

Solubility Written Response Key:

1.

3. A solution is prepared by mixing equal moles of $\text{Ba}(\text{NO}_3)_2$, K_2SO_4 and BaS and precipitation occurs. Identify the precipitate(s) and write the net ionic equation(s) for the reaction(s).

(3 marks)

Solution:

For Example:

Precipitate: $\text{BaSO}_4(\text{s})$

← 1 mark

Net Ionic Equation: $\text{Ba}^{2+}(\text{aq}) + \text{SO}_4^{2-}(\text{aq}) \rightarrow \text{BaSO}_4(\text{s})$

← 2 marks

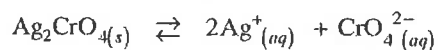
2.

3. Calculate the mass of solid AgNO_3 that can be added to 2.0 L of a 0.10 M K_2CrO_4 solution in order to just start precipitation.

(4 marks)

Solution:

For Example:



$$K_{sp} = [\text{Ag}^+]^2 [\text{CrO}_4^{2-}] = 1.1 \times 10^{-12}$$

← 1 mark

$$[\text{CrO}_4^{2-}] = 0.10 \text{ M}$$

$$[\text{Ag}^+]^2 = \frac{1.1 \times 10^{-12}}{0.10}$$

← 1 mark

$$[\text{Ag}^+] = 3.3 \times 10^{-6} \text{ M}$$

$$\text{Mass of AgNO}_3 = 3.3 \times 10^{-6} \frac{\text{mol}}{\text{L}} \times 2.0 \text{ L} \times \frac{169.9 \text{ g}}{1 \text{ mol}}$$

← 1 mark

$$= 1.1 \times 10^{-3} \text{ g}$$

← 1 mark

(Deduct $\frac{1}{2}$ mark for incorrect significant figures.)

3.

3. a) How would a saturated solution be prepared at room temperature? (1 mark)

Solution:

For Example:

Add solute to solvent until no more solute dissolves. ← 1 mark

- b) Write a chemical equation to illustrate the equilibrium that exists in a saturated solution of $\text{Be}_3(\text{PO}_4)_2$. (2 marks)

Solution:

For Example:

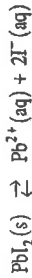


← 2 marks

4.

3. (4 marks)

Consider the equilibrium for a saturated solution of PbI_2 :



What is the maximum $[\text{Ag}^+]$ that can exist in a saturated solution of PbI_2 without causing a precipitate to form?

Solution:

For Example:

For the PbI_2 :

$$K_{sp} = [\text{Pb}^{2+}][\text{I}^{-}]^2 = 8.5 \times 10^{-9}$$

s = solubility

$$4s^3 = 8.5 \times 10^{-9}$$

$$s = \sqrt[3]{\frac{8.5 \times 10^{-9}}{4}} = \sqrt[3]{2.1 \times 10^{-9}}$$

$$s = 1.286 \times 10^{-3} \text{ M}$$

$$[\text{I}^{-}] = 2s = 2.57 \times 10^{-3} \text{ M}$$

← 1 mark

← 1 mark

For AgI :

$$K_{sp} = [\text{Ag}^+][\text{I}^{-}] = 8.5 \times 10^{-17}$$

$$[\text{Ag}^+] = \frac{8.5 \times 10^{-17}}{2.57 \times 10^{-3}}$$

$$[\text{Ag}^+] = 3.3 \times 10^{-14} \text{ M}$$

← 1 mark

← 1 mark