3.6 Indicators of a chemical change

Take some broken pieces of egg shell in a test tube and add lemon juice to it. You could see bubbles of carbon-di-oxide evolving in the test tube. This is because of the chemical change between the two. Hence, we can say that evolution of bubbles serve as an indicator that of a chemical change.

When water is added to quicklime (calcium oxide) there will be evolution of lot of heat along with the formation of slaked lime (calcium hydroxide). This is a chemical change and it is indicated by the evolution of heat when the reaction sets in between quicklime and water.

Every day we cook food stuffs and clean the empty cooking utensils. Suppose when we leave the cooked utensils with some cooked food and leave them without washing for a day, we could sense a foul-smell coming from the vessels the next day. This is because the food stuff had become rotten and produces a foul-smell. Here spoilage of food is a chemical change and it is indicated by the foul smell. So, change of odour is also an indicator of a chemical change.

When an iron nail is kept in water for a few days and taken out, the nail will become reddish brown in colour indicating that it has rusted. We know that rusting is a chemical change and it is indicated by a change in colour of the iron nail.

We know that hot milk curdles to form white lumps of curd when mixed with lemon juice. A lump of curd is the precipitate that is obtained by the chemical reaction between hot milk and lemon juice. So, formation of precipitate is also an indication of a chemical change.

To conclude, there can be evolution of bubbles, evolution of heat, change of odour, change in colour or formation of a precipitate that serve as indicators for us to understand that a chemical change had taken place.

3.7 Exothermic and Endothermic chemical changes

B9L8I5

Just as the physical change, Chemical reaction will be either endothermic or exothermic.

ACTIVITY 9

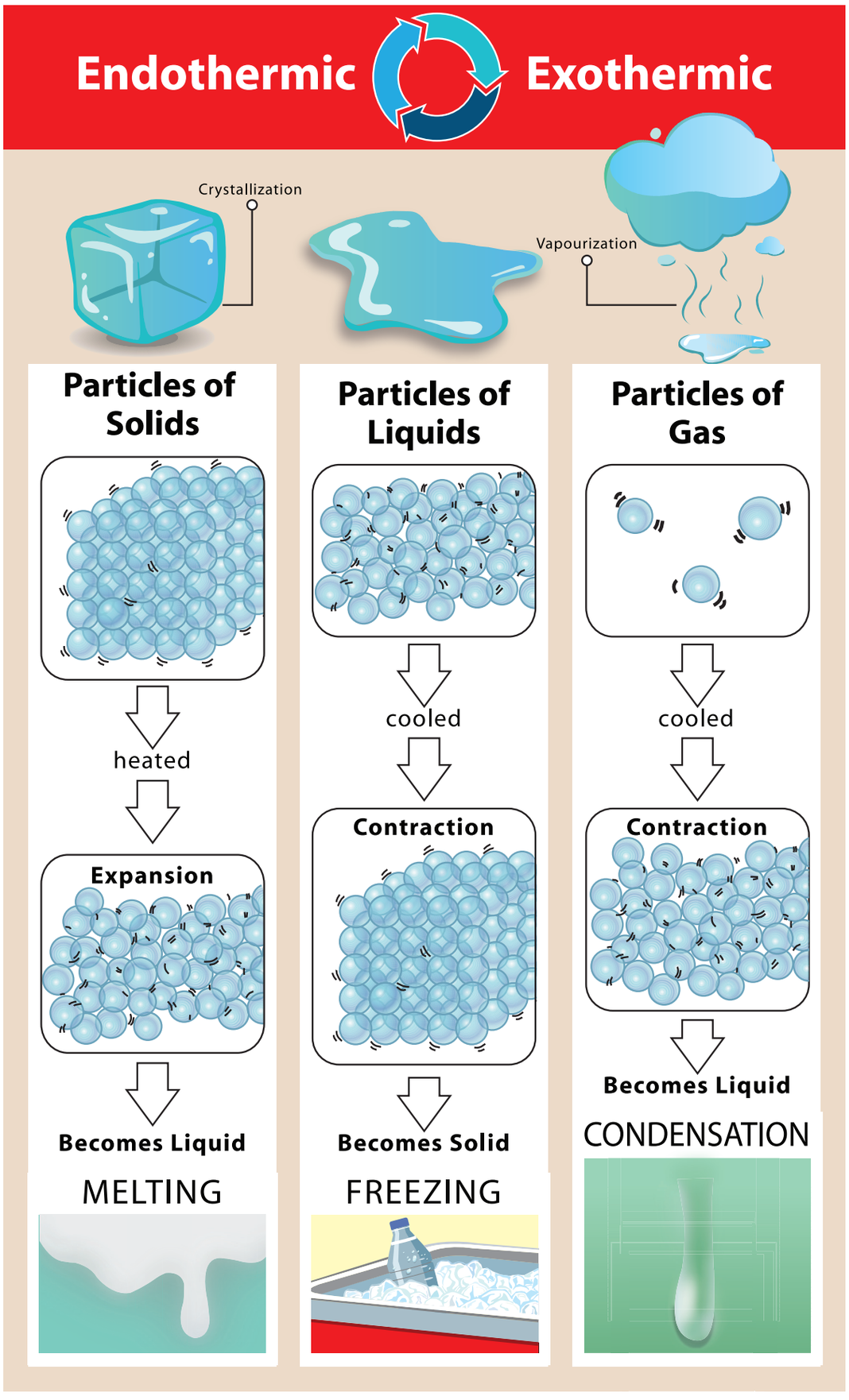
Ask a student to stretch both hands, put a pinch of soap powder in one hand and a pinch of glucose in the other hand. Add a few drops of water to soap powder and ask how the student feels upon adding water. Now add a few drops of water to the glucose at the other hand. Now ask the student how he /she feels on adding water, What is the feeling when water is added to glucose?

.....

What is the difference when water is added to soap powder and when water is added to glucose?

.....

In this activity, the student reported that he / she felt the warmness in the palm when water is added to soap powder. Right! We saw that the burning of magnesium ribbon gives out heat and light. Similarly, burning of wood also releases heat and light. Such changes in which heat is released are known as exothermic changes.

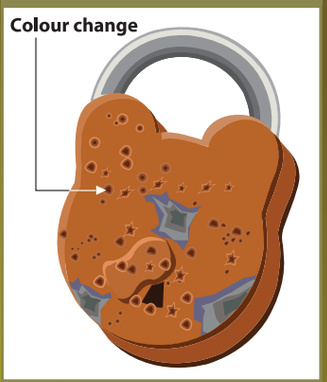


PERIODIC CHANGE

NON-PERIODIC CHANGE

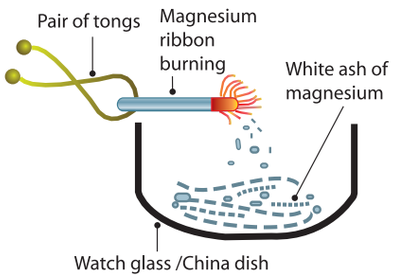
MIXING EGG SHELL OR BAKING SODA WITH LEMON JUICE

RUSTING OF IRON

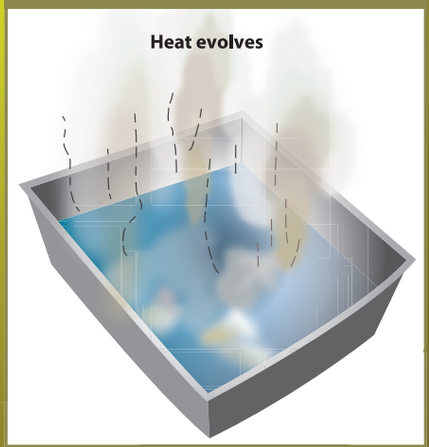


BURNING OF MAGNESIUM RIBBON

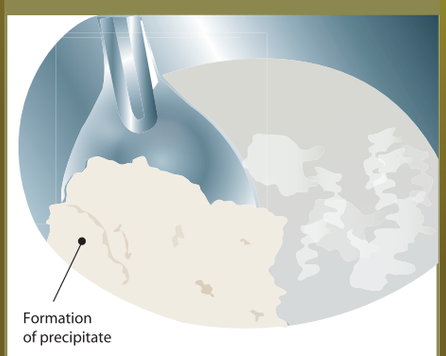
Formation of new product:
Magnesium oxide



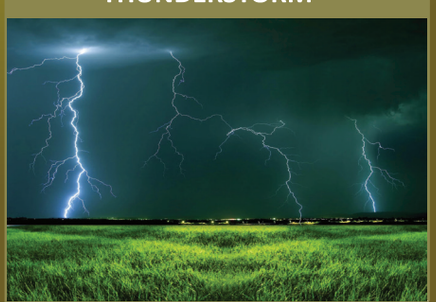
MIXING QUICK LIME WITH WATER



CURDLING OF MILK



THUNDERSTORM



There are some changes in which heat is absorbed. For example, water absorbs heat when it evaporates to form water vapours. Similarly ice absorbs heat when it melts to form water. Such changes in which heat is absorbed are known as endothermic changes. Dissolution of glucose in water is also an endothermic change.

3.8 Periodic and non-periodic change

Depending on whether or not a change repeats itself after a definite period of time, it can be classified as periodic change or a non-periodic change.

Periodic changes

Changes that repeat themselves after a definite interval of time are called **periodic changes.**

Rotation and Revolution of earth, beating of the heart, clock striking every hour, motion of the seconds-hand / minute-hand / hour-hand of a clock are some examples of periodic changes.

Every year we observe that seasons changes. We go from rains to winter and winter to summer and so on.

❖ What types of clothes are worn in winter?

❖ What are the clothes that we wear in summer? ----------

If the winter season changes into summer, we observe change in the texture type of clothes we wear. We wear woolen clothes in winter and cotton clothes in summer. Similarly, we observe that the winter season is cool and summer season is hot. In winter, duration of night is longer than in summer. We take cold drinks in summer but prefer hot tea, coffee or milk in winter. These changes that we observe show the change of seasons.

The seasons and changes in weather occur because earth rotates on its fixed axis. Changing seasons are almost periodic in nature.

Non-periodic changes

Changes that do not repeat themselves after a definite interval of time and occur randomly are called **non-periodic changes**. Eruption of a volcano, occurrence of an earthquake, a streak of lighting flash across the sky during a thunderstorm, running of a batsman between the wickets, movement of legs while dancing are a few examples of non-periodic changes.

POINTS TO REMEMBER

- ❖ Particle arrangement within the state of matter gets disturbed upon heating. The disturbance is seen either as expansion or contraction.
- ❖ A process in which liquid changes into vapour on heating is called evaporation.
- ❖ A process in which solid changes into liquid on heating is called melting or fusion.
- ❖ A process in which gas changes into a liquid is called condensation.
- ❖ A process in which liquid changes into solid is called freezing.
- ❖ Physical changes are the changes in which only physical properties of a substance undergo a change and there is no change in its chemical composition.
- ❖ Solid substances are usually purified by the process of crystallization.
- ❖ Evaporation is the technique used to separate dissolved solids from a solid-liquid mixture.
- ❖ Certain solid substances like camphor, naphthalene get converted into gas directly without becoming liquid upon heating by sublimation.

- ❖ Changes that occur with the formation of new substance with different chemical composition or transformation of a substance into another substance with the evolution or absorption of heat or light energy are termed as chemical changes.
- ❖ Changes that repeat themselves after a definite interval of time are called periodic changes.
- ❖ Changes that do not repeat themselves after a definite interval of time and occur randomly are called non-periodic changes.
- ❖ Changes in which heat is absorbed are known as endothermic changes.
- ❖ Changes in which heat is released are known as exothermic changes.

Evaluation

I. Choose the best answer

1. When a woolen yarn is knitted to get a sweater, the change can be classified as _____ .
   a. physical change b. chemical change
   c.endothermic change
   d. exothermic change
2. _____ of the following are endothermic changes.
   a. Condensation and melting
   b. Condensation and freezing
   c. Evaporation and melting
   d. Evaporation and freezing
3. The chemical change is _____ .
   a. water to clouds
   b. growth of a tree
   c. cow dung to bio-gas.
   d. ice-cream to molten ice-cream.
4. _____is an example of a periodic change.
   a. Earthquake.
   b. Formation of rainbow in sky
   c. Occurrence of tides in seas.
   d. Showering of rain
5. _____ is not a chemical change.
   a. Dissolution of ammonia in water
   b. Dissolution of carbon-di-oxide in water
   c. Dissolution of oxygen in water
   d. Melting of polar ice caps

II. Fill in the blanks

1. Filling up a balloon with hot air is a _____ change.
2. Stretching gold coin into a ring is a _____ change.
3. Opening a gas cylinder knob converts _____ fuel into _____ fuel. This is an example of _____ change.
4. Spoiling of food is a _____ change.
5. Respiration is a _____ change.

III. True or False. If false, give the correct answer.

1. Cutting of cloth is an example of a periodic change.
2. Taking a glass of water and freezing it by placing it in the freezer is a chemical change.
3. A bean plant collecting sunlight and turning it into bean seeds is an example of physical and non-periodic change.
4. If the chemical properties of a substance remain unchanged and the appearance or shape of a substance changes it is called a periodic change.
5. Tarnishing of silver is an example of endothermic change.

IV. Match the following

A	B	C
1. Melting	Change of state from liquid to solid	Ticking of clock
2. Condensation	Change of state from liquid to gas	Formation of ice cube
3. Evaporation	Change of state from solid to liquid	Collecting flowers
4. Freezing	Change of state from gas to liquid	Ice cube to water
5. Periodic change	Occurs at irregular time intervals	Water to steam
6. Non-periodic change	Occurs at regular time intervals	Steam to water drops

V. Classify the following changes as physical and chemical changes

A rough piece of wood is sanded and polished resulting in change in texture, Rusting of a iron nail, Painting the grill, Bending a paper clip, Pounding silver into thin plate, Rolling the chappathi dough into thin wire, Occurrence of day and night, eruption of volcano, burning of matchstick, dosa from the batter, blinking of eyelids, occurrence of a thunderstorm, rotation of the earth, formation of eclipses.

Physical changes	Chemical changes

VI. Analogy

1. Physical Change: Boiling::Chemical Change: _____.
2. Wood to saw dust:_____ :: Wood to Ash: Chemical change
3. Forest fire: _____ change::Change in period in a school: periodic change

VII. Very short answer type question

1. State two examples of periodic changes.
2. Mention any two exothermic reactions.
3. Cold milk is heated and it becomes hot. Which type of change it is?
4. What type of change is artificial ripening of fruit?
5. What type of change is colouring of a paper?
6. Growing of nails is a periodic change. Why?
7. What type of energy changes is associated when ice melts?

VIII. Short answer type question

1. Distinguish physical and chemical changes.
2. How can a change occur in a substance?
3. Can you suggest a method to collect water from sea water?
4. Is solar eclipse a periodic change? Give your reason.
5. What is the difference between dissolution of sugar and burning of sugar?

IX. Long answer type question

1. Explain the following statement: Digestion is a chemical change.
2. How the iron blade is fixed into a wooden handle in tools used to dig the soil?

X. Higher order Thinking questions

1. Peeled and unpeeled banana does not look the same. Does that mean peeling banana is a chemical change?
2. A very hot glass on putting in cold water cracks. What does this change indicate?
3. Boiling of water is a physical change; but boiling of egg is a chemical change. Why?

XI. Assertion – Reason type question

1. Assertion: The explosion of fire cracker is a physical change.

Reason: A physical change is a reversible change.

a. Both A and R are true and R is the correct explanation of A.

b. Both A and R are true but R is not the correct explanation of A.

c. A is true but R is false.

d. A is false but R is true.

2. Assertion: The process of conversion of liquid water to its vapours by heating the liquid is called boiling.

Reason: The process of conversion of water vapours to liquid by cooling the vapours is called condensation.

a. Both A and R are true and R is the correct explanation of A.

b. Both A and R are true but R is not the correct explanation of A.

c. A is true but R is false.

d. A is false but R is true.

3. Assertion: Burning of wood log to charcoal is a physical change.

Reason: The products formed of burning a piece of wood can be easily converted back to wood log.

a. Both A and R are true and R is the correct explanation of A.

b. Both A and R are true but R is not the correct explanation of A.

c. A is true but R is false.

d. A is false but R is true.

4. Assertion: The formation of iron oxide from iron is a chemical change.

Reason: For the rust to form from iron, it must be exposed to air and water.

a. Both A and R are true and R is the correct explanation of A.

b. Both A and R are true but R is not the correct explanation of A.

c. A is true but R is false.

d. A is false but R is true.

5. Assertion: A drop of petrol when touched with finger gives a chill feeling.

Reason: The above phenomenon is an endothermic one.

a. Both A and R are true and R is the correct explanation of A.

b. Both A and R are true but R is not the correct explanation of A.

c.A is true but R is false.

d. A is false but R is true.

XII. Picture based question

1. Observe the picture and list down the changes that are accompanied in the picture.

a) ……..

b) ……

c) ……..

2. Observe the picture containing a kettle and note that it has salt water in it and answer the following questions:

a) What is name of the process that is done to the kettle?

b) What will happen to the content of the kettle?

c) What kind of change is occurring on the cold surface of the metal plate?

d) What can you say about the quality of water that is obtained in the beaker?

UNIT 4

MATTER

Learning Objectives

KWBDE1

After completing this lesson you will be able to

- Know about the types of matter.
- Know the symbols of various elements.
- Classify elements into metals,non-metals and metalloids
- Compare the properties of metals and non metals.
- Acquire knowledge about compounds of solids, liquids and gases state.
- Know about the uses of compounds in daily life.

INTRODUCTION

a)

b)

c)

Figure 4.1 a) Ice, b)water, c) Steam

In the universe all manifestations, phenomena and evolution of life are caused by matter and energy. The various objects which exist around us are made of some kind of matter. We perceive some of these objects through our senses like sight, touch, hearing, taste and smelling. A glass tumbler can be seen, agarbatti burning can be recognized by its smell whereas wind blowing can be felt. All kinds of matter possess mass and occupy space, of course some are heavy and others are light. Thus, matter can be defined as anything, which occupies space or volume and mass and can be perceived by our senses.

As we know already matter exists in

Solids: Substances like wood, stone, sand, iron etc.

Liquids: Substances like water, milk, fruit juice, etc

Gases: Substances like oxygen, nitrogen, carbon dioxide, steam, etc.,

How the matter is composed?

Matter in any physical state is composed of smaller particles such as atom, molecules or

ions. Molecules are also made up of atoms of same or different kinds. Hence, atoms are the building blocks of matter.

1. **Atom:** An atom is the smallest particle of an element, which exhibits all the properties of that element. It may or may not exist independently but takes part in every chemical reaction. We have learned about the basics of atoms in Class VII, atomic structure chapter.
2. **Molecules**: Atoms of the same element or different elements combine to form a molecule. A molecule is the smallest particle of a pure substance (element or compound), which can exist independently and retain the physical and chemical properties of the substance.
3. **Ions :** Atoms or group of atoms having a charge (positive or negative) are called ions.

4.1 Why symbols?

A symbol is an image, object, etc., that stands for some meaning. For instance, a dove is a symbol of peace. Similarly, we denote mathematical operations by symbols. For example (+) denotes addition; (–) denotes subtraction, etc. In the same way in chemistry each element is denoted by a symbol. Writing out the name of an element every time would become too troublesome. So, the name of an element is represented by shortened form called as symbol.

4.1.1 Symbol of elements

Let us learn the brief history of symbols of elements.

Greek symbols

The symbols in form of the geometrical shapes were those used by the ancient Greeks to represent the four basic elements around us such as earth, air, fire and water.

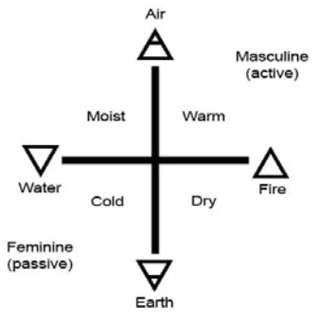


Figure 4.2 Greek symbols

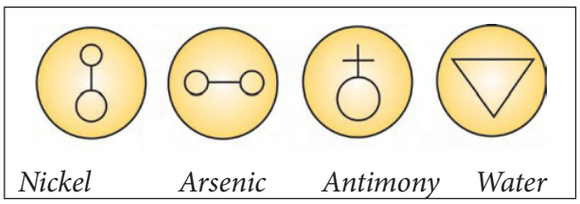
Alchemist symbol

In the days of alchemists, the different materials that they used were represented by the above-mentioned symbols while they try to change less valuable metal into gold. The process was called **alchemy** and the men who did this work were known as **alchemists**.

Dalton symbols

In 1808, John Dalton, English scientist tried to name the various elements based on these pictorial symbols. These symbols are difficult to draw and hence they are not used. It is only of historical importance.

Pictorial symbols



Daltons 1808AD(CE) symbols and formulae.

Hydrogen	Soda	Ammonia
Nitrogen	Pot Ash	Olefiant
Carbon	Oxygen	Carbonic Oxide
Sulphur	Copper	Carbonic Acid
Phosphorus	Lead	Sulphuric Acid
Alumina	Water	

Figure 4.3 Dalton Symbols

Berzelius symbols

In 1813, Jon Jakob Berzelius devised a system using letters of alphabet rather than signs.,. The modified version of Berzelius system follows under the heading 'System for Determining Symbols of the Elements'

Present System for Determining Symbols of the Elements

1. The symbols of the most common elements, mainly non-metals, use the first letter of their English name.

Element	Symbol	Element	Symbol
Boron	B	Oxygen	O
Carbon	C	Phosphorus	P
Fluorine	F	Sulphur	S
Hydrogen	H	Vanadium	V
Iodine	I	Uranium	U
Nitrogen	N	Yttrium	Y

2. If the name of the element has the same initial letter as another element, then symbol uses the first and second letters of their Element name. First letter in upper case and the second letter is in lower case.

Element	Symbol	Element	Symbol
Aluminium	Al	Gallium	Ga
Barium	Ba	Helium	He
Beryllium	Be	Lithium	Li
Bismuth	Bi	Neon	Ne
Bromine	Br	Silicon	Si
Cobalt	Co	Argon	Ar

3. If the first two letters of the names of elements are the same, then the symbol consists of first letter and second or third letter of English name that they do not have in common.

Element	Symbol	Element	Symbol
Argon	Ar	Calcium	Ca
Arsenic	As	Cadmium	Cd
Chlorine	Cl	Magnesium	Mg
Chromium	Cr	Manganese	Mn
Bromine	Br	Silicon	Si
Cobalt	Co		

4. Some symbols are used on the basis of their old names or Latin name of an element. There are eleven elements.

Name of element	Latin Name	Symbol
Sodium	Natrium	Na
Potassium	Kalium	K
Iron	Ferrum	Fe
Copper	Cupurum	Cu
Silver	Argentum	Ag
Gold	Aurum	Au
Mercury	Hydrargyrum	Hg
Lead	Plumbum	Pb
Tin	Stannum	Sn
Antimony	Stibium	Sb
Tungsten	Wolfram	W

5. Some elements are named using name of country/scientist/colour/mythological character/planet.

Name	Symbol	Name Derived from
Americium	Am	**Am**erica (country)
Europium	Eu	**Eu**rope (country)
Nobelium	No	Alfred **No**bel (scientist)
Iodine	I	Violet (colour, Greek)
Mercury	Hg	God Mercury (mythologic character)
Plutonium	Pu	Pluto (planet)
Neptunium	Np	Neptune (Planet)
Uranium	U	Uranus (planet)

Do you know how to write a symbol for a given element?

While writing a symbol for an element, we should adhere to the following method.

1. If the element has a single English letter as a symbol, it should be written in capital letter.
2. For elements having two letter symbols, the first letter should be in capital followed by small letter

What is the significance of the symbol of an element?

Symbol of an element signifies

- Name of the element
- One atom of the element For example,

- The symbol O stands for the element of Oxygen
- One atom of oxygen

Activity 1

Teacher: Dear students, let us play a memory game. This is an interesting game, which helps you to remember the symbols and their names. Make cards as instructed and then form a small group with your class mates to play.

INSTRUCTIONS:
Prepare 15 cards with the name of elements written on them and 15 cards with their corresponding symbols. Here is a list of names of elements (you have the freedom to choose the name of the elements)

Hydrogen	Calcium	Arsenic
Sodium	Mercury	Oxygen
Argon	Chlorine	Gold
Magnesium	Copper	Helium
Chromium	Iron	Manganese

How to play?

1. Shuffle the 30 cards and place the cards face down on the table.
2. Start the game. Each player will get a chance of taking 2 cards at a time to see. If a player does not get the correct pair, then he/she should keep the cards at the original position. If the name and symbol of the cards match correctly, then he/she can show to all the players and can keep the correct pair of cards with him/her. If correct pairs are shown, players will get another chance until the player makes wrong match. Game will continue till all the cards are taken up. The winner is the one having maximum number of cards.

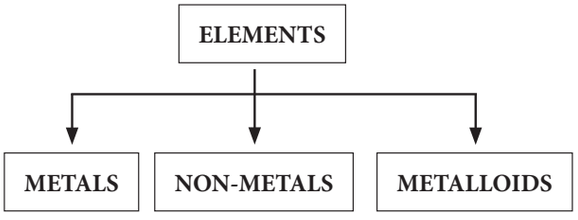
4.2 METALS AND NON-METALS

The progress of man towards civilization is linked with the discovery of several metals and non-metals. Even today, the index of prosperity of a country depends upon the amount of metals and non-metals it produces and uses. The wealth of a country is measured by the amount of gold in its reserve.

These days, metals and non-metals are used for making tools, machines, cars, utensils, etc. Some of the common metals used are iron, copper, silver, gold, lead, zinc, aluminium, magnesium, nickel, chromium and mercury etc. Similarly, the common non-metals used are nitrogen, oxygen, hydrogen, carbon, sulphur, phosphorus and chlorine etc.

An element can be identified as metal or non-metal by comparing its properties with the general properties of metals and non- metals. In doing so, we find that some elements neither fit with the metals or with non-metals. Such elements are called semi-metals or metalloids.

Elements are classified into metals, non-metals, and metalloids based on their properties



4.2.1 METALS

Iron,copper,gold,silver, etc. that we use in our daily life are metals. Can you add some more examples that you come across in day to day activities.

Figure 4.4 Copper

Physical properties of metals

1. **Physical state**: Metals are solid under normal conditions of temperature and pressure. Mercury is liquid at room temperature. Elements cesium (Cs), rubidium (Rb), Francium (Fr) and Gallium (Ga) become liquid at or just above room temperature.
2. **Hardness**: Most metals are hard. The exception here is sodium and potassium, which is soft enough to be cut by a knife. Osmium is so hard that it can scratch glass.
3. **Lustre**: All metals are shiny. The typical shine of metals is called metallic lustre. All metals have a typical metallic lustre. An exception is calcium.

Figure 4.5 Shine Appearance

4. **Density**: Metals generally have high density. Sodium and potassium have exceptionally low density.
5. **Melting point and boiling point:** Metals in general have high melting point and boiling point. Sodium,potassium,mercury and gallium are exceptions.
6. **Tensile strength**: Metals have the capacity to withstand strain without breaking. This property is called tensile strength. It is the property that owes the use of iron for the construction of railway tracks. Zinc, arsenic and antimony are exceptions.
7. **Malleability:** Metals can be hammered into very thin sheets. This tendency of metals is called malleability. Aluminum makes use of this property to transform into silvery foils.

Activity 2

Take a hammer and beat the samples, which are given below. Observe the changes in samples. Record your observations in the table

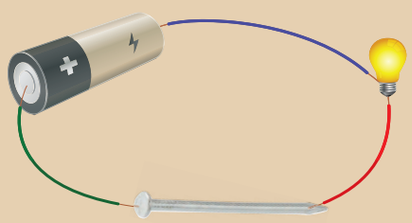
Name of sample	Observing the change in sample
Coal piece	Breaks/ converts into powder
Iron nail	
Copper wire	
Sulphur	

8. **Ductility:** Metals can be drawn into thin wires. This property of metals is called ductility. Example: copper wires.
9. **Conductivity:** Metals are good conductors of heat and electricity. Silver and copper are very good conductors of electricity. However, bismuth and tungsten are poor conductors.

Activity 3

Recall how to make an electric circuit to test whether electricity can pass through an object or not .

Object to be used: iron nail and pencil lead (graphite)



10. **Sonorous**: On being hit, metals produce a typical sound. Hence, they are said to be sonorous. This property is being made used in making temple bells.

4.2.2 NON-METALS

Elements that generally do not shine, neither too hard nor too soft, are non-metals. All gases are non-metals. Some non-metals are Sulphur, Carbon, Oxygen etc..


sulphur


carbon

Figure 4.6 Non-metals

PHYSICAL PROPERTIES OF NON-METALS

1. **Physical state:** Non-metals occur as solids, liquids or gases at normal temperature; for example sulphur, phosphorus occurs in solid state while bromine occurs in liquid state. Gases like oxygen, nitrogen, etc., occur in the gaseous state.
2. **Hardness:** Non-metals are generally not hard except diamond.(a form of carbon)
3. **LUSTRE:** Non-metals have a dull appearance; Graphite and iodine are exceptions as they are shiny and lustrous.

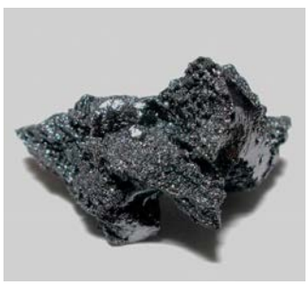


Figure 4.7 Dull appearance

4. **Density:** Non-Metals are generally soft and have low densities. The exception here is diamond (a form of carbon) which is the hardest naturally occurring substance
5. **Melting point and boiling point:** Non-metals have low melting point and boiling point. However, carbon, silicon and boron are exceptions.
6. **Tensile strength:** Non-metals do not have tensile strength. However, carbon fibre (a form of carbon) is as tensile as steel.
7. **Malleability:** Non-metals are non-malleable. If hammered, they form a powdery mass. Actually non-metals in solid state are brittle in nature.
8. **Ductility:** Non-metals are not ductile. Carbon fibre is highly ductile.
9. **Conductivity:** Non-Metals are generally bad conductor of electricity. Graphite (a form of carbon) is exception.
10. **Sonorous**: Non-Metals do not produce sound(non-sonorous) when hit.

Activity 4

To demonstrate that metals produce a sound when struck.

Strike a metal utensil with a metal spoon. Note the kind of sound emitted. Now, strike a piece of wood charcoal with the same spoon. Do you find a difference in the kind of sound produced?

Most metals produce ringing sound when struck i.e. they are sonorous. Non-metals are non sonorous.

A Compartive Study of Metals and Non-Metals

Property	Metal	Non Metal
Physical state at room Temperature	Usually Solid (Occasionaly liquid)	Solid, liquid or gas
Malleablity	Good	Poor-usually soft or brittle
Ductility	Good	Poor-usually soft or brittle
Melting point	Usually high	Usually low
Boiling point	Usually high	Usually low
Density	Usually high	Usually low
Conductivity (Thermal and electrical)	Good	Very poor

4.2.3 Uses of Metals and Non-Metals

Metal

1. Iron is used for making bridges,engine parts, iron-sheet and bars.

2. Copper is used for making electrical wires, coins and statue.

Figure 4.8 Coins contain nickel

3. Silver and gold are used for making jewels,in decorative purposes and photography.

Figure 4.9 Gold is very decorative

4. Mercury is used in thermometers and barometers because of its high density and uniform expansion at different temperature.
5. Aluminium is used in electrical wires, cables and in aerospace industries.

Figure 4.10 Planes are made of an alloy which contains magnesium and aluminium

6. Lead is used in automobile batteries, X-ray machines.

Non-Metals

1. Diamond (a form of carbon) is used for making jewels, cutting and grinding equipments. Graphite is used in making pencil lead.

Figure 4.11 Diamond

2. Sulphur is used in the manufacturing of gun powder and vulcanization of rubber.

Figure 4.12 Sulphur

3. Phosphorus is used in matches, rat poison etc.
4. Nitrogen is used for manufacturing ammonia.
5. Chlorine is used as a bleaching agent and in sterilizing water.
6. Hydrogen is used as a rocket fuel and hydrogen flame is used for cutting and welding purposes, as well as a reducing agent

4.2.4 Metalloids

The elements which exhibit the properties of metals as well as non-metals are called metalloids. Examples: boron, silicon, arsenic, germanium, antimony, tellurium and polonium.

Physical properties of metalloids

Metalloids are all solid at room temperature.

1. They can form alloys with other metals
2. Some metalloids, such as silicon and germanium, can act as electrical conductors under the specific conditions, thus they are called semiconductors.
3. Silicon for example appears lustrous, but is not malleable nor ductile (it is brittle - a characteristic of some non metals). It is a much poorer conductor of heat and electricity than the metals
4. The physical properties of metalloids tend to be metallic, but their chemical properties tend to be non-metallic.

Uses of metalloids

1. Silicon is used in electronic devices .
2. Boron is used in fireworks and as a fuel for ignition in rocket.

4.3 Compound

A compound is a pure substance which is formed due to the chemical combination of two or more elements in a fixed ratio by mass. The properties of a compound are different from those of its constituents.

Water, carbon di oxide, sodium chloride etc. are few examples of compounds. A molecule of water is composed of an oxygen atom and two hydrogen atoms in the ratio 1:2 by volume or 8:1 by mass.

4.3.1 Classsification compound

Based on the origin of chemical constituents, compounds are classified as inorganic compounds and organic compounds.

a) Inorganic compounds

Compounds obtained from non living sources such as rock, minerals etc., are called inorganic compounds. Example: chalk, baking powder etc.,

b) Organic compounds

Compounds obtained from living sources such as plants, animals etc., are called organic compound. Example: Protein, carbohydrates, etc.,

Both inorganic and organic compounds exists in all three states of matter ie., solids, liquids and gases.

Let us learn some important compounds in solids, liquids and gaseous state.

4.3.2 Compounds in solid

Some important compounds that exist in solid state are tabulated as follows

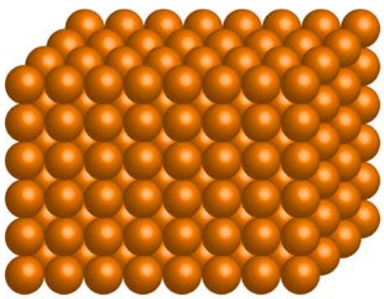
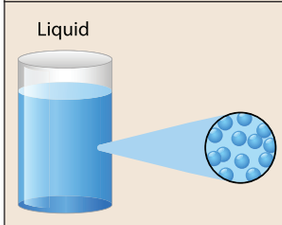


Figure 4.13 Solid

Compound	Consititutent Elements
Silica (sand)	Silicon, Oxygen
Potassium hydroxide (caustic potash)	Potassium, Hydrogen, Oxygen
Sodium hydroxide (Caustic soda)	Sodium, Oxygen, Hydrogen
Copper sulphate	Copper, Sulphur, Oxygen
Zinc carbonate (calamine)	Zinc, carbon, oxygen

4.3.3 Compounds in liquid

Some important compounds that exist in liquid state are tabulated as follows

Compound	Consititutent Elements
Water	Hydrogen, Oxygen
Hydro chloric Acid	Hydrogen, Chlorine
Nitric Acid	Hydrogen, Nitrogen, Oxygen
Sulphuric Acid	Hydrogen, Sulphur, Oxygen
Acetic acid (Vinegar)	Carbon, Hydrogen, Oxygen
	

4.3.4 Compounds in gas

Some important compounds that exist in gaseous state are tabulated as follows

Compound	Consitituent Elements
Carbon dioxide, carbon monoxide	Carbon, Oxygen
Sulphur dioxide	Sulphur, Oxygen
Methane	Carbon, Hydrogen
Nitrogen dioxide	Nitrogen, Oxygen
Ammonia	Nitrogen, Hydrogen

XSX83W

4.3.5 Uses of Compounds

Let us tabulate some compounds and their constituents that we use in our daily life.

Common Name	Chemical Name	Constituents	Uses
Water	Hydrogen Oxide	Hydrogen and oxygen	For drinking and as solvent
Table salt	Sodium chloride	Sodium and chlorine	Essential component of our daily diet, preservative for meat and fish.
Sugar	Sucrose	Carbon, hydrogen and oxygen	Preparation of sweets, toffees and fruit juices.
Baking soda	Sodium bicarbonate	Sodium, hydrogen, carbon and oxygen	Fire extinguisher, preparation of baking powder and preparation of cakes and bread.
Washing soda	Sodium carbonate	Sodium,carbon and oxygen	As cleaning agent in soap and softening of hardwater.
Bleaching powder	Calcium oxy chloride	Calcium, oxygen and chlorine	As bleaching agent, disinfectant and sterilisation of drinking water.
Quick lime	Calcium oxide	Calcium and oxygen	Manufacture of cement and glass.
Slaked lime	Calcium hydroxide	Calcium, oxygen and hydrogen	White washing of walls.
Lime stone	Calcium carbonate	Calcium ,carbon and oxygen	Preparation of chalk pieces.

More to Know

Compound	Consititutent Elements
Copper sulphate	Blue Vitriol
Ferrous sulphate	Green Vitriol
Potassium nitrate	Saltpetre
Sulphuric acid	Oil of Vitriol
Calcium sulphate	Gypsum
Calcium sulphate hemi hydrate	Plaster of paris
Potassium chloride	Muriate of potash

Points to remember

- **Matter:** Anything which occupies space and has mass is called matter.
- **Compound:** The molecule of a substance that contains two or more atoms of different elements combined together in a definite ratio,is said to be a molecule of a compound.
- **Solid:** Material which has a definite shape and definite volume at room temperature with any number of free surfaces is called solid.
- **Liquid:** Material which has a definite volume, but no definite shape and has one free surface, is called liquid.

- **Gases:** Material which has neither definite shape nor definite volume, is easily compressible and has no free surface is called gas.
- **Metals:** Metals are elements that are hard and shiny in appearance.Some metals used in our daily life are iron,copper,gold,silver, etc. Metals conduct heat and electricity.
- **Non metal:** Elements that generally do not shine, neither too hard nor too soft are non-metals. All gases are non-metals.Some non-metals are sulphur,carbon,oxygenetc..
- **Metalloids:** Elements which have some properties of metal and some of non-metals are called metalloids. Some examples are arsenic, germanium etc…
- **Sonority:** On being hit, metals produce a typical sound. They are said to be sonorous. This property is being made used in making temple bells.
- **Symbol:** The easiest way to represent the element and to write the chemical formulas easily.

A-Z GLOSSARY

Disinfectant	Chemical substance which kills or prevents the disease causing microorganism.
Semiconductor	Substance which acts as bad conductor at low temperature and act as good conductor at high temperature.
Reducing agent	Substance which undergo oxidation reaction.
Carbohydrate	Compound contains carbon, hydrogen and oxygen are called carbohydrate.
Bleaching agent	Substance which is used to remove the colour.
Preservative	Substance which prevent from food spoiling organism.

TEXT BOOK EXERCISE

APJ2SS

I. Choose the best answer.

1. Matter is composed of

a) atoms b) molecules

c) ions d) all of the above

2. The liquid metal used in thermometers is

a) Copper b) Mercury

c) Silver d) Gold

3. The Pictorial symbol for water given by the alchemists was

a)  b) 

c)  d) 

4. Which one of the element name not derived from planet?

a) Plutonium b) Neptunium

c) Uranium d) Mercury

5. Symbol of Mercury is

a) Ag b) Hg

c) Au d) Pb

6) A form of non-metal which has high ductility is

a) nitrogen b) oxygen

c) chlorine d) carbon

7. Which one of metal possess low tensile strength?

a) Silver b) Copper

c) Zinc d) Aluminium

8. The property which allows metals to be hammered into their sheets is _____

a) ductility b) malleability

c) conductivity d) tensile strength

9. The non-metal which conduct current is

a) carbon b) oxygen

c) aluminium d) sulphur

10. Pencil lead contains

a) graphite b) diamond

c) aluminium d) sulphur

II. Fill in the blanks.

1. The element which possess character of both metals and non metals are called……

2 . The symbol of Tungsten……..

3. Melting point of most metal is _____ than non-metal.

4. Water contains …….. and ……. element.

5 …….. is the used in semiconductor industry.

III. True or False , if false correct the statement

1. Metals are generally good conductors of electricity, but not good conductors of heat.

2. Gallium metal is in solid state at or just above room temperature.

3. Compounds can be made up of one atom.

4. Coal can be drawn into wires.

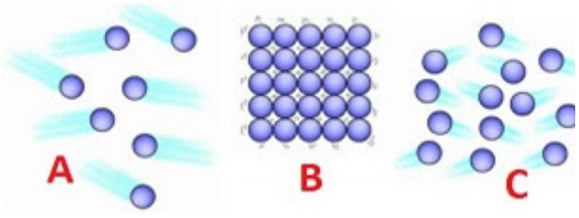
5. Zinc is highly ductile in nature.

IV. Match the substance given in column A with their use given in Column B.

A	B
1. Iron	For making wires
2. Copper	Sewing needle
3. Tungsten	As a fuel for ignition in rocket.
4. Boron	Making the filament of a bulb

2. Match the following:

1. Atom	A. building block of matter
2. Element	B. atoms of different kinds
3. Compound	C. atoms of the same kind



4. Molecule ---- D. smallest unit of a substance

A)1 - A, 2 - C, 3 - B, 4 - D

B) 1 - C, 2 - A, 3 - B, 4 - D

C) 1 - D, 2 - C, 3 - B, 4 - A

D)1 - B, 2 - C, 3 - A, 4 - D

3. Identify the state of matter based on the arrangement of the molecules.

A) A - gas, B - solid, C – liquid

B) A - Liquid, B - solid, C – Gas

C) A - gas, B - solid, C - liquid

D) A - Liquid, B - Gas, C - Solid

V. Very Short Answer Questions

1 .What is ductility?

2. Write the constituent elements and their symbols for the following compounds

a) Carbon monoxide

b) Washing soda

3. Write the symbols for these elements

   a) Oxygen b) Gold

   c) calcium d) cadmium e) Iron

4. Name two soft metals that can be cut with a knife.

5. Which non-metal is essential for our life and all living beings inhale it during breathing?

6 .Why are bells made of metals?

7. What does a chemical symbol represent?

8. Give two examples for metalloids.

9. Mention any three compounds that exist in liquid state.

10. Write three properties of metalloids.

VI. Short Answer Questions

1. Can you store pickle in an aluminium utensil? Explain.

2. Tabulate four points of difference between metals and non-metals.

3. Define tensile strength.

4. Why are utensils made up of aluminium and brass?

5. Define a Alchemy.

6. Name the elements for following symbols.

   a) Na b) W c) Ba d) Al e) U

7. Name six common non-metals and write their symbols.

8. Mention any four compounds and their uses.

9. Mention the metals that are used in jewellery.

10. Mention the uses for the following compounds.

a) Baking soda b) Bleaching powder c) quick lime

VII. Reason out

1.Give reasons for the following.

   (a) Aluminum foils are used to wrap food items.

   (b) Immersion rods for heating liquids are made up of metallic substances.

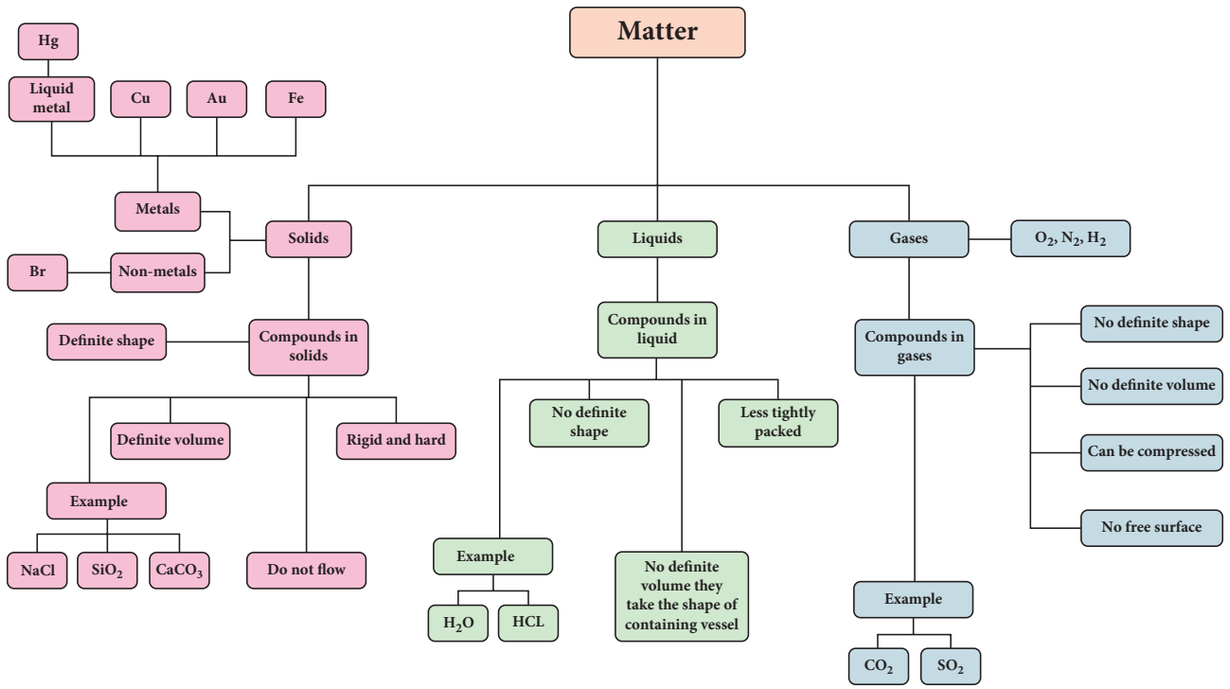
   (c) A doctor prescribed a tablet to a patient suffering from iron deficiency. The tablet does not look like iron.

   (d) Sodium and potassium are stored in kerosene.

   e) Mercury is used in thermometers.

2. Why wires cannot be drawn from materials such as stone or wood?

Mind Map

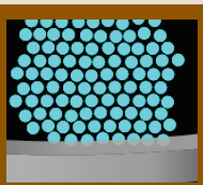


ICT CORNER MATTER

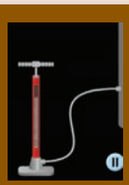
This activity enables the students helps to know about the States of Matter

Steps

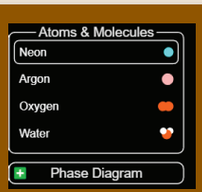
- Open the Browser and type the URL link given below (or) Scan the QR Code.
- Select the title "States of Matter: Basics"
- States of Matter: Basics display on the screen. Follow this Experiment
- Click the next and to know about this states of matter



Step1



Step2



Step3

Step4

Cells alive

URL: https://phet.colorado.edu/sims/html/states-of-matter-basics/latest/states-of-matter-basics_en.htm (or) scan the QR Code

*Pictures are indicative only

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UNIT 5

CHANGES AROUND US

Learning Objectives

4BPSEI

At the end of this lesson, students will be able to:

- Define chemical reaction
- Differentiate chemical changes from physical changes
- Learn how chemical reactions take place by physical contact, solution of reactants, electricity, heat, light and catalyst.
- Experiment chemical reactions based on contact, solutions, heat, light, electricity and catalyst
- Learn about the importance and effects of chemical reactions
- Identify chemical reactions in day to day life
- Observe the changes during a chemical reaction
- Infer what happens during a chemical reaction

INTRODUCTION

Adithya, a standard VIII student once visited Qutub Minar, Delhi and wondered about the 1500 years old rust resistant iron-pillar. He was thinking about why the iron pillar has not rusted for more than 1500 years. One day he noticed milk turned into curd and he wondered how it is happening.

As you studied earlier in standard VII changes like folding 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.

Now, shall we do an activity?

Dear students, can you define a chemical change? Yes, you can. A chemical change is a permanent, irreversible change and produces a new substance.

Activity 1

Identify the following changes as Physical or Chemical.

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, 8. Browning of apples, 9. Running of steam engine, 10. Combustion of petrol and diesel, 11. recycling of plastics

Complete: A chemical change is --------- 1----------, -------- 2 ---------- and produces 3 --------

1. Temporary/permanent
2. Reversible/Irreversible
3. New substance / no 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).

Reactant(s) ⟶ Product(s)

In a society people live in different conditions not under same conditions. Likewise, all chemical reaction will not occur at all conditions. For every chemical reaction to take place, certain specific condition is required.

Do you know what are the conditions required for a chemical reaction to take place?

Chemical reactions can be done through;

1. Physical contact 2. Solution of reactants 3. Electricity 4. Heat 5. Light 6. catalyst

Let us discuss the conditions that are necessary to carryout a chemical reaction with one or two examples.

5.1 CHEMICAL REACTIONS BASED ON PHYSICAL CONTACT

Dear children, could you remember some of the day to day activities like burning of matchstick on rubbing, iron materials turning into reddish brown. Why and how these changes happen?

EIH3ZR

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

1) 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.
2) When a matchstick is rubbed on the sides of a matchbox, a chemical reaction takes place to form heat, light and smoke.
3) When quick lime (calcium oxide) comes in contact with water, it forms slaked lime (calcium hydroxide).

Fig:5.1 Burning a match stick

From 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 as well. But this time pour some coconut oil above the water level to completely immerse the nail inside. 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?

5.2 CHEMICAL REACTIONS BASED ON SOLUTION OF REACTANTS

Do you like coffee? How coffee is prepared? As your mother does, when milk is mixed with coffee decoction the colour of milk and decoction changes due to chemical reaction. Your mother adds enough sugar to make it tasty.

MORE TO KNOW

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

Like this when we mix two substances(Reactants)in solution form, the chemical reaction takes place 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, the reactants in solid state have no recations. Now you dissolve the same reactants in water in separate test tubes. 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. Fom the above reaction, we infer that some chemical reactions proceed only in solution form not in solid form.

5.3 CHEMICAL REACTION BASED ON ELECTRICITY

Can we live without electricity? Absolutely not. Electricity is very essential for our living. We use electricity for cooking, lighting, grinding, watching TV, charging mobiles, laptops, computers, water heaters etc. Do you know electricity can be used to carry out chemical reactions? Yes, by using electricity many chemical reactions are done which are industrially very important. As you know, water is made of hydrogen and oxygen molecules. When electricity is passed through water containing 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 a very important reaction to produce chlorine industrially.

From the above two reactions, we infer that some chemical reactions proceed only by the passage of electricity. Hence, such reactions are called as **electrochemical reaction** or **electrolysis**.

DO YOU KNOW?

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

5.4 CHEMICAL REACTIONS BASED ON HEAT

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

You can perform this reaction in your laboratory. Take 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 of the chemical reactions can be achieved by the supply of heat only. These reactions are called **thermo chemical reactions** or **thermolysis**.

DO YOU KNOW?

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

MORE TO KNOW

Chemical reactions accompanying evolution of heat are called exothermic reactions whereas reactions involving absorbtion of heat are called endothermic reactions.

5.5 CHEMICAL REACTIONS BASED ON LIGHT

What will happen if there is no sunlight? All the human activities will be affected and there will be no food for us to survive. Isn't it?

Sunlight is important not only for us but also for plants as welll. As you know photosynthesis is a process in which light energy from the sun is used by the plants to prepare starch from carbondioxide and water. The sunlight in uses the chemical reactions beween carondioxide and water, which finally ends up in the production of starch (photo means light and synthesis means production). These chemical reactions in used by light are called as photochemical reactions.

DO YOU KNOW?

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

MORE TO KNOW

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

5.6 CHEMICAL REACTION BASED ON CATALYST:

Do you like cakes and buns? Yes, you do. Have you ever questioned about why idly batter prepared by your mother turns into sour taste after few hours? The answer for your question is fermentation. It is a chemical reaction in which a substance is decomposed with the help of yeast or bacteria to give simpler products.In the case of yeasts, the enzymes released by the yeast makes the reaction faster. Like this, in industries some chemical substances are used to alter the speed of a chemical reaction. These substances are called catalysts. For example, metallic iron is used as a catalyst in the manufacture of ammonia using Haber process. This ammonia is the basic material for the production of urea, an important fertilizer in agriculture. In Vanaspati ghee (dalda) preparation finely divided nickel is used as a catalyst.

Thus, speed of the certain reactions is influenced by the catalysts and such reactions are called **catalytic reactions**.

Fig 5.2 Applying urea on paddy crops

DO YOU KNOW?

Enzymes and yeasts are called biocatalysts.

MORE TO KNOW

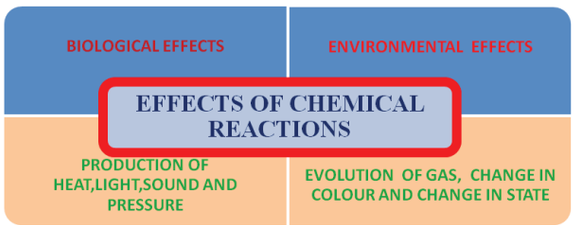
Alcoholic beverages like beer, wine etc are produced by fermentation process in industries .The beer making industries are called BREWERIES.

Activity 3

Buy some fresh yeast from a grocery shop nearby. 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?

5.7 EFFECTS OF CHEMICAL REACTIONS

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. Let us discuss these effects elaborately.



5.7.1 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 catalyzed by the enzymes result in the degradation of food quality such as development of bad tastes and odor, deterioration and loss of nutrients.

e.g. 1. Rotten eggs develop a bad smell due to formation of hydrogen sulphide gas

e.g. 2. Decaying of vegetables and fruits due to microbes

b) Rancidity of fishes and meat:

Fishes and meat containing high levels of polyunsaturated fatty acids that undergo oxidation causes bad odour when exposed to air or light. This process is called Rancidity.

Fig 5.3 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 that when in contact with oxygen catalyses a biochemical reaction of plants' phenolic compounds to brown pigments known as melanins.

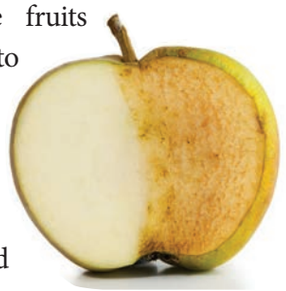


Fig 5.4 Browning of apple

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5.7.2 Environmental Effects

a) Environment is the place around you that comprises both living and non living things. Our environment provides air to breathe, water to drink and the land to produce food. Due to human activities like industries, increasing number of automobiles etc our environment is badly affected now-a-days. So, there is an unwanted change in 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.

Fig 5.5 Smoke from industries