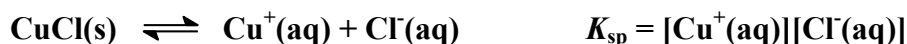


- Order the following salts from lowest to highest molar solubility.

**Marks**  
**4**

Salt	CuCl	Cd(IO <sub>3</sub> ) <sub>2</sub>	BaSO <sub>4</sub>	Ag <sub>2</sub> CrO <sub>4</sub>
$K_{sp}$	$1.9 \times 10^{-7}$	$2.3 \times 10^{-8}$	$1.1 \times 10^{-10}$	$2.6 \times 10^{-12}$

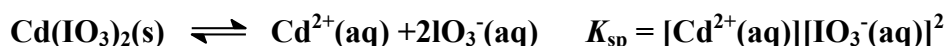
(1) For CuCl,  $K_{sp}$  refers to the dissolution reaction:



If the solubility is  $x \text{ mol L}^{-1}$  then  $x \text{ mol}$  of CuCl(s) dissolves in one litre. From the dissolution equation, this leads to  $[\text{Cu}^+(\text{aq})] = x \text{ M}$  and  $[\text{Cl}^-(\text{aq})] = x \text{ M}$ . Hence,

$$K_{sp} = (x)(x) = x^2 = 1.9 \times 10^{-7} \quad \text{or } x = (1.9 \times 10^{-7})^{1/2} \quad \text{M} = 4.4 \times 10^{-4} \text{ M}$$

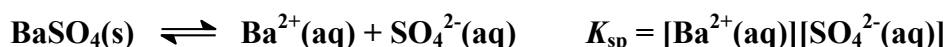
(2) For Cd(IO<sub>3</sub>)<sub>2</sub>,  $K_{sp}$  refers to the dissolution reaction:



If the solubility is  $x \text{ mol L}^{-1}$  then  $x \text{ mol}$  of Cd(IO<sub>3</sub>)<sub>2</sub> (s) dissolves in one litre. From the dissolution equation, this leads to  $[\text{Cd}^{2+}(\text{aq})] = x \text{ M}$  and  $[\text{IO}_3^-(\text{aq})] = 2x \text{ M}$ . Hence,

$$K_{sp} = (x)(2x)^2 = 4x^3 = 2.3 \times 10^{-8} \quad \text{or } x = (2.3 \times 10^{-8} / 4)^{1/3} \quad \text{M} = 1.8 \times 10^{-3} \text{ M}$$

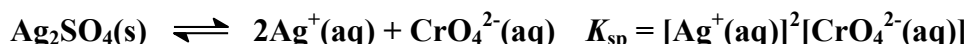
(3) For BaSO<sub>4</sub>,  $K_{sp}$  refers to the dissolution reaction:



If the solubility is  $x \text{ mol L}^{-1}$  then  $x \text{ mol}$  of BaSO<sub>4</sub>(s) dissolves in one litre. From the dissolution equation, this leads to  $[\text{Ba}^{2+}(\text{aq})] = x \text{ M}$  and  $[\text{SO}_4^{2-}(\text{aq})] = x \text{ M}$ . Hence,

$$K_{sp} = (x)(x) = x^2 = 1.1 \times 10^{-10} \quad \text{or } x = (1.1 \times 10^{-10})^{1/2} \quad \text{M} = 1.0 \times 10^{-5} \text{ M}$$

(4) For Ag<sub>2</sub>CrO<sub>4</sub>,  $K_{sp}$  refers to the dissolution reaction:



If the solubility is  $x \text{ mol L}^{-1}$  then  $x \text{ mol}$  of Ag<sub>2</sub>CrO<sub>4</sub>(s) dissolves in one litre. From the dissolution equation, this leads to  $[\text{Ag}^+(\text{aq})] = 2x \text{ M}$  and  $[\text{CrO}_4^{2-}(\text{aq})] = x \text{ M}$ . Hence,

$$K_{sp} = (2x)^2(x) = 4x^3 = 2.6 \times 10^{-12} \quad \text{or } x = (2.6 \times 10^{-12} / 4)^{1/3} \quad \text{M} = 8.7 \times 10^{-5} \text{ M}$$

Overall, solubility increases in the order:

