Solubility Written Response Key:

1.

3. A solution is prepared by mixing equal moles of $Ba(NO_3)_2$, 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: $BaSO_4(s)$ ← **1 mark**

Net Ionic Equation: $Ba^{2+}(aq) + SO_4^{2-}(aq) \rightarrow BaSO_4(s)$ ← **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:

$$Ag_2CrO_{4(s)} \rightleftarrows 2Ag^+_{(aq)} + CrO_4^{2-}{}_{(aq)}$$

$$K_{sp} = [Ag^+]^2[CrO_4^{2-}] = 1.1 \times 10^{-12}$$ ← **1 mark**

$$[CrO_4^{2-}] = 0.10\,M$$

$$[Ag^+]^2 = \frac{1.1 \times 10^{-12}}{0.10}$$ ← **1 mark**

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

$$\text{Mass of } AgNO_3 = 3.3 \times 10^{-6}\,\frac{\text{mol}}{\text{L}} \times 2.0\,\text{L} \times \frac{169.9\,\text{g}}{1\,\text{mol}}$$ ← **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 $Be_3(PO_4)_2$. (2 marks)

Solution:

For Example:

$$Be_3(PO_4)_{2(s)} \rightleftarrows 3Be^{2+}_{(aq)} + 2PO_4^{3-}{}_{(aq)}$$ ← 2 marks

4.

3. (4 marks)

Consider the equilibrium for a saturated solution of PbI_2:

$$PbI_2(s) \rightleftarrows Pb^{2+}(aq) + 2I^-(aq)$$

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

Solution:

For Example:

For the PbI_2:

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

s = solubility

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

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

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

← 1 mark

$[I^-] = 2s = 2.57 \times 10^{-3}$ M ← 1 mark

For AgI:

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

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

← 1 mark

$[Ag^+] = 3.3 \times 10^{-14}$ M ← 1 mark