

Measurement of reactants and products in balanced equation



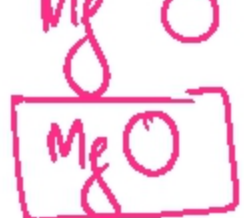
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apply stoichiometry

## Formula Making

Simple formula when (2 elements)

Magnesium oxide



Calcium chloride



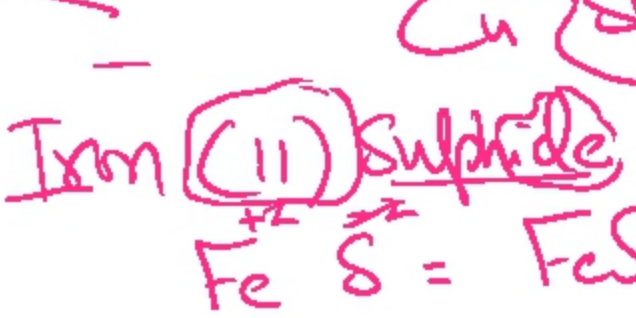
Aluminium sulphide



Lithium nitride (N<sup>-3</sup>)

Formula

+



Silver (I) nitrate



Sulphite  
phosphite  
nitrite

To find their symbols and charge

Complex formula have more than 2 elements

Complex ions Polyatomic ions



Sodium phosphate



Potassium hydroxide



Ammonium sulphate



Calcium hydrogen carbonate



Copper (II) sulphate



Iron (II) sulphide



## Balancing

Reactants → Products  
Then/element on both sides are number equal, we will they are balance

In balancing

First you have to balance any other element

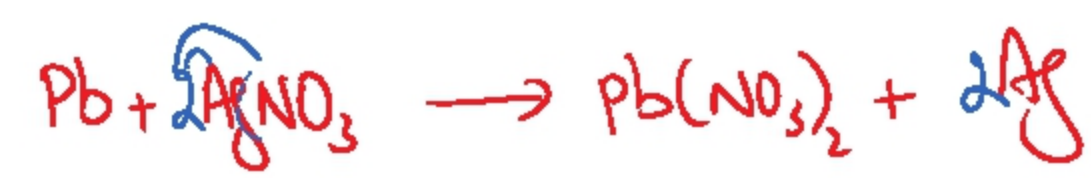
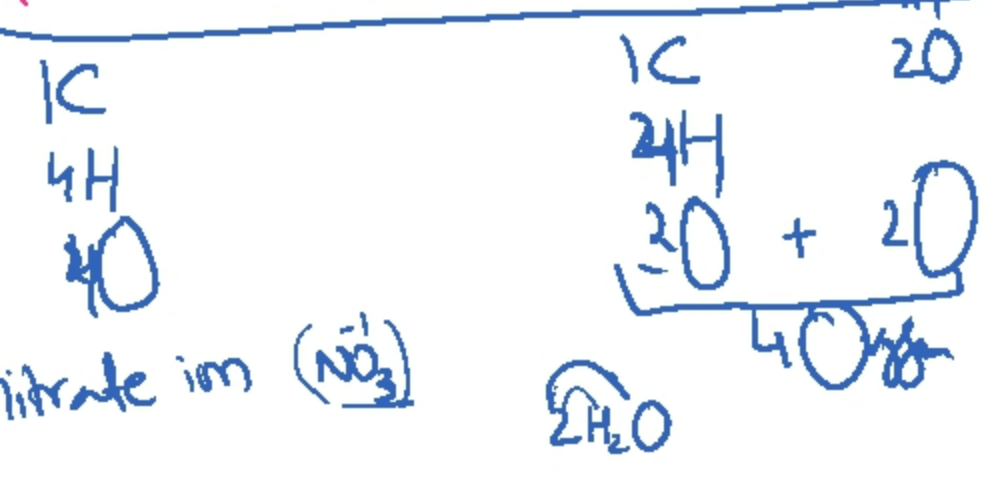
1) any element → Hydrogen → Oxygen

2) In balancing you will add only coefficients

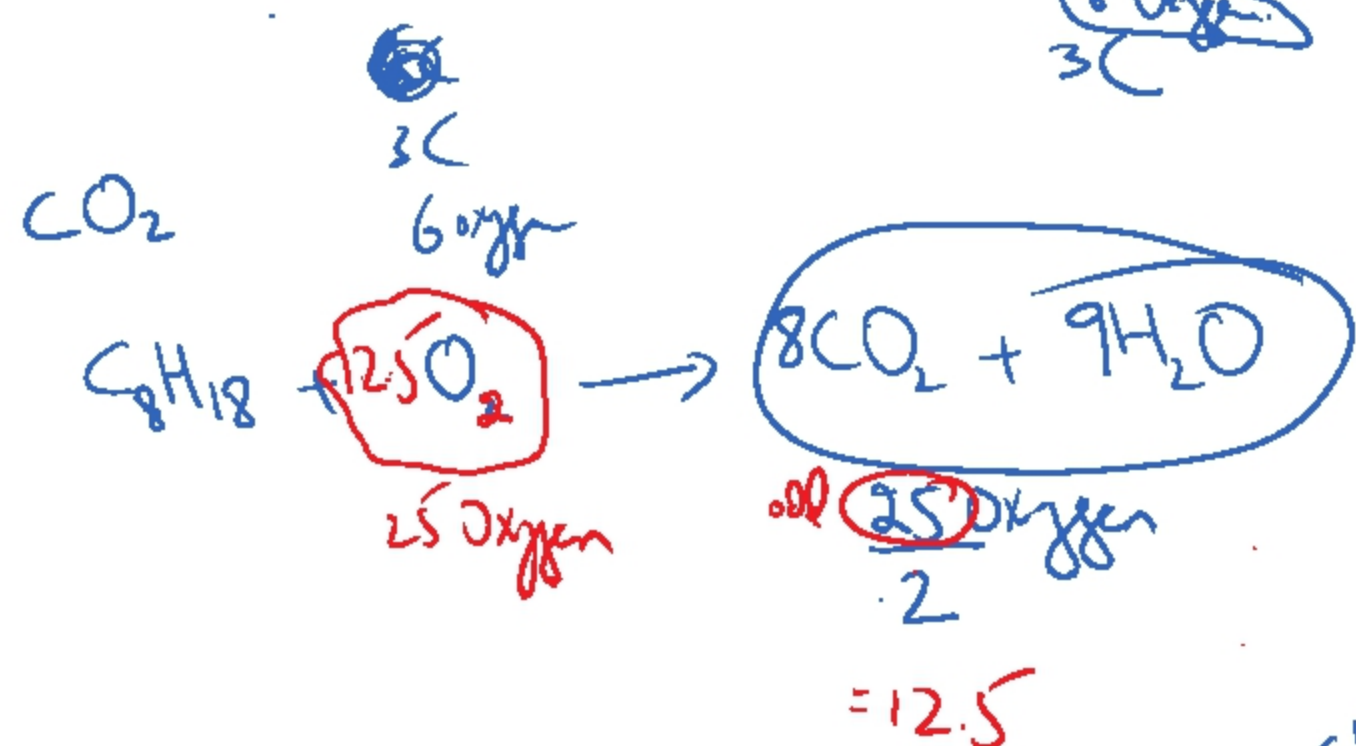
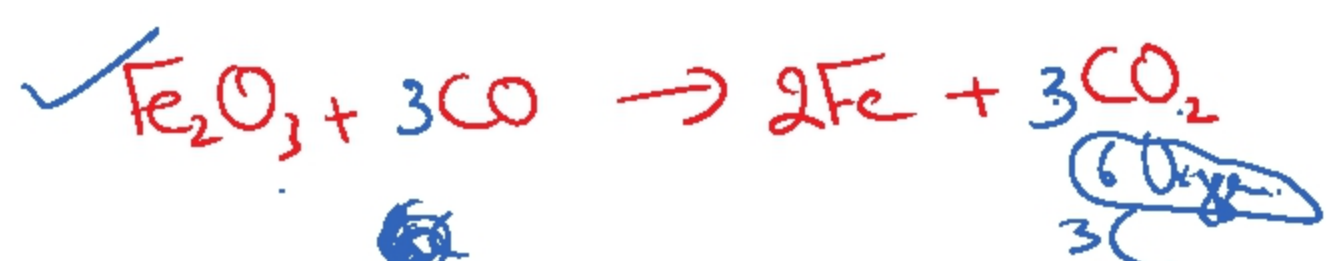
3) Don't change the subscripts



Carbon (1)  
Oxygen  
Hydrogen



100% 6U + 4U  
100% 10 Oxygen



(State Symbol)  
4 state symbols

Solid (s)  
Liquid (l)  
Gas (g)  
Aqueous (aq)

Chap 1  
States of matter  
s l g

Aqueous (solution form)  
dissolve in water.

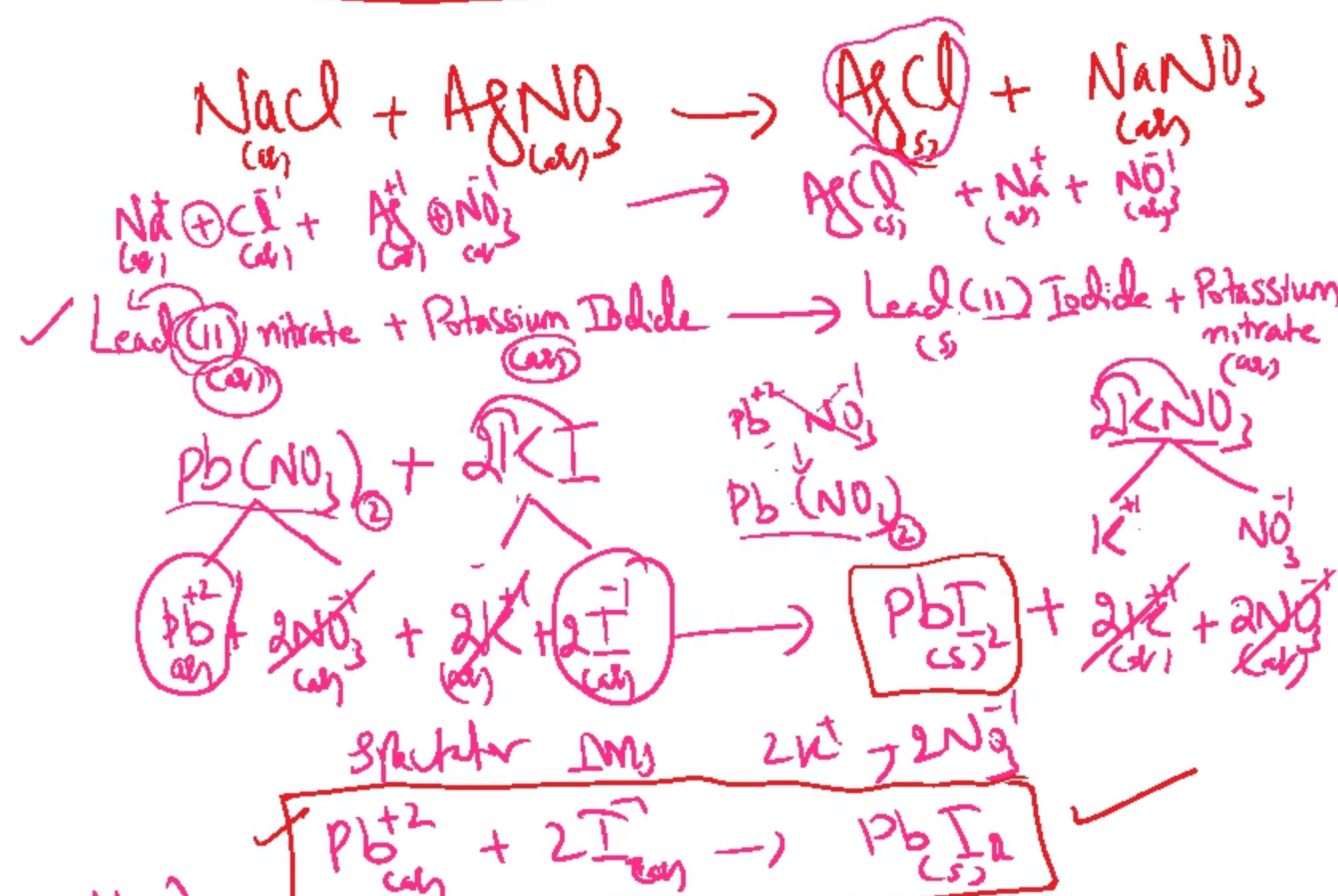
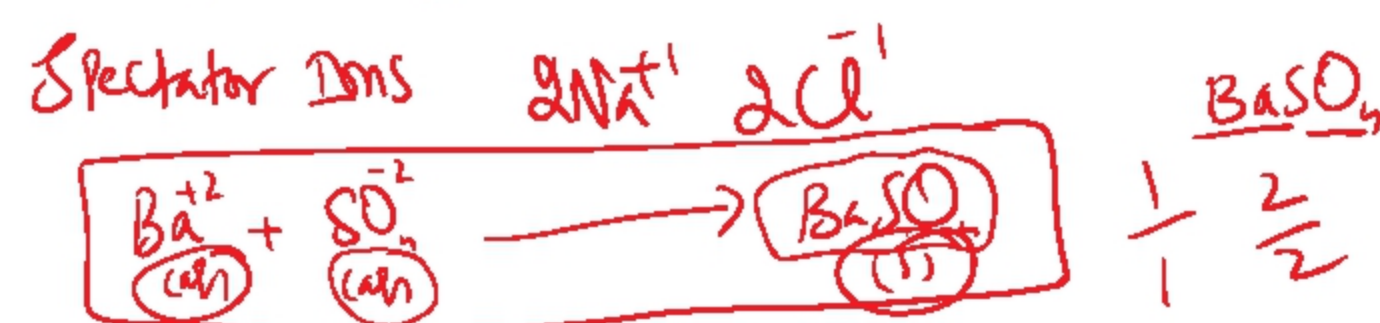
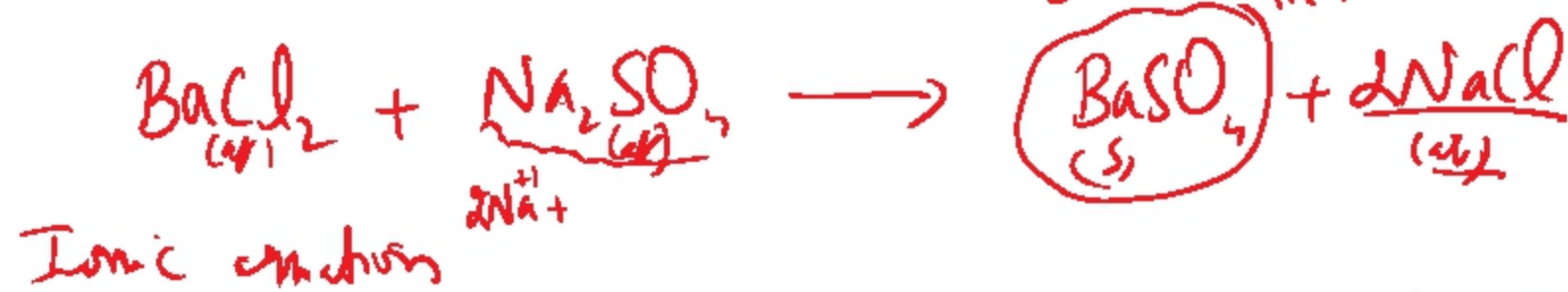


Word equation → 1) symbol equation  
2) balancing  
3) state symbols

100% Ionic Equation

(1) Precipitation Reaction  
Salt + Salt → Salt + Salt  
(aq) (aq) (s) (aq)  
Precipitate

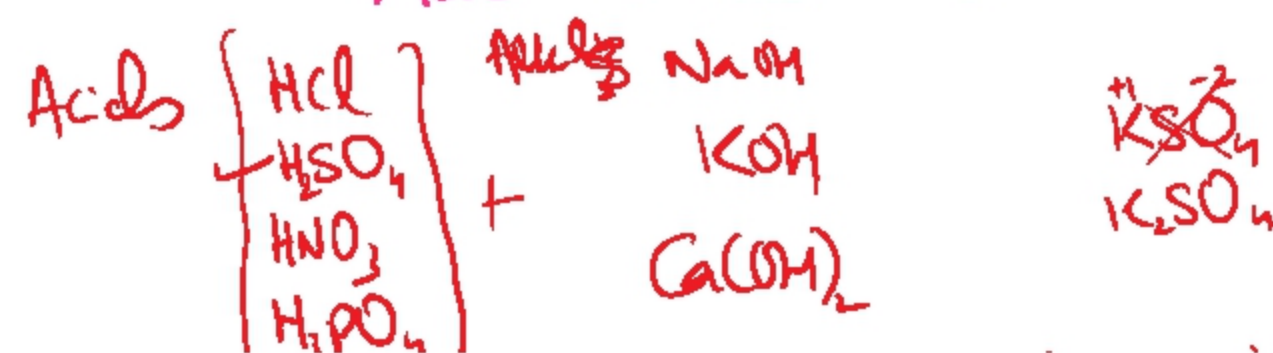
(2) Acid/Base Reaction  
Acid + Alkali → Salt + H<sub>2</sub>O  
(aq) (aq) (aq) (l)  
Base is insoluble  
Alkali is soluble in H<sub>2</sub>O

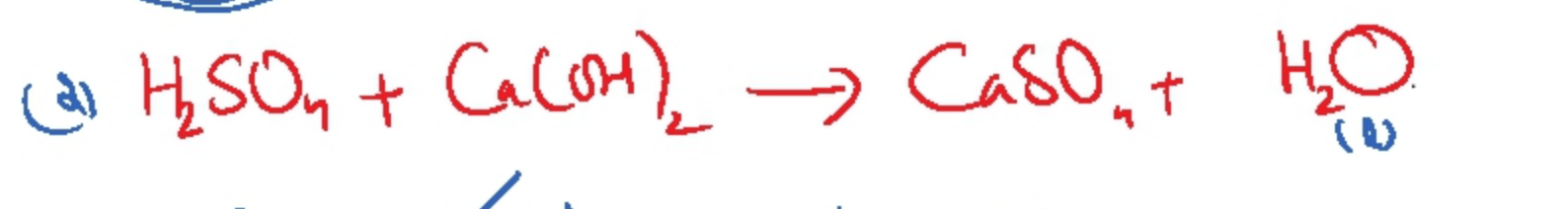
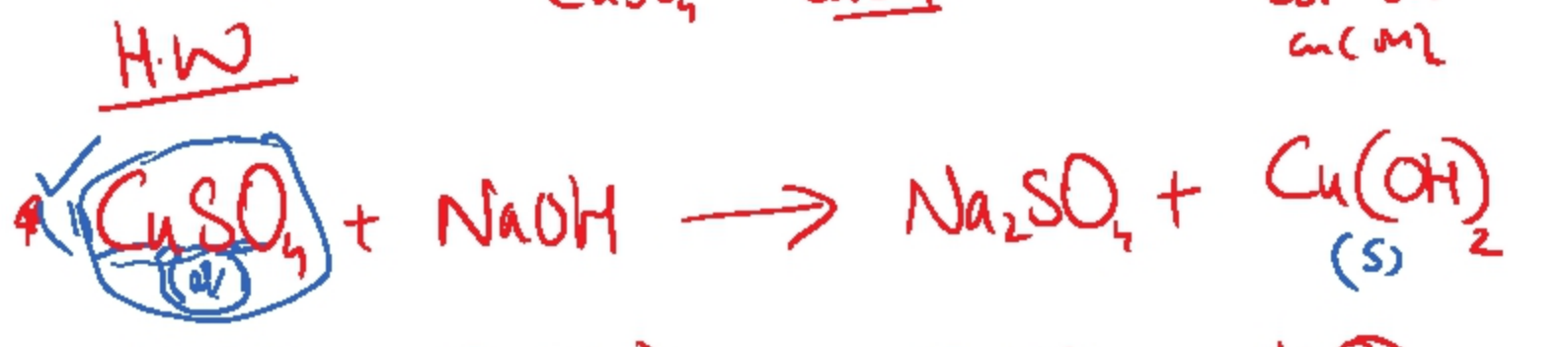
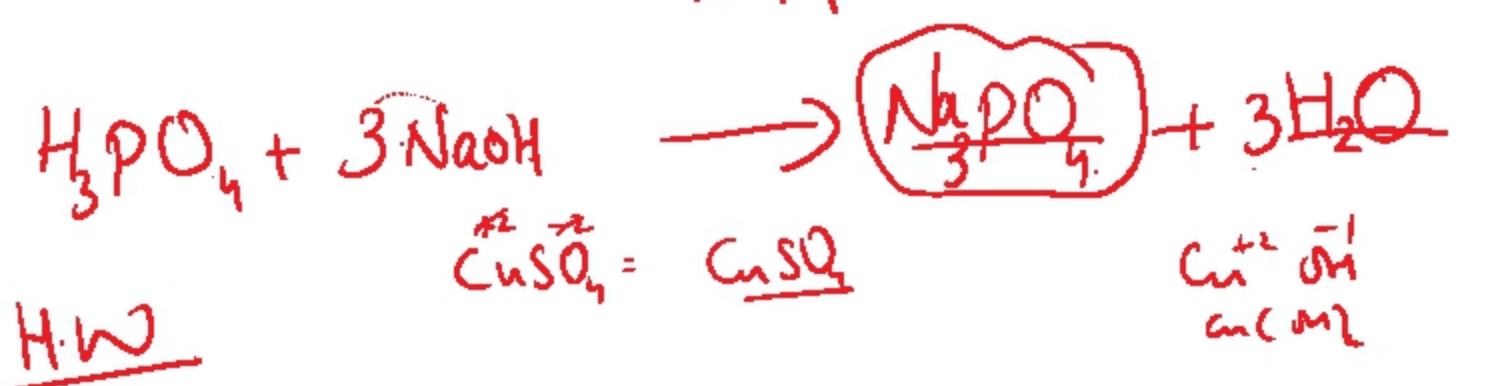
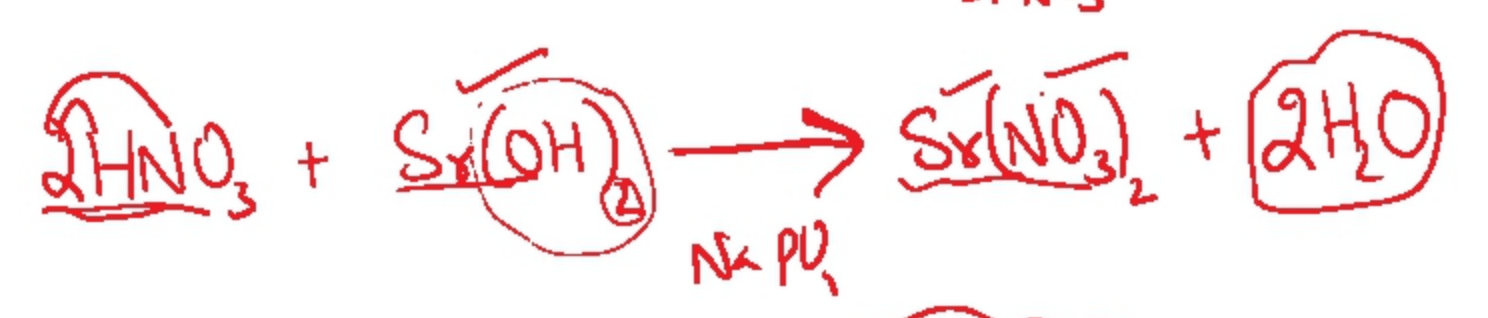
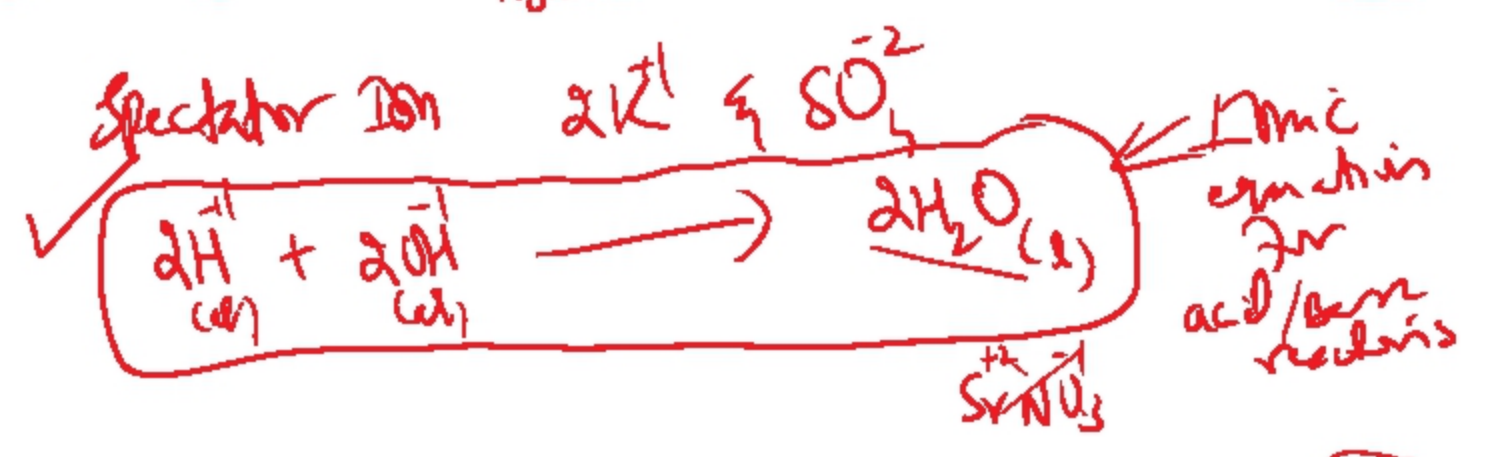
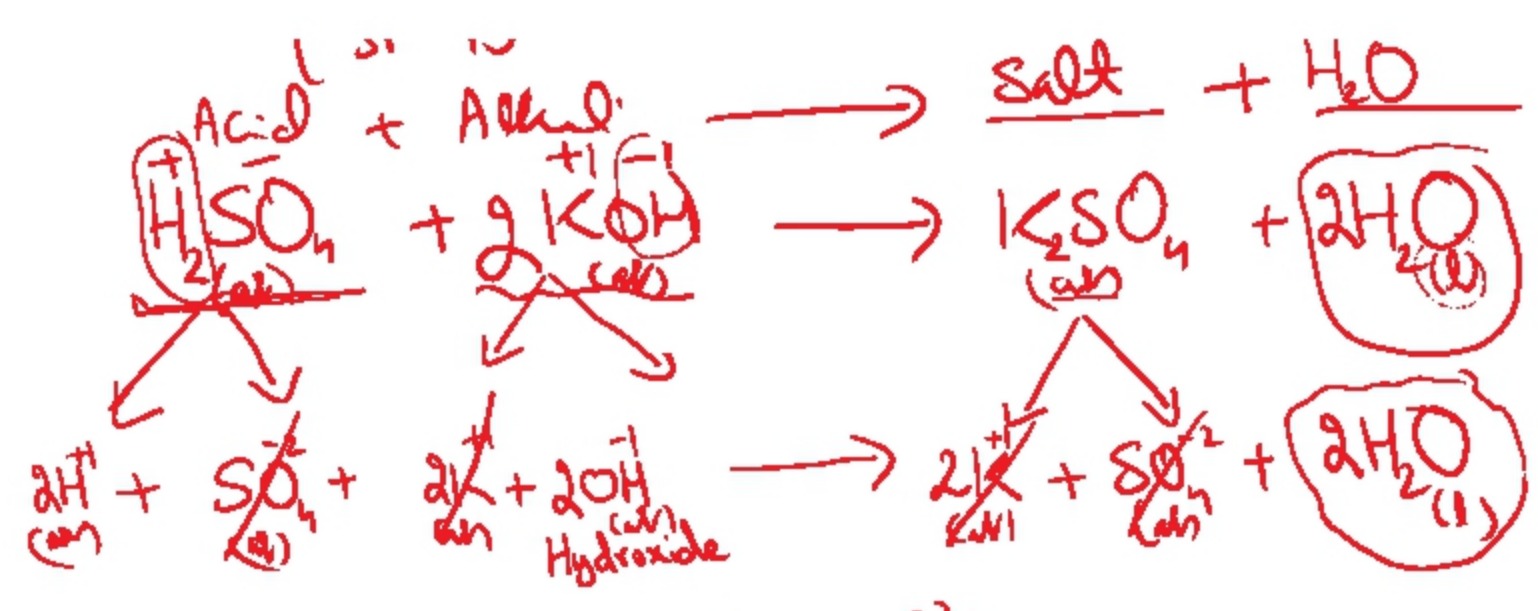


HW

An aqueous sodium sulphide is mixed with aqueous copper(II) nitrate to produce solid copper(II) sulphide and aqueous sodium nitrate. Write word symbol equation, ionic equation and also mention spectator ions.

Acid Base Reaction





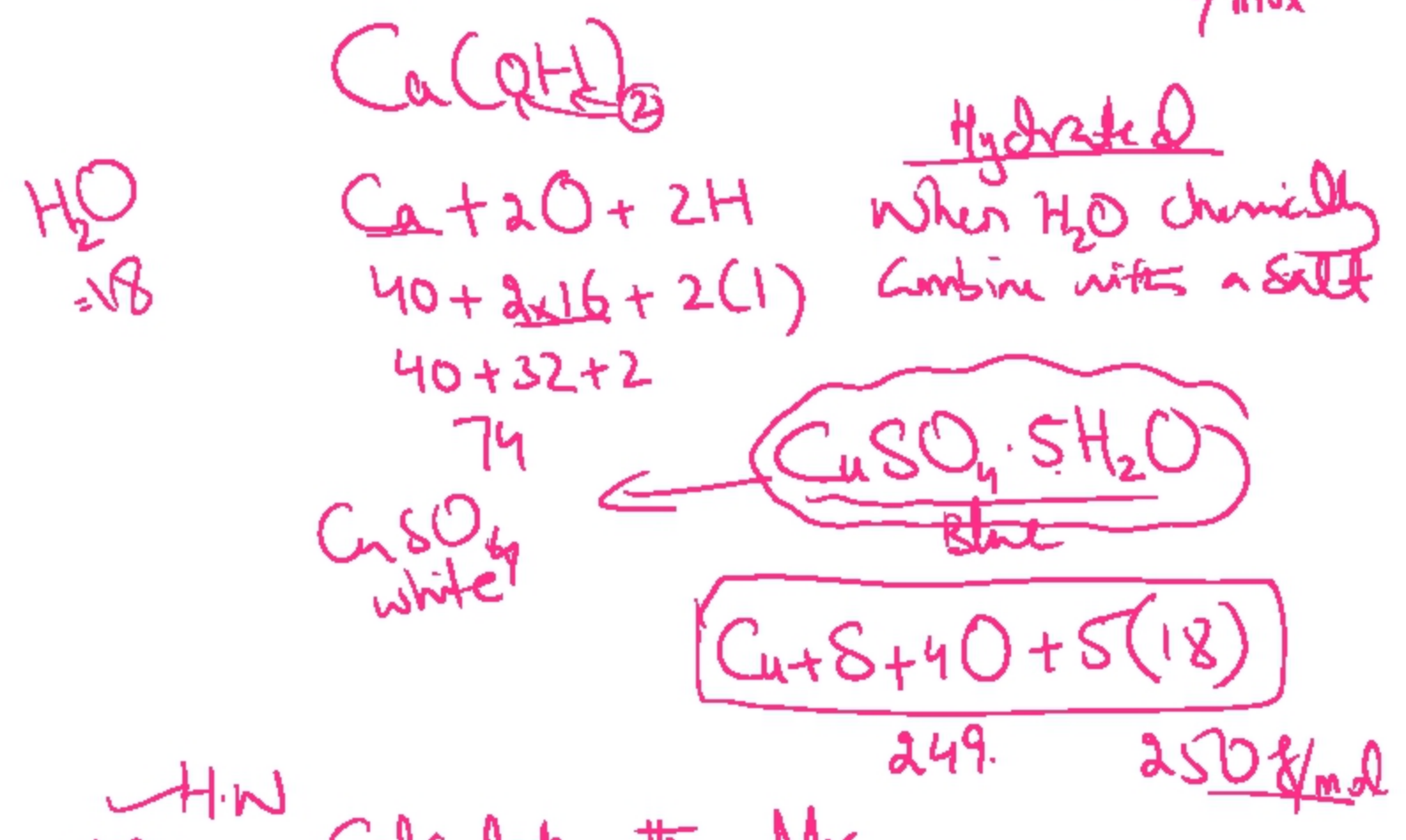
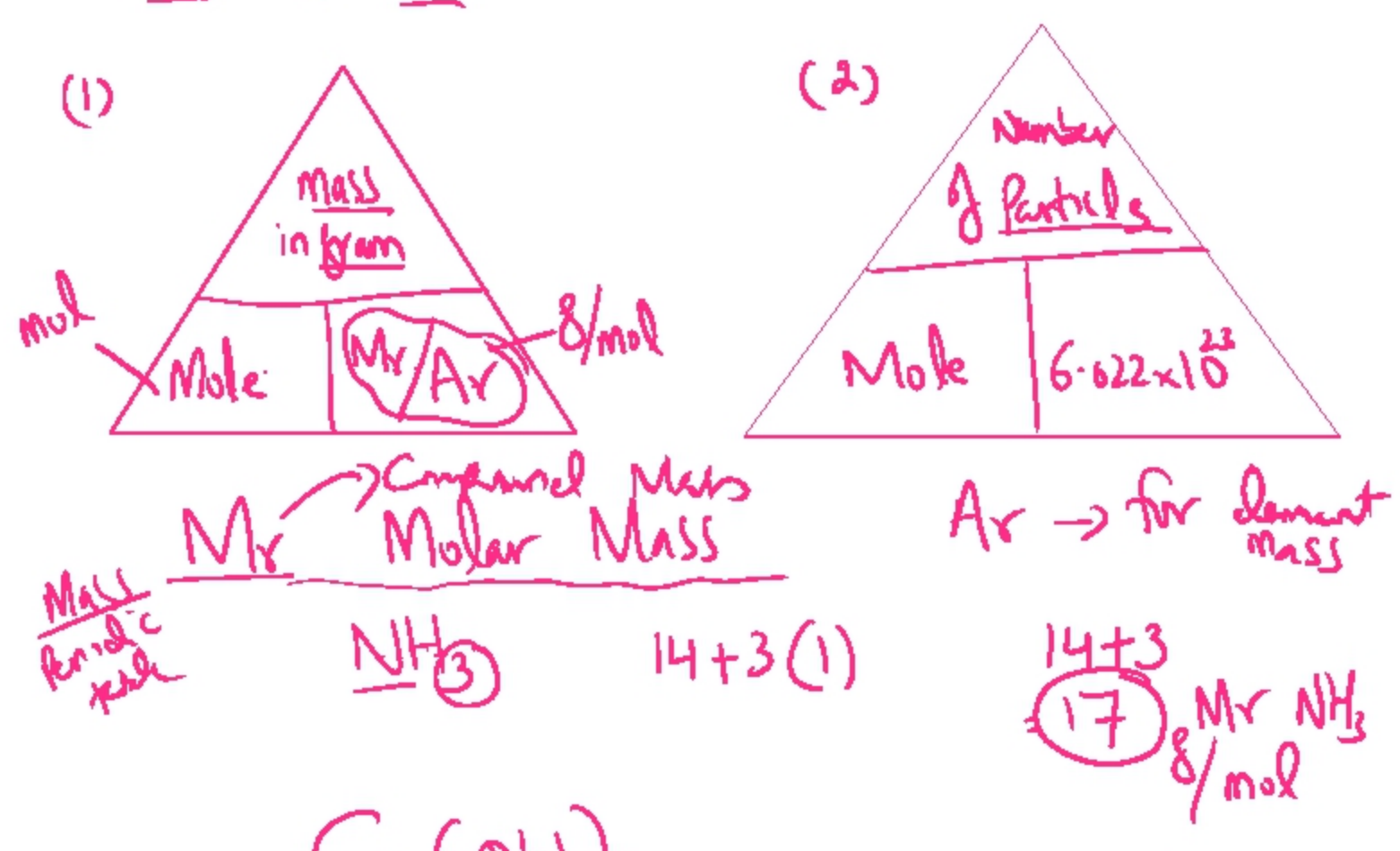
chemistry **Mole** (unit of amount of substance)

1 dozen = 12 eggs  
 1 dozen = 12 oranges

1 Mole =  $6.022 \times 10^{23}$  particles  
 Avogadro's number  
 atom molecule ion  
 2 mole =  $2 \times 6.022 \times 10^{23}$

Mole is an amount of substance which consist of  $6.022 \times 10^{23}$  Avogadro's number

1 mole of  $\text{H}_2$  molecule = 2g =  $6.022 \times 10^{23}$  molecules  
 2 mole  $\text{H}_2$  atom = 2g =  $2 \times 6.022 \times 10^{23}$  atoms  
 Mr or Ar  $1 \times 2 = 2$



- H.W Calculate the Mr  
 (1)  $(\text{NH}_4)_3\text{PO}_4$  (2)  $\text{NaNO}_3$   
 (3)  $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$  (4)  $\text{Mg(NO}_3)_2$   
 (5)  $\text{C}_6\text{H}_{12}\text{O}_6$

What is  $\checkmark$   
 $X = ?$   
 $\text{Cl}$

$\boxed{\text{F}_2}$   $r_2$   
 $38$   
 $M_r = 73.5 - 38$   
 $35.5$   $\text{Cl}$

Mole Questions  
 there are 8g of Mg, find number of atoms in Mg

grams  $\rightarrow$  mole  $\rightarrow$  number of atoms

$\frac{m}{M_r} = \frac{8}{24} = 0.33 \text{ mol} \rightarrow \text{number of atoms}$

number of atoms =  $0.33 \times 6.02 \times 10^{23}$   
 $1.986 \times 10^{23}$

$\frac{m}{M_r} \times \text{atoms}$   $\text{Na}$

- (1) How many moles are in 15g of Lithium?
- (2) How many molecules are in 23 moles of oxygen?  
 $1.38 \times 10^{25}$
- (3) How many grams are in  $82 \times 10^{22}$  molecules of  $\text{N}_2\text{I}_5$

(4) How many oxygen atoms are in 1.25 moles of  $\text{SO}_2$ ?

$\text{SO}_2$

$\frac{m}{M_r} \times \text{atoms}$

$1.25 \times 6.02 \times 10^{23}$   
 $= 7.527 \times 10^{23}$   
 $2 \times 7.527 \times 10^{23}$   
 $= 1.505 \times 10^{24}$  number of O atoms in  $\text{SO}_2$

atoms ions

Q1 How many atoms of Na are in 5.95 moles of  $\text{Na}_2\text{SO}_4$ ?

Q2 How many ions of Na are in 5.95 moles of  $\text{Na}_2\text{SO}_4$ ?



Number of ions = moles  $\times 6.02 \times 10^{23}$   
 $= 5.95 \times 6.02 \times 10^{23}$   
 $= 1 \times 3.583 \times 10^{24}$   
 $= 3.583 \times 10^{24}$   $\times 2$

Molar Volume

$\text{cm}^3 \rightarrow \text{dm}^3$

$\frac{m}{M_r} \times \text{molar ratio}$

$6.02 \times 10^{23}$  constant

Masses are different

$\text{CO}_2$  1 mole 44g 24dm<sup>3</sup>

$\text{H}_2$  1 mole 2g 24dm<sup>3</sup>

$\text{O}_2$  1 mole 32g 24dm<sup>3</sup>

RIP  $\rightarrow T = 20^\circ\text{C}$  Volume = 24dm<sup>3</sup>  
 Room temp pressure  $P = 1 \text{ atm}$

"Equal mole of all gases at same temp and pressure, they will occupy same volume"

1 mole = volume 24dm<sup>3</sup>  $\frac{1 \text{ mole} = 1 \text{ NA}}{2 \text{ mole} = 2 \text{ NA}}$   
 2 mole = ? 48dm<sup>3</sup>

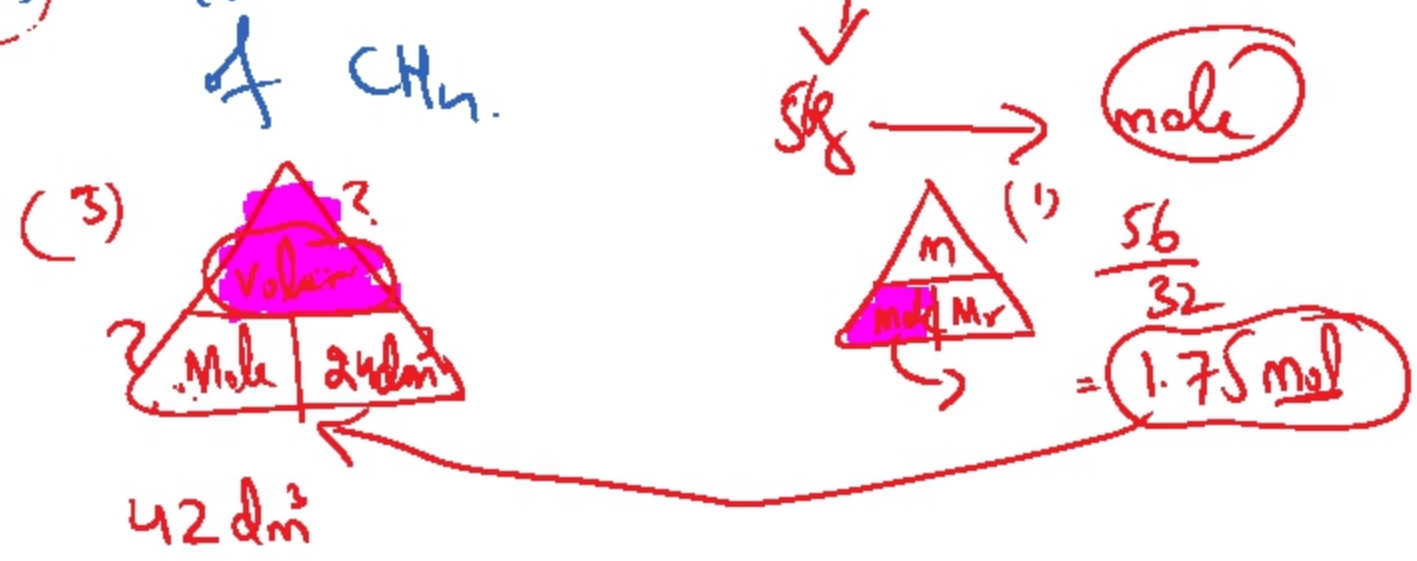
1 What will be the volume of Ammonia if number of moles are 0.02 moles

2 Find the number of moles of sulphur dioxide  
 2.1 0.3  $\text{SO}_2$

gas it volume is 760 cm<sup>3</sup>

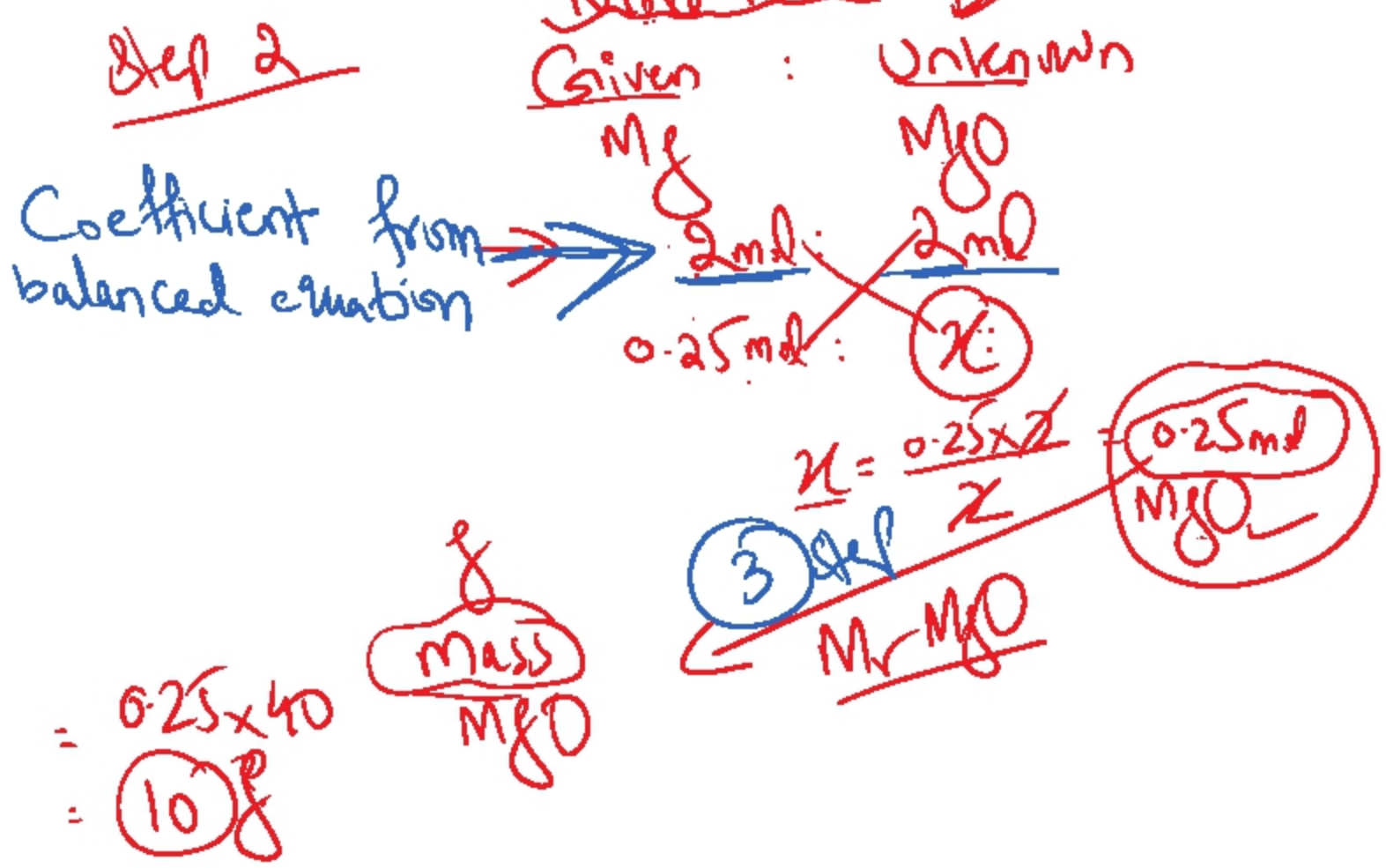
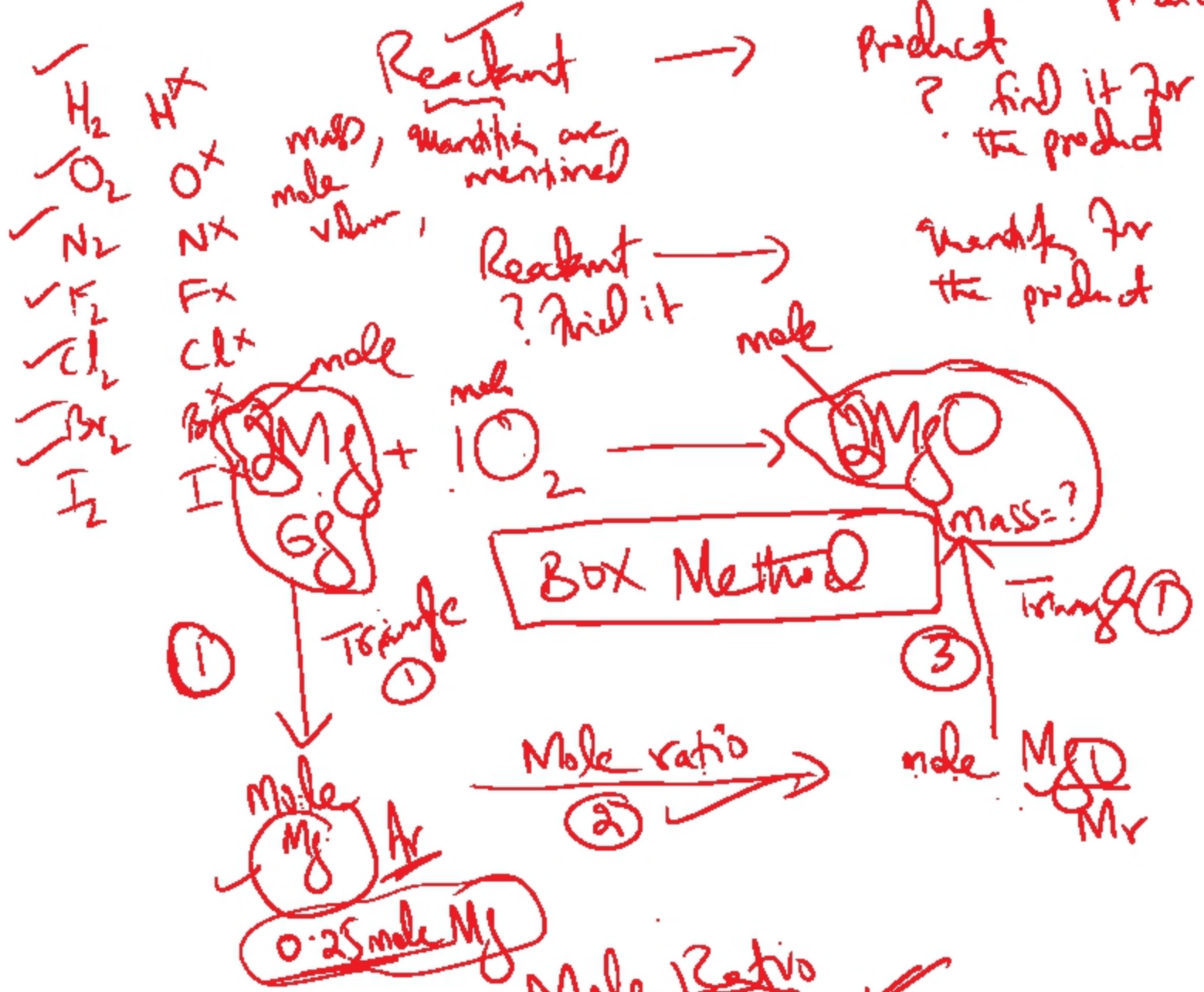
HW

- (1) Find the volume of 4.5 moles of H<sub>2</sub>
- (2) Find the volume of 56g of O<sub>2</sub>
- (3) Find the volume of 5.2 x 10<sup>23</sup> molecules of CH<sub>4</sub>



### Reaching Masses

If (G) of (M) are available  
 what will be the mass of the product



HW Calculate the mass of Al that can be produced from 30g of Al<sub>2</sub>O<sub>3</sub>

30g  
 102  
 = 0.294 mol

2Al<sub>2</sub>O<sub>3</sub> → 4Al + 3O<sub>2</sub>  
 mole = ?

### (2) Finding Mole ratio

Given data : Unknown  
 Al<sub>2</sub>O<sub>3</sub> : Al  
 2 mol : 4 mol  
 0.294 mol : x mol

$$x = \frac{0.294 \times 4}{2} = 0.588 \text{ mol Al}$$

3 mol = mass  
 Al = 27 x 1.176 = 31.76g

$$11x \text{ mass} = 26.18g$$

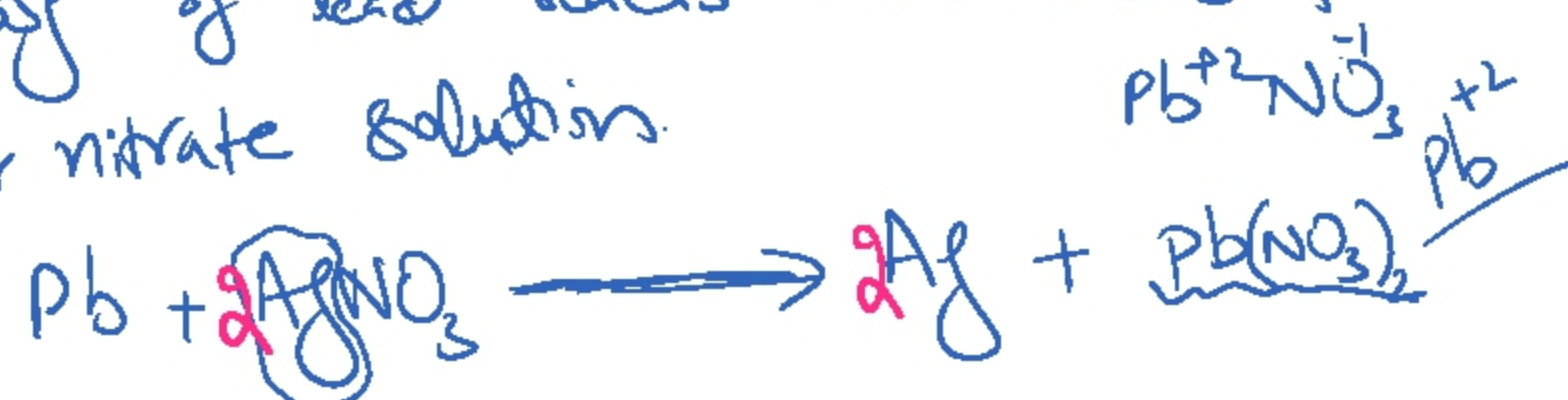
Q. Calculate the mass of magnesium chloride formed from the reaction of 4.8g Mg with hydrochloric acid?



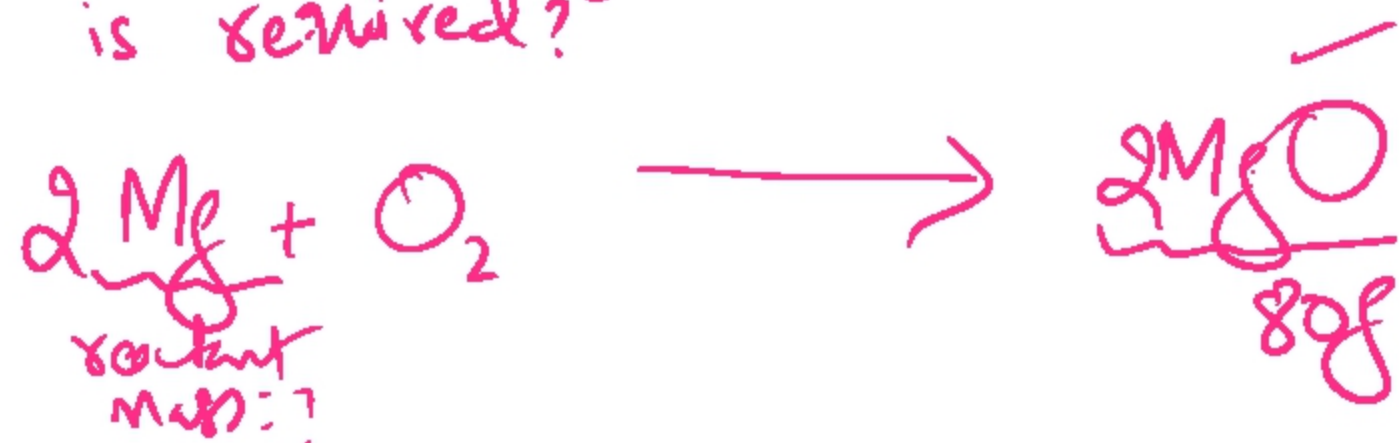
Q. Calculate the mass of  $\text{CO}_2$  produced when 24g of C reacts completely with  $\text{O}_2$ .



Calculate the mass of silver which is displaced when 1.035g of lead reacts with excess of silver nitrate solution.

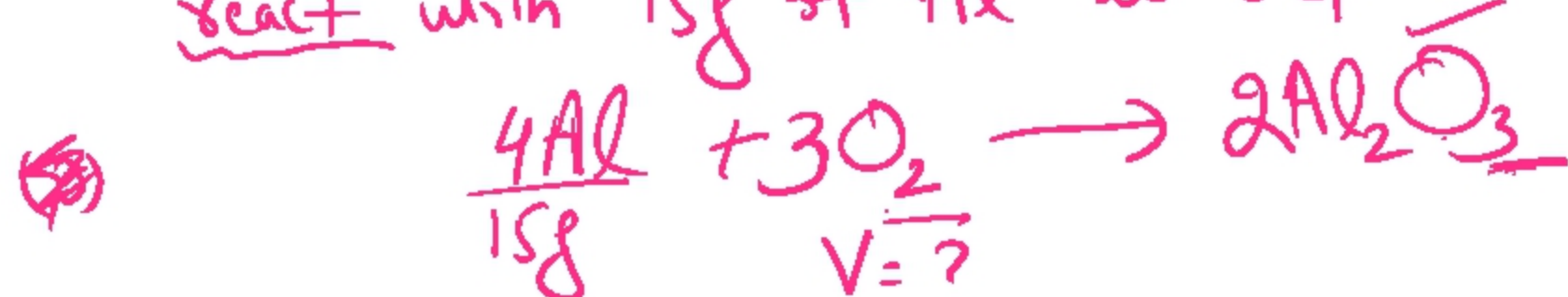


A student needs to prepare 80g of magnesium oxide by combustion of magnesium metal in oxygen. What mass of Mg is required?

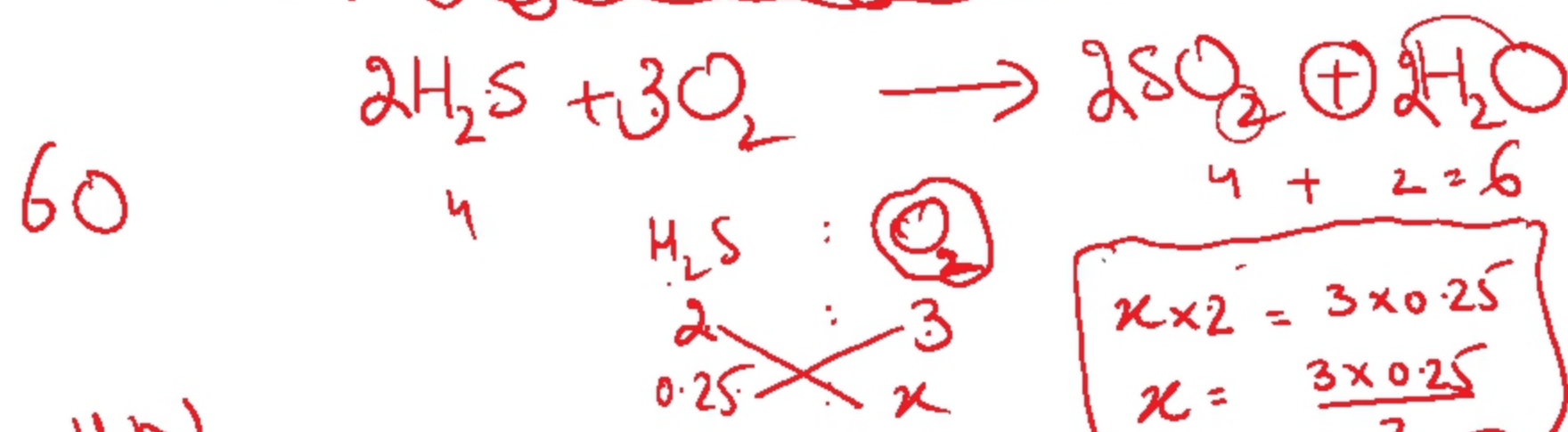


(1) What is the volume occupied by 1.75 moles of  $\text{CO}_2$ ?

(2) What volume of  $\text{O}_2$  gas is needed to completely react with 15g of Al at rtp.

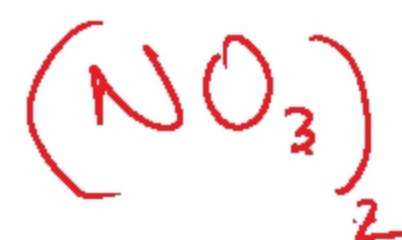


Q1 What mass of oxygen is needed to react with 8.5g of hydrogen sulphide

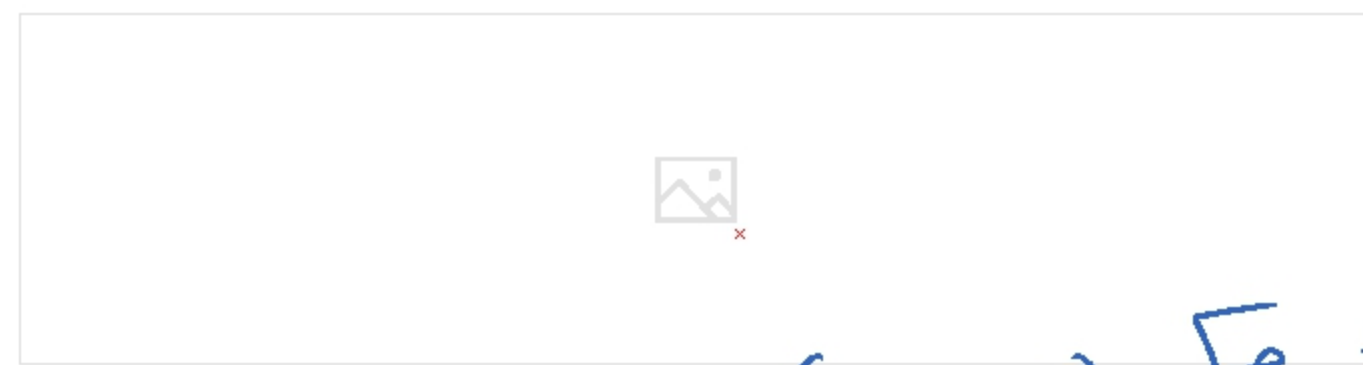
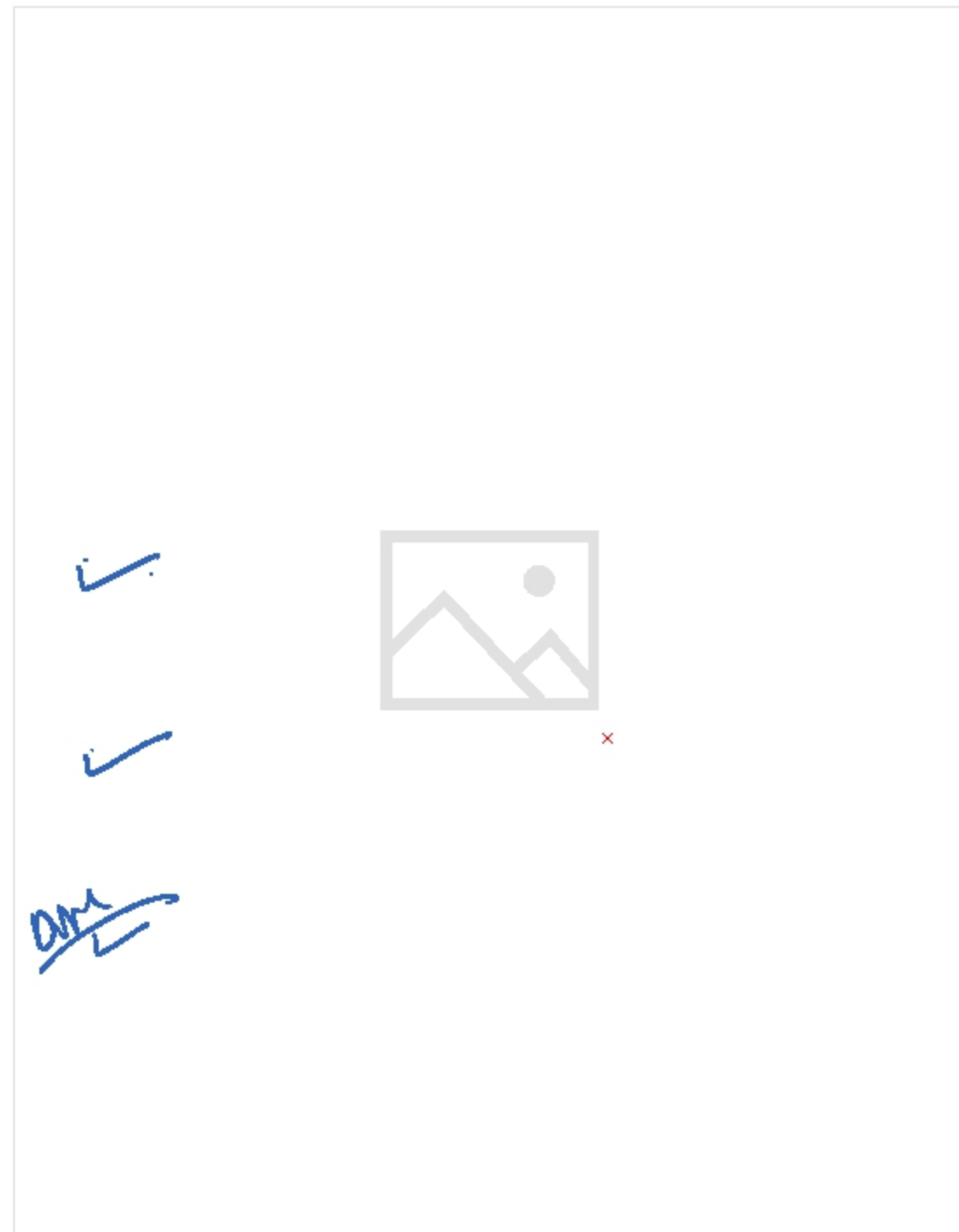


H.W

Q2 Calculate the mass of nitric acid required to react completely with 90g of Cu



subscript multiply with coefficients



c.w. Find the volume in  $\text{dm}^3$  of  $\text{CO}_2$  produce if mass of Carbon is 20g.



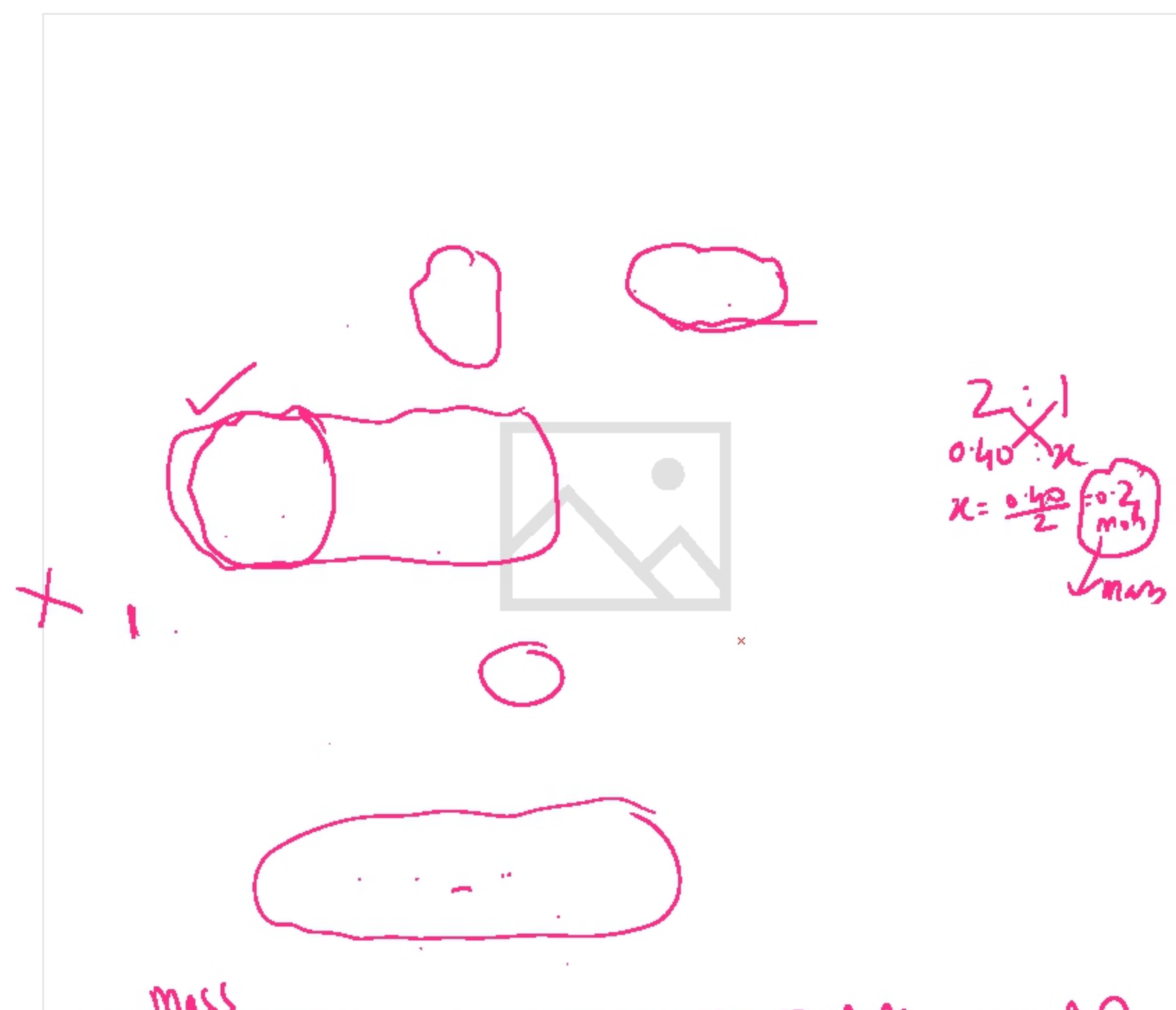
H.W. How much volume of  $\text{NH}_3$  will be produced from 7.8g of hydrogen?



2 Chicken Patties and 5 Bread slices

1 chicken patty + 2 bread slices  $\rightarrow$  1 sandwich  
Reactants Product

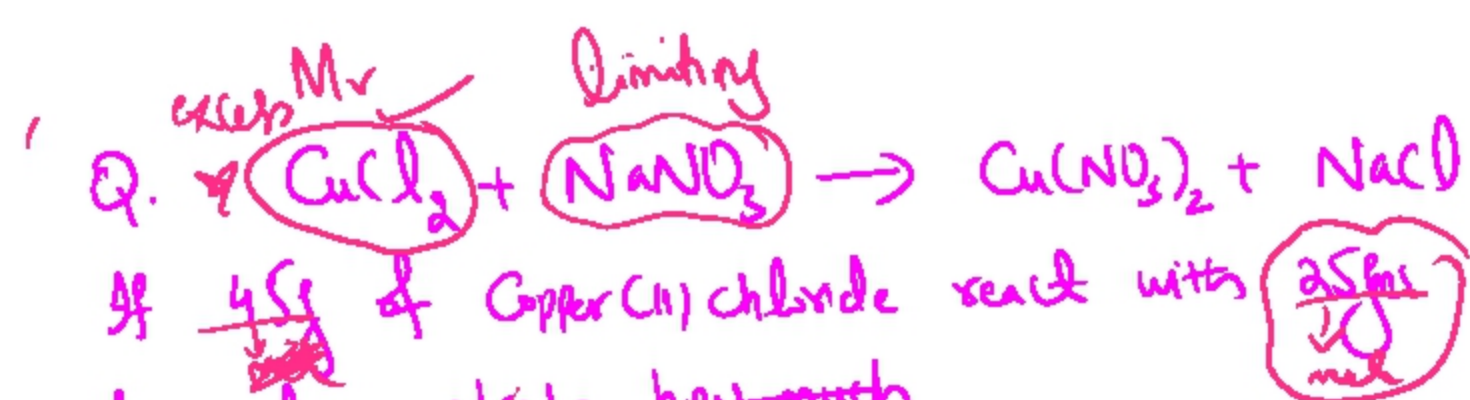
Chicken Patty  $\rightarrow$  limiting reactant  
2 Bread slice  $\rightarrow$  excess reactant



How much is excess reactant left unreacted?  
 $0.25 - 0.20 = 0.05 \text{ mol}$

How much sodium sulphide is produced in this reaction.

mass = moles  $\times$  Mr

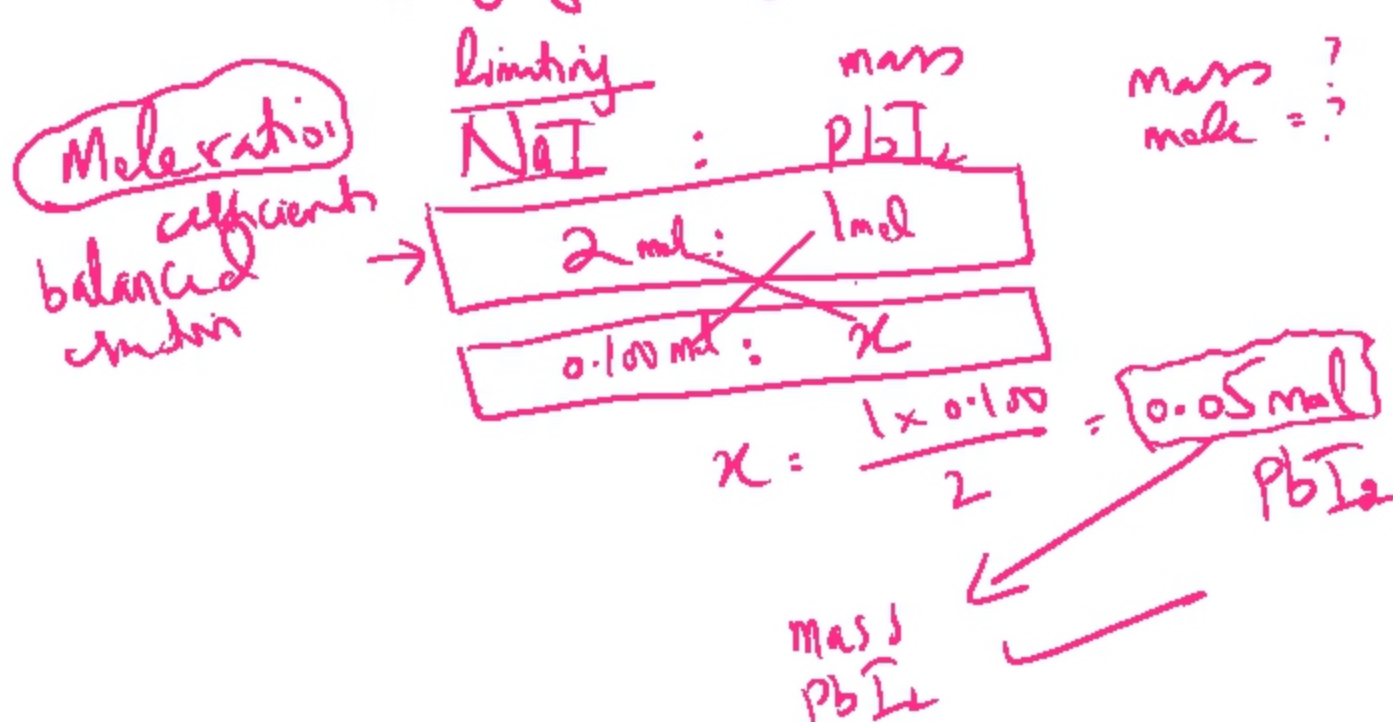


- (a) What is the limiting reactant for the reaction?  
 (b) How much of the excess reactant is left over in this reaction?  
 (c) How much of the Sodium chloride can be formed?



If I start with 25g of lead(II) nitrate and 15g of sodium iodide.

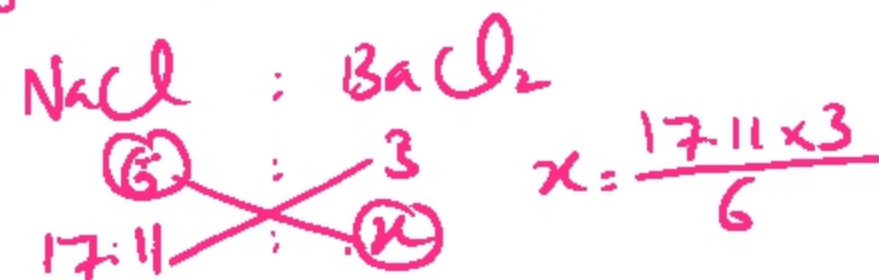
- (a) which one is limiting and which one is excess  
 (b) How many moles of excess reactant left unreacted.  
 (c) How many grams of lead(II) iodide is formed.



H.W 1000g of NaCl combined with 2000g of Barium phosphate



- (a) Which one is the limiting reactant?  
 (b) How many grams of excess reactant are left?  
 (c) How many grams of BaCl<sub>2</sub> are produced?



| %age Composition | %age by mass |
|------------------|--------------|
|------------------|--------------|



%age H %age O = ?

$\% \text{age of an element} = \frac{\text{Ar of element} \times \text{number of atoms of that element}}{\text{Mr Compound}} \times 100$

$= \frac{1 \times 2 \times 100}{18}$

$= 11.11\%$

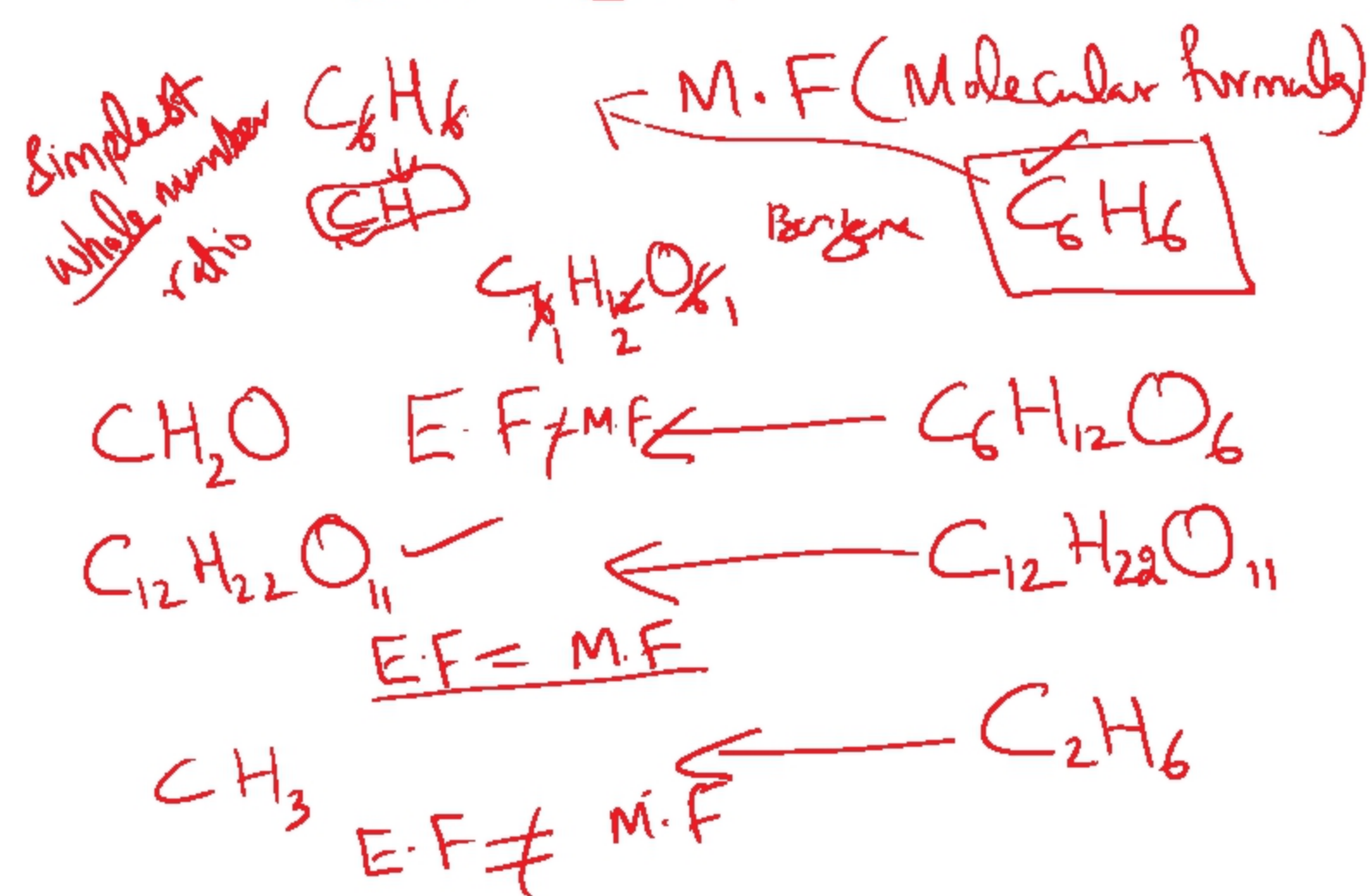


Calculate %age by mass of H<sub>2</sub>O in

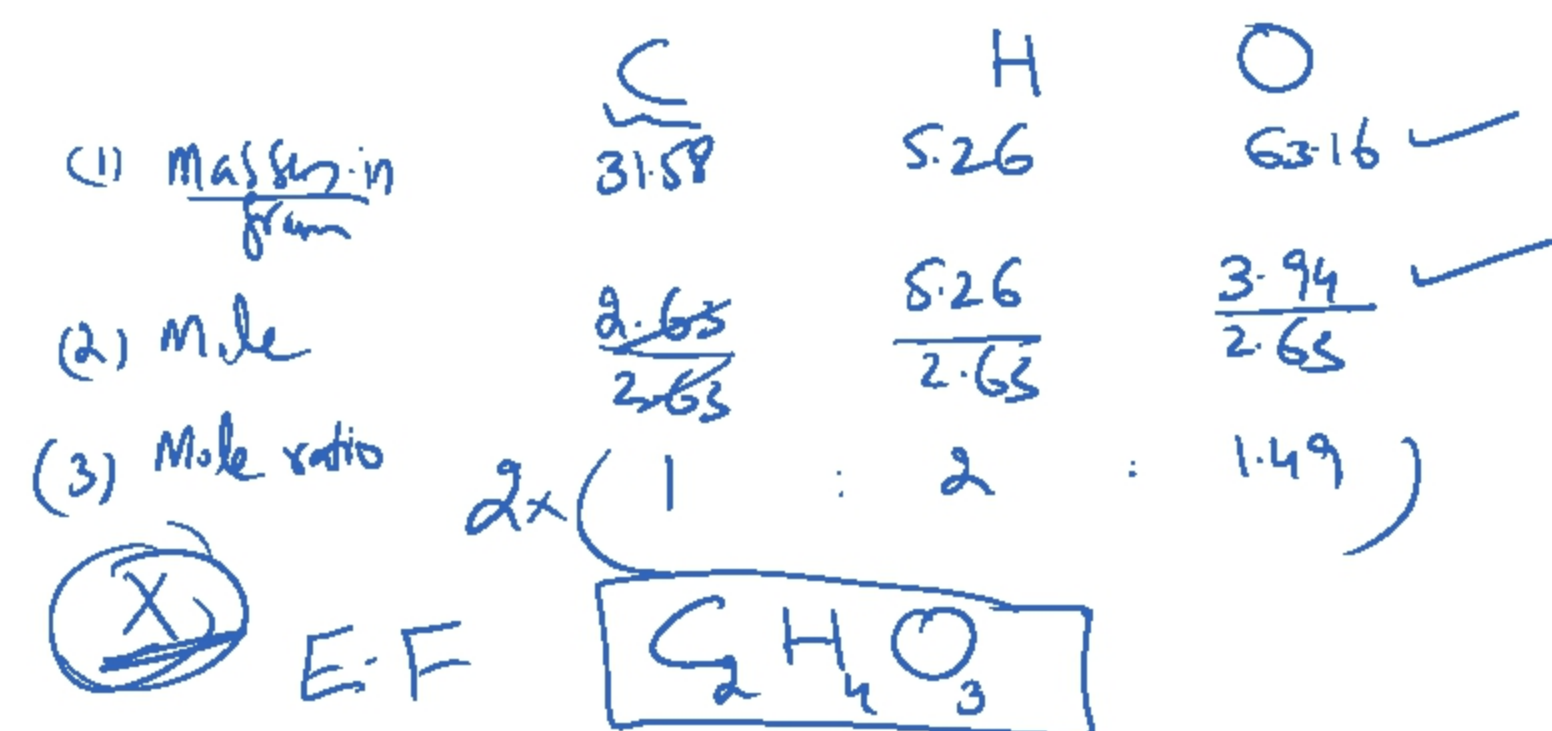
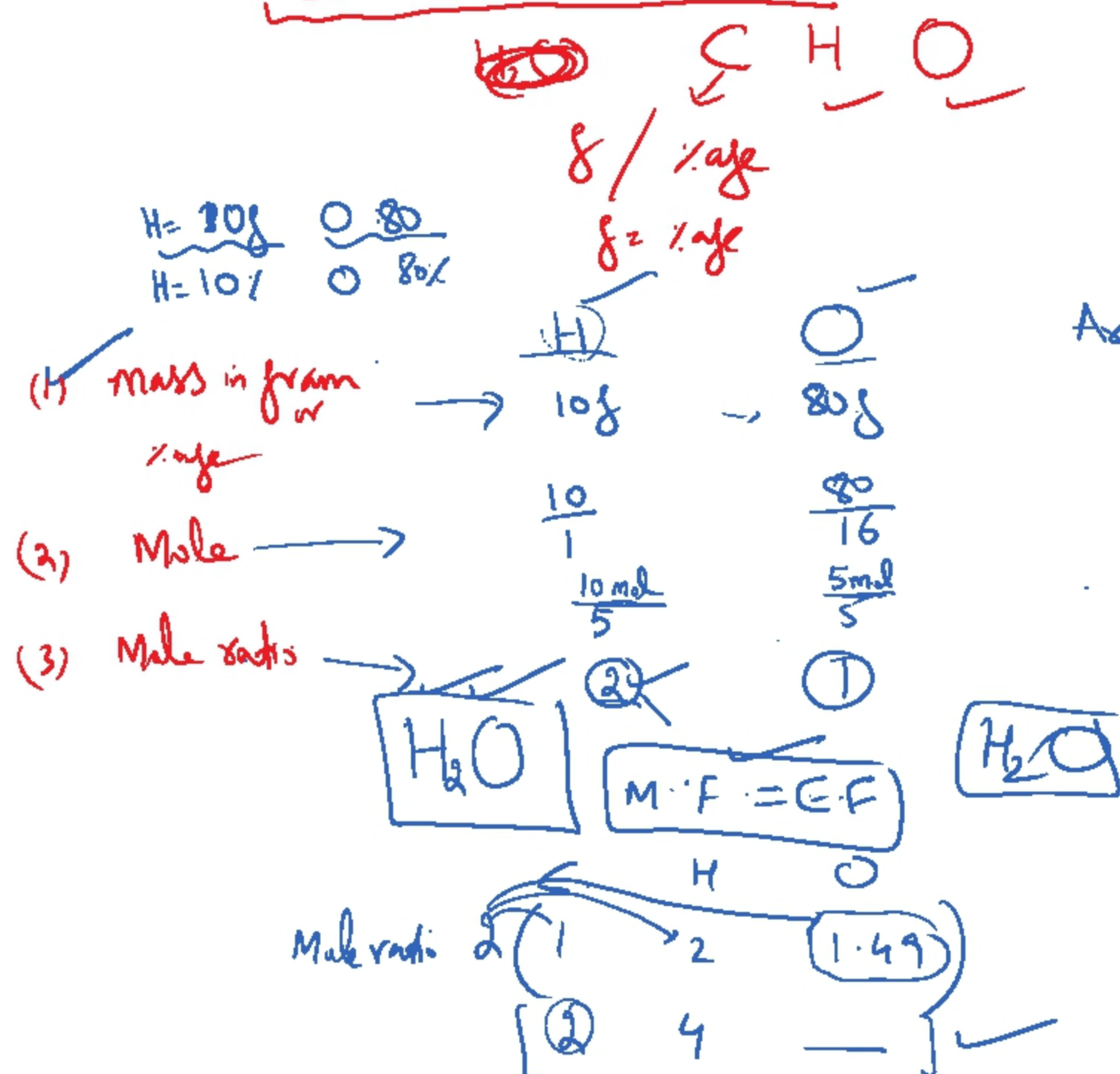


%age of H<sub>2</sub>O =  $\frac{18 \times 5 \times 100}{250}$

E.F (Empirical Formula)

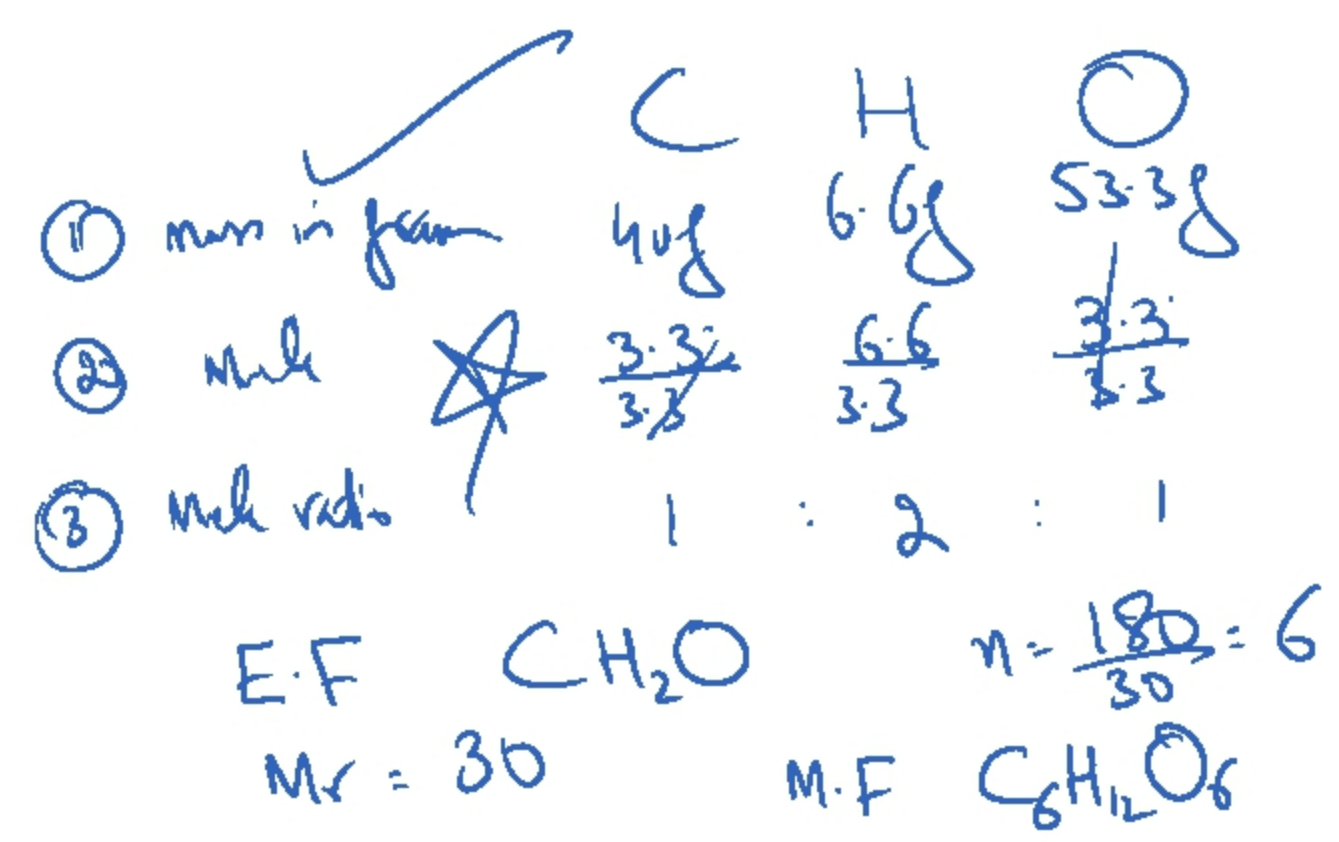
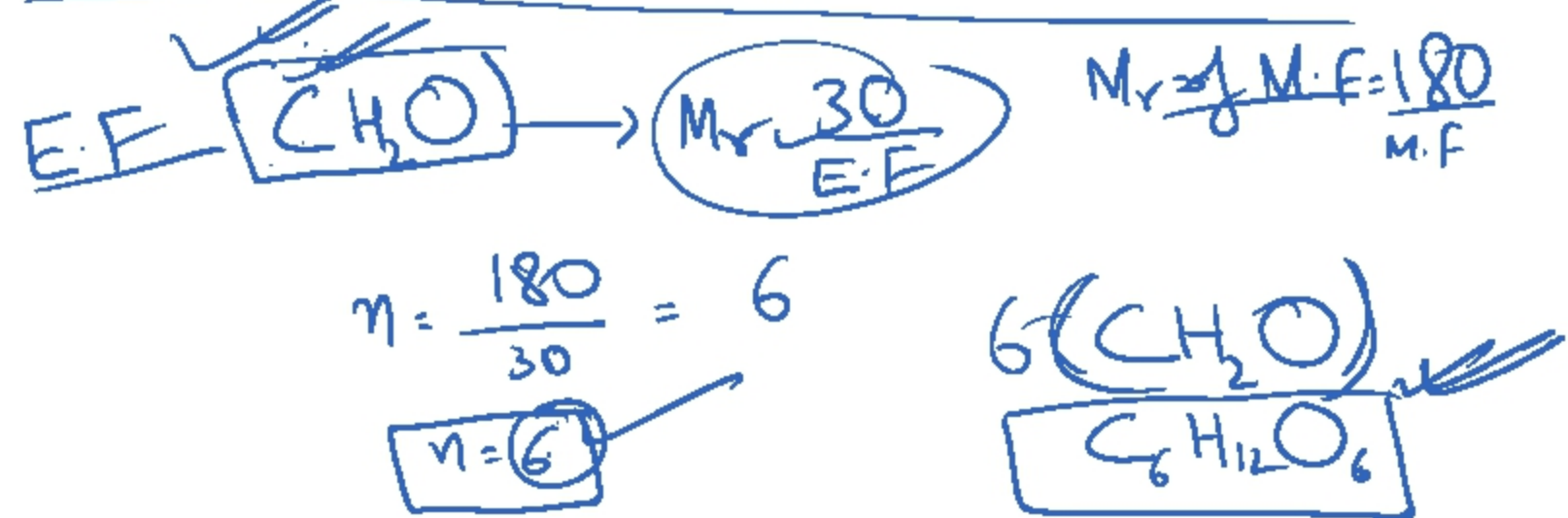


### E.F Calculation



How to calculate M.F (Molecular formula)

$$n = \frac{Mr \text{ of (M.F)}}{Mr \text{ of E.F}}$$

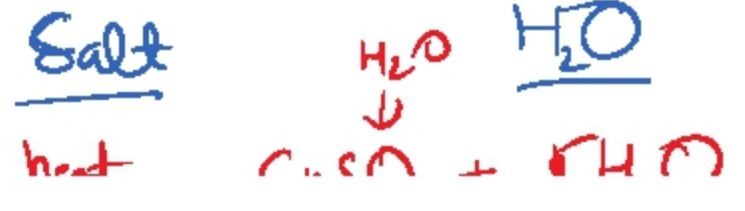


### Hydrated Salt

Having water in their chemical formula



Empirical formula of hydrated salt



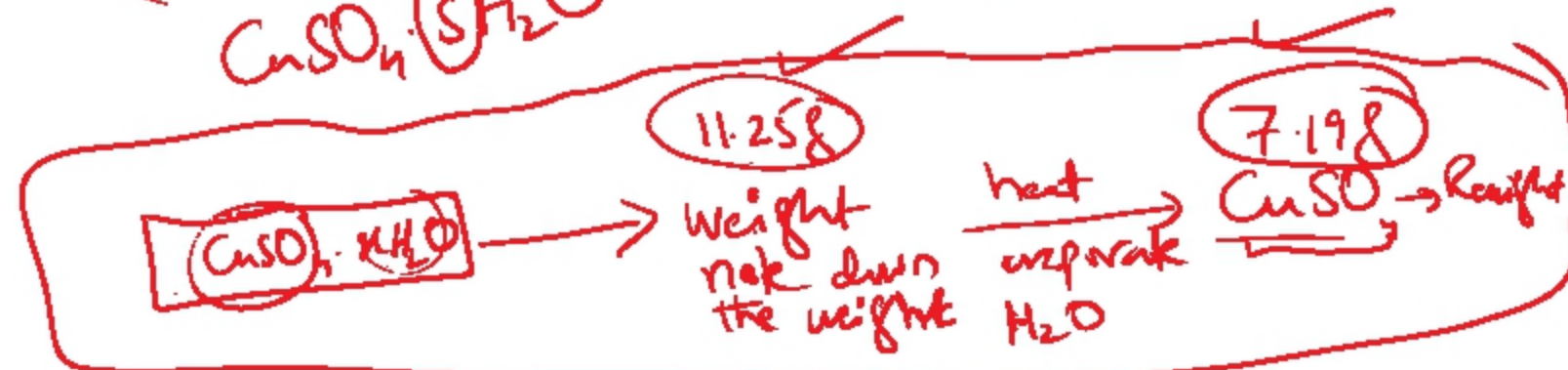


Find E.F of Hydrated Salt

- (1) Mass in gram  
 (2) Mole

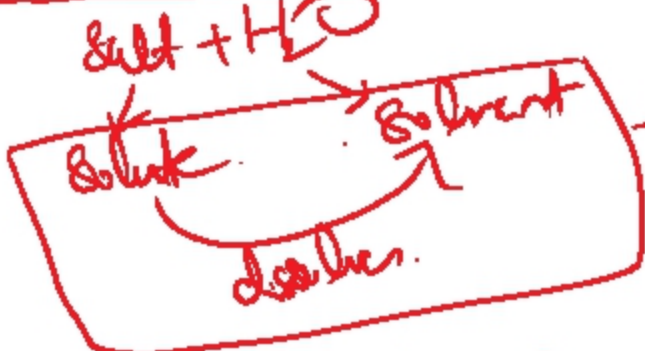
(3) Molar ratio  
 $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$

| Salt                  | $\times \text{H}_2\text{O}$ |
|-----------------------|-----------------------------|
| $\text{CuSO}_4$       |                             |
| 7.19g                 | 11.25 - 7.19 = 4.06         |
| 7.19                  | 4.06                        |
| 160                   | 18                          |
| $= 0.045 \text{ mol}$ | $= 0.225 \text{ mol}$       |
| 0.045                 | 0.045                       |
| 1                     | 5                           |



Concentration  
 Sugar is solute  
 Concentrated

Clean water



Solution  
 A solution which contains more solute will be called concentrated solution

A solution which contains less solute is called dilute solution.

Concentration  
 Amount of solute dissolve  
 Per dm<sup>3</sup> of solvent

Amount of Solute  $\propto$  Concentration



Units of Concentration  
 $\text{g/dm}^3$  or  $\text{mol/dm}^3$

$C = \frac{\text{mass in gram of solute}}{\text{Volume of solution in dm}^3}$   
 $C = \frac{\text{mole of solute}}{\text{Volume of solution in dm}^3}$   
 $(\text{g/dm}^3)$   $(\text{mol/dm}^3)$

$75\text{cm}^3 \rightarrow \text{dm}^3$

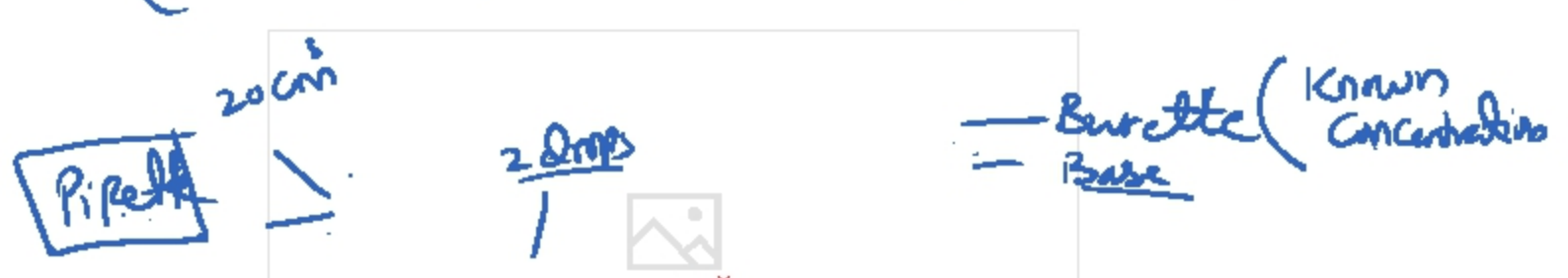
$\text{mass} = 3\text{g}$   $V = 100\text{cm}^3$   $C = ? \text{ mol/dm}^3$   
 $C = \frac{\text{mass of solute}}{\text{Volume in dm}^3} = \frac{3}{0.1} = 30 \text{ g/dm}^3$   
 $C = \frac{30}{40} = 0.75$   
 $\text{mole} = \frac{m}{M_r}$

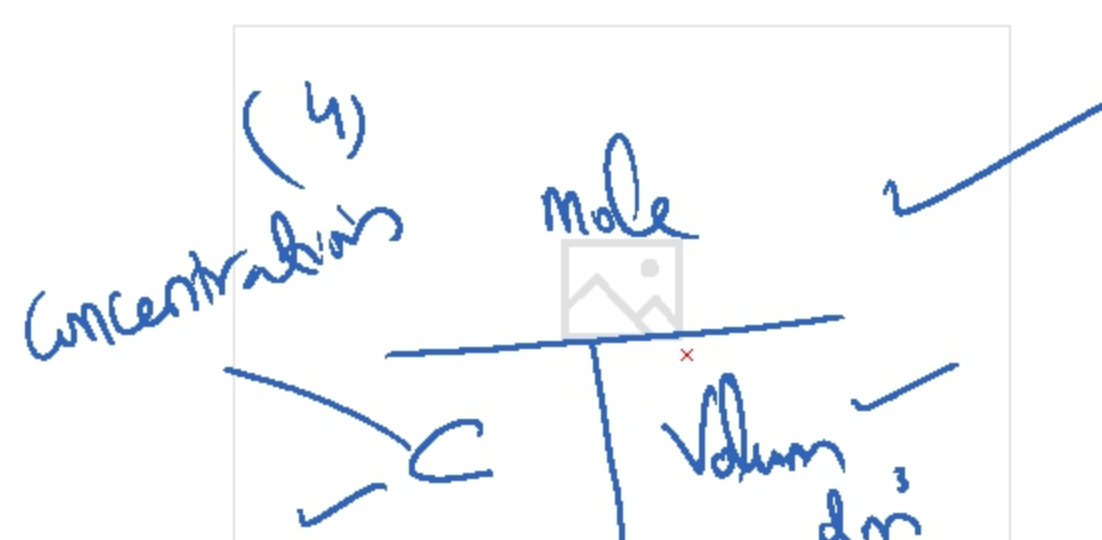
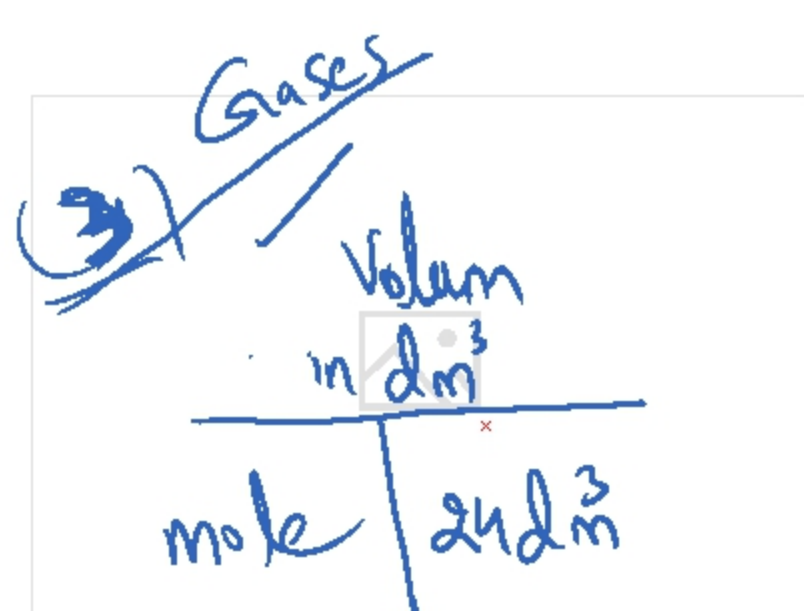
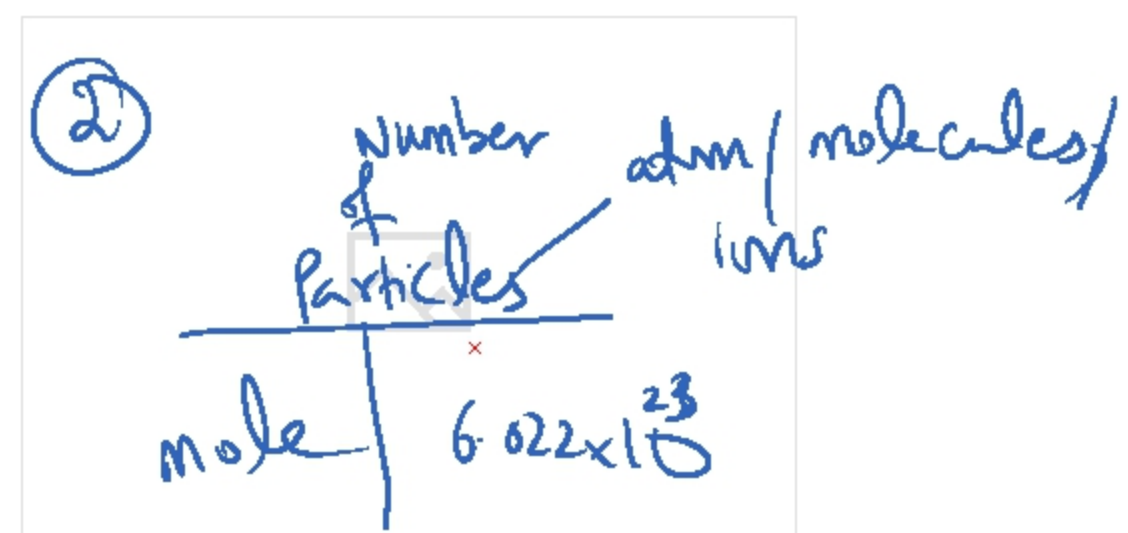
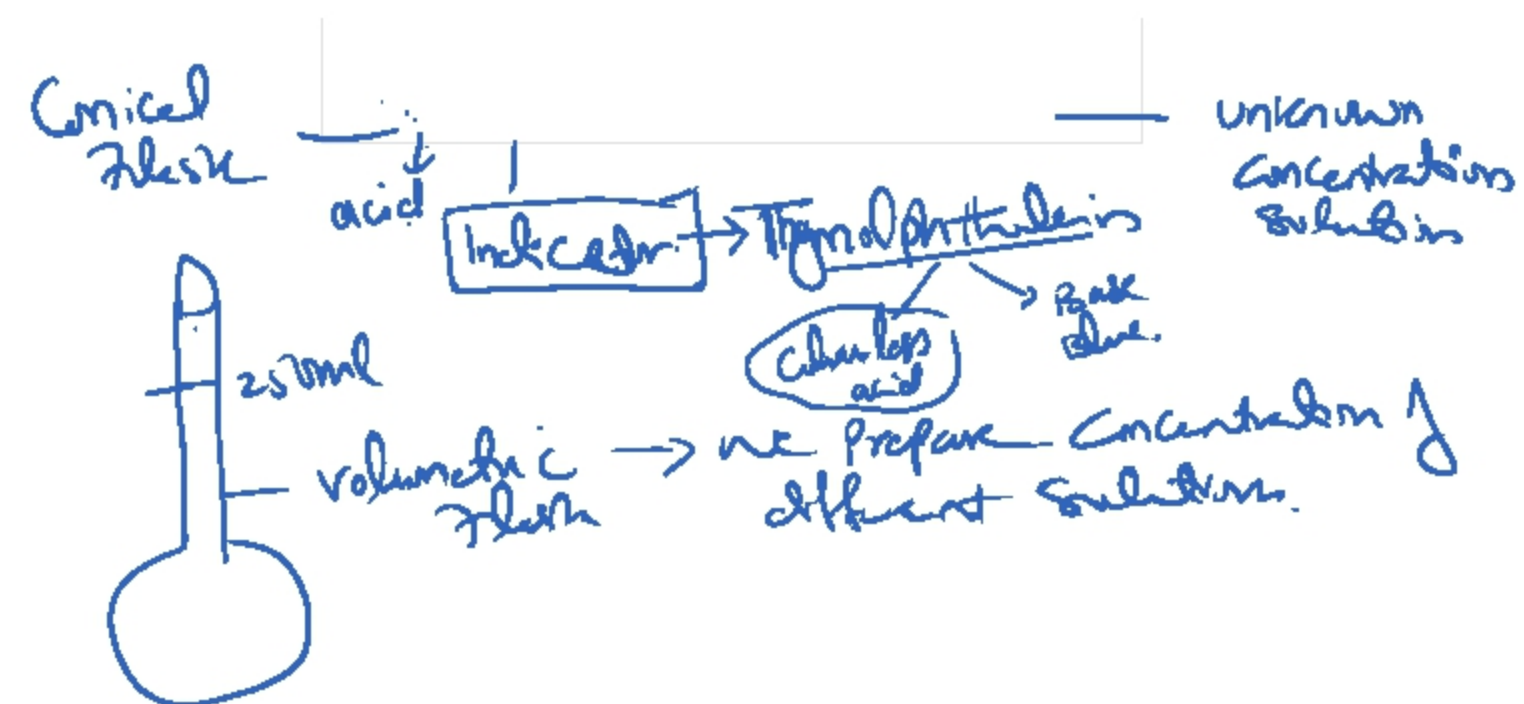
Practice

$C = \frac{73}{36.5} = 2 \text{ mol/dm}^3$   $C = 73 \text{ g/dm}^3$   $C = \frac{\text{moles}}{\text{Volume}}$   
 $V = 250\text{cm}^3$   $\text{moles of HCl} = ?$   $36.5$   
 $= \frac{2 \times 250}{1000} = 0.5 \text{ mol}$

Titration Acid/Base Titration

Burette  
 Pipette  
 Conical flask  
 find an unknown concentration of any solution may be acid / base





Iron (III) sulphate

Sodium nitride

Magnesium chloride

Ar O =

$$G_4 = \frac{XO}{m(2)} \times 2$$

$$= X + 16 \times 2$$

$$G_4 = X + 32$$

$$= X$$

