

# Chemical Reactions & EQUATIONS

FREE MIND

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## Physical change

Physical change do not involve any chemical reaction.

eg: — Melting of wax, Boiling of water, Chopping vegetables etc.

## Chemical Change

Chemical change involves chemical reaction.

eg: — Respiration, Burning Paper, Ripening of fruits etc.

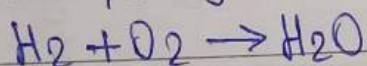
Various things happen in chemical reactions: —

- Combustion
- Rust
- Digestion
- Photosynthesis
- Batteries
- Fermentation
- Washing
- Baking

## Chemical Reaction

The process of interaction of chemicals to form new chemicals.

eg: — Hydrogen reacts with oxygen to form water.

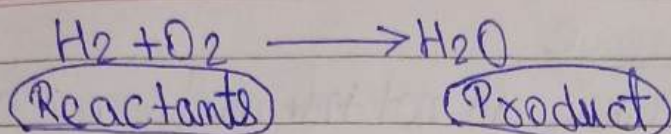


## Chemical Equation?

Symbolic representations of chemical reactions that involve the use of

Formula and Symbols





- \* A chemical equation having an equal number of atoms on both sides of the equation is called a balanced chemical equation.

### More Conditions in Reactions

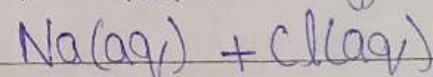
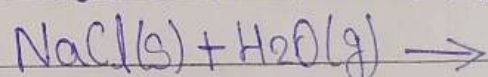
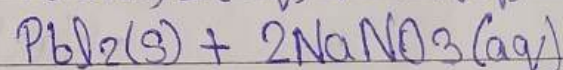
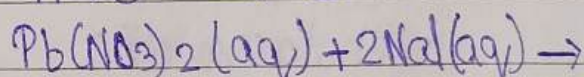
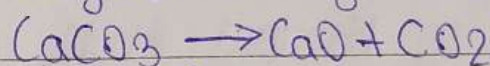
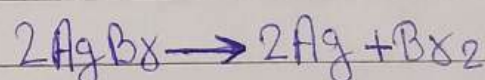
Heat ( $\Delta$ ), sunlight, pressure

Gas Liberation

Catalyst

Precipitate Formed

Physical states



- \* Catalyst : Any substance that increases or decreases the rate of reaction without itself being consumed.

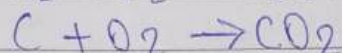
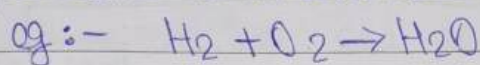
### Types of Chemical Reactions

- (1) Combination Reaction
- (2) Decomposition Reaction
- (3) Displacement Reaction

#### (iv) Double Displacement Reaction

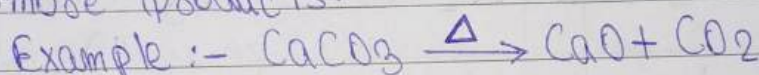
#### \* Combination Reaction

2 or more reactants combine to form a single product.  $[A+B+C+D \rightarrow E]$



#### \* Decomposition Reaction

A single reactant decompose to form 2 or more products.

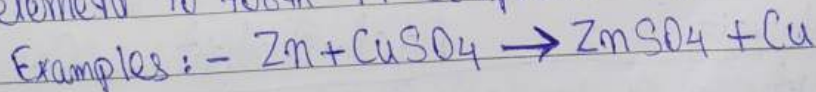


#### THREE TYPES OF DECOMPOSITION REACTION

- (1) Thermal decomposition : Due to heat
- (2) Electrolytic decomposition : Due to electricity [eg:-  $H_2O$ ]
- (3) Photochemical decomposition : Due to sunlight

#### \* Displacement Reaction

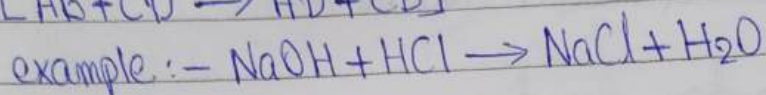
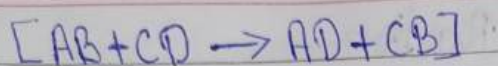
A more reactive element displaces a less reactive element to form its compound.  $[A+BC \rightarrow AC+B]$



#### \* Double Displacement Reaction

Mutual exchange of ions takes place.

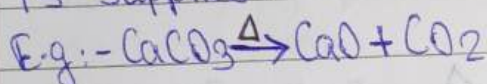




## Types of Reactions (Energy Flow)

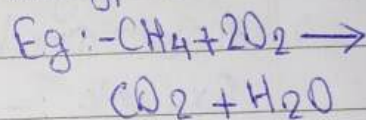
### Endothermic Reactions

Reaction in which energy is supplied.



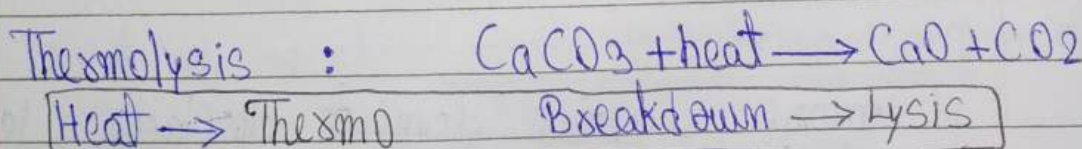
### Exothermic Reactions

Reaction in which energy is evolved (released)



\* For breakdown of compounds always an energy is required to supply.

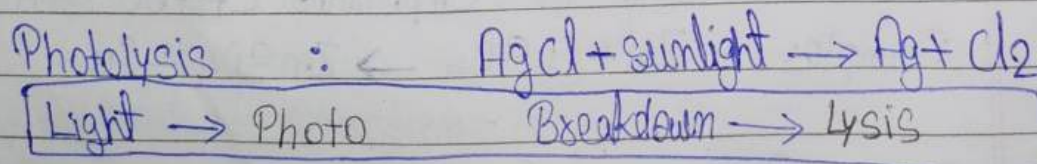
## Decomposition Reactions (ENDOTHERMIC)



Heat  $\rightarrow$  Thermo

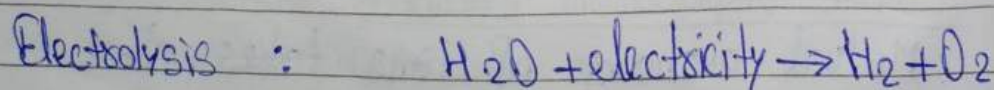
Breakdown  $\rightarrow$  Lysis

\*



Light  $\rightarrow$  Photo

Breakdown  $\rightarrow$  Lysis



Electricity  $\rightarrow$  Electron Breakdown  $\rightarrow$  Lysis

## REDOX REACTION

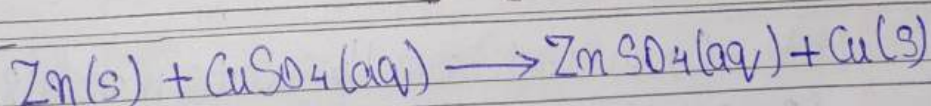
When oxidation and reduction take place simultaneously in any given reaction it is called Redox Reaction.

### Reduction

The process of removal of oxygen or Addition of Hydrogen or electron is called Reduction reaction.

### Oxidation

The process of Addition of Oxygen or Removal of Hydrogen or Electron is called Oxidation reaction.



- \* In this, in reactant Zinc have 0 charge i.e. it has neither gained or lost electron but in product in order to form a compound it have lose 2 electrons which is Oxidation.
- & Cu have lose 2 electrons in reactant to make  $\text{CuSO}_4$  but in product Cu don't have any charge ~~it~~ i.e. to have charge 0 it regained its 2 electrons



which is Reduction.

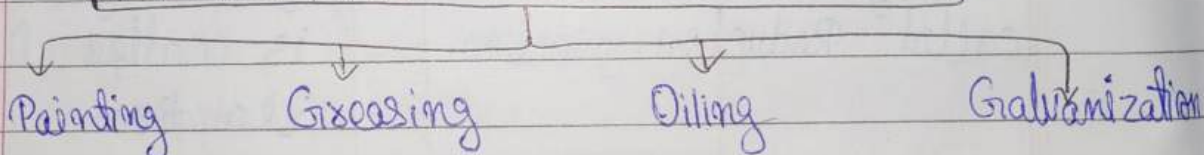
- \* In this reaction reducing agent is Zinc and oxidizing agent is Copper.

### Corrosion

When metal surfaces are attacked by substances around it such as oxygen, moisture, acids, etc., it is said to corrode and this process is called Corrosion.

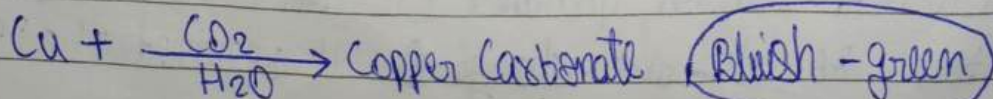
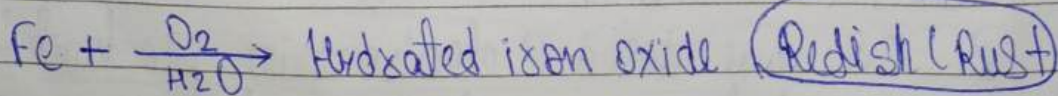
It is undesirable since it reduces strength & fades appearance.

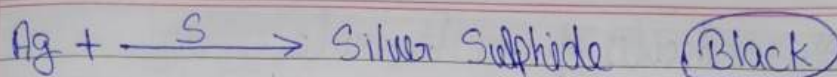
### PREVENTION FROM CORROSION



Note: - Corrosions mostly occurs in metals that's why it is associated with metals, but it can occur in other materials too.

### CORROSION EXAMPLES





## RANCIDITY

The taste and odour of food material containing fat and oil changes when they are left exposed to air for long time.

It is caused due to oxidation of fat and oil present in food material

## PREVENTION FROM RANCIDITY

Adding antioxidants

Using flush bags  
with nitrogen gases.

Storing in air-tight  
Container  
~~with~~

## UNDERSTANDING COEFFICIENT AND SUBSCRIPT

In  $2\text{HF}$  how many atoms are there of each element?  
As your answer 2 hydrogen and 1 fluorine then this is incorrect because there's 2 molecules of  $\text{HF}$ , 2H and 2F.

\* Coefficient (Big number before a formula):- It tells



no. of molecules of a formula.

In  $H_2O$ , there's 2 hydrogen and 1 oxygen because 2 is subscript here, it is only with H.

Subscript (Small no. in a formula):- Indicates the no. of atoms of an element in one molecule of a compound.

Other examples:-

In  $2NH_3$ :- Nitrogen =  $2 \times 1 = 2$

Hydrogen =  $2 \times 3 = 6$

$2H_2O$ :- Hydrogen =  $2 \times 2 = 4$

Oxygen =  $2 \times 1 = 2$

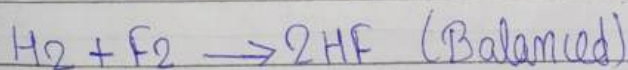
$2HF$ :- Hydrogen =  $2 \times 1 = 2$

Fluorine =  $2 \times 1 = 2$

$H_2O$ :- Hydrogen = 2

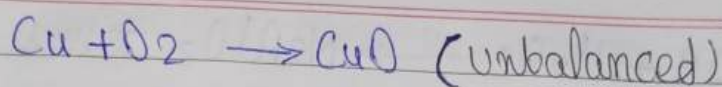
Oxygen = 1

### Balancing Chemical Equations

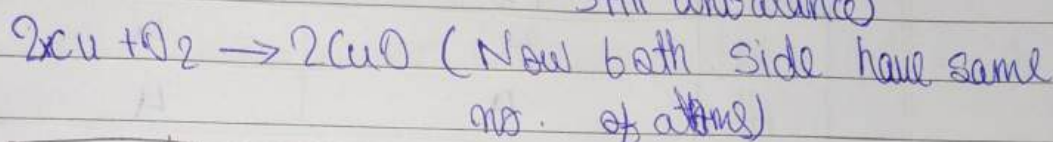
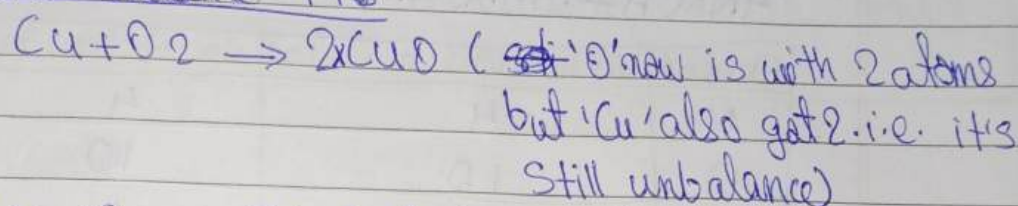


Elements	No. of atoms in reactant	No. of atoms in product
H	2	2
F	2	2

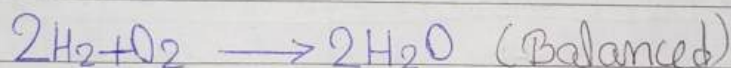




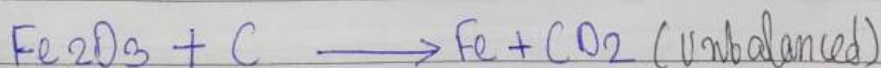
Let's balance it



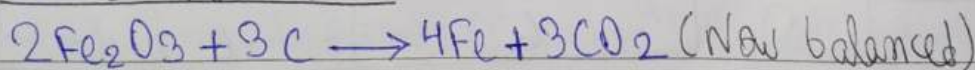
Elements	No. of atoms in reactant	No. of atoms in product
Cu	2	2
O	2	2



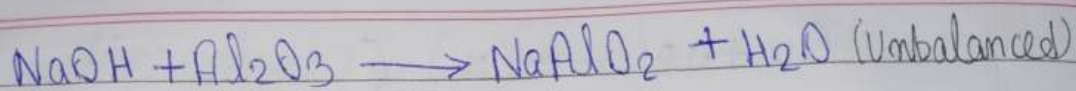
Elements	No. of atoms in reactant	No. of atoms in product
H	4	4
O	2	2



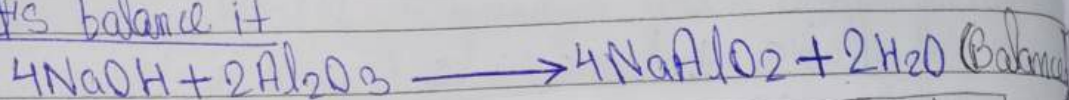
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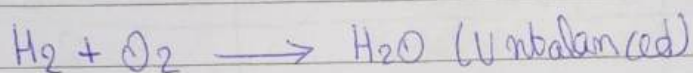
Elements	No. of atoms in reactant	No. of atoms in product
Fe	$2 \times 2 = 4$	$1 \times 4 = 4$
O	$2 \times 3 = 6$	$3 \times 2 = 6$
C	$3 \times 1 = 3$	$3 \times 1 = 3$



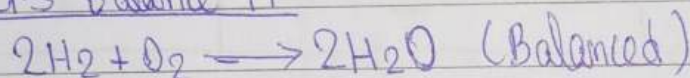
Let's balance it



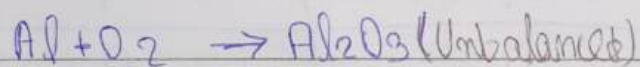
Elements	No. of atoms in reactant	No. of atoms in product
Na	4	4
O	10	10
H	4	4
Al	4	4



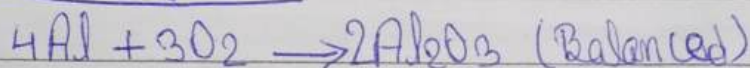
Let's balance it



Elements	No. of atoms in reactant	No. of atoms in product
H	4	4
O	2	2



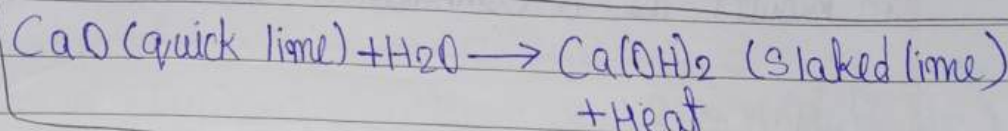
Let's balance it



Elements	No. of atoms in reactant	No. of atoms in product
Al	4	4
O	6	6



### Activity 1-1



### Questions

- (1) What happened when Calcium Oxide reacts with  $\text{H}_2\text{O}$ ?

OR

What happened when Quicklime reacts with water?

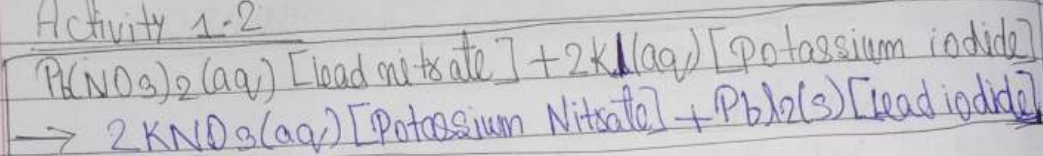
Answer: When  $\text{CaO}$  (Quicklime/Calcium oxide) reacts with the water to form a new compound called Slaked lime  $[\text{Ca(OH)}_2]$ . Also, the heat is produced at the time of reaction.

- (2) Is there any change in temperature when water is added to calcium oxide or quicklime in a beaker?

Answer: Calcium oxide reacts vigorously with water to produce slaked lime (Calcium hydroxide) releasing a large amount of heat. In this reaction, calcium oxide and water combine to form a single calcium hydroxide. Such a reaction in which a single

product is formed from two or more reactants is known as a combination reaction.

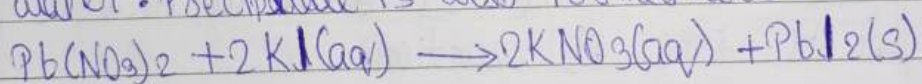
### Activity 1-2



### Questions

- (1) What do you observe when potassium iodide solution is added to lead nitrate solution in a test tube?

Answer: White lead nitrate reacts with white potassium iodide to form yellow lead iodide which is insoluble in water. Precipitate is also formed here.



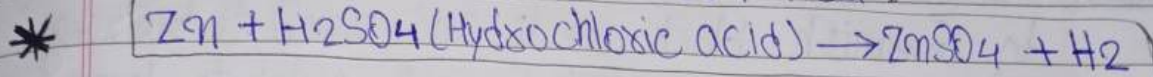
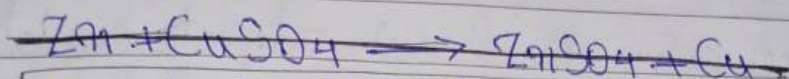
- (2) What is Precipitation Reaction?

Answer: This is a type of reaction in which when two aqueous soluble solutions combine/react together to form a semi-soluble salt and that salt is called as Precipitate.

And in any reaction, when Precipitate is formed then that is called a Precipitation Reaction.



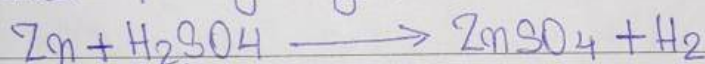
### Activity 1.3



#### Questions

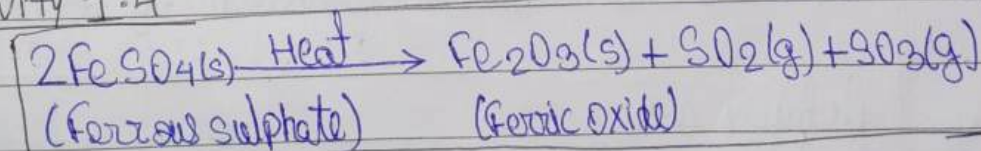
- (1) What happened when Zn Gramules are added to the HCl /  $\text{H}_2\text{SO}_4$ ?

Answer: When zinc granules are added to dilute sulphuric acid, there occurs a change in <sup>the</sup> state of zinc granules and they are converted to zinc sulphate ( $\text{ZnSO}_4$ ) and hydrogen gas is evolved.



This reaction is exothermic, i.e. it involves release of heat and so the flask becomes hot and temperature of the system increases.

### Activity 1.4



#### Questions

- (1) Do you observe any change in the colour of ferrous sulphate crystals when they are heated in the boiling



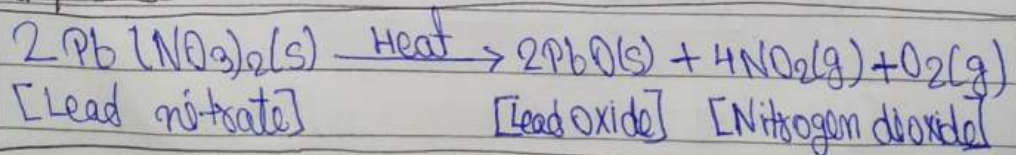
tube over the flame of a burner or spirit lamp?

Answer: The green colour of ferrous sulphate crystals changes to brownish black oxide and smell of burning sulphur will be observed. Ferrous sulphate decomposes to form ferric oxide ( $\text{Fe}_2\text{O}_3$ ), sulphur dioxide ( $\text{SO}_2$ ) and sulphur trioxide ( $\text{SO}_3$ ). So, the gas emitted smells like burning sulphur, in this reaction, the single reactant  $\text{FeSO}_4$  decomposes to form three different products. So, the reaction is a decomposition reaction.

(2) List any two observations when ferrous sulphate is heated in a dry test tube?

Answer: ~~✗~~ Observation: Change in colour of crystals from green to brown. This is because of the ferrous sulfate crystals on heating will lose ~~✗~~ water molecules and turn to white which immediately turns brown due to formation of ferric oxide.

### Activity 1.5





### Questions

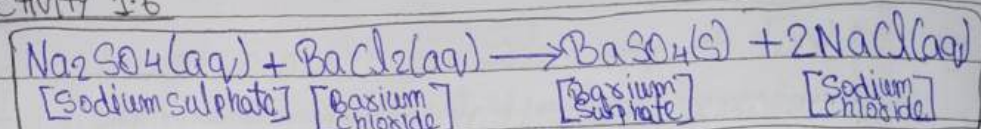
- (1) What do you observe when a boiling test tube containing lead nitrate powder is heated it over a flame?

Answer: On heating lead nitrate decomposes with a crackling sound along with the evolution of brown fumes of nitrogen dioxide ( $\text{NO}_2$ ) which has an irritating smell. The gas turns blue litmus red; hence, it is acidic in nature. A yellow solid residue of lead oxide ( $\text{PbO}$ ) remains in the test tube.

- (2) You want to study a decomposition reaction by taking ferrous sulphate crystals in a boiling tube. List two steps you would follow while doing the experiment.

Answer: Take a test tube and dry it completely. Take a small amount of the given sample in the test tube. Hold it with a clamp and heat the tube over a burner. Crystals will first become dirty and then change to brown.

### Activity 1.6



### Questions

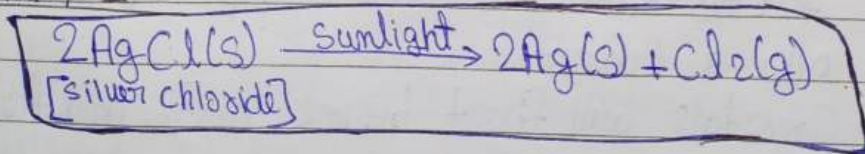
- (i) While studying the double displacement reaction, the solutions of barium chloride and sodium sulphate are mixed together.
- (ii) What do you observe as soon as the two solutions are mixed together?
- (iii) What will happen in the above observation made by you after ten minutes?

Answer: (i) A white precipitate of barium sulphate is immediately formed.

(ii) The white precipitate will settle down at the bottom of the tube and the solution above the precipitate will become colourless.

### Activity 1.7

\*



### Questions

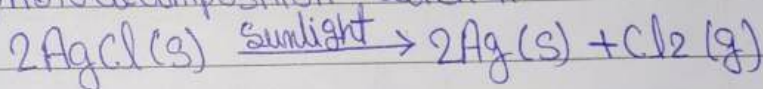
- \* (i) Why AgCl is kept in a Black box or Bottles?



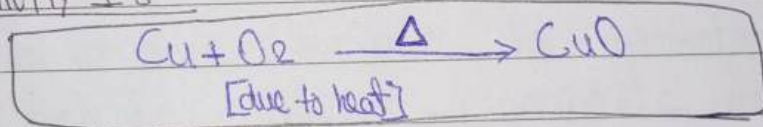
Answer: As you know now,  $\text{AgCl}$  shows a photolytic decomposition that's why we kept  $\text{AgCl}$  in a black color bottle to protect it from the sunlight.

(2) Silver chloride when kept in the open turns grey. illustrate this with a balanced chemical equation.

Answer: Silver chloride when kept in the open turns grey. It is a photodecomposition reaction.



### Activity 1.8



### Questions

(1) You might have noted that when copper powder is heated in a china dish, the reddish brown surface of copper powder becomes coated with a black substance.

(a) Why has this black substance formed?

(b) What is this black substance?

Answer: (a) Black substance is formed is because of the oxidation of copper.

(b) The black substance formed is Copper Oxide ( $\text{CuO}$ )

(2) How can the black coating on the surface be turned reddish brown?

Answer: If hydrogen gas is passed over this heated material (CuO), the black coating on the surface turns brown as the reverse reaction takes place and copper is obtained.

