

# Elements, Compounds Mixtures Physical and Chemical Changes

## Fundamentals of Chemistry

# Classification of Matter



Matter is any substance having distinct physical characteristics and chemical properties.

Matter is made up of (1) Pure Substances include (a) Elements (b) Compounds

Elements include (1.1) Metals (gold, silver) (1.2) Non-Metals (Oxygen), (1.3) Metalloids (Arsenic) (1.4) Noble Gases (Helium, Neon).



(2) Impure substances are mixtures that may be:

(a) Homogeneous mixtures (salt water solution and sugar solutions)

(b) Heterogeneous mixtures of unrelated substances such as wood and iron or soil.

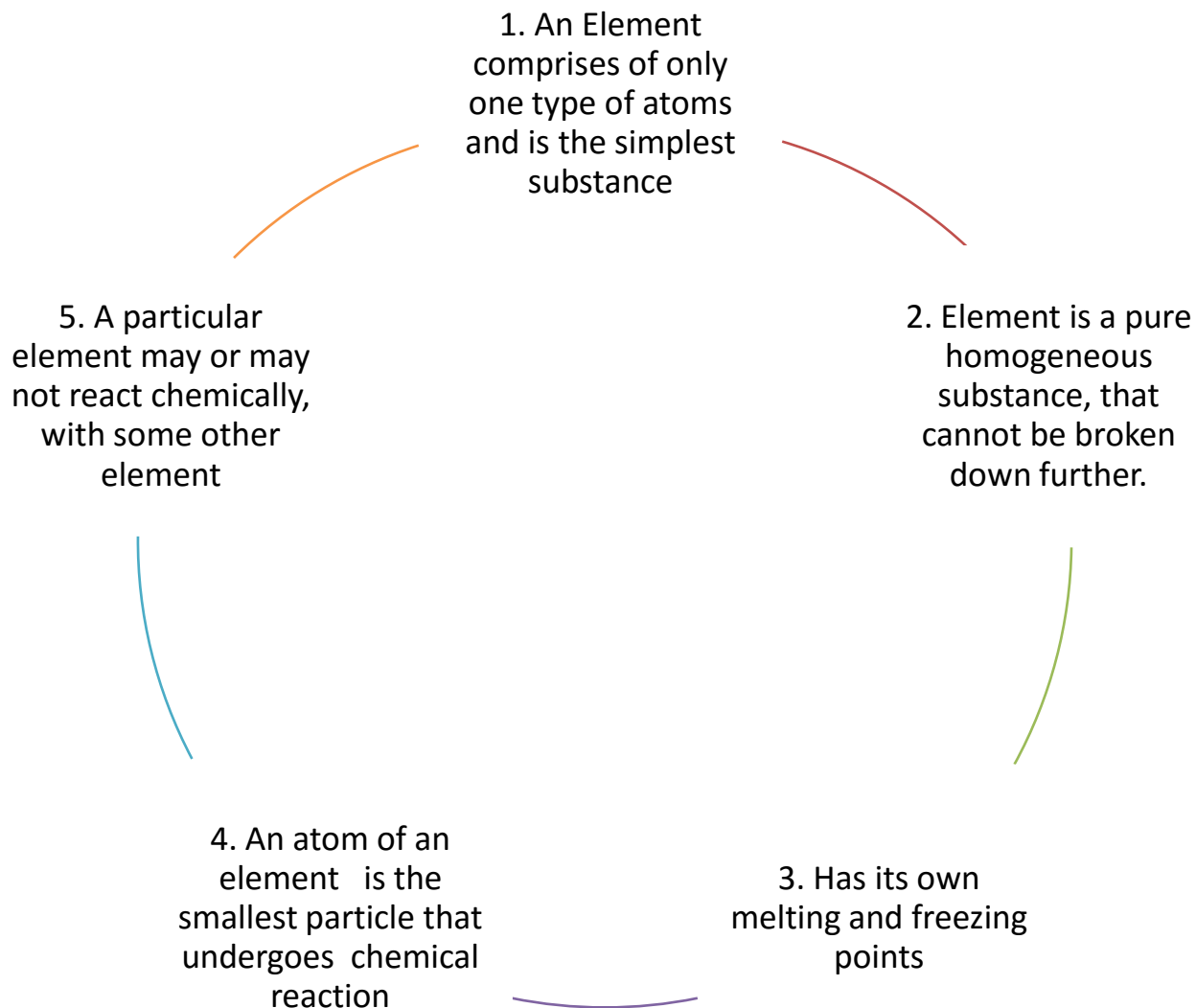
# All Inorganic matter comprises of 92 Elements found in Nature

- In these **92 Elements**, only 8 Element comprise of 98% of all non-living (inorganic) matter.
- These **8 Elements** are
  - Oxygen (49%)
  - Aluminum (8%)
  - Calcium (3%)
  - Potassium ( 2%)
  - Silicon (26%)
  - Iron (5%)
  - Sodium (3%)
  - Magnesium (2%)

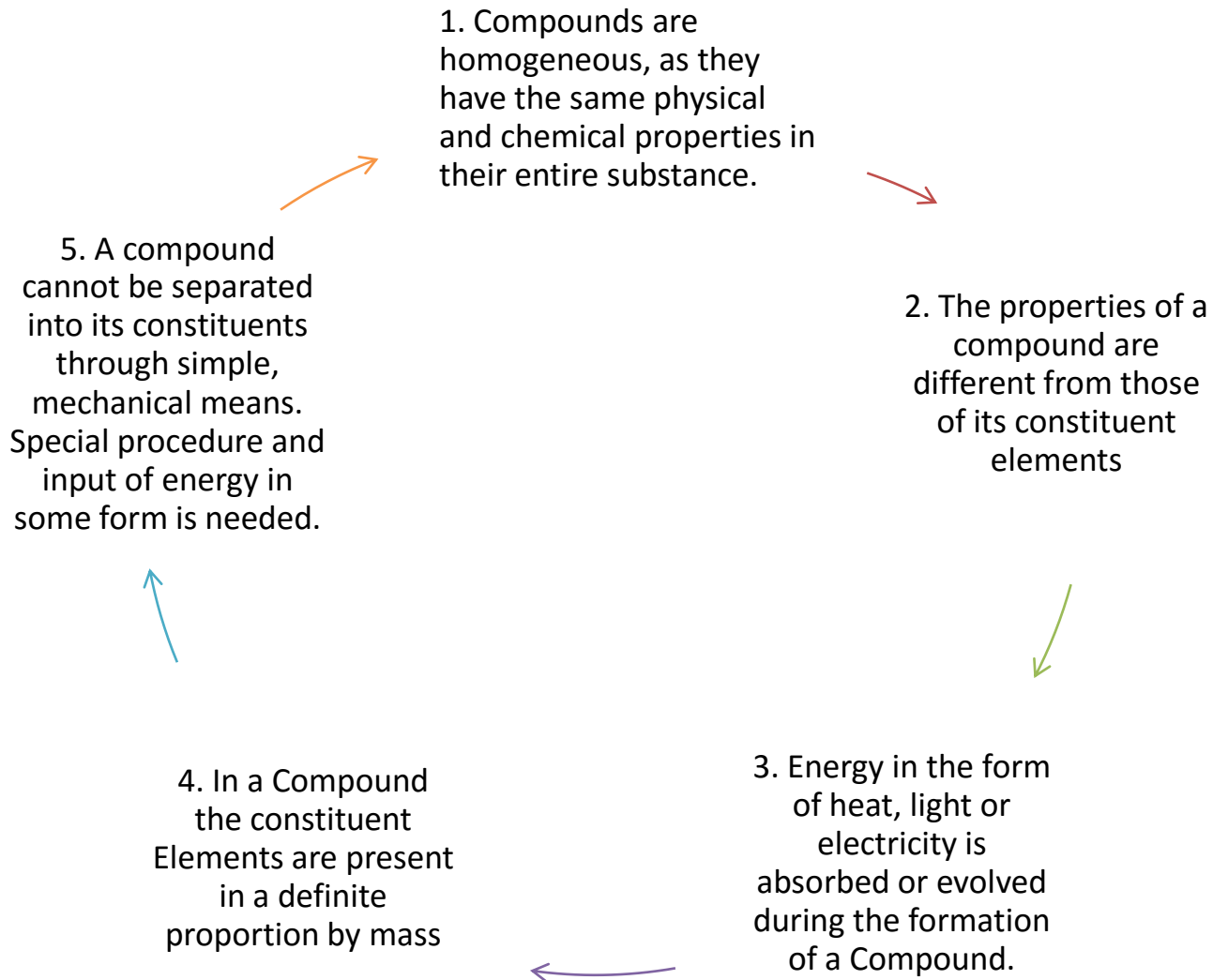
# Chemical Reactions are part of Change

- 92 Elements
- Chemical reaction is said to have taken place when the following four conditions occur:
  - a) Change in state of the element
  - b) Change in colour of the element
  - c) Release of a gas
  - d) Change in temperature

# Characteristics of Elements



# Characteristics of Compounds



# Characteristics of Mixtures

1. A mixture is a physical combination of two or more, element or compound substances, that retain their original properties after being mixed by mass, in any proportion. It may be homogeneous or heterogeneous

2. A mixture exhibits the properties of its constituents, but its own properties vary from the constituent elements and compounds.

3. During the formation of mixtures, its constituents do not react chemically. Even after the mixture is formed, they retain their individual identity in the mixture

5. The mixture does not have its own melting or freezing point, or other characteristics such as density. These vary as per proportion of the constituents. Its constituents can be separated by simple, mechanical techniques

4. The composition of the constituents by proportion is not fixed for making a mixture.

The properties of the constituents are the properties of the mixture.

# Types of Mixtures

1. Mixtures may be homogeneous or heterogeneous.

2. Mixtures are mostly heterogeneous, except in solutions, which are homogeneous

3. Homogeneous mixtures have the same composition and same properties throughout their entire mass. Its components are homogeneously mixed.

4. Heterogeneous mixtures have different composition and different properties in different parts of their mass.

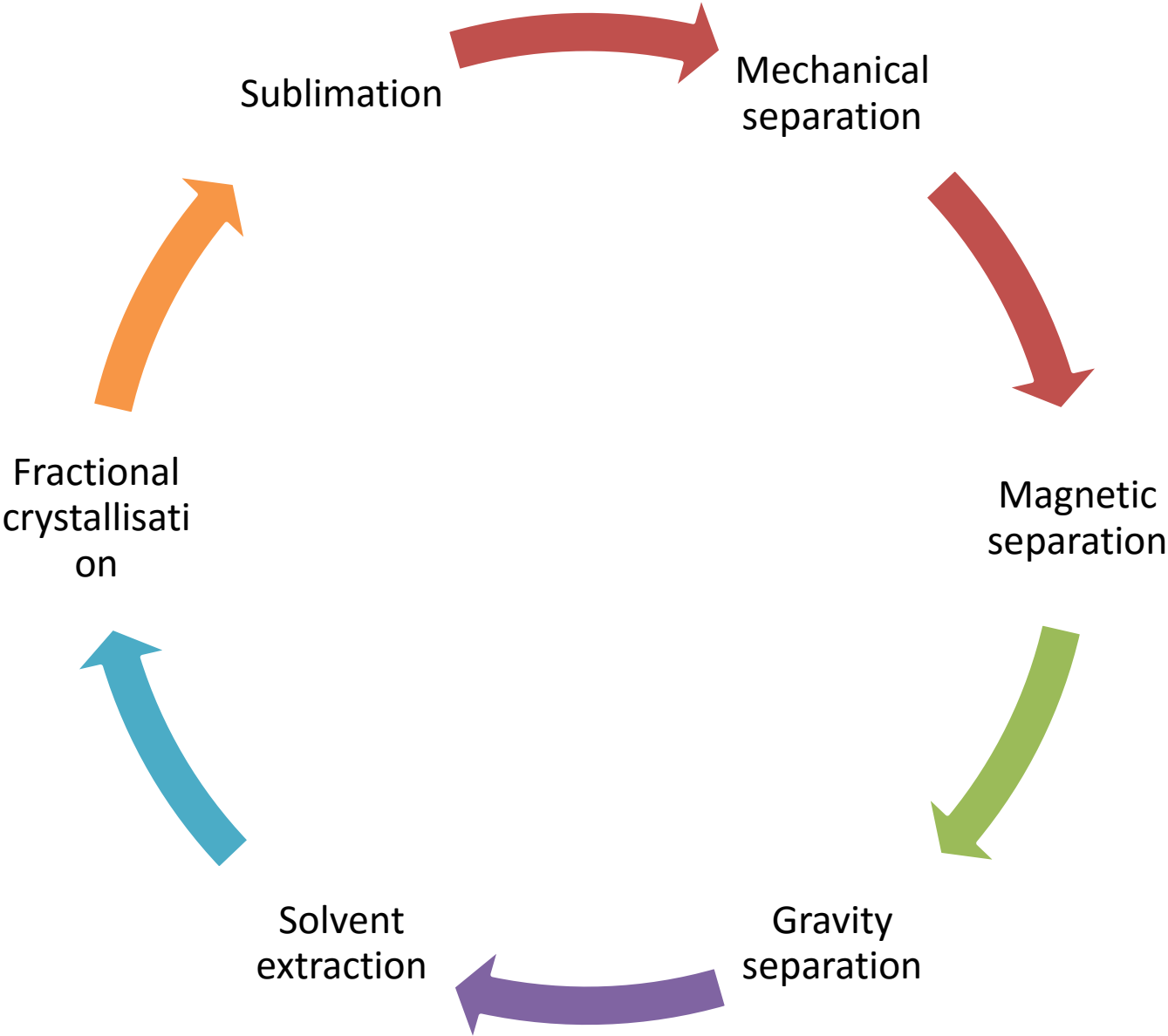
5. No energy change takes place in the formation of a mixture.

6. Properties of a mixture are an average of those of its constituents

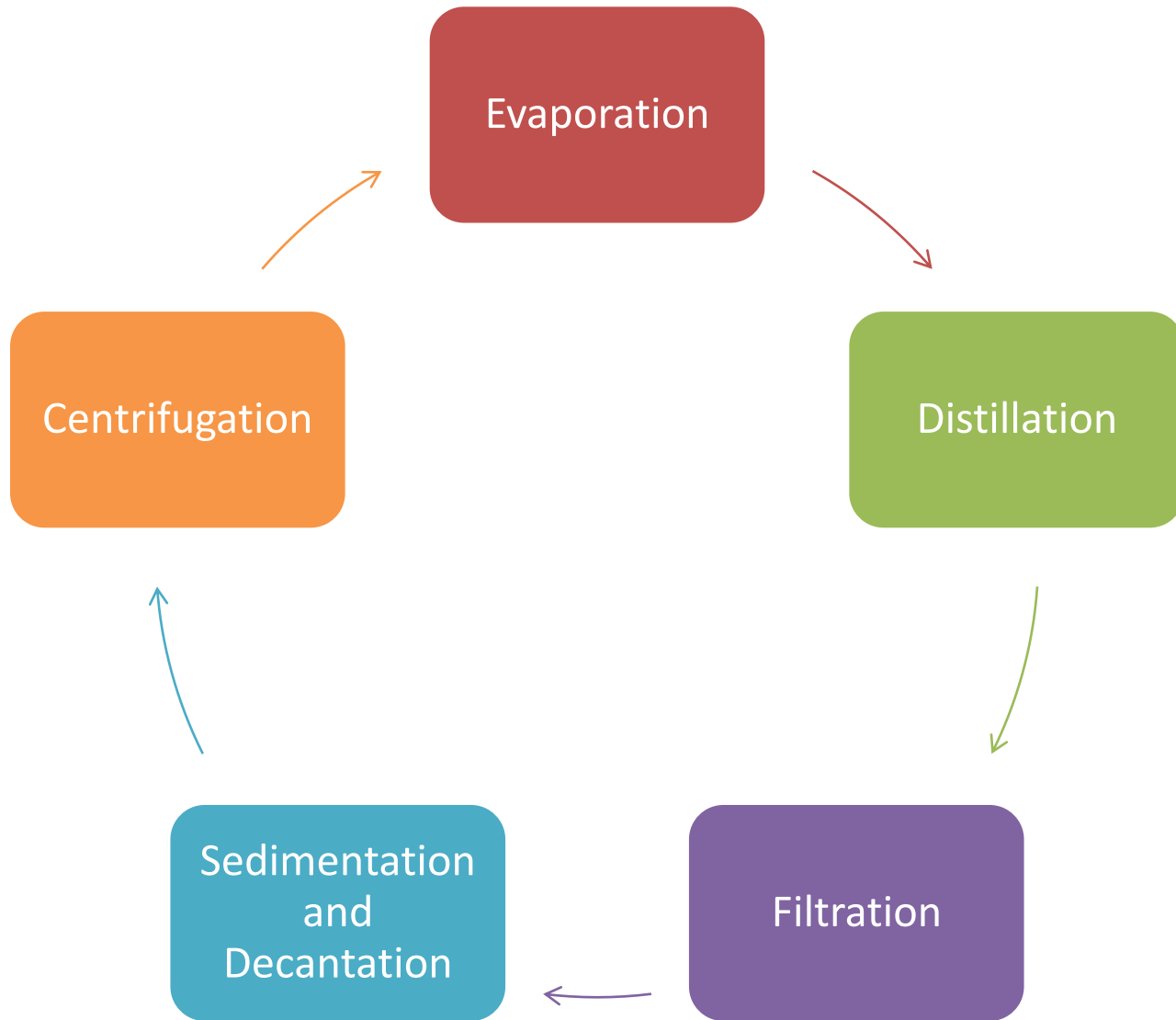
7. The constituents may be present in varying proportions



# Methods of Separation of Solid - Solid Mixtures



# Methods of Separation of Solid - Liquid Mixtures



# Methods of Separation of Mixtures

## Liquid-liquid mixtures

- (a) Separating funnel (b) Distillation (c) Fractional distillation

## Gas-gas mixtures

- (a) Diffusion (b) Dissolution in a solvent (c) Liquefaction

## Liquid – gas mixtures

- (a) Heating

# Physical and Chemical Change

1. Physical properties are Melting point, Boiling point, density, solubility, taste, colour, odour, hardness, conductivity

2. Chemical properties are those that involve a change in the chemical composition of the substances. Example burning, reaction with acids.

3. A physical change is temporary and reversible. No new substance is formed and original chemical composition is retained. Mass remains unchanged, and there is not change in net energy

4. Chemical change is not reversible. A new substance is formed during the change and energy is used and or released. Mass of substances is also changed and close contact between the two substances is involved. Photosynthesis, rusting of iron, burning of paper are examples of chemical change

5. In certain changes, both physical and chemical changes are involved, as in burning of a candle or a chemical reaction.

# Conditions necessary and Types of Chemical Changes

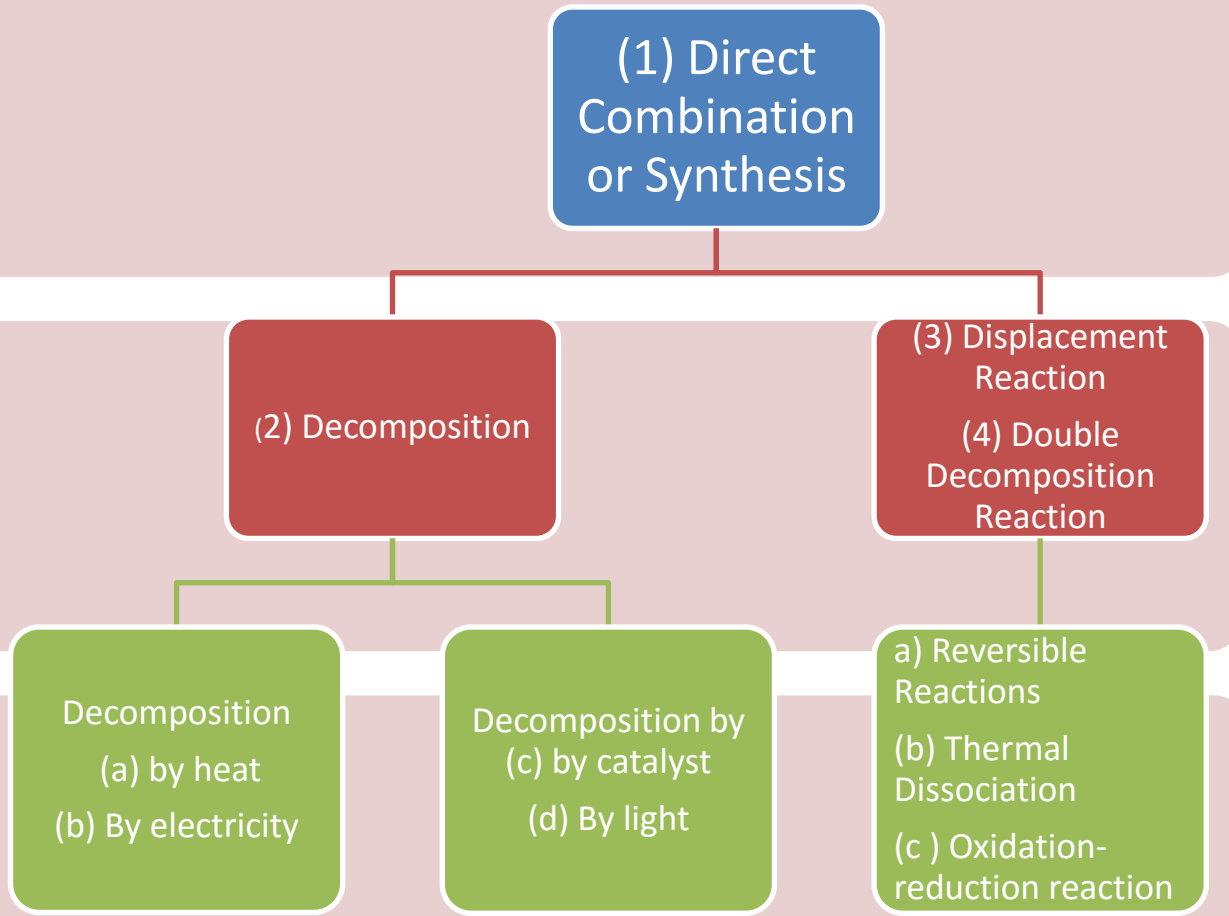
Conditions necessary for chemical reaction (a) Close contact (b) Use of Energy in some form: heat, light, electricity, or pressure (c) Catalyst for change. A positive catalyst accelerates change, and a negative catalyst retards .

(1) In Synthesis two or more substances combine to form a single substance.

(2) In decomposition the compound breaks up into two or more simpler substances. (3) In displacement one element replaces another from its compound to form a new substance

(4) In Double decomposition, both reactants exchange their radicals to give new compounds. (c) Oxidation involves loss of electrons, addition of oxygen, and removal of hydrogen.

Reduction involves gain of electrons, addition of hydrogen and removal of oxygen.



# Energy changes in a chemical change

1. Energy as heat, light, or electricity is released or used. It is used to break existing bonds and to create new chemical bonds

2. Exothermic Reaction is a chemical change involving release of heat - burning of coal in air =  $C + O_2 = CO_2 + \text{heat}$

3. Electrochemical Reaction is one in which absorption of electrical energy takes place. Example, Acidulated water is decomposed into hydrogen and oxygen by passing electricity through it.

4. Endothermic Reaction is a chemical change involving absorption of energy : combining of Nitrogen and Oxygen

5. Photochemical Reaction is a chemical reaction involving absorption of light energy, as in Photosynthesis in green leaves.

# Thank you

