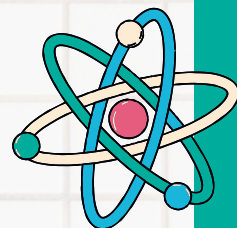
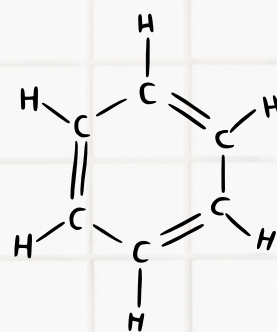
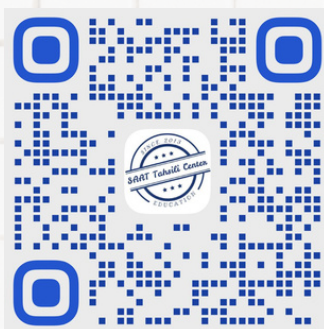
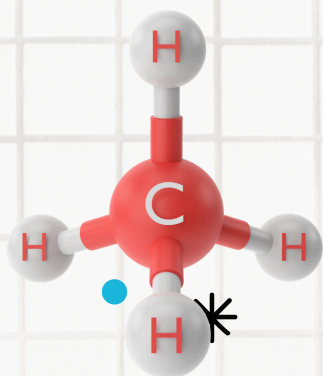


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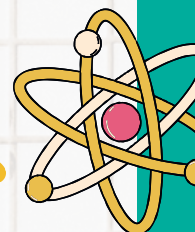
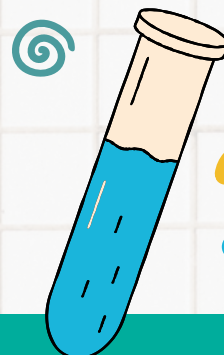
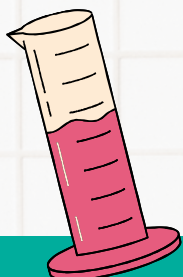
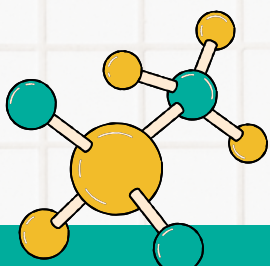
# SAAT TAHSILI CHEMISTRY NOTES+QUESTIONS



## 1-Introduction to Chemistry



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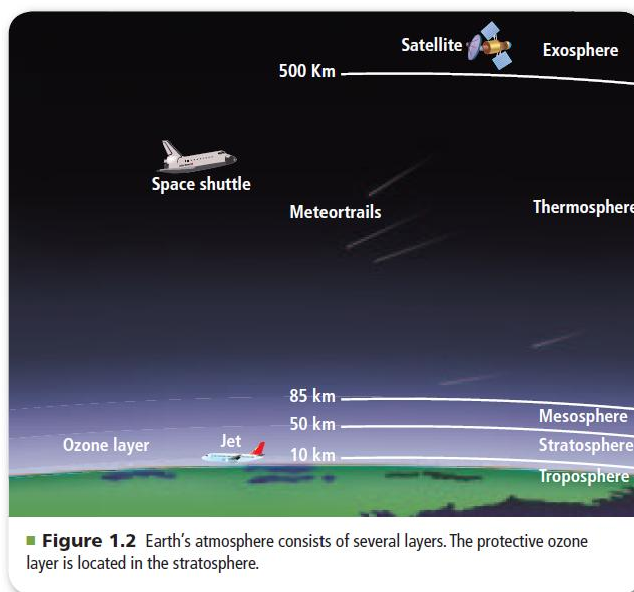


## Chemistry

- **Definition:** The science of studying matter and the changes it undergoes.
- **Branches:**
  - **Analytical Chemistry**  
Concerned with studying the types of materials and their compositions.  
*Examples:* Food analysis and quality control.
  - **Atomic Chemistry**  
Concerned with studying the theories of matter's structure.  
*Examples:* Bonds, orbitals, and electronic configurations.
  - **Biochemistry**  
Concerned with studying matter and biological processes in living organisms.  
*Examples:* Metabolism.
  - **Environmental Chemistry**  
Concerned with studying matter and its interactions with the environment.  
*Examples:* Environmental pollution and chemical treatments.

## The Ozone Layer

- **Function:** Absorbs most of the harmful ultraviolet rays before they reach the Earth.
- **Ozone Gas:** Found in the stratosphere layer and consists of molecules containing three oxygen atoms  $O_3$ .
- **Ozone Hole:** A thinning of the ozone layer above the Antarctic region.
  - The cause: Chlorofluorocarbons (CFCs) used in refrigeration, which are among the most harmful substances to the ozone layer.
  - Consequences: It contributes significantly to climate change.
- **Notes:**
  - The scientist Dobson developed a method for measuring the ozone concentration in the atmosphere.
  - The natural level of ozone gas equals 300 Dobson units (DU).



### Types of Studies and Scientific Research

- **Theoretical Research:**  
The pursuit of knowledge for its own sake.  
*Example:* Studying chlorofluorocarbon (CFC) compounds and their reactions with ozone gas without direct environmental evidence.
- **Applied Research:**  
Research conducted to solve a specific problem.  
*Example:* Measuring the amount of CFCs in the atmosphere and assessing their potential responsibility for ozone depletion.

### Students in the Laboratory

- **One of the safety rules in the laboratory:**  
Wearing safety glasses, a lab coat, and gloves is mandatory, while wearing contact lenses is prohibited.

### Matter

- **Definition:** Everything that has mass and occupies space.
- **Mass:** A measure of the quantity of matter.
- **Note:** Mass is a constant value in any location, whereas weight varies from one place to another depending on the gravitational force.



## States of Matter

### 1. Solid

- Has a definite shape and volume.
- Its particles are tightly packed together.
- *Example:* Sand.

### 2. Liquid

- Has the ability to flow, with a definite volume.
- Takes the shape of the container it is placed in.
- *Example:* Water.

### 3. Gas

- Takes the shape and volume of the container it is placed in.
- Its particles are spread apart and can be compressed easily.
- *Example:* Air.

#### Note:

Researchers have identified another state of matter called **plasma**, which can be described as ionized gas.

#### Symbols Used in Chemical Equations:

- *g*: Gaseous state.
- *l*: Pure liquid state.
- *s*: Solid state.
- *aq*: Aqueous solution (dissolved in water).

Symbol	Purpose
+	separates two or more reactants or products
→	separates reactants from products
⇌	separates reactants from products and indicates a reversible reaction
(s)	identifies a solid state
(l)	identifies a liquid state
(g)	identifies a gaseous state
(aq)	identifies a water solution

#### Physical and Chemical Properties of Matter

##### Physical Properties of Matter:

These properties can be observed or measured without altering the substance's composition.



## Types of Physical Properties of Matter

### 1. Intensive Properties (Qualitative)

- These do not depend on the amount of matter.
- *Examples:* Taste, smell, density, color, and electrical conductivity.

### 2. Extensive Properties (Quantitative)

- These depend on the amount of matter.
- *Examples:* Mass, length, speed, volume, and concentration.

## Chemical Properties of Matter

- **Definition:** The ability of a substance to combine with other substances or transform into a different substance.
  - *Examples:* The formation of rust on iron, the decomposition of sugar into carbon and water vapor, and the burning of wood.
- **Note:** The inability of a substance to change into another substance is also considered a chemical property.
  - *Example:* Table salt does not react with pure water.

## Physical Changes of Matter

- **Definition:** Changes in the physical properties of matter without altering its chemical composition.
  - *Examples:* Breaking a glass sheet, cutting paper, grinding diamonds, and changes in state.
- **Change of State:** The transformation of matter from one state to another.
  - This depends on the temperature, pressure, and surrounding environmental conditions.

## Types of Physical Changes

### Energy Absorption Processes (Endothermic):

- **Melting:** The process of a solid turning into a liquid.
- **Evaporation:** The process of a liquid transforming into a gas or vapor.
- **Sublimation:** The direct transformation of a solid into a gas without passing through the liquid state.

*Example:* The direct transformation of solid naphthalene into a gas.



### Energy Release Processes (Exothermic):

- **Freezing:** The process of a liquid turning into a solid.
- **Condensation:** The process of a gas turning into a liquid.
- **Deposition:** The direct transformation of a gas into a solid without passing through the liquid state.

#### Example:

Water vapor turning into ice crystals (frost formation).

#### Note:

When water freezes, the particles of ice move further apart than they are in liquid water, which increases its volume.

#### Examples of phenomena resulting from condensation:

- Dew
  - Clouds
  - Fog
  - Rain
- **Melting Point:** The specific temperature at which a solid changes into a liquid.
  - **Boiling Point:** The specific temperature at which the vapor pressure of a liquid equals the external atmospheric pressure.

### Chemical Changes of Matter

- **Definition:** Changes in the composition and properties of matter that result in the formation of new substances.
- **Examples:**
  - Combustion
  - Bread fermentation
  - Decomposition



## Element and Compound

- **Element:**

A pure chemical substance that cannot be broken down into simpler substances by physical or chemical means.

- **Examples:** Sodium (Na), Calcium (Ca), Chromium (Cr).
- **Note:** Some elements exist as diatomic molecules.
- **Examples:**

- Hydrogen ( $H_2$ )
- Nitrogen ( $N_2$ )
- Oxygen ( $O_2$ )
- Fluorine ( $F_2$ )
- Chlorine ( $Cl_2$ )
- Bromine ( $Br_2$ )
- Iodine ( $I_2$ )

## Compound

- **Definition:**

A substance formed by the chemical combination of two or more different elements in fixed proportions. Compounds can be broken down into simpler substances by chemical methods.

- **Examples:**
  - Table salt ( $NaCl$ )
  - Water ( $H_2O$ )
  - Iron oxide (rust) ( $Fe_2O_3$ )
- **Note:**

The properties of compounds differ from the properties of the individual elements that compose them.



## Laws of Chemical Composition

### 1. Law of Definite Proportions:

A compound always consists of the same elements in fixed proportions by mass, regardless of the source or quantity.

### 2. Law of Multiple Proportions:

When two elements combine to form more than one compound, the ratios of the masses of one element that combine with a fixed mass of the other element are in simple whole numbers.

- **Example:**

The ratio of oxygen to hydrogen in water ( $H_2O$ ) is 2 : 1, while in hydrogen peroxide ( $H_2O_2$ ) it is 1 : 1.

## Chemical Reactions

- **Definition:**

A process in which the arrangement of atoms in one or more substances is reorganized to form new and different substances.

- **Types of Chemical Reactions:**

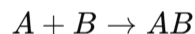
- Combination (Synthesis)
- Combustion
- Decomposition
- Single Replacement
- Double Replacement

## Combination Reaction (Synthesis)

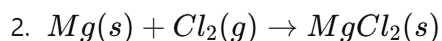
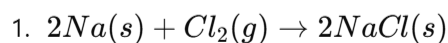
- **Description:**

A chemical reaction in which two or more substances combine to form a single product.

- **General Equation:**



- **Examples:**





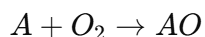


## Combustion Reaction

- **Description:**

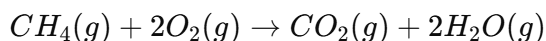
A reaction in which a substance reacts with oxygen ( $O_2$ ), releasing energy in the form of heat and light.

- **General Equation:**



- **Example:**

Combustion of methane gas ( $CH_4$ ):

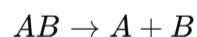


## Decomposition Reaction

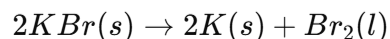
- **Description:**

A chemical reaction in which a single compound breaks down into two or more simpler substances.

- **General Equation:**



- **Example:**

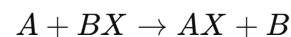


## Single Replacement Reaction

- **Description:**

A reaction in which one element (the more reactive) replaces another element (the less reactive) in a compound.

- **General Equation:**



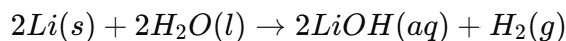
■ **Figure 9.13** An activity series, similar to the series shown here for various metals and halogens, is a useful tool for determining whether a chemical reaction will occur and for determining the result of a single-replacement reaction.

<b>Most active</b>	↓	<b>METALS</b>
		Lithium
		Rubidium
		Potassium
		Calcium
		Sodium
		Magnesium
		Aluminum
		Manganese
		Zinc
		Iron
		Nickel
		Tin
		Lead
		Copper
<b>Least active</b>	Silver	
	Platinum	
	Gold	
<b>Most active</b>	↓	<b>HALOGENS</b>
		Fluorine
		Chlorine
<b>Least active</b>		Bromine
	Iodine	



- **Examples:**

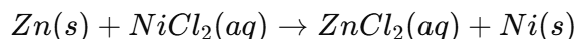
1. **Metal replacing hydrogen in water:**



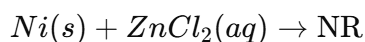
2. **Metal replacing another metal:**

A more reactive metal can replace a less reactive metal in a solution based on the reactivity series.

- Example of replacement:



- Example of no reaction (indicated as NR):

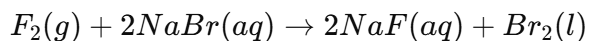


*(This shows that less reactive metals cannot replace more reactive metals.)*

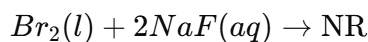
3. **Halogen replacing another halogen:**

A more reactive halogen replaces a less reactive halogen.

- Example of replacement:



- Example of no reaction (NR):



*(Fluorine is more reactive than bromine, so bromine cannot replace fluorine.)*

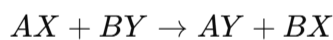
### Double Replacement Reaction

- **Description:**

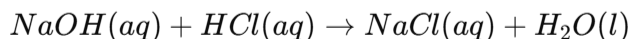
A reaction in which the ions of two compounds exchange places to form two new compounds.

This reaction often produces water, a precipitate, or a gas.

- **General Equation:**



- **Example:**



- **Note:**

These reactions typically occur in aqueous solutions, and most involve ionic compounds.



## Balancing Chemical Equations and Chemical Calculations

- **Balancing Chemical Equations:**
  - A chemical equation must include equal numbers of atoms for each element on both sides (reactants and products).
  - Balanced equations comply with the **Law of Conservation of Mass**.
- **Law of Conservation of Mass:**
  - States that mass is neither created nor destroyed during a chemical reaction.
  - The total mass of reactants equals the total mass of products.

## Chemical Calculations

- **Definition:**

The study of the quantitative relationships between the reactants and the products in a chemical reaction.
- **Steps for Performing Chemical Calculations:**
  1. Begin with a balanced chemical equation.
  2. Calculate the number of moles.
  3. Convert between mass and moles, or vice versa.

## Chemical Coefficient and Mole Ratio

- **Coefficient:**

In a chemical equation, the coefficient is the number written before the reactant or product, indicating the number of moles involved.

  - Example:
$$2Al(s) + 3Br_2(l) \rightarrow 2AlBr_3(s)$$
- **Mole Ratio:**

The ratio of the number of moles of any two substances in a balanced chemical equation.

  - Example:

For the reaction  $2K(s) + Br_2(l) \rightarrow 2KBr(s)$ :

$$\text{Mole ratio} = \frac{2 \text{ mol K}}{2 \text{ mol KBr}} = \frac{2 \text{ mol K}}{1 \text{ mol Br}_2}$$



**01: Which branch of chemistry studies the types and compositions of substances?**

- A: Atomic Chemistry
- B: Biochemistry
- C: Organic Chemistry
- D: Analytical Chemistry

**02: Studying bonds, orbital shapes, and electronic structure falls under which branch of chemistry?**

- A: Analytical Chemistry
- B: Atomic Chemistry
- C: Biochemistry
- D: Organic Chemistry

**03: Which branch of chemistry investigates and analyzes decomposition materials in the environment?**

- A: Biochemistry
- B: Environmental Chemistry
- C: Industrial Chemistry
- D: Physical Chemistry

**04: The type of radiation mostly absorbed by ozone gas is...**

- A: Infrared
- B: Ultraviolet
- C: X-rays
- D: Gamma rays

**05: Ozone gas (O<sub>3</sub>) is found in the atmosphere within a layer called...**

- A: Stratosphere
- B: Troposphere
- C: Mesosphere
- D: Thermosphere



**06: How many ozone molecules are formed from 18 oxygen atoms?**

- A: 2
- B: 3
- C: 6
- D: 9

**07: What is the cause of ozone depletion in the atmosphere?**

- A: Chlorofluorocarbon (CFC) compounds
- B: Air currents in the stratosphere
- C: Ultraviolet radiation
- D: Combination of oxygen gas with its atoms

**08: Which of the following is considered the most harmful to the atmosphere?**

- A: Nitrogen
- B: Chlorofluorocarbons (CFCs)
- C: Carbon monoxide
- D: Carbon dioxide

**09: The study of CFC compounds and their reactions with ozone gas without direct environmental evidence is considered...**

- A: Theoretical Research
- B: Practical Research
- C: Experimental Research
- D: Applied Research

**10: Research conducted to solve a specific problem is called...**

- A: Theoretical Research
- B: Philosophical Research
- C: Descriptive Research
- D: Applied Research

**11: Which of the following is NOT a laboratory safety rule?**

- A: Wearing a lab coat
- B: Wearing gloves
- C: Wearing safety goggles
- D: Wearing contact lenses



**12: Which of the following is NOT classified as matter according to the scientific definition?**

- A: Water
- B: Air
- C: Heat
- D: Soil

**13: Which of the following represents a measure of the quantity of matter only?**

- A: Volume
- B: Mass
- C: Density
- D: Weight

**14: Which of the following statements describes matter in the solid state?**

- A: It has the ability to flow.
- B: It can be compressed into a smaller volume.
- C: It takes the shape and volume of its container.
- D: Its particles are tightly packed together.

**15: Which state of matter has an indefinite shape and volume, with its particles far apart?**

- A: Plasma
- B: Gaseous state
- C: Solid state
- D: Liquid state

**16: Which of the following is considered an intensive property?**

- A: Mass
- B: Volume
- C: Length
- D: Density

**17: Which of the following is considered a qualitative property of matter?**

- A: Volume
- B: Speed
- C: Length
- D: Color



**18: Which of the following represents a physical property?**

- A: Formation of rust on iron
- B: Burning of a piece of wood
- C: Tarnishing of silver
- D: Electrical conductivity of copper

**19: The quantitative property of the answer sheet in your hand is...**

- A: Its color
- B: Its dimensions
- C: Its smell
- D: Its texture

**20: Which of the following represents a quantitative property?**

- A: Salt dissolving in hot water
- B: Solution concentration of 1 mol/L
- C: Sodium being a caustic substance for skin
- D: Clouds containing a certain amount of rainfall

**21: Which of the following is considered a chemical property?**

- A: Water is colorless.
- B: Sugar decomposes into carbon and water vapor.
- C: Table salt is a solid crystal.
- D: Carbon monoxide gas is released.

**22: Which property of table salt represents a chemical property?**

- A: Its salty taste
- B: Its white color
- C: Its crystalline structure
- D: It does not react with pure water

**23: Two factors determine the state of matter. They are...**

- A: Density and mass
- B: Pressure and temperature
- C: Volume and density
- D: Mass and temperature



**24: Which of the following is considered a physical change?**

- A: Digestion of food
- B: Rusting of iron
- C: Breaking glass
- D: Burning wood

**25: Which of the following is classified as an energy-releasing physical state change?**

- A: Sublimation
- B: Evaporation
- C: Freezing
- D: Melting

**26: Which process is accompanied by the release of energy?**

- A: Crystallization
- B: Evaporation
- C: Sublimation
- D: Condensation

**27: The temperature at which the vapor pressure of a liquid equals atmospheric pressure is called...**

- A: Melting Point
- B: Condensation
- C: Sublimation
- D: Boiling Point

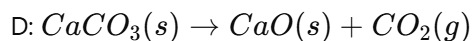
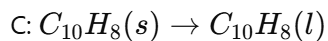
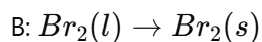
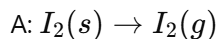
**28: Smelling the scent of solid naphthalene in the air indicates the occurrence of...**

- A: Sublimation
- B: Freezing
- C: Evaporation
- D: Melting

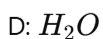




29: Which of the following processes represents sublimation?



30: Which substance increases in volume when transitioning from the liquid state to the solid state?



31: The deposition process is the reverse of which process?

A: Sublimation

B: Melting

C: Condensation

D: Evaporation

32: What type of change occurs in the composition and properties of a substance, resulting in the formation of new materials?

A: Physical change

B: Physical property

C: Chemical change

D: Freezing

33: Which of the following represents a chemical change?

A: Melting of ice

B: Condensation of water vapor

C: Burning of a candle wick

D: Evaporation of mercury



34: Which of the following is NOT considered a compound?

- A:  $H_2SO_4$
- B:  $NaCl$
- C:  $Br_2$
- D:  $H_2O$

35: A substance with a fixed composition made up of multiple elements is called...

- A: Homogeneous mixture
- B: Heterogeneous mixture
- C: Compound
- D: Isotope

36: Which of the following is considered a compound?

- A: Coal
- B: Ozone
- C: Rust (Iron Oxide)
- D: Mercury

37: Table salt is classified as...

- A: An element
- B: A solution
- C: A mixture
- D: A compound

38: A characteristic that distinguishes a compound is that its components...

- A: Combine in any ratio
- B: Can be separated by filtration
- C: Undergo a chemical reaction
- D: Retain their fundamental properties



39: The ratio of the mass of sodium  $Na$  to the mass of chlorine  $Cl$  in table salt  $NaCl$  represents...

- A: Law of conservation of mass
- B: Law of conservation of energy
- C: Law of definite proportions
- D: Law of multiple proportions

40: The mass of oxygen in  $H_2O_2$  compared to its mass in  $H_2O$  represents the law of...

- A: Conservation of energy
- B: Conservation of mass
- C: Multiple proportions
- D: Definite proportions

41: The process in which the arrangement of atoms in a substance changes to produce one or more new substances is called...

- A: Chemical equilibrium
- B: Reaction rate
- C: Chemical reaction
- D: Dissolution process

42: The type of reaction that produces a single substance is...

- A: Replacement
- B: Decomposition
- C: Synthesis
- D: Analysis

43: Which of the following represents a synthesis reaction?

- A:  $2NaF(aq) \rightarrow 2Na(s) + F_2(g)$
- B:  $Mg(s) + Cl_2(g) \rightarrow MgCl_2(s)$
- C:  $2H_2O(l) \rightarrow 2H_2(g) + O_2(g)$
- D:  $MgCl_2(s) \rightarrow Mg(s) + Cl_2(g)$



44: What type of reaction is  $\text{Ca(s)} + \text{Cl}_2\text{(g)} \rightarrow \text{CaCl}_2\text{(s)}$ ?

- A: Synthesis
- B: Simple Replacement
- C: Double Replacement
- D: Decomposition

45: Which equation represents a combustion reaction?

- A:  $\text{H}_2\text{(g)} + \text{Cl}_2\text{(g)} \rightarrow 2\text{HCl(aq)}$
- B:  $\text{Mg(s)} + 2\text{HCl(aq)} \rightarrow \text{MgCl}_2\text{(s)} + \text{H}_2\text{(g)}$
- C:  $\text{KOH(aq)} + \text{HNO}_3\text{(aq)} \rightarrow \text{KNO}_3\text{(aq)} + \text{H}_2\text{O(l)}$
- D:  $\text{CH}_4\text{(g)} + 2\text{O}_2\text{(g)} \rightarrow \text{CO}_2\text{(g)} + 2\text{H}_2\text{O(g)}$

46: The reaction of methane gas with oxygen gas is classified as..

- A: Formation
- B: Combustion
- C: Decomposition
- D: Single displacement

47: A chemical reaction where a single substance produces two or more substances is classified as..

- A: Displacement
- B: Combustion
- C: Decomposition
- D: Addition

48: What type of reaction occurs when an electric current passes through molten potassium bromide, resulting in the production of bromine and potassium?

- A: Synthesis
- B: Decomposition
- C: Combustion
- D: Displacement



49: What type of chemical reaction is represented by the equation  $A + BX \rightarrow AX + B$ ?

- A: Single displacement
- B: Double displacement
- C: Decomposition
- D: Synthesis

50: What type of reaction is represented by the equation  $Ni(s) + CuCl_2(aq) \rightarrow Cu(s) + NiCl_2(aq)$ ?

- A: Double displacement
- B: Decomposition
- C: Combustion
- D: Single displacement

51: Which of the following is classified as a displacement reaction?

- A:  $2Al(s) + 3S(s) \rightarrow Al_2S_3(s)$
- B:  $2Li(s) + 2H_2O(l) \rightarrow 2LiOH(aq) + H_2(g)$
- C:  $H_2O(l) + N_2O_5(g) \rightarrow 2HNO_3(aq)$
- D:  $4NO_2(g) + O_2(g) \rightarrow 2N_2O_5(g)$

52: Complete the reaction:  $Zn(s) + NiCl_2(aq) \rightarrow ?$

- A:  $ZnCl_2(aq) + Ni(s)$
- B:  $ZnCl_2(aq) + 2Ni(s)$
- C:  $2ZnCl_2(aq) + Ni(s)$
- D: NR (No Reaction)

53: Complete the equation:  $F_2(g) + 2NaBr(aq) \rightarrow 2NaF(aq) + ?$

- A:  $F_2(g)$
- B:  $Na(s)$
- C:  $Br_2(l)$
- D:  $Br(l)$

54: Why does the reaction  $Br_2(l) + NaF(aq) \rightarrow NR$  stop?

- A: The reaction loses heat.
- B: Bromine is a molecular covalent compound.
- C: Fluorine is more reactive than bromine.
- D: The reactants are heterogeneous.



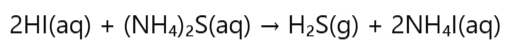
**55: What type of reaction is represented by  $AX + BY \rightarrow AY + BX$ ?**

- A: Decomposition
- B: Double displacement
- C: Synthesis
- D: Single displacement

**56: What type of reactions occur frequently in aqueous solutions?**

- A: Single displacement
- B: Double displacement
- C: Decomposition
- D: Synthesis

**57: What is the type of the following reaction?**



- A: Synthesis
- B: Decomposition
- C: Combustion
- D: Displacement

**58: Balanced chemical equations satisfy the law of..**

- A: Conservation of Energy
- B: Conservation of Mass
- C: Conservation of Charge
- D: Constant Proportions

**59: If 12.2 g of X reacts with 78.9 g of Y, producing 91.1 g of XY, this represents the law of..**

- A: Constant Proportions
- B: Conservation of Mass
- C: Multiple Proportions
- D: Conservation of Energy



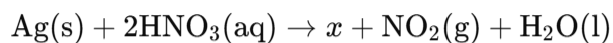
60: When 20 g of substance X reacts with substance Y, producing 30 g of XY, what is the mass of Y that reacted (in grams)?

- A: 10
- B: 20
- C: 30
- D: 50

61: The study of the relationship between the reactants and the products in a chemical reaction is called..

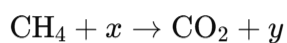
- A: Chemical calculations
- B: Chemical equations
- C: Molar ratios
- D: Limiting reactant

62: What is the compound  $x$  produced in the following balanced equation?



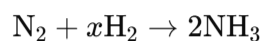
- A:  $\text{Ag}_2\text{O}(s)$
- B:  $\text{AgNO}_3(\text{aq})$
- C:  $\text{AgNO}_2(s)$
- D:  $\text{AgO}(s)$

63: Represent  $x$  and  $y$  in the balanced equation below:



- A:  $\text{O}_2, \text{H}_2\text{O}$
- B:  $\text{O}_2, 2\text{H}_2\text{O}$
- C:  $2\text{O}_2, \text{H}_2\text{O}$
- D:  $2\text{O}_2, 2\text{H}_2\text{O}$

64: Which of the following represents the coefficient  $x$  of hydrogen in the equation below?



- A: 1
- B: 2
- C: 3
- D: 6

