

## 11. Chemical reactions and their types

### Exercises

#### 1 A. Question

Balancing of equations is based on,

- A. Avogadro number
- B. the principle of conservation of momentum
- C. conditions for a chemical reaction to take place
- D. the law of conservation of mass or matter

#### Answer

**Balanced chemical equation:** A chemical equation in which the number of atoms of reactants and the number of atoms of products is equal is called a balanced equation.

**Every chemical equation should be balanced because:**

- i) According to the law of conservation of mass, atoms are neither created nor destroyed in chemical reactions.
- ii) It means the total mass of the products formed in a chemical reaction must be equal to the mass of reactants consumed.

Hence, the correct option is (d)

#### 1 B. Question

Identify the balanced equation in the following.

- A.  $\text{SiO}_2 + \text{Mg} \rightarrow \text{Si} + \text{MgO}$
- B.  $\text{SiO}_2 + 2\text{Mg} \rightarrow \text{Si} + 2\text{MgO}$
- C.  $\text{SiO} + \text{Mg} \rightarrow \text{Si} + \text{MgO}_2$
- D.  $\text{SiO}_2 + \text{Mg} \rightarrow \text{SiO} + 2\text{MgO}$

#### Answer

In the reaction (b)  $\text{SiO}_2 + 2\text{Mg} \rightarrow \text{Si} + 2\text{MgO}$

Check whether the equation is balanced or not by comparing the atoms:

	Reactants (left side)	Products (right side)
Element	Number of atoms	Number of atoms
Si	1	1
O	2	2
Mg	2	2

We found that the equation is completely balanced. Hence, the option (b) is correct.

### 1 C. Question

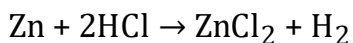
Correct statement about chemical displacement is,

- A. less reactive element displaces more reactive element
- B. a non-metal displaces more reactive non metal
- C. more reactive element displaces less reactive element
- D. evolution of heat when carbon is burnt in air

### Answer

Chemical displacement is a reaction in which more reactive element displaces the less reactive element from their compounds and form a new compound itself.

For example:



In the reaction, zinc (being more reactive) has displaced hydrogen from HCl and form a new compound, i.e.,  $\text{ZnCl}_2$ .

### 1 D. Question

Dissolving sugar in water is not an example of a chemical reaction because,

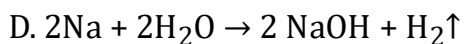
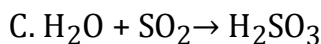
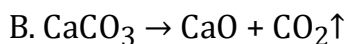
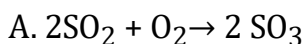
- A. there is no change in energy
- B. sufficient heat is not produced
- C. no new substances are formed
- D. no gases are evolved

### Answer

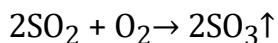
In a chemical reaction, new substances are formed. Hence, dissolving sugar in water is not an example of a chemical reaction because no new substances are formed during the change.

### 1 E. Question

Which of the following represents a combination of two compounds forming another compound?



**Answer**



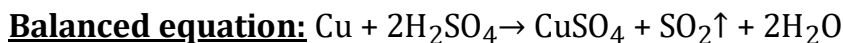
In the given reaction, sulphur dioxide and oxygen (reactants) combined together to form a single product, i.e.,  $\text{SO}_3$ . Hence, this reaction is an example of decomposition reaction.

## 2 A. Question

Balance the following reactions :



**Answer**



Step 1: Write the unbalanced equation



Step 2: Compare the number of atoms of reactants with the number of atoms of products.

	Reactants (left side)	Products (right side)
Element	Number of atoms	Number of atoms
Cu	1	1
H	2	2
O	4	7
S	1	2

Step 3: Now, first we consider the element having unequal no. of atoms on both sides. Thus, first let us consider the oxygen atom. If we multiply 2 in the reactant (in  $\text{H}_2\text{SO}_4$ ) and 2 in the product (in  $\text{H}_2\text{O}$ ), we will get the equal number of oxygen atoms in both sides.

No. of atoms of oxygen	Reactant (in H <sub>2</sub> SO <sub>4</sub> )	Product (in CuSO <sub>4</sub> + SO <sub>2</sub> + H <sub>2</sub> O)
Initially	4	7
To balance	4 × 2 = 8	4 + 2 + 1 × 2 = 8

Step 4: Write the resulting equation:



Step 5: Now check whether the equation is balanced or not by comparing the atoms

	Reactants (left side)	Products (right side)
Element	Number of atoms	Number of atoms
Cu	1	1
H	4	4
O	8	8
S	2	2

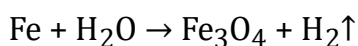
We find that the equation is balanced now.

Step 6: Write down the final balanced equation:

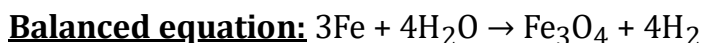


## 2 B. Question

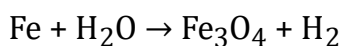
Balance the following reactions :



**Answer**



Step 1: Write the unbalanced equation



Step 2: Compare the number of atoms of reactants with the number of atoms of products.

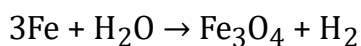
	Reactants (left side)	Products (right side)
Element	Number of atoms	Number of atoms
Fe	1	3
H	2	2
O	1	4

Step 3: Now, first we consider the element having unequal no. of atoms on both sides. Thus, first let us consider Fe atom. If we multiply 3 in the reactant

(in Fe), we will get the equal number of atoms as in product (in  $\text{Fe}_3\text{O}_4$ )

No. of atoms of Fe	Reactant (in Fe)	Product (in $\text{Fe}_3\text{O}_4$ )
Initially	1	3
To balance	$1 \times 3 = 3$	3

Step 4: Write the resulting equation:



Step 5: Now check whether the equation is balanced or not by comparing the atoms

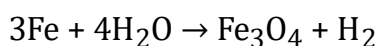
	Reactants (left side)	Products (right side)
Element	Number of atoms	Number of atoms
Fe	3	3
H	2	2
O	1	4

We find that the equation is not balanced yet. As the number of oxygen atoms is unequal on the two sides. Hence, balance the oxygen atom.

Step 6: If we multiply 4 in the reactant (in  $\text{H}_2\text{O}$ ), we will get the equal number of oxygen atoms on both sides.

No. of atoms of oxygen	Reactant (in $\text{H}_2\text{O}$ )	Product (in $\text{Fe}_3\text{O}_4$ )
Initially	1	4
To balance	$1 \times 4 = 4$	4

Step 7: Write the resulting equation:



Step 8: Now check whether the equation is balanced or not by comparing the atoms.

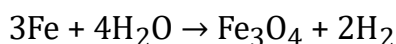
	Reactants (left side)	Products (right side)
Element	Number of atoms	Number of atoms
Fe	3	3
H	8	2
O	4	4

We find that the equation is not balanced yet. As the number of hydrogen atoms is unequal on the two sides.

Step 9: Now, we consider hydrogen atoms. If we multiply 2 in the product (in  $\text{H}_2$ ), we will get the equal number of hydrogen atoms as in reactants.

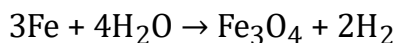
No. of atoms of hydrogen	Reactant (in $4\text{H}_2\text{O}$ )	Products ( $\text{H}_2$ )
Initially	8	2
To balance	8	$2 \times 4 = 8$

Step 10: Write the resulting equation:



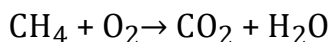
We find that the equation is balanced now.

Step 11: Write down the final balanced equation:



## 2 C. Question

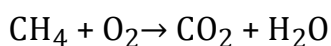
Balance the following reactions :



**Answer**

**Balanced equation:**  $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$

Step 1: Write the unbalanced equation



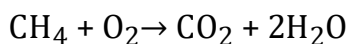
Step 2: Compare the number of atoms of reactants with the number of atoms of products.

	Reactants (left side)	Products (right side)
Element	Number of atoms	Number of atoms
C	1	1
H	4	2
O	2	3

Step 3: Now, first we consider the element having unequal no. of atoms on both sides. Thus, first let us consider the hydrogen atom. If we multiply 2 in the product (in  $\text{H}_2\text{O}$ ), we will get the equal number of hydrogen atoms as in reactant (in  $\text{CH}_4$ )

No. of atoms of hydrogen	Reactant (in CH <sub>4</sub> )	Product (in H <sub>2</sub> O)
Initially	4	2
To balance	4	2 × 2 = 4

Step 4: Write the resulting equation:



Step 5: Now check whether the equation is balanced or not by comparing the atoms

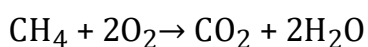
	Reactants (left side)	Products (right side)
Element	Number of atoms	Number of atoms
C	1	1
H	4	4
O	2	4

We find that the equation is not balanced yet. As the number of oxygen atoms is unequal. Hence, balance the oxygen atom.

Step 6: If we multiply 2 in the reactant (in O<sub>2</sub>), we will get the equal number of oxygen atoms on both sides.

No. of atoms of oxygen	Reactant (in O <sub>2</sub> )	Product (in CO <sub>2</sub> + 2H <sub>2</sub> O)
Initially	2	4
To balance	2 × 2 = 4	4

Step 7: Write the resulting equation:

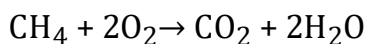


Step 8: Now check whether the equation is balanced or not by comparing the atoms.

	Reactants (left side)	Products (right side)
Element	Number of atoms	Number of atoms
C	1	1
H	4	4
O	4	4

We find that the equation is balanced now.

Step 9: Write down the final balanced equation:







### 3 A. Question

Answer the following:

Write any three differences between physical change and chemical change.

#### Answer

Differences between a physical change and chemical change:

Physical change	Chemical change
A physical change is a temporary change.	A chemical change is a permanent change
No new substance is formed during the change.	The new chemical substance is formed during the change.
No change in mass takes place.	Mass of the substance changes.
No energy or a small energy is involved during the change.	Energy is generally involved during the change.
<p><u>For example</u> Melting of ice cream and lightning of bulb are physical changes:</p> <div style="display: flex; justify-content: space-around; align-items: center;">   </div> <p>Melting of Ice cream    Lighting of electric bulb</p>	<p><u>For example</u> Burning of fuel and explosives are chemical changes:</p> <div style="display: flex; justify-content: space-around; align-items: center;">   </div> <p>Burning of fuel    Bursting of explosives</p>

### 3 B. Question

Answer the following:

Group the following into physical change and chemical change.

Dissolving salt in  $\text{H}_2\text{O}$ , Burning of a fuel,

Rusting of iron, melting of an ice cube.

#### Answer

**Physical change:** It is a temporary change in which no new substance is formed and the mass of the substance remains the same. Hence, dissolving the salt in  $\text{H}_2\text{O}$  and melting of an ice cube are physical changes.





**Dissolving salt in water**



**Melting of ice cube**

**Chemical change:** It is a permanent change in which a new substance is formed and the weight of the substance changes. Hence, rusting of iron and burning of fuel are chemical changes.



**Rusting of iron**



**Burning of fuel**

### 3 C. Question

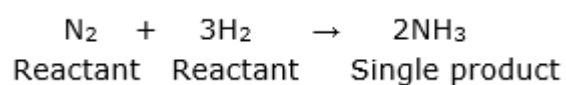
Answer the following:

Mention one example each for the different types of chemical reactions.

**Answer**

**i) Chemical combination:** It is the reaction in which two or more reactants combine together to form a new product.

For example:

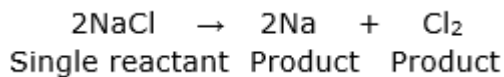


**ii) Chemical decomposition:** It is a reaction in which a single reactant breaks up into two or more products. For this purpose, sufficient energy is provided.

## Decomposition Reaction



For example:

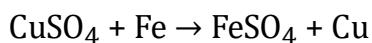


**iii) Chemical displacement:** It is the reaction in which a more reactive element displaces the less reactive from their compounds.



**single displacement reaction**

For example:



In the above reaction, Fe being more reactive displaces the Cu from its compound ( $\text{CuSO}_4$ ) and form a new compound ( $\text{FeSO}_4$ )

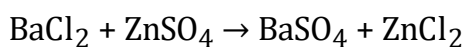
**iv) Double displacement reaction:** In this reaction, the two reactants exchange their constituents chemically and form two products.



A and C are Cations (Positive Ions)  
B and D are Anions (Negative Ions)

**Double Displacement Reaction**

For example:

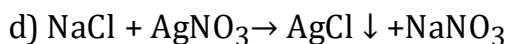
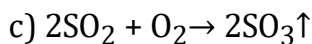
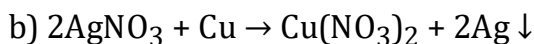
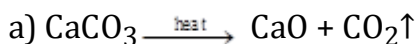


In this reaction, exchange of ions of Ba and Zn are taking place.

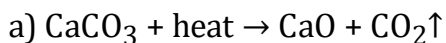
### 3 D. Question

Answer the following:

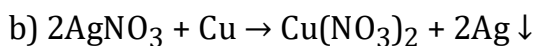
Classify the following into chemical combination, decomposition, displacement and double displacement reaction.



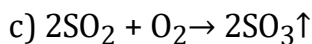
**Answer**



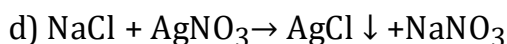
In the given reaction,  $\text{CaCO}_3$  used sufficient energy in the form of heat and breaks up into calcium oxide ( $\text{CaO}$ ) and carbon dioxide gas. Hence, this reaction is an example of decomposition reaction.



In the given reaction, copper being more reactive displaces silver ( $\text{Ag}$ ) from its compound ( $\text{AgNO}_3$ ) and form a new compound ( $\text{Cu}(\text{NO}_3)_2$ ). Hence, this reaction is an example of displace reaction.



In the given reaction, sulphur dioxide and oxygen (reactants) combined together to form a single product, i.e.,  $\text{SO}_3$ . Hence, this reaction is an example of combination reaction.



In the given reaction, the exchange of ions of  $\text{Na}$  and  $\text{Ag}$  are taking place. Hence, this reaction is an example of double displacement reaction.

**3 E. Question**

Answer the following:

Write the advantages of writing a chemical equation using formulae and symbols.

**Answer**

The advantages of writing a chemical equation using formulae and symbols:

For example:  $\text{C} + \text{O}_2 \rightarrow \text{CO}_2$

**The equation using symbols**

i) This method helps us in knowing the reactants and products only.

ii) This method also helps us in knowing the correct relation between the quantities of reactants consumed and products formed  $C:O_2:CO_2 = 1:1:1$

### 3 F. Question

Answer the following:

During winter many plant leaves fallen on the earth do not cause pollution. But plastic papers which are thrown on the earth cause pollution. Name the types of chemical reaction associated with this observation.

#### Answer

The type of chemical reaction associated with this observation is an exothermic reaction.

i) It is a reaction in which heat is also released along with the formation of products.

ii) Plastic papers releases too much energy.

iii) The energy they release is very harmful to the environment.

### 3 G. Question

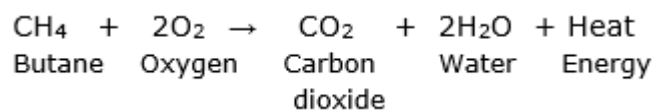
Answer the following:

L.P.G. gas contains butane. Its molecular formula is  $C_4H_{10}$ . Name the possible products obtained by its complete combustion.

#### Answer

The possible products obtained by the combustion of butane are carbon dioxide and water and energy are also released.

The chemical reaction for this process is:



### 3 H. Question

Answer the following:

Suggest some measures to avoid rancidity of oils.

#### Answer

When we use old, left over cooking oil for making food stuff, it is found to have foul odour called rancidity.

i) Rancidity is an oxidation reaction.

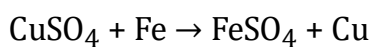
- ii) When oils or fats are left aside for a long time, they undergo air oxidation and become rancid.
- iii) By keeping food in air tight container helps to slow down oxidation.
- iv) Rancidity in the food stuff cooked in oil or ghee is also prevented by using antioxidants.
- v) Usually antioxidants such as nitrogen gas flushed into bags containing food.

#### 4 A. Question

Give a scientific reason for the following.

Iron displaces copper from copper sulphate but copper cannot displace iron.

**Answer**



- i) Iron is more reactive than copper.
- ii) In the above reaction, iron being more reactive than copper displaces it from its compound ( $\text{CuSO}_4$ )
- iii) As a result, a new compound  $\text{FeSO}_4$  is formed.
- iv) The above reaction is an example of a single displacement reaction.

#### 4 B. Question

Give a scientific reason for the following.

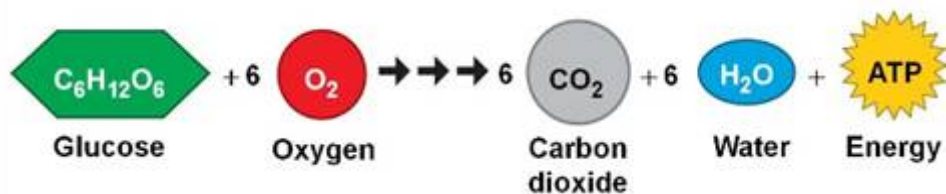
Respiration is an exothermic reaction.

**Answer**

**Exothermic reaction:** A reaction in which heat is released when reactants change into products.

Respiration is considered as an exothermic reaction because:

- i. In respiration, a large amount of heat energy is released when oxidation of glucose takes place.
- ii. The glucose combines with the oxygen in the cells of our body and gives energy.



#### 4 C. Question

Give a scientific reason for the following.

In chemical equations, oxygen is represented as  $O_2$  but not O and chlorine is represented as  $Cl_2$  but not Cl.

**Answer**

In chemical equations, oxygen is represented as  $O_2$  but not O and chlorine is represented as  $Cl_2$  but not Cl because oxygen and chlorine are diatomic molecules (consisting of only two atoms). They both exist in nature as diatomic molecules.

**4 D. Question**

Give a scientific reason for the following.

Use of plastic must be avoided or minimized.

**Answer**

Use of plastic must be avoided or minimized because i) Plastic is a non-biodegradable substance.

ii) Non-biodegradable substances are the substances which do not get easily decomposed.

iii) Burning of plastic causes air, water, and soil pollution.

iv) They produce harmful and toxic gases.

v) They cause health problems too. Their toxic chemicals can damage several body organs.