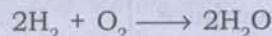


# 6 Physical and Chemical Changes

## Lesson at a Glance

• **Chemical change:** A change in which two or more substances (reactants) combine to produce one or more new substances (products) that has/have different chemical properties than the reactants is called chemical change. A chemical change is also known as *chemical reaction*.

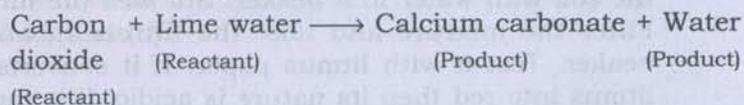
• The substances undergoing a reaction are called *reactants* while the newly formed substances, as a result of the reaction, are called *products*. For example,



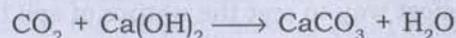
In the above reaction, hydrogen and oxygen are reacting together to form water. So  $\text{H}_2$  and  $\text{O}_2$  are reactants and  $\text{H}_2\text{O}$  is the product.

• **Chemical Equation:** Brief representation of a chemical reaction with the help of symbols and formulae of reactants and products is called a chemical equation.

For example, when carbon dioxide gas is passed through freshly prepared lime water, lime water turns milky due to formation of calcium carbonate. This reaction can be written as:



The chemical reaction between carbon dioxide and lime water can be written in the form of chemical equation as:



where

Substance	Symbol
Carbon dioxide	$\text{CO}_2$
Lime water	$\text{Ca(OH)}_2$
Calcium carbonate	$\text{CaCO}_3$
Water	$\text{H}_2\text{O}$

• In a chemical change new products are formed. The following may also accompany a chemical change:

1. Heat, light or any other radiation (ultraviolet) may be given off or absorbed.
2. Sound may be produced.
3. A change in smell may take place or a new smell may be given off.
4. A colour change may take place.
5. A gas may be formed.

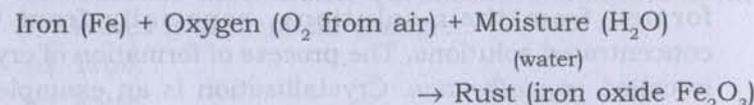
For example, burning of coal or wood is a chemical change which is accompanied with heat and often with light.

• **Characteristics of chemical change:**

- (i) A new product/products formed from reactants in a chemical change are different in chemical properties from the reactants.
- (ii) Most of the chemical changes are irreversible.
- (iii) The chemical changes always result in energy changes.

• **Rusting:** If a piece of iron left in the open for some time, it acquires a film of brownish substance. This substance is called *rust*. The process by which rust is formed on an iron object is called rusting. For rusting the presence of moisture (or water vapour) and oxygen are essential.

• The process of rusting can be represented by the following equation:



Rust of iron is chemically different from iron.

• **Methods to prevent Rusting:** Rusting of iron can be prevented if iron articles are not allowed to come in contact with oxygen or water or both. For this, the following methods can be applied :

- (i) We can apply a coat of paint or grease. These coats should be applied regularly to prevent rusting.
  - (ii) Deposit a layer of a metal such as chromium or zinc on iron.
- The high content of moisture (humidity) in air and higher contents of salts in water make the process of rust formation faster.

- Stainless steel, a product of iron is made by mixing iron with carbon and metals such as nickel, chromium and manganese. Stainless steel does not rust.
- **Galvanisation:** The process of depositing a layer of zinc on iron is known as *galvanisation*. The iron pipes are galvanised to prevent rusting.
- **Physical Properties:** Properties such as shape, size, colour and state of a substance are called *physical properties*.
- **Physical Change:** Change in which only physical properties of any substance change and no new substance is formed is called a *physical change*. A physical change is mostly reversible and does not form a new substance.
- **Characteristics of physical change:**
  - (i) The physical changes do not form a new substance or substances.
  - (ii) The physical change do not change the chemical properties of the substances (reactants) mixed for a physical change.  
For example, freezing of water into ice, stretching of rubber band or spring and attraction of iron filing by a magnet.
  - (iii) Physical changes are reversible.
- **Crystallisation:** Large crystals of pure substances can be formed from their solutions, especially from their concentrated solutions. The process of formation of crystals is called *crystallisation*. Crystallisation is an example of a physical change.
- **Protective shield:** There is *ozone layer* in our environment. This ozone layer absorbs ultraviolet radiations that are very harmful for us and other life form. Ozone acts as a natural shield against *ultraviolet radiations*.

### TEXTBOOK QUESTIONS SOLVED

**Q.1.** Classify the changes involved in the following processes as physical or chemical changes:

- (a) Photosynthesis
- (b) Dissolving sugar in water

- (c) Burning of coal
- (d) Melting of wax
- (e) Beating aluminium to make aluminium foil
- (f) Digestion of food

**Ans.** (a) Chemical change (b) Physical change  
(c) Chemical change (d) Physical change  
(e) Physical change (f) Chemical change

**Q.2.** State whether the following statements are true or false. In case a statement is false, write the corrected statement in your notebook.

- (a) Cutting a log of wood into pieces is a chemical change. (True/False)
- (b) Formation of manure from leaves is a physical change. (True/False)
- (c) Iron pipes coated with zinc do not get rusted easily. (True/False)
- (d) Iron and rust are the same substances. (True/False)
- (e) Condensation of steam is not a chemical change. (True/False)

**Ans.** (a) False

**Correct statement:** Cutting a log of wood into pieces is an irreversible physical change.

(b) False

**Correct statement:** Formation of manure from leaves is a chemical change.

(c) True

(d) False

**Correct statement:** Iron and rust are two different chemical substances.

(e) True

**Q.3.** Fill in the blanks in the following statements:

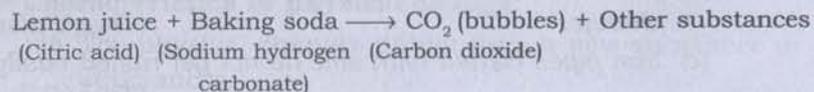
- (a) When carbon dioxide is passed through lime water, it turns milky due to the formation of \_\_\_\_\_.
- (b) The chemical name of baking soda is \_\_\_\_\_.
- (c) Two methods by which rusting of iron can be prevented are \_\_\_\_\_ and \_\_\_\_\_.
- (d) Changes in which only \_\_\_\_\_ properties of a substance change are called physical changes.

(e) Changes in which new substances are formed are called \_\_\_\_\_ changes.

- Ans.** (a) calcium carbonate  
 (b) sodium hydrogen carbonate  
 (c) painting or greasing, galvanisation  
 (d) physical  
 (e) chemical

**Q.4.** When baking soda is mixed with lemon juice, bubbles are formed with the evolution of a gas. What type of change is it? Explain.

**Ans.** The reaction between baking soda and lemon juice can be given as below:



It is a chemical change.

**Q.5.** When a candle burns, both physical and chemical changes take place. Identify these changes. Give another example of a familiar process in which both the chemical and physical changes take place.

**Ans.** When a candle burns, both physical and chemical changes occur:

- (i) Physical change: melting of wax, vapourisation of melted wax.  
 (ii) Chemical change: Burning of vapours of wax to give carbon dioxide, heat and light.

LPG is another example in which physical change occurs when LPG comes out of cylinder and is converted from liquid to gaseous state and a chemical change occurs when gas burns in air.

**Q.6.** How would you show that setting of a curd is a chemical change?

**Ans.** We can say that setting of curd is a chemical change because we can not get the original substance, i.e., milk back and a new substance is formed with different taste, smell and other chemical properties.

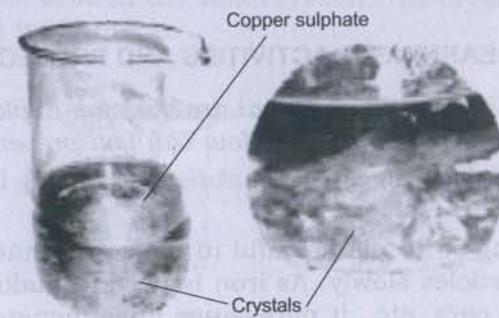
**Q.7.** Explain why burning of wood and cutting it into small pieces are considered as two different types of changes.

**Ans.** Burning of wood is a chemical change because in burning new substances are formed as

Wood + Oxygen  $\longrightarrow$  Charcoal + Carbon dioxide + Heat + Light  
 But cutting it into small pieces is physical change because no new substance is formed. We can only reduce the size of wood.

**Q.8.** Describe how crystals of copper sulphate are prepared.

**Ans.** Take a cupful of water in a beaker and add a few drops of dilute sulphuric acid. Heat the water. When it starts boiling, add copper sulphate powder slowly. Continue to add copper sulphate powder till no more powder can be dissolved. During this process continuously stir the solution. Filter the solution. Leave it for cooling. Look it after some time, you can see the crystals of copper sulphate.



**Fig. 6.1**

**Q.9.** Explain how painting of an iron gate prevents it from rusting?

**Ans.** It is known that for rusting the presence of oxygen and moisture is essential. Painting prevents the iron gate from coming in contact with oxygen and moisture.

**Q.10.** Explain why rusting of iron objects is faster in coastal areas than in deserts.

**Ans.** As content of moisture in the air in coastal areas is higher than in the air in deserts. So, the process of rusting is faster in coastal areas.

**Q.11.** The gas we use in the kitchen is called liquified petroleum gas (LPG). In the cylinder it exists as a liquid. When it comes out from the cylinder it becomes a gas (Change-A) then it burns (Change-B). The following statements pertain to these changes. Choose the correct one.

- (i) Process-A is a chemical change.
- (ii) Process-B is a chemical change.
- (iii) Both processes A and B are chemical changes.
- (iv) None of these processes is a chemical change.

**Ans.** (ii) Process-B is a chemical change.

**Q.12.** Anaerobic bacteria digest animal waste and produce biogas (Change-A). The biogas is then burnt as fuel (Change-B). The following statements pertain to these changes. Choose the correct one.

- (i) Process-A is a chemical change.
- (ii) Process-B is a chemical change.
- (iii) Both processes A and B are chemical changes.
- (iv) None of these processes is a chemical change.

**Ans.** (iii) Both processes A and B are chemical changes.

### EXTENDED LEARNING — ACTIVITIES AND PROJECTS

**Q.1.** Describe two changes that are harmful. Explain why you consider them harmful. How can you prevent them?

**Ans.** Harmful changes: (i) Rusting of iron (ii) Decaying of fruits.

Rusting of iron is harmful in the sense that it destroys iron articles slowly. As iron is used in making bridges, ships, cars, etc., it may cause huge monetary loss.

Similarly decaying of fruits causes health hazards.

**Prevention:** Rusting can be prevented by oiling, polishing and painting. Fruits can be preserved by keeping fruits at low temperature and by using some specific preservatives.

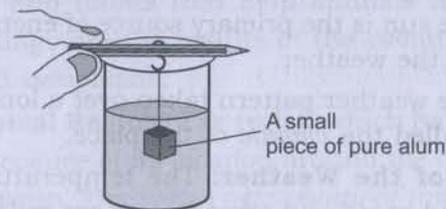
**Q.2.** Take three glass bottles with wide mouths. Label them A, B and C. Fill about half of bottle A with ordinary tap water. Fill bottle B with water which has been boiled for several minutes, to the same level as in A. In bottle C, take the same boiled water and of the same amount as in other bottles. In each bottle put a few similar iron nails so that they are completely under water. Add a

teaspoonful of cooking oil to the water in bottle C so that it forms a film on its surface. Put the bottles away for a few days. Take out nails from each bottle and observe them. Explain your observations.

**Ans.** In test tube A which contains ordinary water rusting takes place because in it iron nail is in direct contact of air and water. The nail in test tube B becomes dull while no rusting takes place in test tube C because it does not come in the contact of air but only water is there. By the above observations we conclude that both air and water are essential for rusting.

**Q.3.** Prepare crystals of alum.

**Ans. Preparation of crystals of alum:** Place a beaker half filled with water on a stand and heat it till it starts boiling. Mix some impure alum powder in boiled water. Continue the mixing of powder till the alum powder stops dissolving. Filter the hot solution into another beaker. Hang a small crystal of pure alum in this solution to obtain a big crystal. Allow the solution to cool slowly for 24 hours. We see a large crystal of alum is formed around the small crystal. The crystals can be removed by filtration.



**Fig. 6.2**

**Q.4.** Collect information about the types of fuels used for cooking in your area. Discuss with your teachers/parents/others which fuels are less polluting and why.

**Ans.** The following types of fuels are used in our area:

- (i) Solid fuels: Coal, dung cake, wood etc.
- (ii) Liquid fuel: Kerosene oil.
- (iii) Gaseous fuel: LPG.

We observe that the solid fuels produce more smoke and unburnt particles. So they are more polluting fuels. Liquid fuels are less polluting fuels. Gaseous fuels are clean fuels and do not produce any pollution.