

CLASS X - SCIENCE 

CHEMICAL REACTION AND EQUATIONS-I

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Aanambh

Notes X

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TOPICS TO BE COVERED

- Change and its classification
 - Physical change & Chemical change**
- Chemical reaction and Chemical equation
- Balancing a chemical equation
- Limitations of chemical equation and their removal
- Types of chemical reactions
 - Combination reaction**
 - Decomposition reaction and its types**

PK HITS

✓ Balancing (MCQs)

- Type of Reaction and Example (Specially

Decomposition)

→ 3 March

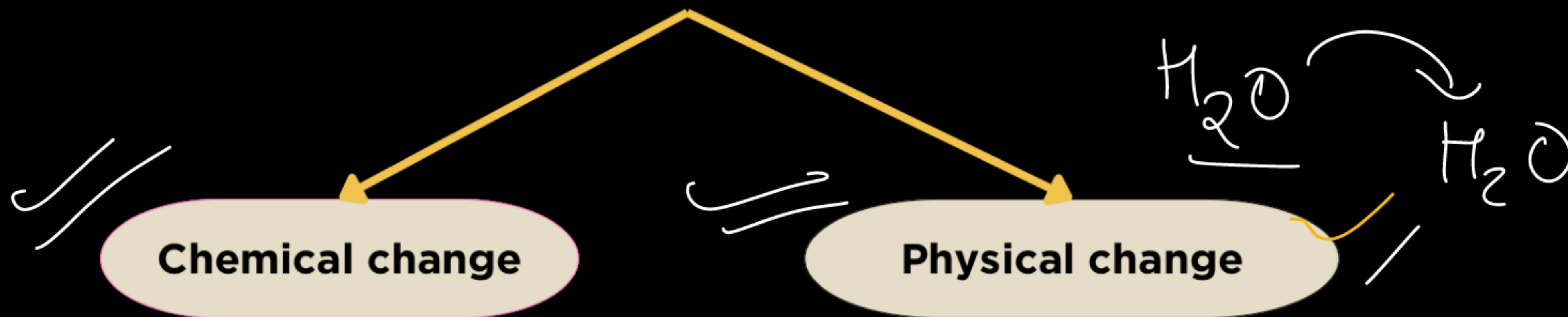
- Color Change Activities

- Redox

CHANGE

A change is a process in which the final state of a substance differs from its initial or original state.

CLASSIFICATION OF CHANGE



Which change is this?



PHYSICAL CHANGE

Shape/Size/Physical state
change e.g. melting of
chocolate, or Ice.



Breaking glass



Folding paper



Chopping Wood



Boiling water

CHEMICAL CHANGE

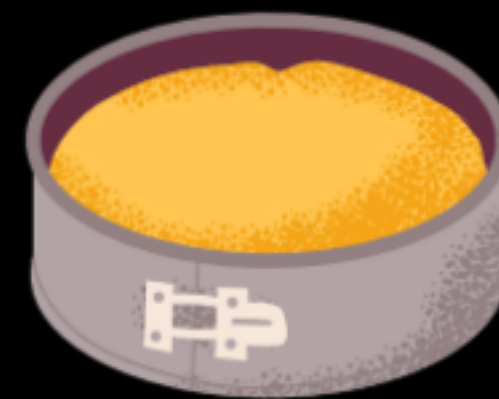
Composition change along with a
change in shape/size/state e.g., Rusting
of Iron or burning of wood.



Iron rust



Burning Wood



Baking a Cake



Metabolism

In a Chemical reaction:



Ekdum se sb badal gya!



When a candle burns both physical and chemical changes takes place.

Physical change - changing of shape due to melting

Chemical change - combustion of fuel in presence of oxygen.

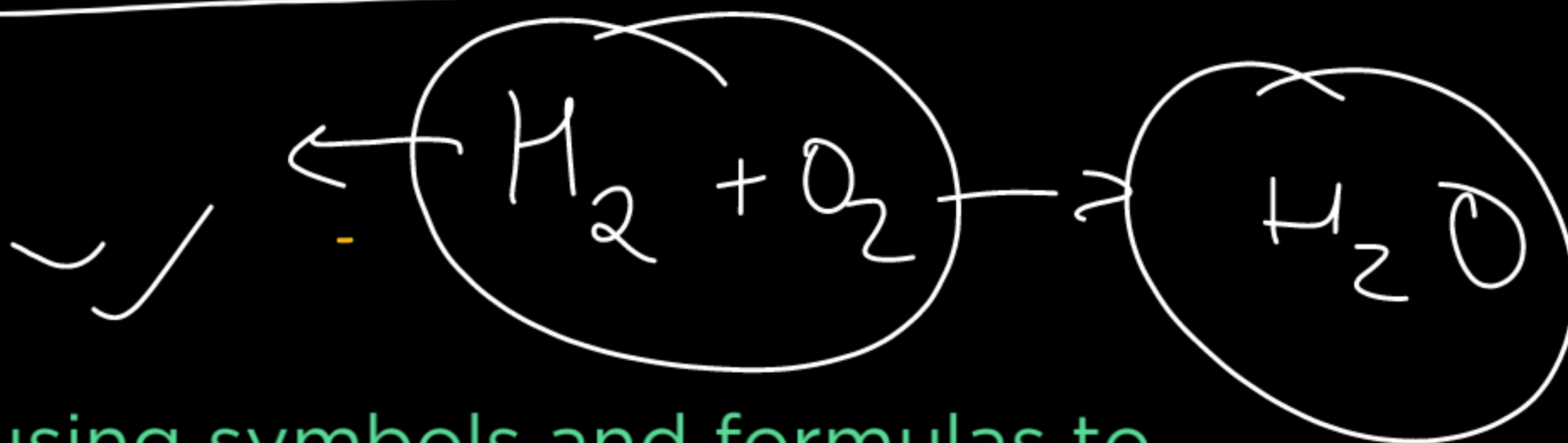


CHEMICAL REACTION

// A chemical reaction is a process in which substances undergo a transformation, resulting in the formation of new substances with different chemical properties.

CHEMICAL EQUATION

It shows a chemical reaction using symbols and formulas to represent the reactants and products involved



For eg: Hydrogen (H_2) + Oxygen (O_2) \rightarrow Water (H_2O)

REPRESENTING CHEMICAL REACTION

When heated in oxygen, magnesium burns with a bright white flame, forming white magnesium oxide powder.

Reactants: Substances that undergo a chemical change.

Products: Substances formed as a result of the chemical change.

WORD REACTION

Magnesium + Oxygen \rightarrow Magnesium Oxide



Shorter way of representing a chemical reaction

NCERT ACTIVITY



Activity: Burning of Magnesium Ribbon

Aim: To observe the burning of magnesium ribbon.

Procedure:

- Clean a 2 cm magnesium ribbon with sandpaper.
- Hold it with tongs and heat it in a flame.

Observation:

- Burns with a white dazzling flame.
- Forms white ash (magnesium oxide).

Conclusion: Magnesium reacts with oxygen to form magnesium oxide (MgO).

Reaction: $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$

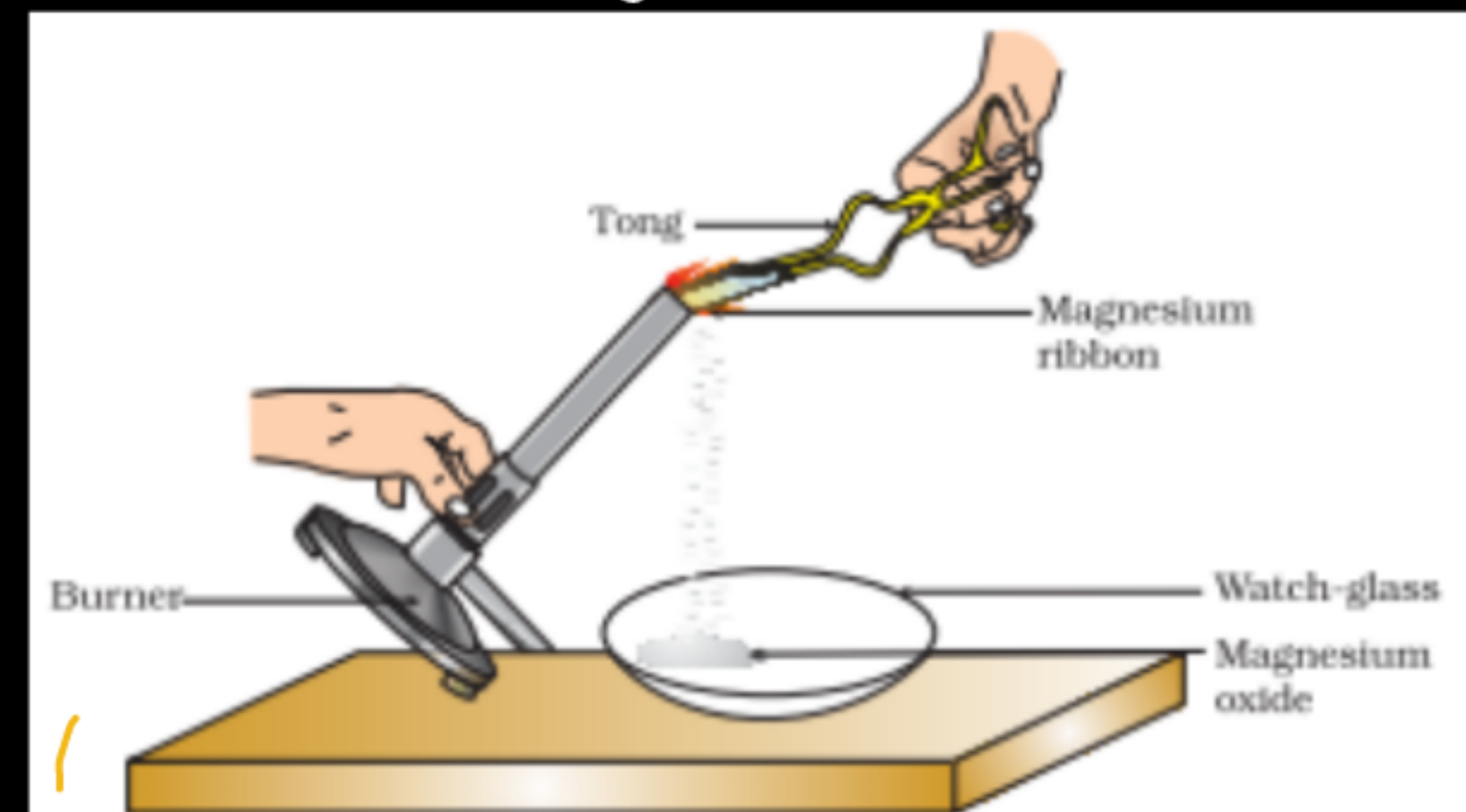
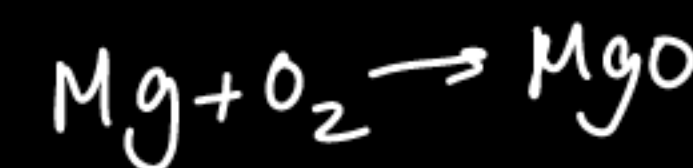


Figure 1.1

Burning of a magnesium ribbon in air and collection of magnesium oxide in a watch-glass

CHARACTERISTICS OF CHEMICAL REACTION



Indicators which tell us whether the reaction took place or not

I. Change in Color



II. Change in temperature



Exothermic
Reaction

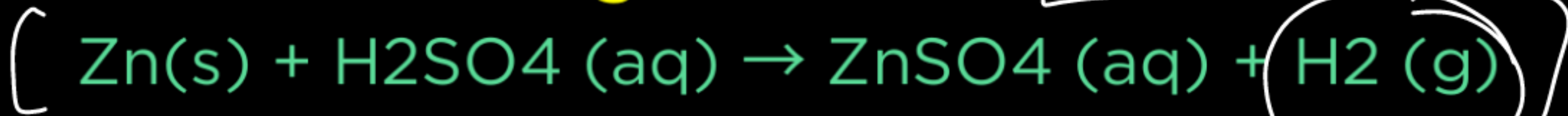
III. Change in state



CHARACTERISTICS OF CHEMICAL REACTION

Activity

VI. Evolution of gas

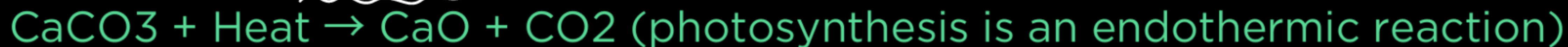


V. Formation of precipitate

→ Insoluble Substance



VI. Endothermic reaction (energy is absorbed)



CaO

VII. ~~Endothermic~~ reaction (energy is absorbed)



Hydrogen Test

↳ Pop Sound Test

NAME AND SYMBOLS OF SOME IONS

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Vale- ncy	Name of ion	Symbol	Non- metallic element	Symbol	Polyatomic ions	Symbol
1.	Sodium	Na ⁺	Hydrogen	H ⁺	Ammonium	NH ₄ ⁺
	Potassium	K ⁺	Hydride	H ⁻	Hydroxide	OH ⁻
	Silver	Ag ⁺	Chloride	Cl ⁻	Nitrate	NO ₃ ⁻
	Copper (I)*	Cu ⁺	Bromide	Br ⁻	Hydrogen carbonate	HCO ₃ ⁻
			Iodide	I ⁻		
2.	Magnesium	Mg ²⁺	Oxide	O ²⁻	Carbonate	CO ₃ ²⁻
	Calcium	Ca ²⁺	Sulphide	S ²⁻	Sulphite	SO ₃ ²⁻
	Zinc	Zn ²⁺			Sulphate	SO ₄ ²⁻
	Iron (II)*	Fe ²⁺				
	Copper (II)*	Cu ²⁺				
3.	Aluminium	Al ³⁺	Nitride	N ³⁻	Phosphate	PO ₄ ³⁻
	Iron (III)*	Fe ³⁺				

Lead (II) Pb²⁺ , Barium Ba²⁺

BALANCING CHEMICAL REACTION

A balanced chemical equation is one where the number of atoms of each element is equal on both the reactant and product sides.

It must follow the *law of conservation of mass* that is, mass is neither created nor destroyed in a chemical reaction.



Not a balanced reaction

LET'S LEARN HOW TO BALANCE AN EQUATION

Step 1. Writing the chemical reaction in word form.



Step 2. Writing the chemical symbols in the form of a skeletal chemical equation



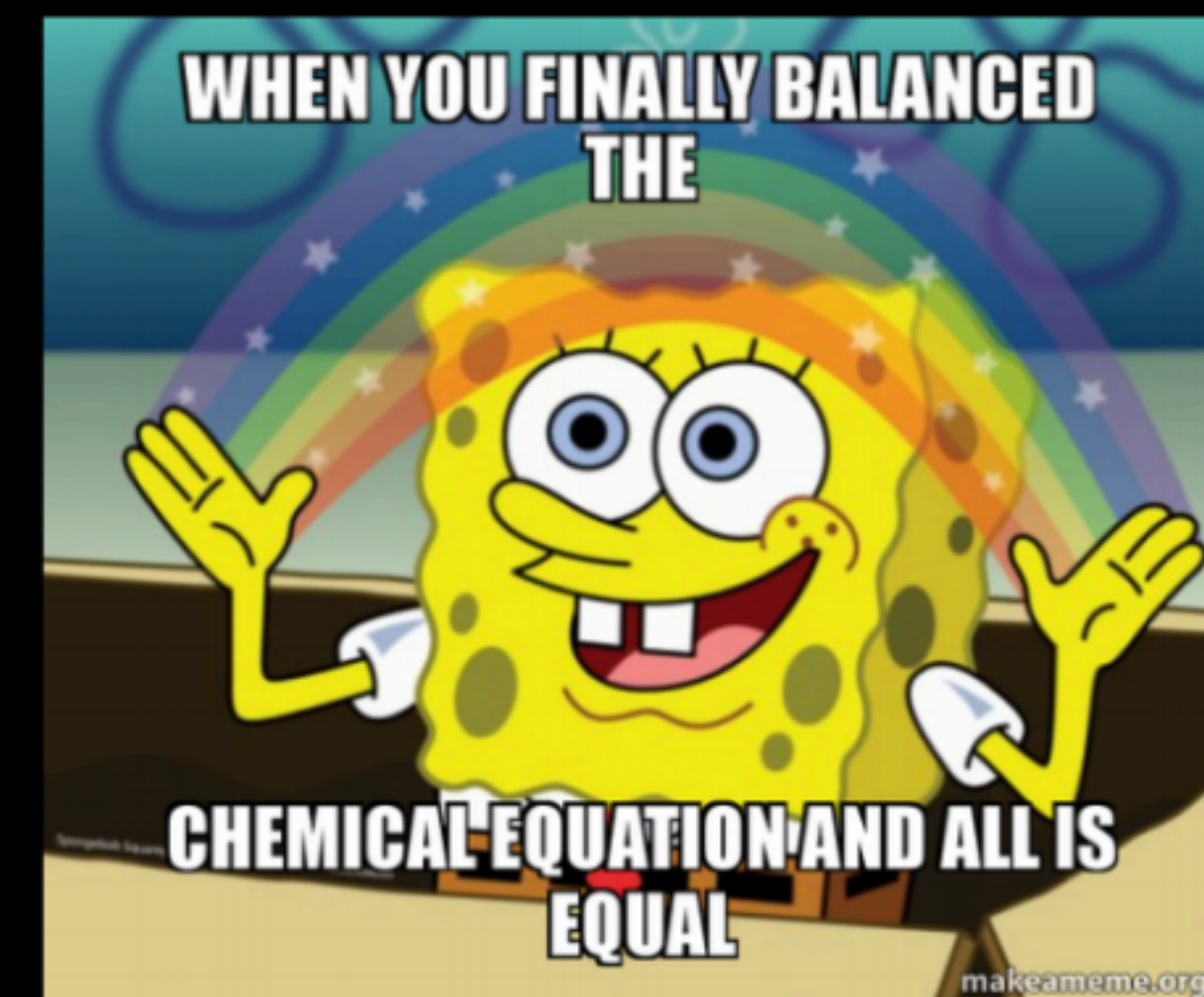
Step 3. List the number of atoms of different elements

Element	Number of atoms (Reactants)	Number of atoms (Products)
Fe	1×3	3
H	$2 \times 4 = 8$	2×4
O \rightarrow	1×4	4

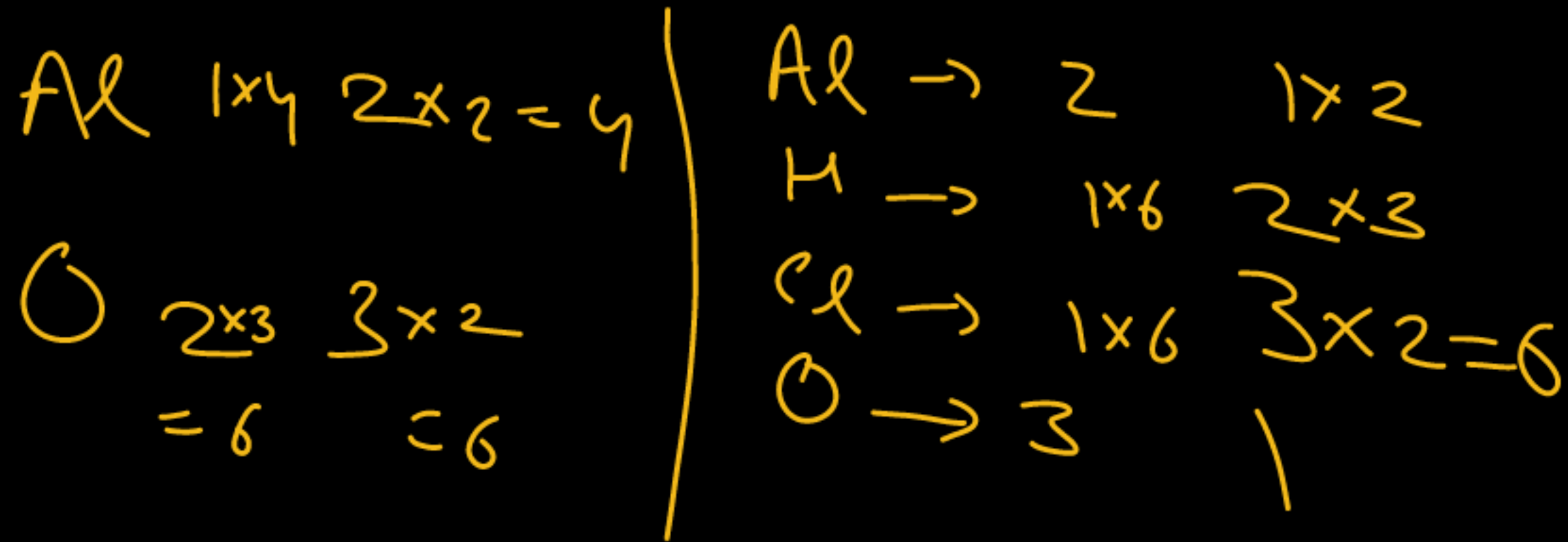
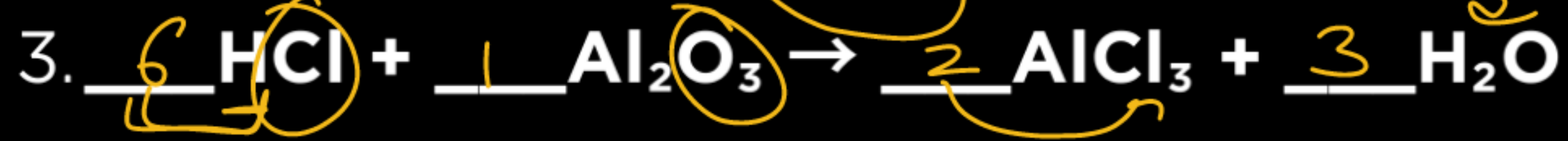
LET'S LEARN HOW TO BALANCE A EQUATION

Step 4. Start balancing the compound (reactant of product) that contains the maximum number of atoms. In that compound, balance the element with the maximum number of atoms

Element	Number of atoms (Reactants)	Number of atoms (Products)
Fe	$1 \times 3 = 3$	3
H	$2 \times 4 = 8$	$2 \times 4 = 8$
O	$1 \times 4 = 4$	4



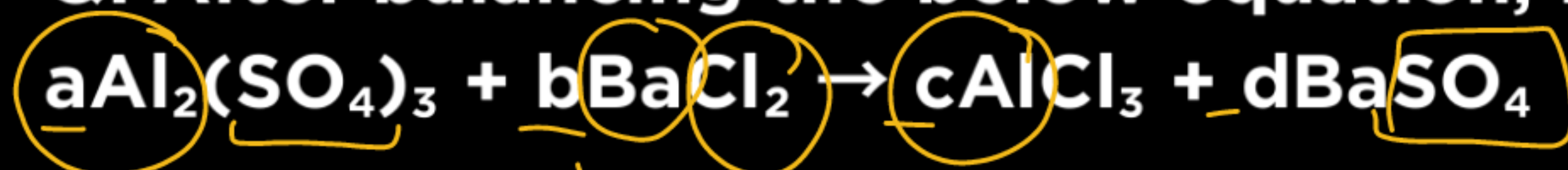
Balance the following equations:



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Q. After balancing the below equation, find the values of a, b, c, and d.



$$\begin{array}{l} 2a = 1c \\ 3a = 1d \\ \hline b = d \\ 2b = 3c \end{array}$$

$$\begin{array}{l} a = 1 \\ c = 2 \\ d = 3 \\ b = 3 \end{array}$$



Q. Balance the following chemical equations:



Q. In the chemical reaction: $a \text{SiO}_2 + b \text{HF} \rightarrow c \text{SiF}_4 + d \text{H}_2\text{O}$

The values of a, b, c, and d are:

(a) $a = 1, b = 1, c = 4, d = 2$

~~(b) $a = 1, b = 4, c = 1, d = 2$~~

(c) $a = 1, b = 2, c = 1, d = 4$

(d) $a = 2, b = 1, c = 2, d = 4$

$$\begin{aligned} a &= c & \Rightarrow a &= 1 \\ 2a &= d & \Rightarrow c &= 1 \\ b &= 2d & \Rightarrow d &= 2 \\ b &= 4c & \Rightarrow b &= 4 \end{aligned}$$



LIMITATIONS OF CHEMICAL EQUATIONS

(aq)

Doesn't tell about the physical state of reactants ✗

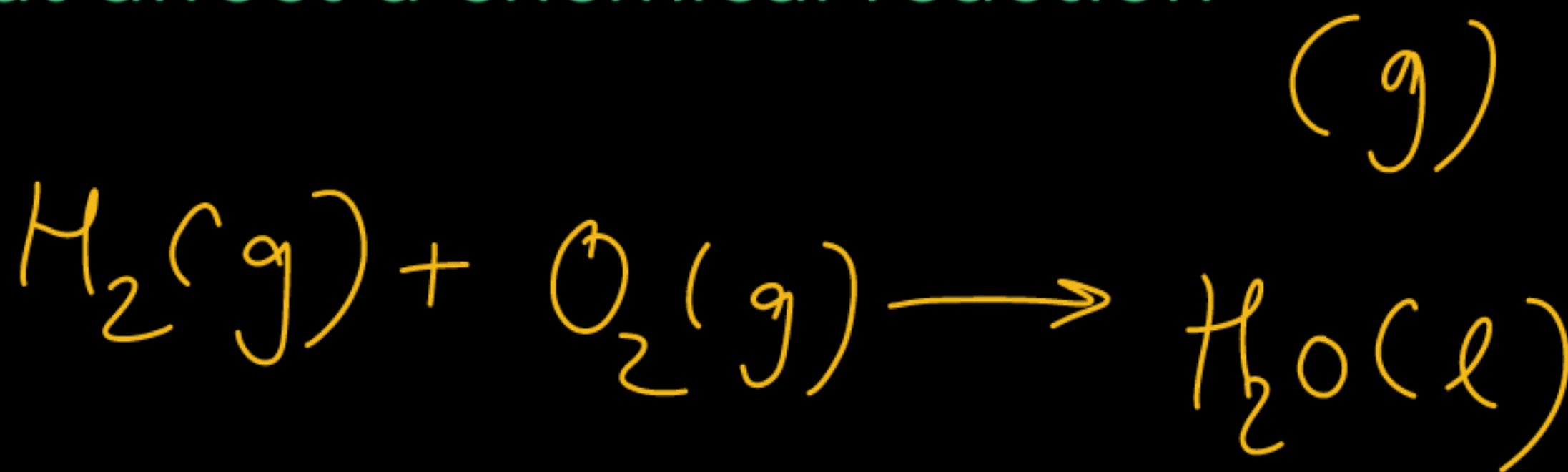
Can't predict whether an equation is reversible or not? ✗

Actual concentration are unknown ✗

Is reaction complete or not? ✗

$\text{BaSO}_4(\text{aq})$

Not knowing the parameters that affect a chemical reaction such as temperature ✗



CATALYST

A substance that increases or decreases the reaction rate without itself being consumed in the reaction.

E.g., Formation of ammonia (Haber's Process) - Fe (+ve catalyst).

Decomposition of Hydrogen peroxide - Phosphoric acid (-ve catalyst).



TYPES OF CHEMICAL REACTIONS

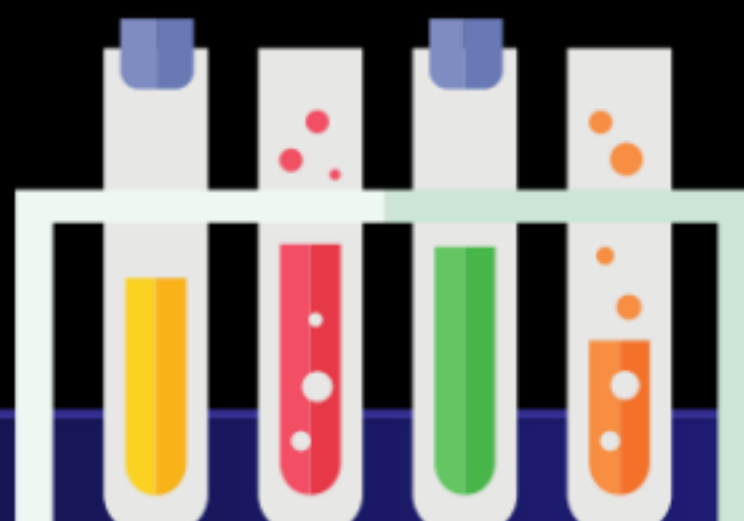
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**Combination
reaction**

**Decomposition
reaction**

**Displacement
reaction**

**Double-Displacement
reaction**



COMBINATION REACTION

A combination or synthesis reaction is a chemical reaction where two or more substances combine to form a single new substance.



COMBINATION OF TWO COMPOUNDS



COMBINATION OF AN ELEMENT AND A COMPOUND

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+



Ex - Oxidation of sulphur dioxide



COMBINATION REACTION AND ITS TYPES:

(i) Reaction of Calcium Oxide (Quick Lime) with Water CaO

• Reaction: $\text{CaO (s)} + \text{H}_2\text{O (l)} \rightarrow \text{Ca(OH)}_2 \text{ (aq)} + \text{Heat}$

Explanation: Quick lime reacts with water to form slaked lime (Calcium hydroxide), releasing heat (exothermic reaction).

Use in White washing: Slaked lime reacts with carbon dioxide in the air after 2-3 days, forming a shiny layer of calcium carbonate (CaCO_3) on walls:



\rightarrow Test of CO_2

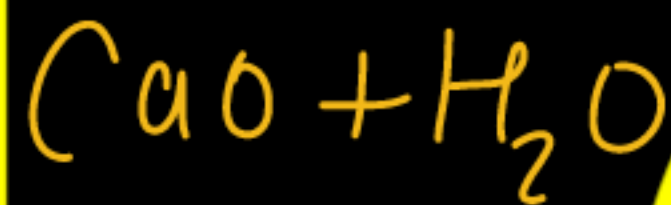
\rightarrow Lime
Water
Test

(ii) Formation of Water : $2\text{H}_2 \text{ (g)} + \text{O}_2 \text{ (g)} \rightarrow 2\text{H}_2\text{O (l)}$

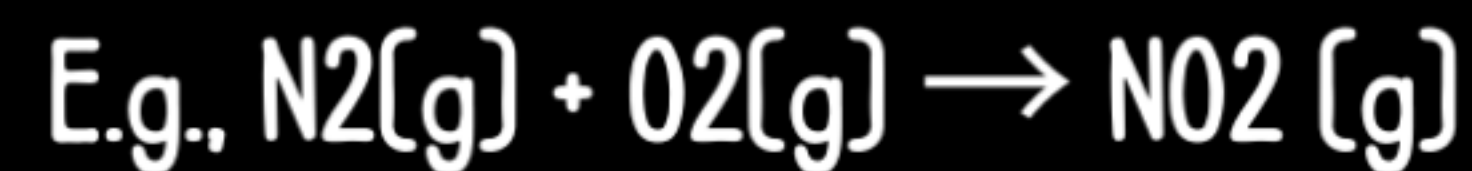
(iii) Burning of Coal : $\text{C(s)} + \text{O}_2 \text{ (g)} \rightarrow \text{CO}_2 \text{ (g)}$



Are all combination reactions
exothermic?



No, not all combination reactions are
exothermic.



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DECOMPOSITION REACTION

A chemical reaction in which a single compound breaks down into two or more elements or compounds when the energy is supplied in the form of heat, electricity or sunlight.



TYPES OF DECOMPOSITION REACTION

Thermolysis



Electrolysis



Photolysis



THERMOLYTIC DECOMPOSITION

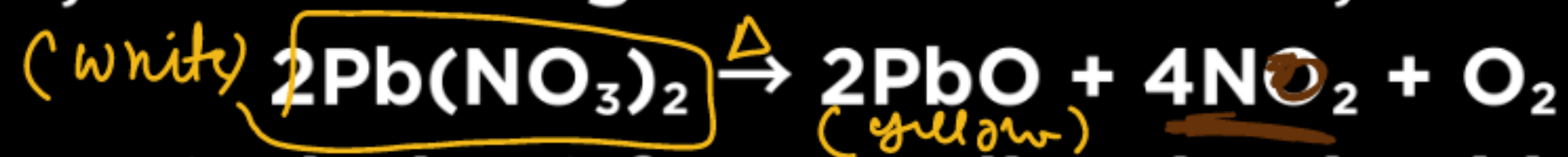
A compound breaks down into simpler substances when **heated**.

Thermolysis of lead nitrate

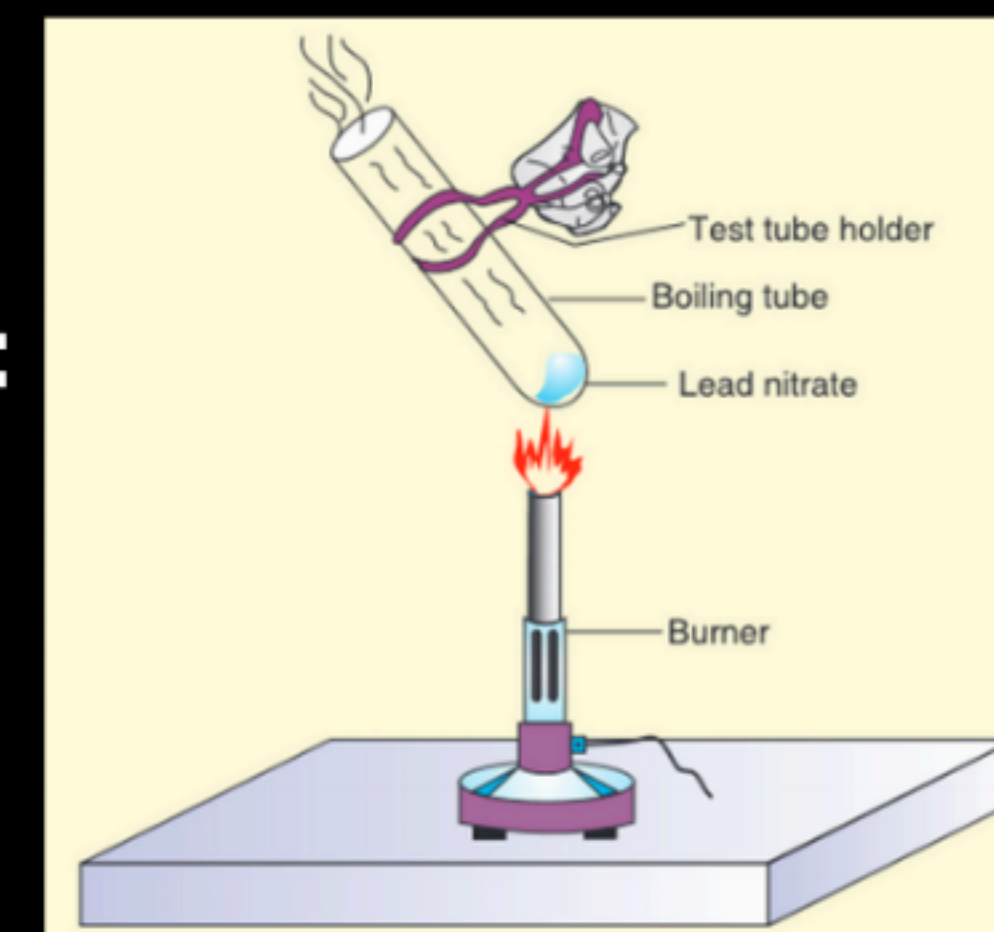
Metal nitrate + heat \rightarrow Metal oxide + Nitrogen dioxide + Oxygen

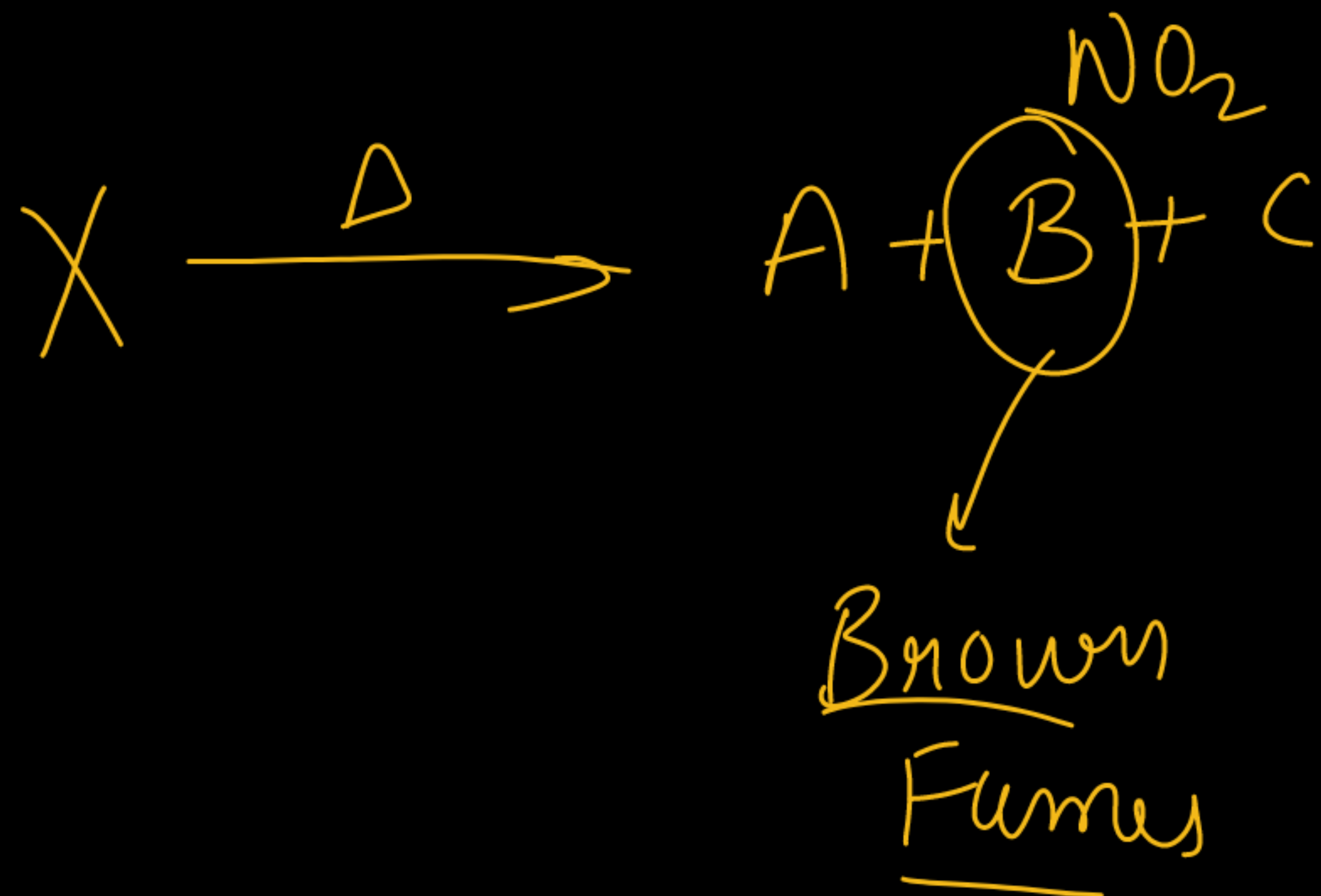
Thermal decomposition of lead nitrate:

- On heating lead nitrate, it decomposes to yellow lead monoxide, brown nitrogen dioxide fumes, and oxygen gas:



- Lead nitrate (colorless) forms yellow lead oxide, while NO_2 appears as brown fumes.





NCERT ACTIVITY



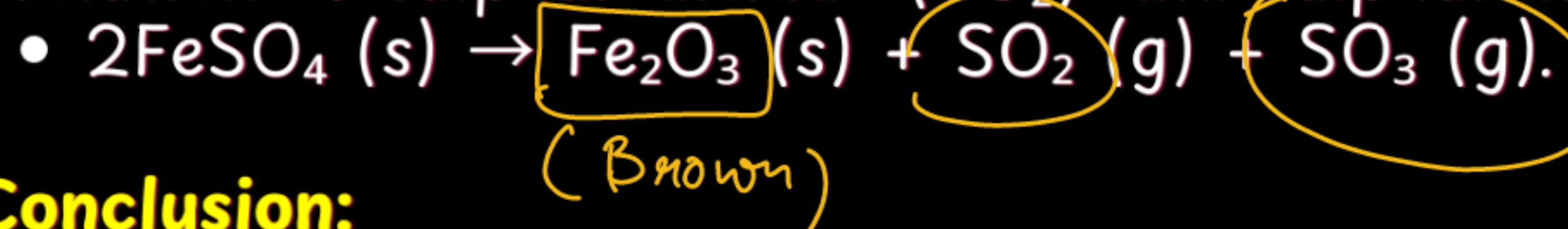
Aim: To observe the decomposition of ferrous sulphate.

Observations:

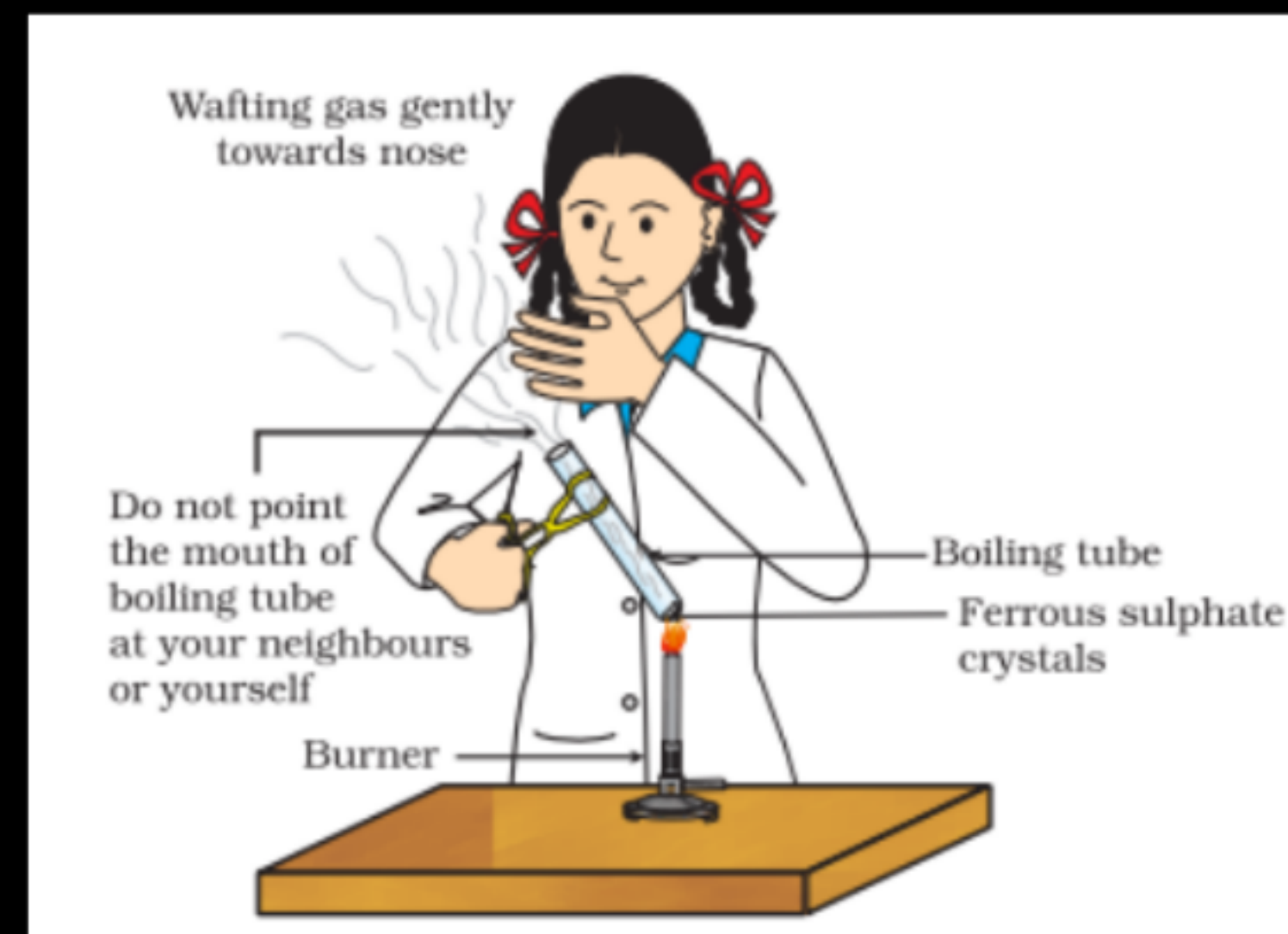
- On heating, ferrous sulphate crystals lose water and change color. *Green* and *white*

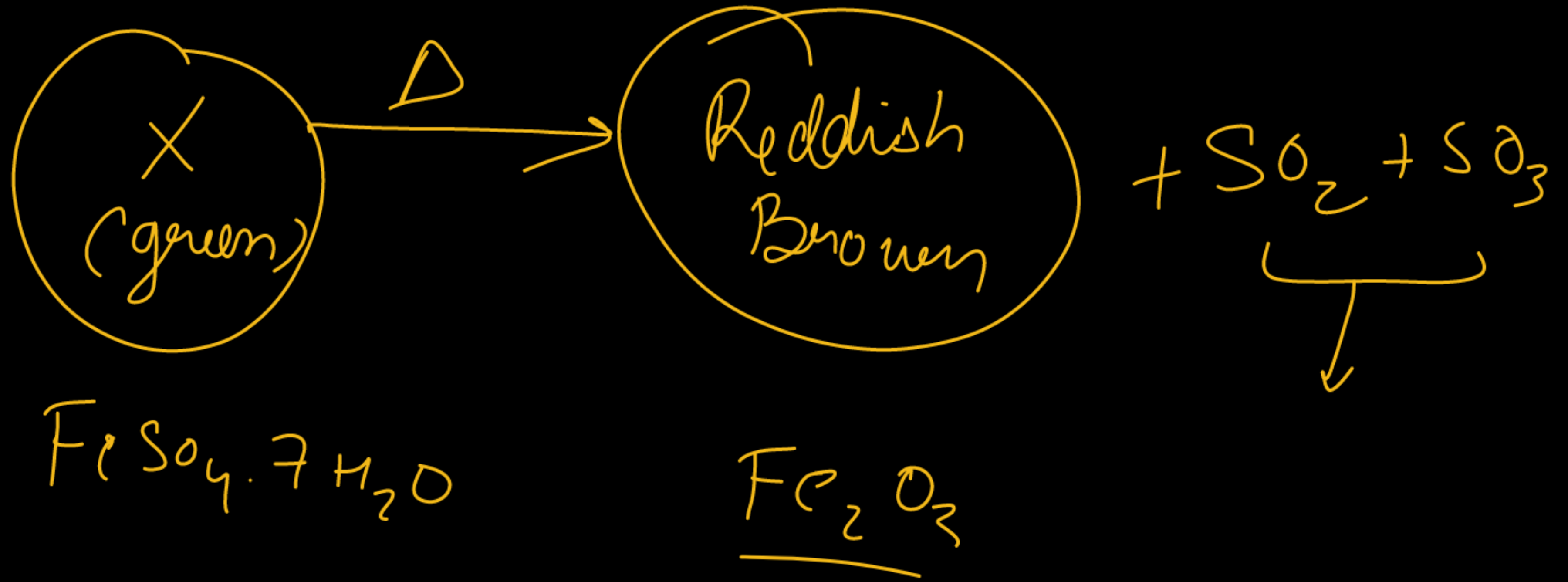


The green crystals of ferrous sulphate turn into a reddish-brown residue (ferric oxide) with the evolution of sulphur dioxide (SO_2) and sulphur trioxide (SO_3):

**Conclusion:**

- Ferrous sulphate decomposes into ferric oxide and releases SO_2 and SO_3 gases.
- This is a thermal decomposition reaction.





Thermolysis of hydrated ferrous sulphate



White color



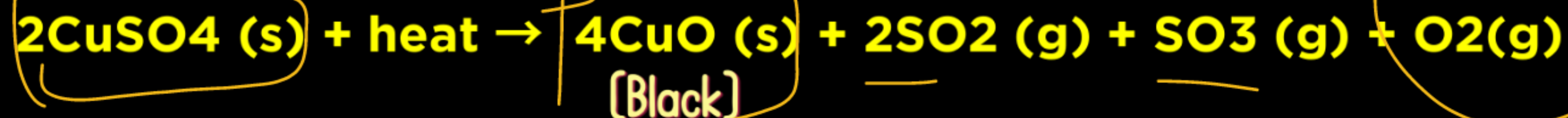
[reddish brown]



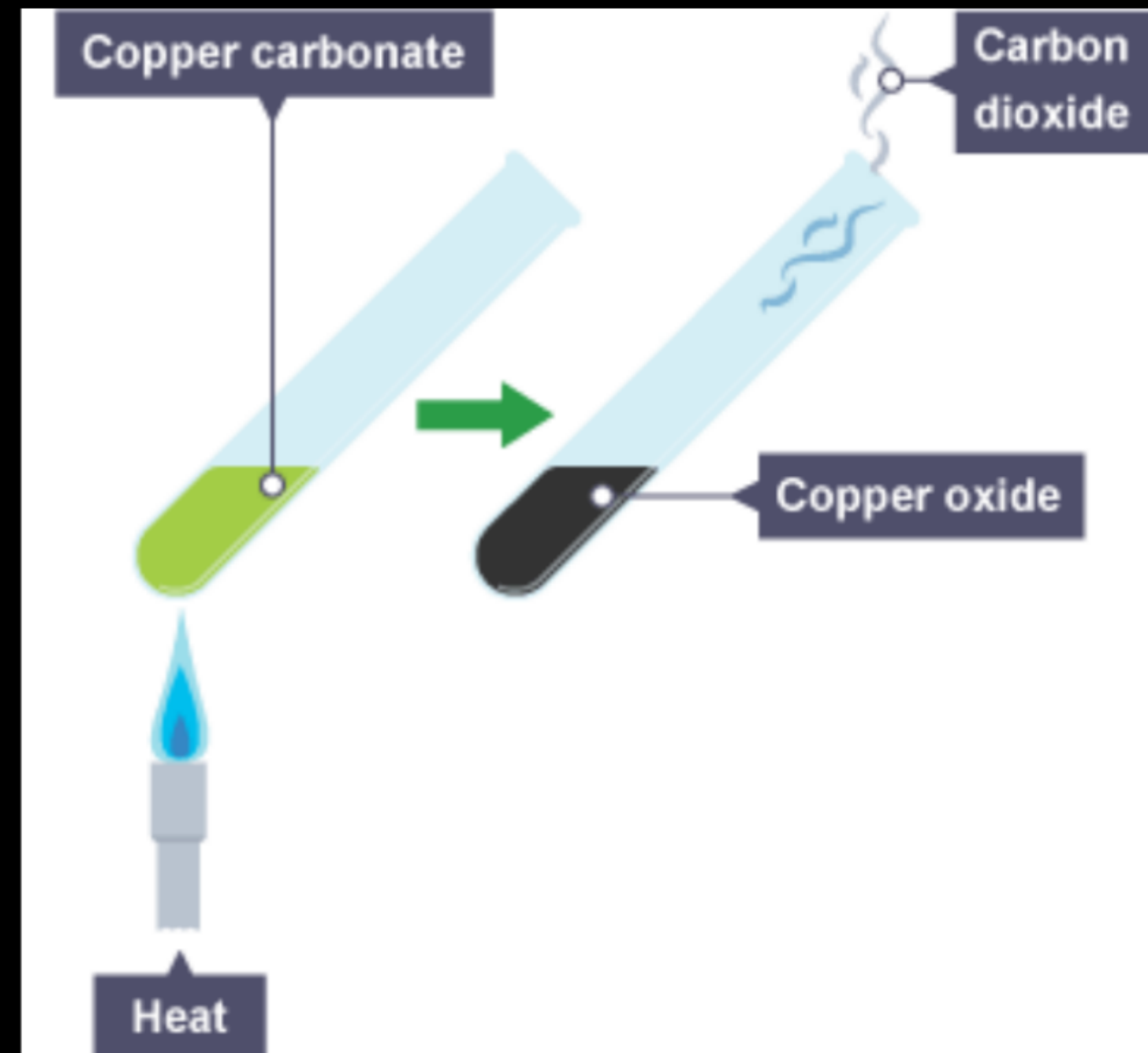
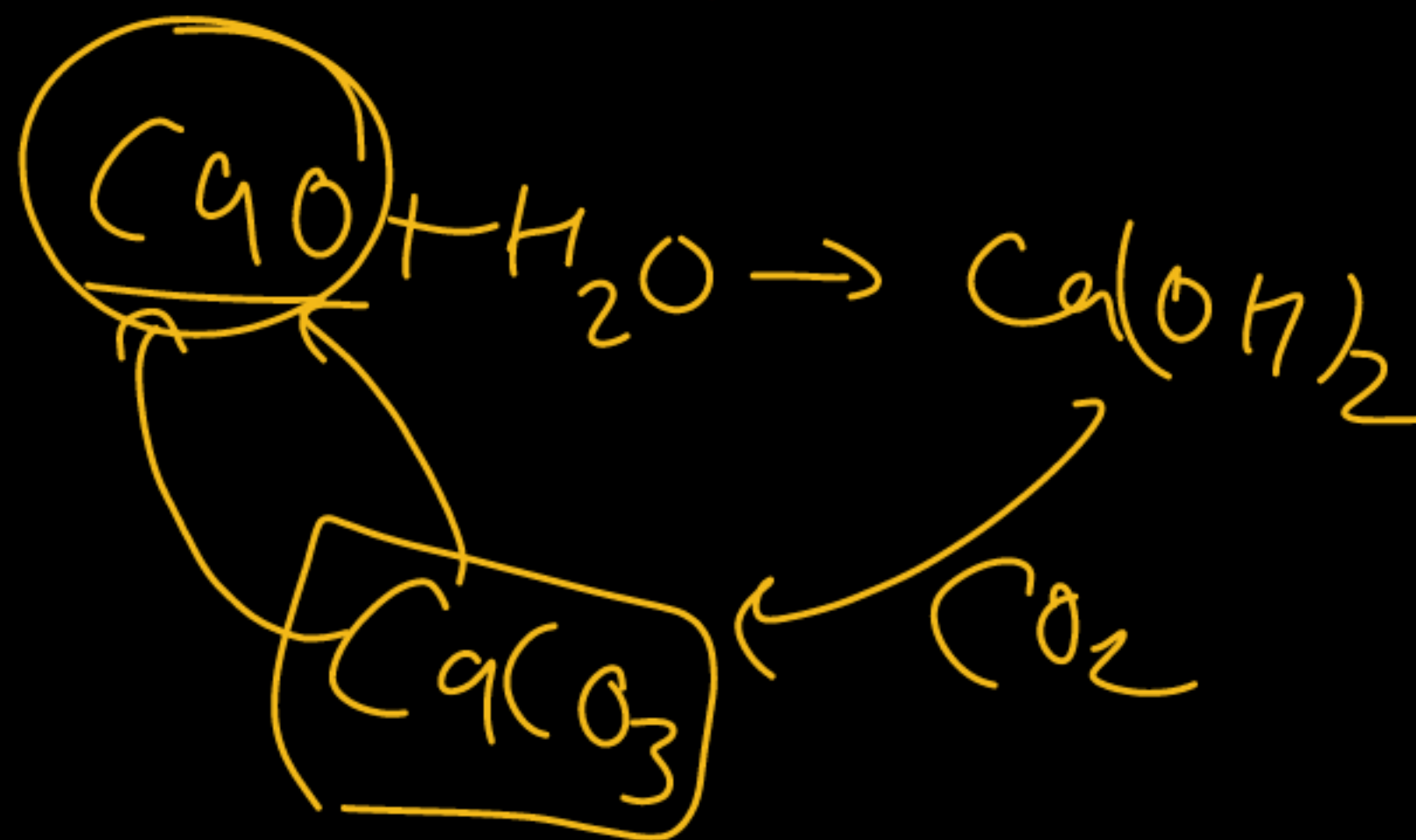
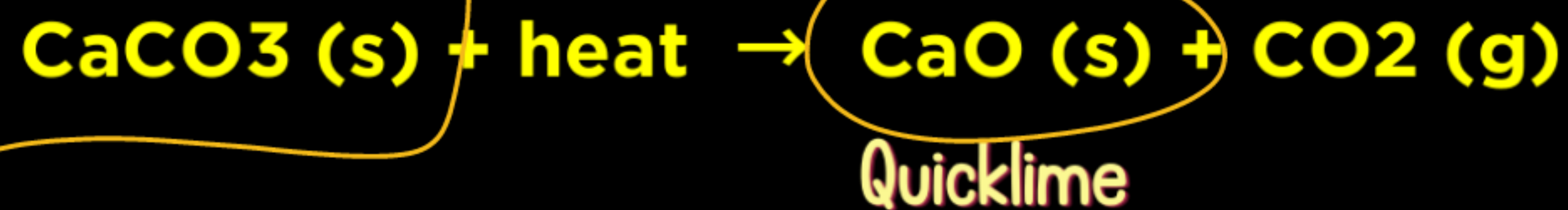
Thermolysis of hydrated copper sulphate



White color



Thermolysis of Calcium Carbonate

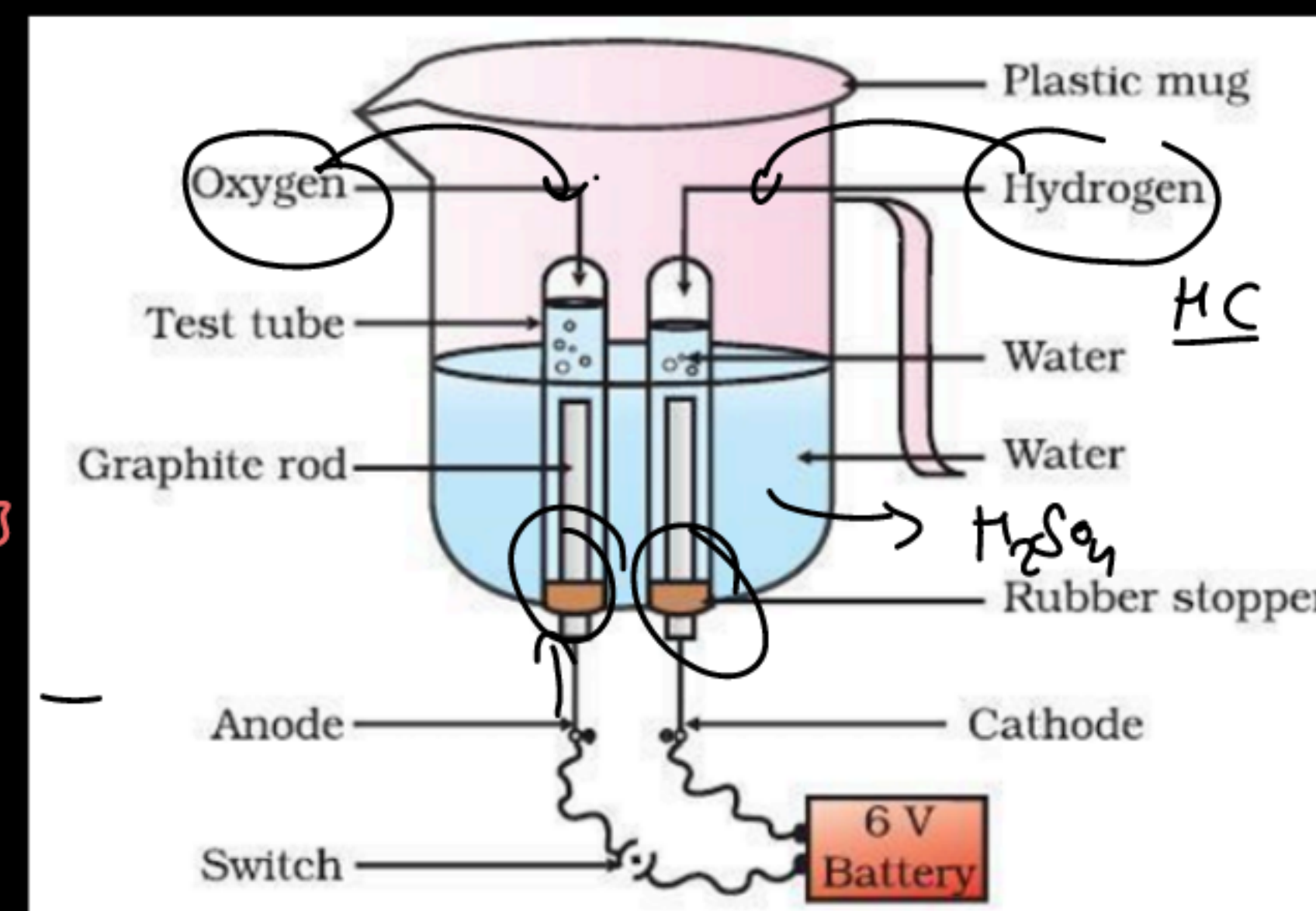


ELECTROLYTIC DECOMPOSITION

An **electric current** is used to decompose or break down compounds into their constituent elements or ions.

Electrolysis of lead nitrate

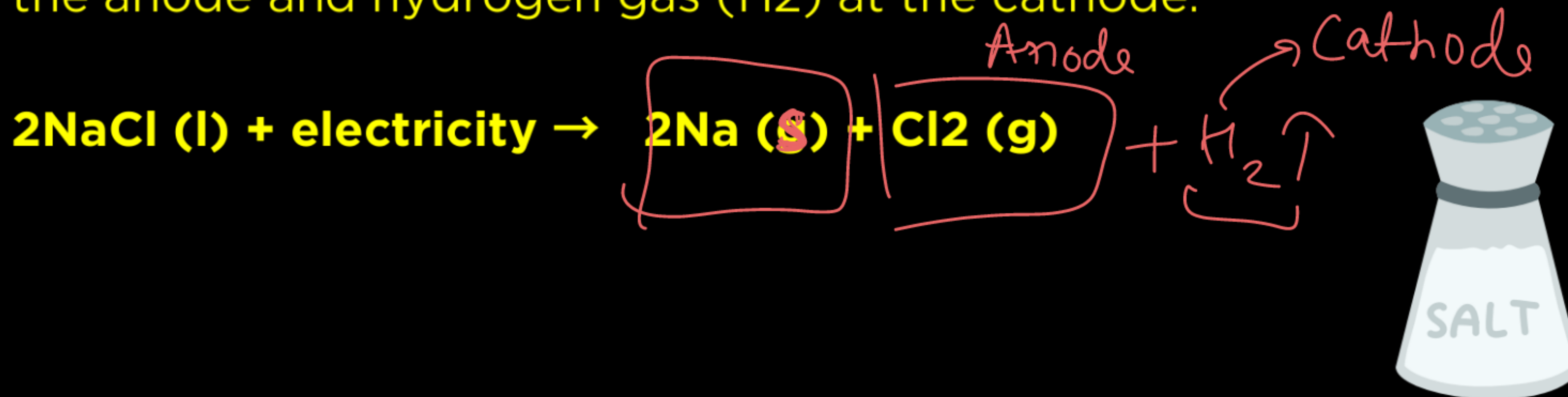
When an electric current is passed through water, it breaks down into hydrogen gas (H_2) at the cathode and oxygen gas (O_2) at the anode.



ELECTROLYTIC DECOMPOSITION

Electrolysis of sodium chloride

When an aqueous solution of sodium chloride (table salt) is subjected to electrolysis, it decomposes into chlorine gas (Cl_2) at the anode and hydrogen gas (H_2) at the cathode.



PHOTOLYTIC DECOMPOSITION

These are initiated by exposure to light.

Photolysis of Silver chloride



White

Grey

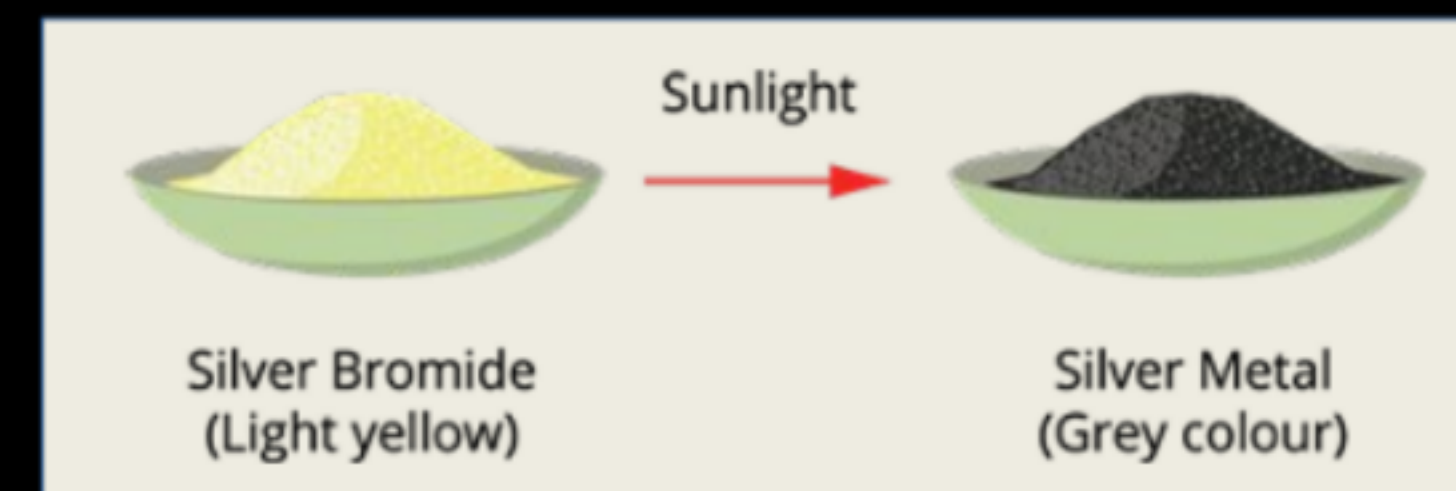


Photolysis of Silver bromide



light yellow

Grey



These reaction of silver halides is used in Black and White photography.

NCERT ACTIVITY



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Observation:

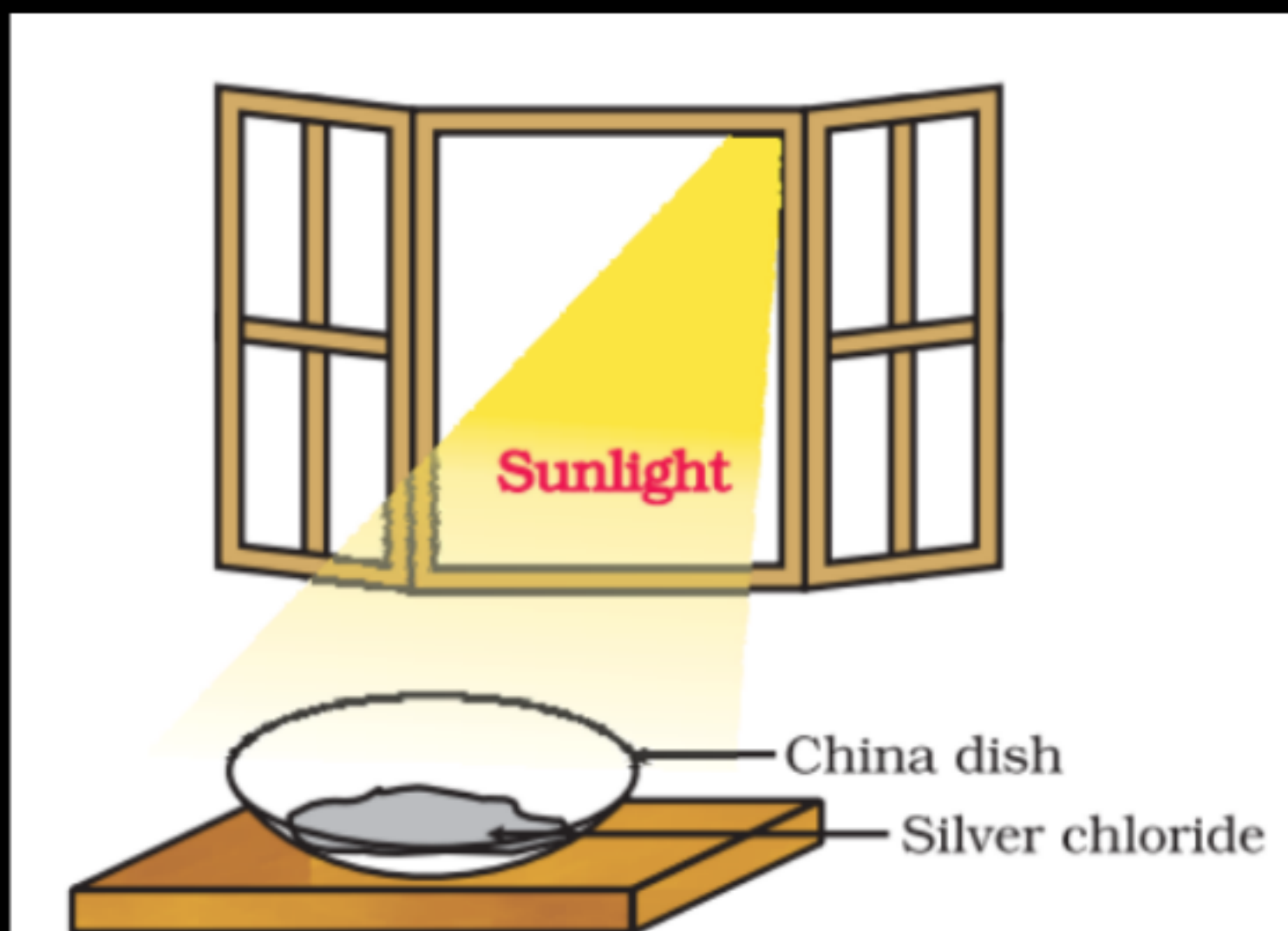
1. Silver chloride (AgCl) is white in color.
2. When 2 g of silver chloride is placed in sunlight, its color changes from white to grey.

Reaction:

- $2\text{AgCl(s)} + \text{Sunlight} \rightarrow 2\text{Ag(s)} + \text{Cl}_2\text{(g)}$
- White \rightarrow Grey (due to silver metal formation).
- Chlorine gas (yellowish-green) is released.

Conclusion:

- Silver chloride decomposes into silver and chlorine gas in the presence of sunlight.
- This reaction is a photolysis reaction, as sunlight initiates the decomposition.



Activity 1.8

- Take about 2 g silver chloride in a china dish.
- What is its colour?
- Place this china dish in sunlight for some time (Fig. 1.7).
- Observe the colour of the silver chloride after some time.

Are all decomposition reactions
endothermic?

Yes all decomposition reactions are endothermic. Decomposition reactions involve breaking of bonds which require energy.



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1. When 2 mL of sodium hydroxide solution is added to a few pieces of granulated zinc in a test tube and warmed, the reaction that occurs can be written as a balanced chemical equation. Which of the following is correct?

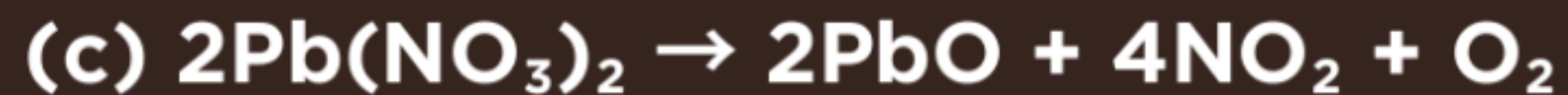
- (a) $\text{NaOH} + \text{Zn} \rightarrow \text{NaZnO}_2 + \text{H}_2\text{O}$
- (b) $2\text{NaOH} + \text{Zn} \rightarrow \text{Na}_2\text{ZnO}_2 + \text{H}_2$
- (c) $2\text{NaOH} + \text{Zn} \rightarrow \text{NaZnO}_2 + \text{H}_2$
- (d) $2\text{NaOH} + \text{Zn} \rightarrow \text{Na}_2\text{ZnO}_2 + \text{H}_2\text{O}$



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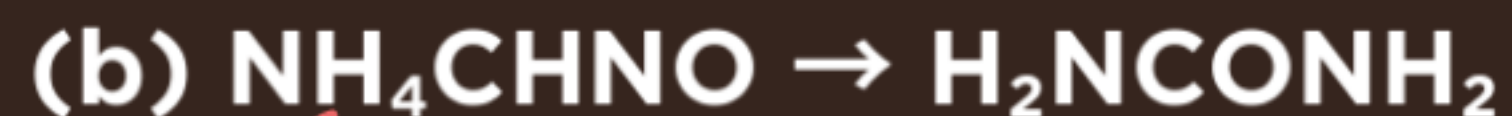
2. Which of the following is a combination reaction?



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3. Which of the following is a decomposition reaction?

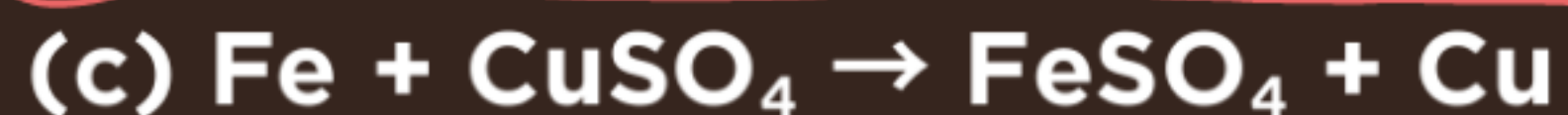


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4. Which of the following is not correct?

✗ Pta lge ga



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5. In an electrolytic cell where electrolysis is carried, anode has:

- (a) Positive charge
- ~~(b) Negative charge~~
- (c) Connected to negative terminal of the battery
- (d) None of these is correct.

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6. Assertion: "All decomposition reactions are endothermic."

Reason: Energy is required to break chemical bonds in the reactant.

Options:

- ☒ **A. Both Assertion and Reason are true, and Reason is the correct explanation.**
- B. Both Assertion and Reason are true, but Reason is not the correct explanation.**
- C. Assertion is true, but Reason is false.**
- D. Both Assertion and Reason are false.**

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7. What is a balanced chemical equation? Why is it important to balance a chemical equation, and which law is followed while doing so?

A balanced chemical equation is one in which the number of atoms of each element is the same on both sides (reactant and product side) of the equation.

Balancing a chemical equation is important because it ensures that the law of conservation of mass is followed. This law states that mass can neither be created nor destroyed in a chemical reaction. Therefore, the total mass of the reactants must be equal to the total mass of the products, ensuring that the number of atoms of each element remains unchanged during the reaction.