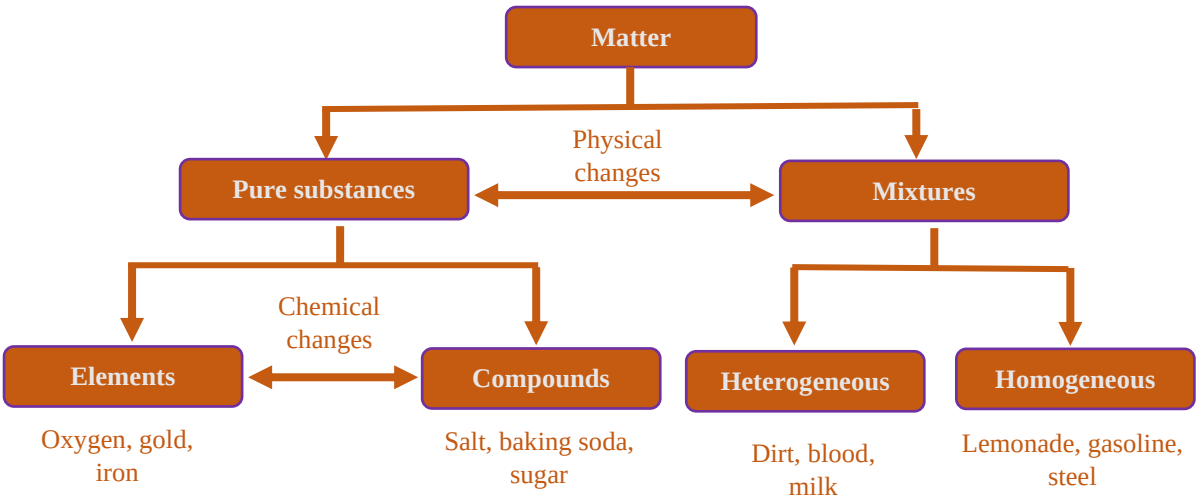
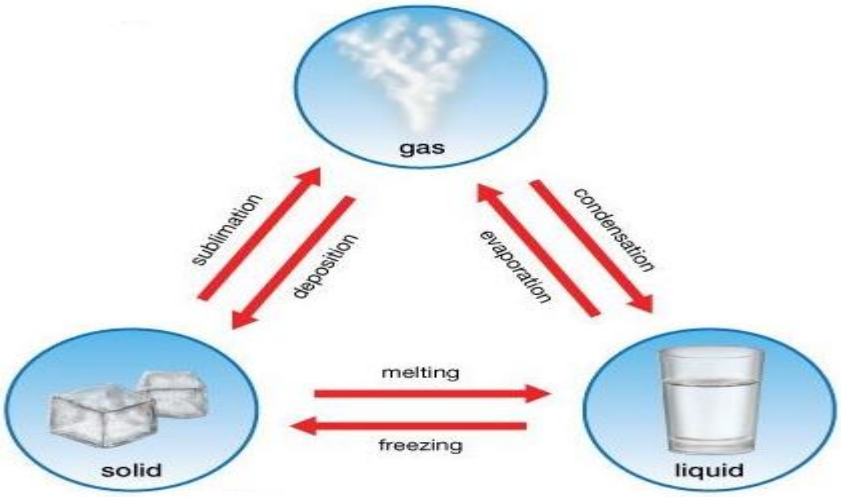


Types of Solution Systems	
System	**Examples**
Gas–gas	Air is primarily a mixture of nitrogen, oxygen, and argon gases.
Gas-liquid	Carbonated beverages contain carbon dioxide gas in the solution.
Liquid–gas	Moist air contains water droplets in the air (which is a mixture of gases).
Liquid-liquid	Vinegar contains acetic acid in water.
Solid-liquid	Sweetened powder drink contains sugar and other solid ingredients in water
Solid–solid	Steel is an alloy of iron containing carbon

Types of Colloids			
Category	Dispersed particles	Dispersing medium	Example
Solid sol	Solid	Solid	Colored gems
Sol Blood, gelatin	Solid	Liquid	Blood, gelatin
Solid	Liquid	Solid	Emulsion Butter, cheese
Emulsion	Liquid	Liquid	Milk, mayonnaise
Solid foam	Gas	Solid	Marshmallow, soaps that float
Foam	Gas	Liquid	Whipped cream, beaten egg white
Aerosol	Solid	Gas	Smoke, and dust in the air
Aerosol	Liquid	Gas	Spray deodorant, clouds

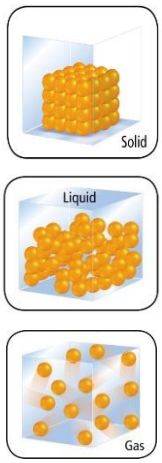
State of matter characteristics			
Characteristics	**Gas**	**Liquid**	**Solid**
Shape	Indefinite	Indefinite	Definite
Volume	Indefinite	Definite	Definite
Rigidity/ Fluidity	Not rigid, can flow	Not rigid, can flow	Rigid, cannot flow
Intermolecular forces	Very less	Less than solids	Maximum
Intermolecular spaces	Maximum	More than solids	Very less
Compressibility	Highly compressible	Compressible	Negligible



CHAPTER 2: Matter—Properties and Changes

Part 1: Matter

Matter s anything that has mass and takes up space, matter is everything around us.
The matter with a uniform and unchanging composition is a **substance**.
- The physical forms of matter, either solid, liquid, or gas, are called the **states of matter**.
- **Solids** are a form of matter that have their own definite shape and volume.
- **Liquids** are a form of matter that has a definite volume but takes the shape of a container.
- **Gases** have no definite shape or volume. They expand to fill their container.
- **Vapor** refers to the gaseous state of a substance that is a solid or liquid at room temperature.
- Compared gas to solids and liquids, Because of the significant amount of space between particles, the particles of gases are very far apart and easily compressed.



A physical property is a characteristic that can be observed or measured without changing the sample's composition.
- **Extensive properties**, such as mass, length, and volume, are dependent on the amount of substance present.
- **Intensive properties,** such as density, boiling point, freezing point, and melting point
are dependent on what the substance is not how much there is.

A **chemical property is** the ability of a substance to combine with or change into one or more other substances.
Both physical and chemical properties can change with specific environmental conditions, such as **temperature** and **pressure**.
Density is the mass of a substance in relation to its volume (equals mass divided by volume)

Q1 **Which of the following is true in regards to the solid state of water:**
CH 2
A Its particles are tight together
B Particles spaced
C It is considered a fluid
D It has an indefinite shape and volume
The particles of matter in a solid are tightly packed →A

Q2 **The state of matter that has indefinite size and shape and whose particles are far apart is**
CH 2
A Liquid **B** Solid
C Gas **D** Plasma
Gases have no definite shape or volume. They expand to fill their container. →C

Q3 **Which of the following is not considered a substance:**
CH 2
A Sand **B** Cotton **C** Air **D** Heat
Light, sound, heat, temperature, and pressure are not considered a substance or matter →D

Q4 **The Density is**
CH 2
A The mass of the substance in relation to its volume
B The volume of the substance in relation to its mass
C The mass of the substance
D Earth's gravitational force of matter
Density is the mass of a substance in relation to its volume (equals mass divided by volume) →A

Q5 **Which of the following is a physical property?**
CH 2
A The ability of the paper to burn
B The ability of sodium to react with water
C The ability of paper to change its shape
D The inability of plastic to react with water
A **physical property** is a characteristic that can be observed or measured without changing the sample's composition. →C

Q6 **Which of the following states of matter is compressible?**
CH 2
A Liquid **B** Solid **C** Gas **D** Plasma
Compared gas to solids and liquids, Because of the significant amount of space between particles, the particles of gases are very far apart and easily compressed. →C

Q7 **Which of the following is a chemical property**
CH 2
A Dissolving salt in hot water
B Boiling water and rising steam.
C Ice melting.
D susceptibility of iron to rust
A **chemical property** is the ability of a substance to combine with or change into one or more other substances. →D

Q8 **Which of the following is an extensive physical property?**
CH 2
A The freezing point of water
B The boiling point of water
C Density of water
D The mass of water
Extensive properties, such as mass, length, and volume, are dependent on the amount of substance present. →D

Q9 **Which of the following is an intensive physical property?**
CH 2
A Length of pen
B The boiling point of water
C The volume of ice cube
D The mass of water
Intensive properties, such as density, boiling point, freezing point, and melting point
are dependent on what the substance is not how much there is. →B

Q10 **Which of the following formations is a physical property?**
CH 2
A Blackening of a silver spoon
B Copper turning green
C Iron conduction of electricity
D Chromium reacts with water very slowly
A **physical property** is a characteristic that can be observed or measured without changing the sample's composition. →C

Q11 **Which of the following formations is a chemical property?**
CH 2
A Water vapor condensation
B Iron fusion
C Boiling of oil
D Incombustibility of a substance
A chemical property is the ability of a substance to combine with or change into one or more other substances.
→D

Q12 **The intensive physical property is**
CH 2
A The density of oil is less than the density of water.
B The temperature of the water is higher than the temperature of the oil.
C The volume of water is less than the volume of oil.
D The mass of oil is greater than the mass of water
Intensive properties, such as density, boiling point, freezing point, and melting point are dependent on what the substance is not how much there is. →A

Q13 **Which of the following is an extensive physical property of water?**
CH 2
A Its boiling point is 100℃
B Its melting point is 0℃
C Its Volume
D Its freezing point is 0℃
Extensive properties, such as mass, length, and volume, are dependent on the amount of substance present. → C

Q14 **Which of the following is an intensive physical property of ice?**
CH 2
A Its volume
B It's mass
C Its melting point
D Its shape
Intensive properties, such as density, boiling point, freezing point, and melting point are dependent on what the substance is not how much there is. →C

Q15 **Which of the following is a physical property?**
CH 2
A The reaction of sodium with water
B Dissolving salt in hot water
C Sugar does not react with cold water
D Iron oxidation
A physical property is a characteristic that can be observed or measured without changing the sample's composition. →B

Q16 **Which of the following properties of table salt is a chemical property?**
CH 2
A It tastes salty
B It is white in color
C It is crystalline
D It does not react with pure water
A chemical property is the ability of a substance to combine with or change into one or more other substances. →D

Q17 **Which of the following is a chemical property of oxygen gas?**
CH 2
A Compressibility
B Incompressible
C The ability to flow
D It can react with some substances
The ability to react with other substances is a chemical property →D

1 Do It? **Which of the following is NOT a physical property of water?**
A Ice melts at 0°C.
B Water boils at 100°C.
C Water reacts violently with pure sodium.
D Water is a liquid at room temperature.

Q18 **Which of the following properties of Sodium carbonate is a chemical property?**
CH 2
A It tastes salty
B It is white in color
C It is crystalline
D Its react with pure water
A chemical property is the ability of a substance to combine with or change into one or more other substances. →D

Q19 **Which of the following is a chemical property?**
CH 2
A Sublimation of iodine
B Boiling of ether
C Evaporation of water
D Burning of wood
A chemical property is the ability of a substance to combine with or change into one or more other substances. →D

Q20 **Which of the following is a physical property?**
CH 2
A The ability of potassium to react with water
B The ability of iron to be malleable and ductile
C The inability of aluminum to oxidize
D The ability of sugar to burn
A **physical property** is a characteristic that can be observed or measured without changing the sample's composition. →B

Q21 **Which of the following is a physical property?**
CH 2
A The ability of Sodium to react with water
B The oil is not mixed with water
C The inability of Nickel to oxidize
D The ability of wood to burn
A **physical property** is a characteristic that can be observed or measured without changing the sample's composition. →B

Q22 **Which of the following is a chemical property?**
CH 2
A Evaporation **B** Condensation
C Sublimation **D** Silver loss of its luster
A chemical property is the ability of a substance to combine with or change into one or more other substances. →D

23 **Which of the following formations is a physical property of copper?**

CH 2

A A deep blue solution when in contact with ammonia.
B A new substance when combined with nitric acid.
C A green copper carbonate compound when in contact with moist air.
D A formation of a drill gauge and wire.

A physical property is a characteristic that can be observed or measured without changing the composition of an element. →D

2 **Which of the following is a physical property of mercury?**

Do It?

A Its ability to react with air.
B It is incapable of reacting to air.
C Susceptibility to oxidation
D Being in the liquid state at room temperature.

3 **Which of the following is a chemical property of Hydrogen?**

Do It?

A Its ability to react with Oxygen.
B Its low boiling point.
C The ability to flow.
D Being in the gaseous state at room temperature.

Part 2: Changes in Matter

- A change that alters a substance without changing its composition is known as a **physical change**, Ex: Glass breaking, paper cutting, wood sawing, paper folding, shape change, size change, and phase change.
A phase change (Change in the state) is a transition of matter from one state to another, Boiling, freezing, melting, and condensing all describe **phase changes** in chemistry.
Ex: **Melting or fusion**: Solid → Liquid (Endothermic), **Freezing**: Liquid → Solid (Exothermic), **Vaporization**: Liquid → Gas (Endothermic), **Condensation**: Gas → Liquid (Exothermic), **Sublimation**: Solid → Gas (Endothermic).
When liquids freeze, they contract, which means their volume decreases, except for water (H_2O), when it freezes, it expands, meaning its volume increases.

- A change that involves one or more substances turning into new substances is called a **chemical change**.
EX: Decomposing, rusting, chemical reaction, corrode, tarnish, ferment, rot, exploding, cooking food, boiling eggs, burning, color change, or oxidizing.
The **law of conservation of mass** states that mass is neither created nor destroyed in a chemical change (chemical reaction), it is conserved, (**Mass** $_{reactants}$ = mass $_{products}$).

Q24 **Which of the following is a physical change:**

CH 2

A Rusting iron
B Breaking a sheet of glass
C Boiling an egg
D Burning paper

A change that alters a substance without changing its composition is known as a physical change, Ex: Glass breaking, paper cutting, wood sawing, paper folding, shape change, size change, and phase change. →B

Q25 **When solid water (ice) turns into liquid water, it is:**

CH 2

A A chemical change
B A physical change
C Both physical and chemical change
D Nuclear change

A change that alters a substance without changing its composition is known as a physical change, Ex: Glass breaking, paper cutting, wood sawing, paper folding, shape change, size change, and phase change. →B

Q26 **Which of the following indicates a physical change?**

CH 2

A Rotting bread **B** Cooking food
C Sublimation **D** Burning wood

Sublimation is a phase change from solid to gas and it's an example of physical change. →C

Q27 **Evaporation of water indicates:**

CH 2

A A nuclear change
B A chemical change
C A physical change
D No significant change

A change that alters a substance without changing its composition is known as a physical change, Ex: Glass breaking, paper cutting, wood sawing, paper folding, shape change, size change, and phase change. →C

Q28 **Which of the following needs energy?**

CH 2

A Condensation of water vapor
B Freezing of liquid water
C Freezing of oil
D Melting of ice

Melting: Solid → Liquid (Endothermic) →D

Q29 **Which of the following produces energy?**

CH 2

A Sublimation of iodine
B The fusion of iron
C Freezing of oil
D The boiling of water

Freezing: Liquid → Solid (Exothermic) →C

Q30 **The substance that increases in volume when it freezes is**

CH 2 **A** NH_3 **B** CCl_4 **C** H_2O **D** H_2S

When liquids freeze, they contract, which means their volume decreases, except for water (H_2O), when it freezes, it expands, meaning its volume increases. →C

Q31 **Which of the following indicates a chemical change?**

CH 2
A Boiling oil
B Breaking a glass
C Burning a wooden spoon
D Condensation of water vapor

A change that involves one or more substances turning into new substances is called a chemical change.
Ex: Decomposing, rusting, chemical reaction, corrode, tarnish, ferment, rot, exploding, cooking food, boiling eggs, burning, color change, or oxidizing. →C

Q32 **Blackening a silver ring is an of:**

CH 2
A A change of state
B A physical change
C A chemical change
D Both physical and chemical change

A change that involves one or more substances turning into new substances is called a chemical change.
Ex: Decomposing, rusting, chemical reaction, corrode, tarnish, ferment, rot, exploding, cooking food, boiling eggs, burning, color change, or oxidizing. →C

Q33 **A number of substances with a mass of 20 grams and a chemical change occurred, the final product of this change is**

CH 2 **A** 40 grams **B** 30 grams **C** 20 grams **D** 10 grams

The **law of conservation of mass** states that mass is neither created nor destroyed in a chemical change (chemical reaction), it is conserved,
(Mass $_{reactants}$= Mass $_{products}$). →C

Part 3: Elements, Compounds, and Mixtures

The **matter** is anything has mass and takes up space.
• **Pure matter** (substances): a matter has a fixed composition and properties.
• An **element** is a pure substance that cannot be separated into simpler substances by physical or chemical means (118 Elements in the periodic table). Ex: H, C, N, O. F, Na, Fe, Mg, Cl, Br, S.
• A **compound** is made up of two or more elements combined chemically.
• Most of the matter exists as compounds ex: Table salt NaCl, table sugar $C_{12}H_{22}O_{11}$, water H_2O, and Calcium oxide CaO.

Mixtures can be separated by:
- *Filtration* is a technique that uses a porous barrier to separate a solid from a liquid in a heterogeneous mixture. (sand from sand water mixture)
- *Distillation* is a separation technique for homogeneous mixtures that is based on the differences in boiling points of substances. (alcohol/vinegar solution – Oil – petroleum oil – water from sea seawater
- *Crystallization* is a separation technique for homogenous mixtures that results in the formation of pure solid particles from a solution containing the dissolved substance. (gold from its ore – zinc from zinc impurities)
- *Sublimation* is the process of a solid changing directly to a gas, which can be used to separate mixtures of solids when one sublimates and the other does not. (dry ice or carbon dioxide –iodide)
- *Chromatography* is a technique that separates the components of a mixture based on the tendency of each to travel across the surface of another material. Ex: (ink – chlorophyll)

• The **mixture** is a combination of two or more pure substances in which each pure substance retains its individual chemical properties.
• A homogenous mixture (solutions) is a mixture where the composition is constant throughout. (seawater – air)
The solid-solid solution known as steel is called an alloy. An alloy is a homogeneous mixture of metals or a mixture of a metal and a nonmetal in which the metal substance is the major component. Alloys are also used in spacecraft and automobiles.
• A *heterogeneous mixture* is a mixture where the individual substances remain distinct (milk – blood – clay or Mud)
- A *suspension*: is a mixture containing particles that settle out if left undisturbed. Ex. Muddy water, some clays
- A *colloid*: is a heterogeneous mixture that has particles of sizes between 1nm to 1000nm in diameter and does not settle out. Ex. Milk
(The sound we hear when opening a can of soft drink is carbon dioxide leaking from it)
- *Brownian motion*: is the random movement of liquid colloid particles. (Brownian motion prevents solute particles from precipitating into the mixture)
- *Tyndall effect*: is the scattering of light due to the dispersed colloid particles.

- The **law of definite proportions** states that a compound is always composed of the same elements in the same proportion by mass, no matter how large or small the sample
- The **law of multiple proportions** states that when different compounds are formed by a combination of the same elements, different masses of one element combine with the same relative mass of the other element in whole number ratios.
Example: Peroxide, H_2O_2, and water, H_2O.

Q34 **Which of the following is an element?**

CH 2 **A** H_2O **B** HCl **C** CO_2 **D** Cr

Each element has its own chemical name and symbol. The symbol consists of one, two, or three letters, so that the first letter is uppercase, and the rest of the letters are lowercase. →D

Q35 **Which of the following is not a compound?**
CH 2 **A** H_2O **B** H_2SO_4 **C** HCl **D** Br_2
A compound is a combination of two or more different elements →D

Q36 **Table salt NaCl is…**
CH 2 **A** An element **B** A compound **C** A solution **D** A mixture
A compound is a chemical combination of two or more different elements →B

Q37 **The simplest form of pure matter that cannot be broken down is**
CH 2 **A** An element **B** A compound **C** A mixture **D** An aqueous solution
An element is a pure substance that cannot be Separated into simpler substances by physical or chemical means →A

Q38 **Which of the following is a chemical compound?**
CH 2 **A** Ca **B** CO **C** Co **D** N_2
A compound is a combination of two or more different elements →B

Q39 **Which of the following is a chemical compound?**
CH 2
A  **B** 
C  **D** 
A compound is a combination of two or more different elements →C

Q40 **Properties of mixtures include…**
CH 2 **A** Components retain their individual chemical properties **B** Produced as a result of a chemical reaction **C** Its substance form indefinite properties **D** Components separate chemically
It will not change its properties but the compound has different properties from it →A

Q41 **Which of the following is from the properties of homogenous mixtures?**
CH 2 **A** Separate with time **B** Brownian motion **C** Tyndall effect **D** Components are indistinguishable
We can not see the components of a homogenous mixture →D

Q42 **Which of the following is a homogenous mixture?**
CH 2 **A** Mixed nuts **B** Salad **C** Group of fruits **D** Table salt dissolved in water
Solutions are the best examples of homogenous Mixtures →D

Q43 **Substances that don't blend smoothly throughout and in which the individual substances remain distinct …**
CH 2 **A** Homogenous mixture **B** Heterogeneous mixture **C** Suspension **D** A solution
A heterogeneous mixture is a mixture where the individual substances remain distinct (milk – blood – clay or Mud) →B

Q44 **A colloid is considered …**
CH 2 **A** Homogenous mixture **B** Heterogeneous mixture **C** Suspension **D** A solution
A colloid: is a heterogeneous mixture that has particles of sizes between 1nm to 1000nm in diameter and does not settle out →B

Q45 **Milk is …**
CH 2 **A** A colloid **B** A suspension **C** Homogenous mixture **D** A solution
milk is one of the examples of colloid →A

Q46 **You hear a banging sound when you open a can of fizzy drink, because of the emission of gas...**
CH 2 **A** CO **B** NH_3 **B** CO_2 **D** SO_2
The sound we hear when opening a can of soft drink is carbon dioxide leaking from it →C

Q47 **The erratic movement of solute particles in a colloid**
CH 2 **A** Circular motion **B** Colloidal motion **C** Vibratory motion **D** Brownian motion
Brownian motion: is the random movement of liquid colloid particles →D

Q48 **Brownian motion stops solute particles from….in the mixture.**
CH 2 **A** Ionization **B** Bonding **C** Precipitation **D** Solvation
Brownian motion prevents solute particles from precipitating into the mixture →C

Q49 **Salt and sand mixture can be separated by...**
CH 2 **A** Distillation **B** Crystallization **C** Filtration **D** Chromatography
Filtration is a technique that uses a porous barrier to separate a solid from a liquid in a heterogeneous mixture. (sand from sand water mixture) →C
.

Q50 **A Solid is separated from a liquid by...**
CH 2 **A** Distillation **B** Analysis **C** Filtration **D** Chromatography
Filtration is a technique that uses a porous barrier to separate a solid from a liquid in a heterogeneous mixture →C
.

Q51 **A technique used to separate the components of The ink from water...**

CH 2

A Distillation **B** Distillation

C Filtration **D** Chromatography

Chromatography is a technique that separates the components of a mixture based on the tendency of each to travel across the surface of another material. Ex: (ink –chlorophyll) →D

.

Q52 **Tyndall effect...**

CH 2

A Light scattering **B** Random movement

C Light analysis **D** Rapid movement

Tyndall effect: is the scattering of light due to the dispersed colloid particles. →A

Q53 **Can be used to determine the number of a colloid particles in suspension...**

CH 2

A Brownian motion **B** Tyndall effect

C Electrostatic **D** Osmosis

Tyndall effect: is the scattering of light due to the dispersed colloid particles. Colloids are categorized according to the phases of their particles. →B

Q54 **Which of the following is a solution?**

CH 2

A Homogenous mixture **B** Heterogeneous mixture

C Suspension **D** Colloid

Solutions are the best examples of homogenous Mixtures →A

.

Q55 **Which of the following consists of a solvent and a solute?**

CH 2

A Solution **B** Heterogeneous mixture

C Suspension **D** Colloid

A solution consists of solute and solvent →A

Q56 **Which type of solvent and solute does air contain?**

CH 2

A Liquid-liquid **B** Gas-gas

C Liquid-gas **D** Solid-liquid

Gas–gas, because air is primarily a mixture of nitrogen, oxygen, and argon gases →B

Q57 **Dental amalgam is from...**

CH 2

A Liquid solutions **B** Solid solutions

C Colloid **D** Suspension

Dental amalgam is a solid solution →B

Q58 **Adding ammonia to water is an example of**

CH 2

A Liquid-liquid **B** Gas-gas

C Liquid-gas **D** Solid-liquid

Liquid-gas (solvent is liquid, ammonia is gas Solute →C

Chapter 2: Do It Answer key		
1	2	3
C	D	A