

practical work N°1 :**EQUILIBRIUM: PRECIPITATION - DISSOLUTION****1-Objectives:**

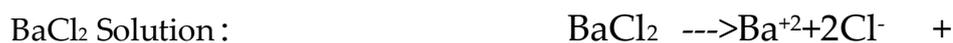
- Write the precipitation - dissolution equilibrium equations
- Calculate the solubility and solubility product
- Experimentally determine the precipitation bases.

2-Definition :**2-1-Solubility**

The solubility S of a solid compound is the maximum number of moles of this solid that can dissolve in one litre of solvent at a given temperature.

2-2-Reaction of precipitation.

When two solutions containing the two ions (Ba^{2+} and SO_4^{2-}) of a poorly soluble compound BaSO_4 are mixed, the latter precipitates during mixing (provided that saturation with BaSO_4 is reached).

Example :**2-3- Solubility product.**

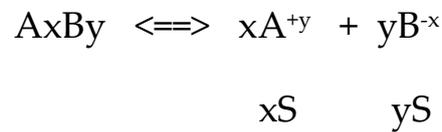
$$K_C = [\text{Ba}^{2+}][\text{SO}_4^{2-}] / [\text{BaSO}_4] ; \quad [\text{BaSO}_4] = 1$$

$$K_C = K_S = [\text{Ba}^{2+}][\text{SO}_4^{2-}] \text{ mol}^2 \cdot \text{l}^{-2}$$

K_S is the solubility product of BaSO_4 .

We also define $pK_s = -\log K_s$, which is a characteristic of $BaSO_4$. The more soluble the compound, the greater the K_s , the smaller the pK_s .

To compare two compounds, it is more accurate to compare their solubilities. For a solid, the general formula is: A_xB_y :



$$K_s = [A^{y+}]^x [B^{x-}]^y$$

$$\Rightarrow K_s = (XS)^x (YS)^y$$

$$S = (K_s / X^x Y^y)^{1/x+y}$$

3-Materials :

- Test tubes
- Balance
- 50 mL flasks
- Graduated cylinders
- Graduated pipette
- Spray bottles of distilled water

4- Solutions used:

-HCl(0.1M) ; Na_2SO_4 (0.1M) ; NaOH(1M)

- $Pb(NO_3)_2$ (0.1M); $FeSO_4$ (0.1M); $CuSO_4$ (0.1M); $AgNO_3$ (0.1M).

Data : $M(Cu)=63,5$ g/mol ; $M(Cl)= 35,5$ g/mol ; $M(Na)=23$ g/mol

- $M(Ag)=108$ g/mol ; $M(Fe)=55.84$ g/mol ; $M(Pb)=207.2$ g/mol

5-Method of operation

- 1- Prepare the previous solutions? (V= 20 ml)
- 2- Make the preparation of the mixtures as indicated in the table?

3- Complete the table below?

+	A :HCl(0.1M)	B :Na ₂ SO ₄ (0.1M)	C :NaOH(1M)
1 :Pb(NO ₃) ₂ (0.1M)	1A= K _s =1,6 . 10 ⁻⁵	1B= K _s = 1,8 . 10 ⁻⁸	1C= K _s = 2.8 . 10 ⁻¹⁶
2 :FeSO ₄ (0.1M)	2A= 	2B= 	2C= K _s = 7,9. 10 ⁻¹⁵
3 :CuSO ₄ (0.1M)	3A= 	3B= 	3C= K _s = 1,6 . 10 ⁻¹⁹
4 :AgNO ₃ (0.1M)	4A= K _s = 1,8 . 10 ⁻¹⁰	4B= K _s = 1,7 . 10 ⁻⁵	4C= K _s = 2,0 . 10 ⁻⁸

Note:

1A2A3A4A 1B2B3B4B 1C2C3C4C are solubility products

6-Questions:

- 1- Name all the reagents used in this experiment?
- 2- Also name the precipitates obtained?
- 3- Write down the precipitation equations for each mixture?
- 4- What do you notice in each experiment?
- 5- Calculate the solubility S of the elements in the mixtures you have chosen?
- 6- For each equation calculate pks?
- 7- Compare the solubility product and ks of the experiments chosen?

Exercise:

A mixture containing:

-50 ml of BaCl₂ = 10⁻⁵M

- 50 ml of NaSO₄ = 2.10⁻²M

-100 ml of AgNO₃ = 10⁻⁵M

-Total volume = 200 ml

-Will BaSO₄ and AgCl precipitate during mixing?

Knowing that at 25°C: $K_s(\text{BaSO}_4) = 1,1 \times 10^{-10}$ et $K_s(\text{AgCl}) = 1,6 \times 10^{-10}$.