

CHANGES AROUND US



Learning Objectives

After the completion of this lesson, students will be able to:

- ◆ define chemical reaction.
- ◆ differentiate chemical changes from physical changes.
- ◆ know about the factors which determine a chemical reaction.
- ◆ know about the importance and effects of chemical reactions.
- ◆ identify the chemical reactions in day to day life.
- ◆ observe the changes during a chemical reaction.



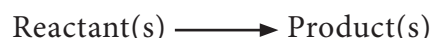
Introduction

Have you ever visited Qutub Minar in Delhi? There you can see a rust resistant iron-pillar. It has not rusted for more than 1500 years. But, not all things are unchanged like this. Many things we see in our life are changing. You could have noticed milk turning into curd. How it is happening? We see number of changes in our surrounding. Some of them are physical changes and some of them are chemical changes.

As you have studied earlier, changes like folding and unfolding a paper, drying wet clothes, bending of iron rod are some examples for physical changes. On the other hand, changes like burning of paper, digestion of food, turning of milk into curd and decaying of vegetables are some of the examples for chemical changes. In this lesson, you will study about chemical changes, factors determining chemical changes and the effects of chemical changes.

10.1 Chemical changes

A chemical change is a permanent and irreversible change which produces a new substance. Chemical changes are otherwise called as chemical reactions, because one or more substances (reactants) undergo a reaction to form one or more new substances (products).



Activity 1

Adithya wants to classify the following changes as physical or chemical. Can you help him?

1. Melting of ice
2. Ripening of fruits
3. Rusting of iron
4. Spoilage of food
5. Burning of wood
6. Bursting crackers
7. Burning of camphor

Physical Changes	Chemical Changes

10.1.1 Factors determining Chemical changes

Chemical changes will not occur at all conditions. For a chemical change to take place, certain specific conditions are required. Chemical changes can take place in the following conditions.

- Contact in physical states
- Solution of reactants
- Electricity
- Heat
- Light
- Catalyst



a. Contact in physical states

We experience many events in our daily life like burning of matchstick on rubbing and iron materials turning into reddish brown. Why and how these changes happen?

These changes are due to chemical reactions by contact in physical states. Combination of reactants in their naturally occurring states (solids, liquids, gases) is referred as contact in physical states.

- When dry wood comes into contact with fire, it burns with the help of oxygen to form carbon dioxide, which is given out as smoke.
- When a matchstick is rubbed on the sides of a matchbox, a chemical reaction takes place to form heat, light and smoke.
- When quick lime (calcium oxide) comes into contact with water, it forms slaked lime (calcium hydroxide).



Figure 10.1 Burning a match stick

More to know

The head of a matchstick contains potassium chlorate and antimony trisulphide. The sides of the matchbox contain red phosphorous.

From the above reactions, we can conclude that certain chemical reactions take place only when the reactants are brought in contact with each other in their physical states.

Activity 2

Take two test tubes and couple of rust free iron nails. In one test tube pour some water and put an iron nail. Keep the test tube opened for few days. Take another test tube and pour some water along with some coconut oil. Now, place the second iron nail. Leave the set up for a few days. Observe the changes and record them. Which iron nail gets rusted and why?

b. Solution of reactants

When milk is mixed with coffee decoction the colour of the milk and the decoction changes due to chemical reaction. Similarly, when we mix two substances (reactants) in solution form, a chemical reaction takes place between them to form new substances (products). For example, take small amount of solid silver nitrate and sodium chloride in a test tube. Do you observe any change? No, because the reactants in solid state have no reaction. Now, you dissolve the same reactants in water in a separate test tubes and mix both the solutions. What do you observe? Silver nitrate solution reacts with sodium chloride solution to form a white precipitate of silver chloride and sodium nitrate solution. From the above reaction, we infer that some chemical reactions proceed only in solution form not in solid form.

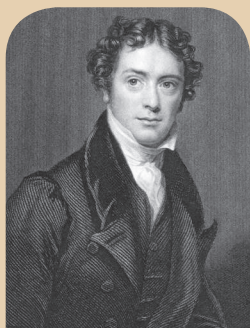
c. Electricity

Electricity is essential for our living. We use electricity for cooking, lighting, grinding, watching television etc. Do you know electricity can be used to carry out chemical reactions also? Many chemical reactions which take place with the help of electricity are industrially very important. As you know, water is made of hydrogen and oxygen molecules. When electricity is passed through water which contains small amounts of sulphuric acid, hydrogen and oxygen gases are liberated. Similarly, a concentrated solution of sodium chloride called brine is electrolysed to produce chlorine and hydrogen gases along with sodium hydroxide. This is an important reaction to produce chlorine industrially.

Thus, we can conclude that some chemical reactions proceed only by the passage of electricity. Hence, such reactions are called as **electrochemical reactions** or **electrolysis**.



The term electrolysis was introduced by Michael Faraday in the 19th century. The word electrolysis is a combination of two terms 'electron' and 'lysis'. Electron is related to electricity and lysis means decomposition.



d. Heat

Food is important for our survival and also for the survival of many other living beings. Have you ever closely watched your mother cooking food? She boils rice, cooks vegetables, and prepares gravy by heating them over stove. When enough heat is given some chemical reactions take place to convert the raw food (uncooked) items into cooked ones.

You can learn more about this by conducting a reaction in your laboratory.

More to Know

Chemical reactions accompanying evolution of heat are called exothermic reactions. Whereas chemical reactions which involve absorption of heat are called endothermic reactions.

Take a small amount of lead nitrate in a dry test tube and heat it gently over a flame. Observe the changes closely. You will hear cracking sound and an evolution of reddish brown coloured gas (nitrogen dioxide). In industries limestone rocks are heated to get quicklime (calcium oxide). Hence, some chemical reactions can be achieved by the supply of heat only. These reactions are called **thermochemical reactions** or **thermolysis**.



Limestone is the raw material for quicklime, slaked lime and cement.



e. Light

What will happen if there is no sunlight? All the living organisms will be affected and there will be no food for us to survive, is n't it? Sunlight is important not only for us but also for plants. As you know photosynthesis ('photo' means light and 'synthesis' means production) is a process in which light energy from the sun is used by the plants to prepare starch from carbon dioxide and water. The sunlight induces the chemical reaction between carbondioxide and water, which finally ends up in the production of starch. Thus, chemical reactions induced by light are called as photochemical reactions.



The ultraviolet rays from the sun break ozone (O_3) molecules in the stratosphere into molecular oxygen and atomic oxygen. This atomic oxygen again combines with molecular oxygen to form Ozone.

More to Know

Photochemistry is the branch of chemistry which deals with chemical reactions involving light.

f. Catalyst

Sometimes you are advised by the elders to drink a small amount of 'oma water' after a heavy meal. Do you know, why? This is because oma water makes digestion faster. Likewise, in industries some chemical substances are used to speed up chemical reactions. These substances are called catalysts. For example, metallic iron is used as a catalyst in the manufacture of ammonia using Haber's process. This ammonia is the basic material for the production of urea, an important fertilizer in agriculture. In vanaspathi ghee (dalda) preparation, finely divided nickel is used as a catalyst. Thus, speed of certain reactions is influenced by the catalysts and such reactions are called **catalytic reactions**.



Figure 10.2 Urea applied on paddy crops

DO YOU KNOW?

Enzymes and yeasts are called biocatalysts.



Activity 3

Buy some fresh yeast from a grocery shop. Prepare a paste of wheat flour with water in a vessel. Add some yeast and leave the vessel closed for few hours under sunlight. Observe the changes closely. What do you infer?

10.2 Effects of Chemical changes

We know that every chemical reaction requires a specific condition to occur. When chemical reactions take place there will be production of heat, light, sound, pressure etc. and also many other effects.



10.2.1 Biological Effects

a. Spoilage of food and vegetables

Food spoilage may be defined as any change that causes food unfit for human consumption. The chemical reactions catalysed by the enzymes result in the degradation of food quality in the form of development of bad tastes and odour, deterioration and loss of nutrients.

Examples

- Rotten eggs develop a bad smell due to formation of hydrogen sulphide gas.
- Decaying of vegetables and fruits due to microbes.

b. Rancidity of fishes and meat

Fishes and meat containing high levels of poly unsaturated fatty acids undergo oxidation. It causes bad odour when exposed to air or light. This process is called rancidity.



Fig 10.3 Rancid fish on the shore

c. Apples and fruits turn brown when cut

Apples and some fruits turn brown due to chemical reaction with oxygen in air. This chemical reaction is called browning. The cells of apples, fruits and other vegetables contain an enzyme called polyphenol oxidase or tyrosinase. When in contact with oxygen it catalyses a biochemical reaction in which the phenolic compounds present in plants become a brown pigment known as melanins.



Fig 10.4 Browning of apple

10.2.2 Environmental Effects

a. Pollution

Our environment provides air to breathe, water to drink and the land to produce food. Due to industrial processes and increasing number of automobiles, our environment is badly affected now-a-days. So, there is an unwanted change in the physical, chemical and biological properties of the environment. This is termed as pollution. The substances which cause these changes are called pollutants. Generally there are three types of pollutions viz

air, water and land pollution. Due to increasing human activities, lot of chemical substances are produced artificially which harm all the living and non living things. The types of chemical substances and their effects are given in table below (Table 10.1).



Fig 10.5 Smoke from industries

b. Rusting

What happens to the steel benches and tables during rainy season? They turn into reddish brown. Isn't it? Do you know why? This is because when the iron metal come into contact with water and oxygen, it undergoes a chemical reaction called rusting.



Fig 10.6 Rusted iron barrels

Table 10.1 The types of chemical substances and their effects.

Type of Pollution	Chemical substances	Effects
Air pollution	Carbon dioxide, Carbon monoxide, Oxides of sulphur, Oxides of nitrogen, Chlorofluorocarbons, Methane etc	Acid rain, global warming, respiratory problems etc.
Water pollution	Waste water containing chemical substances Eg. Dyeing industries, Detergents, Oil spillage etc	Decrease in the quality of water, skin diseases etc
Land pollution	Fertilizers like urea, various pesticides, herbicides, solid wastes, plastics etc.	Spoilage of land, cancer, respiratory diseases etc.



c. Tarnishing of metal articles

Shiny metal surfaces and other articles lose their shining appearance due to chemical reactions on the surface. For example, silver articles become black when exposed to atmospheric air. Similarly, brass vessels which contain copper as one of the constituents develop a greenish layer when exposed to air for a long time. This is due to a chemical reaction between copper and moist air to form basic copper carbonate and copper hydroxide.



Fig 10.7 Damaged iron sheets

10.2.3 Production of Heat, Light, Sound and Pressure

a. Production of Heat

Have you ever rubbed your palms in winter season to keep yourself warm? Have you noticed the heat produced when you use cycle pump? Similarly some chemical reactions produce heat energy also. Such reactions are called **exothermic reactions**. For example, when you add water to quicklime (calcium oxide), lot of heat is released to produce slaked lime (calcium hydroxide).



Activity 4

Take two clean test tubes. Take sulphuric acid in one test tube and a solution of sodium hydroxide in another tube. Slowly and carefully add sodium hydroxide solution to sulphuric acid. Touch the sides of test tube. What do you feel? What do you infer?

b. Production of Light

When you ignite a candle, you get light as a result of burning. Some chemical reactions

produce light. For example, when a piece of magnesium ribbon is burnt in a flame, bright light is produced with heat. Even the fireworks used during festival times produce different coloured lights which are all due to chemical reactions.

c. Production of Sound

When we speak sound is produced. When you hit metals like iron, copper etc., a sound is heard. Some chemical reactions do produce sound when they take place. What happens when you fire crackers during Deepavali? The chemical substances present in the crackers undergo some chemical reactions to produce sound.



Activity 5

Take a clean test tube. Add some dilute hydrochloric acid. Drop a piece of magnesium or a piece of zinc metal. What do you see? Now bring a burning match stick near the mouth of the test tube. What do you hear? What do you infer?

You can hear a pop sound. When metals like zinc or magnesium reacts with dilute acids hydrogen gas is produced. Since hydrogen gas is highly flammable it reacts with oxygen present in air to produce pop sound.

d. Production of Pressure

When you compress hard a balloon having full of air, it will burst. This is due to sudden release of air from the balloon as a result of increased pressure on compression. Some chemical reactions produce gases which increases the pressure when the reaction takes place in a closed container. If the pressure level goes beyond the limit, we get the explosion. Explosives and fireworks burst because of this reason. When they are ignited they explode due to pressure generated by gases from the chemical reactions. Thus, you hear a huge sound.

Points to Remember

- A chemical change is a permanent, irreversible change and it produces a new substance.
- In a chemical reaction reactants produce products.
- The factors determining a chemical reaction are: contact in physical states, solution of reactants, electricity, heat, light and catalyst.
- Rusting is a chemical reaction in which iron objects form hydrated ferric oxide in the presence of oxygen and water.
- Electrolysis is a process in which electricity is used to carry out chemical reactions.
- Photolysis is a process in which light is used to carry out chemical reactions.
- Thermolysis is a process in which heat is used to bring about chemical reactions.
- Chemical substance which is used to speed up a chemical reaction is called as catalyst and the process is called catalysis.
- Chemical reactions cause spoilage of food, vegetables and fruits, acid rain, green house effect and damage to materials.
- Global warming is a dangerous condition in which earth's average temperature rises alarmingly due to various human activities.
- Rancidity is a condition in which the food items develop bad odour due to chemical reactions by microbes.

A-Z GLOSSARY

Biochemical reaction	Chemical reaction involving biological substances.
Catalyst	Substance which alters the speed of a chemical reaction.
Combustion	Burning with oxygen in air.
Enzyme	Catalyzing substance in a biological system.
Fertilizer	Artificial manure/chemically synthesized manure.
Fossil fuel	Fuels like coal and petrol obtained from plants and animals once lived and buried beneath the earth.
Global warming	Rise in earth's average temperature.
Ozone	Oxygen molecule having three oxygen atoms.
Pigments	Colour giving substance/colourants.
Poly unsaturated fatty acids	A long chain carbon based acids present in fats.
Precipitate	A new insoluble substance formed in a chemical reaction.
Product	Substance formed in a chemical reaction.
Reactant	Substance reacting in a chemical reaction.
Spoilage of food	Deterioration of food items.
Yeast	A kind of single celled fungus.



TEXTBOOK EXERCISE



I. Choose the best answer.

- Burning of paper is a _____ change.
a) physical b) chemical
c) physical and chemical d) neutral
- Burning of matchstick is an example for chemical reaction caused by _____.
a) contact in physical states
b) electricity
c) light d) catalyst
- _____ undergoes rusting.
a) Tin b) Sodium
c) Copper d) Iron
- The pigment responsible for browning of apples is _____.
a) hydrated iron (II) oxide b) melanin
c) starch d) ozone
- Brine is a concentrated solution of _____.
a) sodium sulphate b) sodium chloride
c) calcium chloride d) sodium bromide
- Limestone contains _____ mainly.
a) calcium chloride b) calcium carbonate
c) calcium nitrate d) calcium sulphate
- Which of the following factor induces electrolysis?
a) Heat b) Light
c) Electricity d) Catalysis
- In Haber's process of producing ammonia _____ is used as a catalyst.
a) nitrogen b) hydrogen
c) iron d) nickel

- Dissolved gases like sulphur dioxide and nitrogen oxides in rain water causes _____.
a) acid rain b) base rain
c) heavy rain d) neutral rain
- _____ is/are responsible for global warming.
a) Carbon dioxide
b) Methane
c) Chlorofluorocarbons
d) Carbon dioxide, Methane, Chlorofluorocarbons

II. Fill in the blanks.

- Photosynthesis is a chemical reaction that takes place in the presence of _____.
- Iron objects undergo rusting when exposed to _____ and _____.
- _____ is the basic material to manufacture urea.
- Electrolysis of brine solution gives _____ gases.
- _____ is a chemical substance which alters the speed of a chemical reaction.
- _____ is the enzyme responsible for browning of vegetables and fruits.

III. Say true or false. If false, correct the statement.

- A chemical reaction is a temporary reaction.
- Decomposition of lead nitrate is an example for a chemical reaction caused by light.
- Formation of slaked lime from quicklime is an endothermic reaction.

- CFC is a pollutant.
- Light energy may come out due to chemical reactions.

IV. Match the following.

a.

Rusting	Photosynthesis
Electrolysis	Haber's process
Thermolysis	Iron
Food	Brine
Catalysis	Decomposition of limestone

b.

Spoilage	Decomposition
Ozone	Biocatalyst
Tarnishing	Oxygen
Yeast	Chemical reaction
Calcium oxide	Food

V. Answer briefly.

- Define a chemical reaction.
- Mention the various conditions required for a chemical reaction to occur.
- Define catalysis.
- What happens when an iron nail is placed in copper sulphate solution?
- What is pollution?
- What is tarnishing? Give an example.
- What happens to the brine during electrolysis?
- On heating, calcium carbonate gives calcium oxide and oxygen. Is it an exothermic reaction or an endothermic reaction?
- What is the role of a catalyst in a chemical reaction?
- Why photosynthesis is a chemical reaction?

VI. Answer in detail.

- Explain the environmental effects of chemical reactions?
- Explain how food items are spoiled by chemical reactions?

- Explain any three conditions that is required for a chemical reaction to take place. Give example.

VII. Higher order thinking questions.

- Explain the role of yeast in making cakes and buns in a bakery?
- Burning of fossil fuels is responsible for global warming. Justify the statement.
- Discuss how acid rain occurs due to emission of smoke from vehicles and industries?
- Is rusting good for iron materials? Explain.
- Do all the fruits and vegetables undergo browning? Explain.
- Classify the following day to day activities based on chemical reactions by physical contact, solutions of reactants, heat, light, electricity and catalyst.
 - Burning of crackers during festivals
 - Fading of coloured clothes on drying under sunlight.
 - Cooking of eggs.
 - Charging of batteries.

VIII. Value Based Questions.

- Kumar is going to build a house. To purchase the iron rods required for construction, he visited an iron and steel shop nearby. The seller showed him some iron rods which are fresh and good. He also showed him little older iron rods which are brownish in appearance. The price of fresh rods is more than the older ones. The seller also gave some offer to older ones. Kumar's friend Ramesh advised him not to buy the cheaper rods.
 - Is Ramesh right in his suggestion?
 - Could you explain the reason for his suggestion?
 - What are the values shown by Ramesh?

2. Palanikumar is a Lawyer. He lives in a luxurious flat. Due to high rent, he wants to shift his residence to a place where he has a chemical industry nearby. There the rent is very cheap and the area is less populated also. His son Rajasekar, studying VIII, does not like this and likes to go to some other place.

- Is Rajasekar right in his attitude?
- Why did he refuse to go there?
- What are the values shown by Rajasekar?



REFERENCE BOOKS

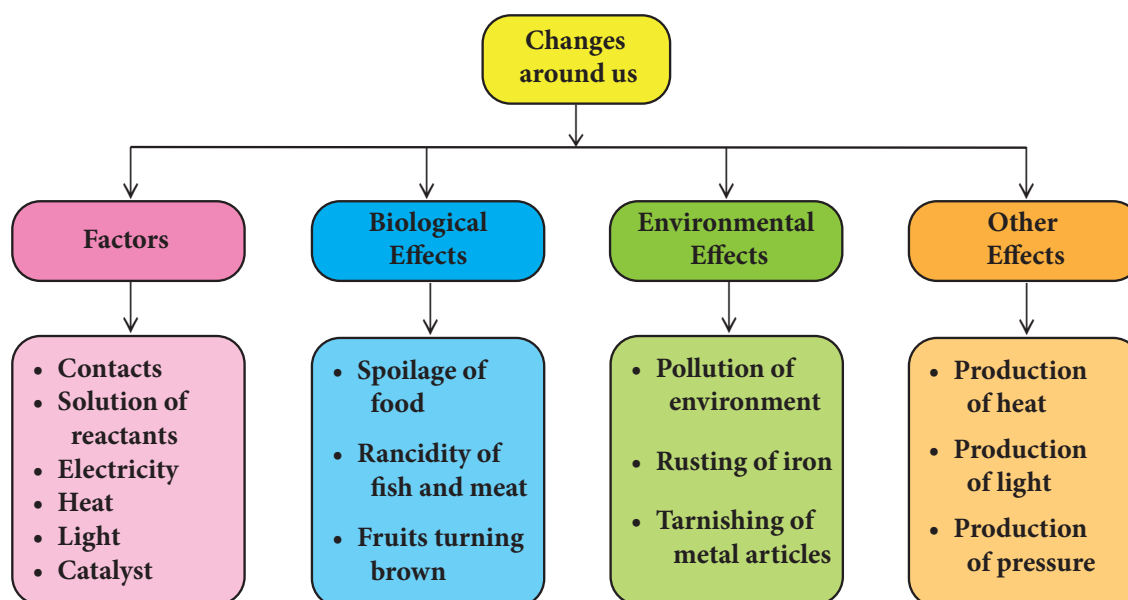
- Basic chemistry by Karen C. Timberlake and William Timberlake
- Pradeep's objective chemistry vol-1 by S.N. Dhawan, S.C. Kheterpal, J.R. Mehta



INTERNET RESOURCES

- <https://www.livescience.com>
- www.khanacademy.org/science/chemistry/chemical-reactions

Concept Map



ICT CORNER

Changes around us

This activity enables the students to understand about the Causes and affects of climate change

Steps

- Open the Browser and type the URL link given below (or) Scan the QR Code.
- Select the topic "Causes & affects of climate change"
- Click the title "Causes & affects of climate change"
- To know the various affects of climatic changes



Web link: <https://video.nationalgeographic.com/video/101-videos/0000015d-3cb1-d1cb>

(or) scan the QR Code