u)
- (2) A – (p, q), B – (r, s), C – (t, u)
- (3) A – (p, q), B – (r, t), C – (s, u)
- (4) A – (p, t), B – (r, q), C – (t, u)

5. **Column-I** **Column-II**
- (A)  $C(s) + 2S(s) \rightarrow CS_2(l)$  (p) Exothermic reaction  
 (B)  $CaO(s) + H_2O(l) \rightarrow Ca(OH)_2(aq)$  (q) Redox reaction  
 (C)  $NaCl(s) + AgNO_3(l) \rightarrow AgCl(s) + NaNO_3$  (r) Endothermic reaction  
 (D)  $H_2S(g) + Cl_2(g) \rightarrow S(s) + 2HCl(l)$  (s) Double displacement reaction
- (1) A – (r); B – (p); C – (s); D – (q)  
 (2) A – (q); B – (p); C – (s); D – (r)  
 (3) A – (p); B – (r); C – (s); D – (q)  
 (4) A – (r); B – (p); C – (q); D – (s)

### Statement Based MCQ

6. Consider the following statements :
- (a) It is possible to write a symbol equation even if we do not know the word equation.  
 (b) A chemical equation is always written under N.T.P conditions.  
 (c) In a chemical equation the diatomic gases must be written in the molecular form.

Which of these statement(s) is/are correct ?

- (1) (a) and (b) (2) (a) and (c)  
 (3) Only (b) (4) Only (c)
7. Consider the following statements :
- (a) For rusting of iron moisture and air are necessary conditions.  
 (b) The formula of rust is  $Fe_3O_4 \cdot 10H_2O$ .

Which of these statement(s) is/are correct ?

- (1) (a) only (2) (b) only  
 (3) Both (a) and (b) (4) Neither (a) nor (b)
8. Consider the following statements :
- (a) Hydrogen gas can be collected over water.  
 (b) A balanced equation must be molecular.

Which of these statement(s) is/are correct ?

- (1) (a) only (2) (b) only  
 (3) Both (a) and (b) (4) Neither (a) nor (b)
9. Consider the following statements :
- (a) Oxidation is the loss of electrons from a substance.  
 (b) Reduction is the gain of electrons by a substance.  
 (c) The formation of  $Na^+Cl^-$  by the action of sodium and chlorine is an example of a redox reaction.

Which of these statement(s) is/are correct ?

- (1) (a) and (b) (2) (a) and (c)  
 (3) (b) only (c) (4) All are correct
10. Consider the following statements :
- (a) Rusting is a double decomposition reaction.  
 (b) Silver salt are generally sensitive to light.

Which of these statement(s) is/are correct ?

- (1) (a) only (2) (b) only  
 (3) Both (a) and (b) (4) Neither (a) nor (b)
11. Consider the following statements :
- (a) On mixing aqueous solution of silver nitrate and sodium bromide no precipitate is formed.  
 (b) Oxidation reaction always occurs in company of a reduction reaction.  
 (c) Rancidity of oils and fats is because of their oxidation.

Which of these statement(s) is/are correct ?

- (1) (a) and (b) (2) (a) and (c)  
 (3) (b) only (c) (4) All are correct

12. Consider the following statements :
- (a) Calcium carbonate is the product formed when calcium oxide reacts with carbon dioxide gas.  
 (b) The precipitate of zinc sulphide is black in colour.

Which of these statement(s) is/are correct ?

- (1) (a) only (2) (b) only  
 (3) Both (a) and (b) (4) Neither (a) nor (b)
13. Consider the following statements :
- (a) The number of atoms of each element is conserved in any chemical reaction.  
 (b) A complete chemical equation represents the reactants, products and their physical states symbolically.

Which of these statement(s) is/are correct ?

- (1) (a) only (2) (b) only  
 (3) Both (a) and (b) (4) Neither (a) nor (b)
14. Consider the following statements :
- (a) A magnesium ribbon burns with a dazzling flame in air (oxygen) and changes into a white substance, magnesium oxide.  
 (b) The reaction between nitrogen and hydrogen to give ammonia is an example of a combination reaction.  
 (c) Action of heat on ferrous sulphate is an example of decomposition reaction.

Which of these statement(s) is/are correct ?

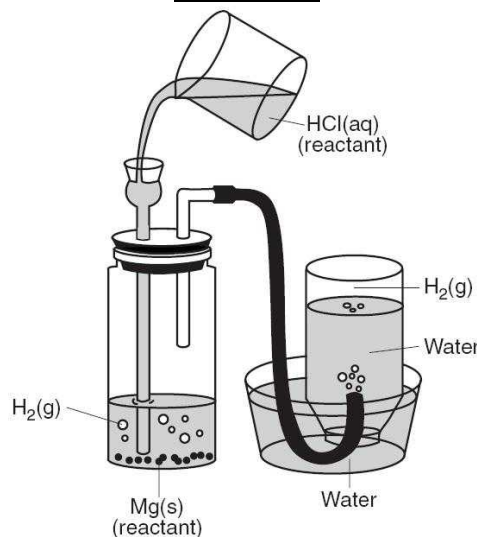
- (1) (a) and (b) (2) (a) and (c)  
 (3) (b) only (c) (4) All are correct

### Passage Based MCQ

**DIRECTIONS (Qs. 15 to 21) :** Read the passage(s) given below and answer the questions that follow.

Carefully observe diagram given below which shows how hydrogen is prepared in laboratory and answers the questions that follows :

#### PASSAGE - 1



15. What type of chemical reaction occurs?
- (1) Combination reaction  
 (2) Neutralisation reaction  
 (3) Displacement reaction  
 (4) Decomposition reaction
16. Which of the following metal can be used in place of magnesium in above reaction?
- (1) Ca (2) Zn  
 (3) Cd (4) Ni

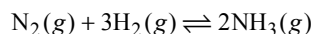


17. Above phenomena represents  
 (1) physical change  
 (2) chemical change  
 (3) Both physical and chemical change  
 (4) None of these
18. Correct chemical equation for process  
 (1)  $\text{Mg(s)} + 2\text{HCl(aq)} \longrightarrow \text{MgCl}_2(\text{aq}) + \text{H}_2(\text{g})$   
 (2)  $\text{Mg(s)} + \text{HCl(aq)} \longrightarrow \text{MgCl}_2(\text{aq}) + \text{H}_2(\text{g})$   
 (3)  $\text{Mg} + 2\text{HCl} \longrightarrow \text{MgCl}_2 + \text{H}_2$   
 (4) None of these

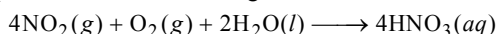
### PASSAGE - 2

Combination reactions has wide application in the manufacturing of some industrially important compounds.

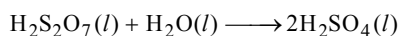
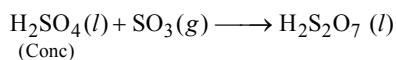
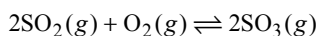
- On a commercial scale, ammonia is manufactured by Haber's process.



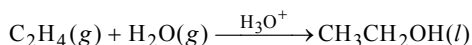
- Ostwald process for manufacturing of nitric acid



- Similarly contact process for manufacturing of sulphuric acid involves following stages of combination reaction



- Manufacture of Ethylalcohol by acid catalysed hydration of ethylene



19. Which of the above process involves combination reaction of elements only?  
 (1) Ostwald process  
 (2) Haber's process  
 (3) Manufacture of  $\text{C}_2\text{H}_5\text{OH}$   
 (4) Contact process
20. Which of the above process involves combination reaction of compounds with element ?  
 (1) Ostwald process  
 (2) Haber's process  
 (3) Manufacture of  $\text{C}_2\text{H}_5\text{OH}$   
 (4) Contact process
21. Which of the above process involves combination reaction of compounds only?  
 (1) Ostwald process  
 (2) Haber's process  
 (3) Manufacture of  $\text{C}_2\text{H}_5\text{OH}$   
 (4) Contact process

### Assertion Reason Based MCQ

**DIRECTIONS (Qs. 22 to 27) :** Following questions consist of two statements, one labelled as the 'Assertion' and the other as 'Reason'. You are to examine these two statements carefully and select the answer to these items using the code given below.

**Code :**

- (1) Both A and R are individually true and R is the correct explanation of A.  
 (2) Both A and R are individually true but R is not the correct explanation of A.  
 (3) A is true but R is false  
 (4) A is false but R is true.

22. **Assertion :** In electrolysis of water the volume of hydrogen liberated is twice the volume of oxygen formed.  
**Reason :** It is because water has hydrogen and oxygen in the ratio of 1: 2.
23. **Assertion :** Copper sulphate can be stored in silver container.  
**Reason :** Silver can't displace copper from copper sulphate as it is less reactive than copper.
24. **Assertion :** Respiration is exothermic in nature.  
**Reason :** Oxygen inhaled in respiration causes the combustion of carbohydrates accompanied by release of energy.
25. **Assertion :** When carbon dioxide gas is passed through lime water, a white precipitate is initially formed.  
**Reason :** White precipitate is of calcium carbonate which is formed during the reaction.
26. **Assertion :** A reduction occurs when a substance loses oxygen or gain hydrogen atom.  
**Reason :** In a reaction of hydrogen with chlorine hydrogen serve as a reducing agent.
27. **Assertion :** The balancing of chemical of chemical equations is based on law of conservation of mass.  
**Reason :** Total mass of reactants is equal to that mass of products.

### Correct Definition Based MCQ

28. Chemical equation is  
 (1) qualitative representation of a chemical reaction in term of symbols and formulae  
 (2) quantitative representation of a chemical reaction in term of symbols and formulae  
 (3) qualitative and quantitative representation of a chemical reaction in term of symbols and formulae  
 (4) qualitative and quantitative representation of a chemical reaction in words.
29. Rancidity is  
 (1) unpleasant change in the colour, flavour and odour of food  
 (2) pleasant change in the flavour, colour and odour of food  
 (3) unpleasant change in the colour and odour of food  
 (4) unpleasant change in the flavour of food
30. Homogeneous reactions  
 (1) are those in which all reactants, products and catalyst are in different physical state  
 (2) are those in which all reactants and products are in different physical state  
 (3) are those in which all reactants and products are in same physical state.  
 (4) are those in which all reactants, products and catalyst are in same physical state
31. Decomposition reactions are  
 (1) those in which a compound breaks down into simpler compounds  
 (2) those in which a simple compound combine to form complex compounds  
 (3) those in which a compound breaks down into simpler compounds via electricity.  
 (4) those in which a compound breaks down into simpler compounds via heat

## Feature Based MCQ

32. On the basis of following features identify the type of reaction  
 (I) One of the product obtained will be in aqueous form.  
 (II) One of the product formed is insoluble solid  
 (1) Displacement reaction  
 (2) Double displacement reaction  
 (3) Precipitation reaction  
 (4) Redox reaction
33. On the basis of following features identify the correct option  
 (I) The reaction occurs during corrosion  
 (II) This reaction occurs during respiration.  
 (1) Combustion reaction  
 (2) Redox reaction  
 (3) Oxidation reaction  
 (4) Exothermic reaction
34. On the basis of following features identify the correct option  
 (I) It is the primary means by which metals deteriorate  
 (II) Protective coatings are applied to prevent metals.  
 (1) Corrosion  
 (2) Chemical erosion  
 (3) Both (1) and (2)  
 (4) Neither (1) nor (2)
35. On the basis of following features identify the correct option  
 (I) A substance breaks down into simpler substances  
 (II) Electrolysis of water is example of this type of reaction.  
 (1) Electrolytic decomposition  
 (2) Thermal decomposition  
 (3) Photochemical decomposition  
 (4) Catalytic decomposition

# Hints & SOLUTIONS

## Exercise 1

1. (4)  $\text{Zn (s)} + 2 \text{HCl (aq)} \longrightarrow \text{ZnCl}_2 \text{ (aq)} + \text{H}_2$
2. (2)                      3. (4)                      4. (3)
5. (4)                      6. (4)
7. (1) Balanced equation is  $2 \text{Fe} + 3 \text{Cl}_2 \longrightarrow 2 \text{FeCl}_3$
8. (2)
9. (4) It is an example of displacement reaction. In it Al metal displaces iron from  $\text{Fe}_2\text{O}_3$  when reaction is carried out in aqueous solution.
10. (1)  $\text{Fe(s)} + 2\text{HCl(dil)} \rightarrow \text{FeCl}_2\text{(aq)} + \text{H}_2\text{(g)}$
11. (3) As iron is above copper in reactivity series.
12. (4) As in all above reactions complex substances decomposes to give simple substances.
13. (4) This reaction is double displacement and precipitation as well because insoluble silver chloride gets precipitated.
14. (4)                      15. (2)
16. (1) As here  $\text{H}_2$  gets oxidised and  $\text{CuO}$  reduced to  $\text{Cu}$ .
17. (2)
18. (3) Carbon reduces  $\text{PbO}$  to  $\text{Pb}$ .
19. (4)
20. (2) Here  $\text{HNO}_3$  acts as an acid which on combining with base  $\text{NaOH}$  forms corresponding salt and water.
21. (2)
22. (3) Rusting is a process in which iron gets converted into hydrated iron oxide in presence of moisture.
- $$2\text{Fe} + \frac{3}{2}\text{O}_2 + x\text{H}_2\text{O} \longrightarrow \text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O}$$
- rust
23. (2)
24. (4) A neutralization reaction is a double displacement reaction. In this reaction two reactants exchange their ions to form two new products. For example  
 $\text{HCl (aq)} + \text{NaOH (aq)} \longrightarrow \text{NaCl(aq)} + \text{H}_2\text{O(l)}$
25. (1) In a combination reaction only one product is formed. For example :  $\text{N}_2\text{(g)} + 3\text{H}_2\text{(g)} \longrightarrow 2\text{NH}_3\text{(g)}$
26. (2)
27. (2) Heat is required to decompose calcium carbonate. Thus this reaction proceeds with absorption of heat therefore it is endothermic reaction.
28. (3) Formation of  $\text{NO}$  involves all reactants and products in gaseous phase.
29. (1)  $\text{Fe}^{++} \rightarrow \text{Fe}^{+++}$   
└───┘  
 (loss of electrons)  
 $\therefore$  Oxidation process
30. (3) The reactions which involve both reduction and oxidation are abbreviated as redox reactions.
- $$\begin{array}{ccc} \text{Oxidation} & & \text{Oxidation} \\ \downarrow & & \downarrow \\ \text{Cu} + \text{I}_2 \longrightarrow \text{CuI}_2 & & \text{Fe} + \text{S} \longrightarrow \text{FeS} \\ \uparrow & & \uparrow \\ \text{Reduction} & & \text{Reduction} \end{array}$$
- So, both are redox reactions.
31. (2)  $2\text{FeCl}_2 + \text{Cl}_2 \rightleftharpoons 2\text{FeCl}_3$   
└───┘  
└───┘  
 Oxidation  
 Reduction
- Oxidising agent is that substance which donate electrons while reducing agent is that substance which accepts electrons.  
 $\therefore \text{Cl}_2$  is an oxidising agent.

32. (3)
33. (3) The substance which oxidises the other substances in a chemical reaction is known as an oxidising agent. Likewise, the substance which reduces the other substance in a chemical reaction is known as reducing agent.
34. (3)                      35. (1)
36. (2)  $\text{CaO} + \text{H}_2\text{O} \longrightarrow \text{Ca(OH)}_2 + \text{Q}$   
 $\text{Ca(OH)}_2$  formed will be basic thus  $\text{pH} > 7$ .
37. (4)
38. (2) Lead sulphate being insoluble will not dissociate into  $\text{Pb}^{2+}$  ions.
39. (4)                      40. (1)                      41. (2)                      42. (4)
43. (2)
44. (4)  $\text{Na}_2\text{SO}_4(\text{aq}) + \text{BaCl}_2(\text{aq}) \longrightarrow \text{BaSO}_4(\text{s}) + 2\text{NaCl}(\text{aq})$
45. (2)                      46. (2)
47. (1) This is essential as a safety measure usually when an exothermic chemical reaction is carried out in a test-tube.
48. (1) Solid compounds do not show chemical reaction.
49. (3)  $\text{Cu} + 4\text{HNO}_3 \longrightarrow \text{Cu(NO}_3)_2 + 2\text{NO}_2 + 2\text{H}_2\text{O}$
50. (3)  $\text{Na}_2\text{CO}_3 + 2\text{HCl} \longrightarrow 2\text{NaCl} + \text{H}_2\text{O} + \text{CO}_2$
51. (1)
8. (3)                      9. (4)
10. (2) Rusting of iron is an oxidation reaction.
11. (3) On mixing  $\text{AgNO}_3(\text{aq})$  and  $\text{NaBr}(\text{aq})$  the precipitate of  $\text{AgBr}$  is formed.
12. (1)                      13. (3)                      14. (4)
15. (3) Here magnesium displaces hydrogen from hydrochloric acid.  
 $\text{Mg}(\text{s}) + 2\text{HCl}(\text{aq}) \rightarrow \text{MgCl}_2(\text{aq}) + \text{H}_2(\text{g})\uparrow$
16. (2)                      17. (2)                      18. (1)
19. (2) Haber's process for the manufacturing of ammonia. It involves combination of elements nitrogen and Hydrogen.
20. (1) Ostwald's process of manufacturing of nitric acid. It involves combination of compounds i.e.  $\text{NO}_2, \text{H}_2\text{O}$  with element oxygen.
21. (3) Manufacturing of ethylalcohol by combination of ethylene and water.
22. (3) 'A' is true but 'R' is false because hydrogen and oxygen in  $\text{H}_2\text{O}$  are in ratio of 2: 1.
23. (1)
24. (1)  $\text{C}_6\text{H}_{12}\text{O}_6(\text{s}) + 6\text{O}_2(\text{g}) \longrightarrow 6\text{CO}_2(\text{g}) + 6\text{H}_2\text{O}(\text{l}) + \text{heat}$   
 Glucose (carbohydrate)
25. (1) Reason is the correct explanation of assertion. Lime water contains traces of calcium hydroxide dissolved in it. It reacts with carbon dioxide gas to form a white precipitate of calcium carbonate.

### Exercise 2

1. (2)                      2. (4)                      3. (3)                      4. (2)
5. (1)                      6. (4)
7. (1) Formula of rust is  $\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O}$ .
26. (2)                      27. (1)
28. (3)                      29. (1)                      30. (4)                      31. (1)
32. (3)                      33. (2)                      34. (3)                      35. (1)

