

Unit 3

On completion of the unit you should be able to:

1. distinguish between physical and chemical properties.
2. define melting point, boiling point and solubility.
3. distinguish between physical and chemical changes.
4. sketch out a classification scheme for matter.
5. define and give examples of elements and compounds.
6. define and give examples of pure substances, homogeneous mixtures and heterogeneous mixtures.
7. define potential and kinetic energy.

MATTER AND ENERGY

3.1 Physical states of matter

Reading: Hebden – page 59- 61

3.2 Physical and chemical properties

Reading: Hebden – page 44 – 48

3.3 Physical and chemical changes

3.4 Classification of matter

Reading: Hebden – page 49- 52

3.5 Energy

Reading: Hebden – page 62 – 64

PROBLEMS:

Matter and energy

Physical States of Matter

What are the 3 phases of matter?

Comparison

A detailed analysis of the three states of matter in terms of its shape, volume, compressibility and submicroscopic properties.

	Shape	Volume	Compressibility	Submicroscopic properties
SOLID	Has definite 3-D shape	Has a definite volume	Negligible	Particles touching, tightly packed in a regular arrangement
LIQUID	Indefinite, takes on the shape of the container it occupies	Has a definite volume	Very little	Particles touching but mobile, can glide over one another (i.e. flow)
GAS	Indefinite, takes on the shape of the container it occupies	Indefinite, takes on the volume of the container it occupies	High	Particles are far apart, move independently of one another

Phase Transitions

Phase transition processes

Depending on the surrounding temperature and pressure, water can exist as:

- solid ice
- liquid water
- gaseous steam

Ice (solid) \rightleftharpoons Water (liquid) \rightleftharpoons Steam (gas)

Melting: Ice \longrightarrow Water (*solid to liquid*)

Freezing: Water \longrightarrow Ice (*liquid to solid*)

Vaporization: Water \longrightarrow Steam (*liquid to gas*)

Condensation: Steam \longrightarrow Water (*gas to liquid*)

Phase Transitions

Other transitions

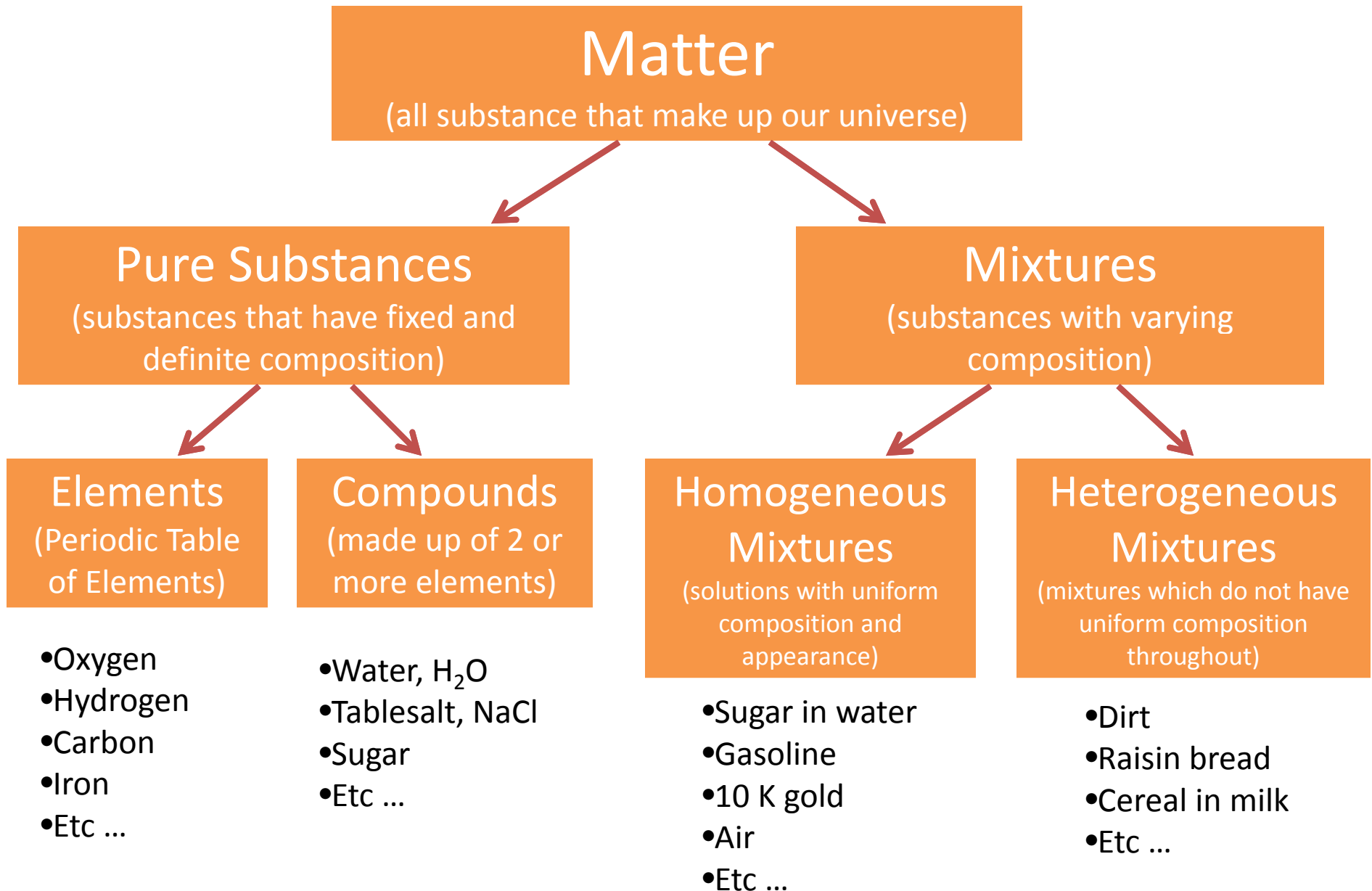
Some materials like dry ice and iodine can undergo phase transition from the solid phase to the gas phase without going through the liquid phase.

Dry Ice (*solid*) \rightleftharpoons **Carbon Dioxide (*solid to gas*)**

Sublimation: Dry ice \longrightarrow Carbon dioxide (*solid to gas*)

Deposition: Carbon dioxide \longrightarrow Dry ice (*gas to solid*)

Classification of Matter



Matter can be classified by their properties

Characteristic Properties of Matter

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graph TD; A[Characteristic Properties of Matter] --> B[Physical Properties  
(no change in the substance's composition)]; A --> C[Chemical Properties  
(results in changes in the substance's composition)];
```

Physical Properties

(no change in the substance's composition)

- Density
- Colour
- Boiling point
- Melting point
- Hardness
- Conductivity
- Hardness
- Malleability
- Ductility

Chemical Properties

(results in changes in the substance's composition)

- Flammability
- Reactivity
- Ability to explode
- Oxidation/Corrosion
- Decay

Matter can undergo changes

Change in Matter

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graph TD; A[Change in Matter] --> B[Physical Change]; A --> C[Chemical Change];
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Physical Change

(change that results in no change in the substance's composition)

- Tearing a piece of paper
- Boiling water
- Water freezes at 0°C

Chemical Change

(change that results in changes in the substance's composition)

- Burnt toast
- Silver tarnishes
- Iron rusts

Energy



The chemical energy stored in the battery



is converted to electrical energy



to useful light energy emitted from a flashlight



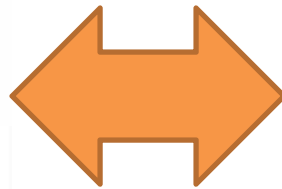
and to less useful heat energy.

Energy

Potential energy



Because of the boulder's altitude, it has stored energy capable of making a splash in the water if it were rolled down. This stored energy is the boulder's potential energy.



Kinetic energy



When the boulder rolls down the cliff, its potential energy is converted to kinetic energy. How much kinetic energy the boulder possesses depends on the mass and the velocity of the boulder.

Energy

When **physical or chemical changes** occur, energy is either produced or absorbed.

When the process produces energy, it is an **exothermic** process.



When the process absorbs energy, it is an **endothermic** process.

Scientific Law:

Law of Conservation of Energy

In any physical and chemical changes, energy is neither created nor destroyed.

Scientists have reached the conclusion that although energy has many different forms that are interconvertible, when one form of energy disappears, some other form of energy of equal magnitude must appear, and vice versa.

In other words, the total quantity of energy in the universe is constant.

Scientific Law: Law of Conservation of Mass

***In any physical and chemical changes,
mass is neither created nor destroyed.***

We will make sure that this scientific law is obeyed by ***balancing*** all the chemical reactions.