

1. K_{sp} is greater than K_{sp} . This means that silver chloride is more soluble than silver bromide.

2. (a) $[I^-]$ in AgI
 $[Ag^+] = 9.1 \times 10^{-9} M$

$$K_{sp} = [Ag^+][I^-]$$

$$9.1 \times 10^{-9} [I^-] = 8.3 \times 10^{-17}$$

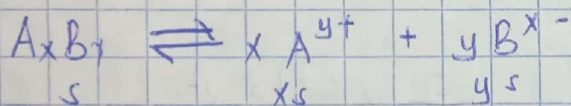
$$[I^-] = \frac{8.3 \times 10^{-17}}{9.1 \times 10^{-9}} = 9.12 \times 10^{-9} M$$

(b) $[OH^+] = 2.9 \times 10^{-9} M$

$$K_{sp} = [Al^{3+}][OH^-]^3$$

$$[Al^{3+}] = \frac{K_{sp}}{[OH^-]^3} = \frac{1.8 \times 10^{-33}}{[2.9 \times 10^{-9}]^3}$$

$$= 7.4 \times 10^{-8} M$$



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

$$= [x s]^x [y s]^y$$

$$= x^x \cdot y^y \cdot s^{x+y}$$

$$s = 4.2 \times 10^{-6} M$$

$$K_{sp} = [Mn^{2+}][CO_3^{2-}]$$
$$= s \cdot s = s^2$$

$$= (4.2 \times 10^{-6})^2$$

$$= 1.764 \times 10^{-11}$$

4.

$$K_{sp} = [Zn^{2+}][OH^-]^2$$

$$[Zn^{2+}] = 5, \quad [OH^-] = 25$$

$$1.8 \times 10^{-14} = 5(25)^2$$

$$1.8 \times 10^{-14} = 45^3$$

$$5 = \sqrt[3]{\frac{1.8 \times 10^{-14}}{3}} = 1.651 \times 10^{-5}$$

$$[OH^-] = 2(1.651 \times 10^{-5})$$

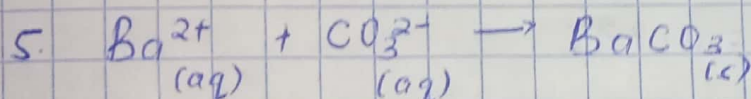
$$= 3.302 \times 10^{-5}$$

$$pOH = -\log[OH^-] = -\log[3.302 \times 10^{-5}]$$

$$= 4.4812$$

$$pH = 14 - 4.4812$$

$$= 9.52$$



$$Ba^{2+}, \text{ moles} = M \times V = 0.1 \times \frac{20}{1000} = 0.002 \text{ mol}$$

$$\text{Total volume} = 20 + 50 = 70 \text{ ml}$$

$$M = \frac{\text{moles}}{\text{volume}} = \frac{0.002}{\frac{70}{1000}} = 0.02857 \text{ M}$$

$$CO_3^{2-}, \text{ moles} = M \times V = 0.1 \times \frac{50}{1000} = 0.005 \text{ mol}$$

$$M = \frac{\text{moles}}{\text{volume}} = \frac{0.005}{\frac{70}{1000}} = 0.0714 \text{ M}$$

$$Q = [Ba^{2+}][CO_3^{2-}]$$

$$= (0.02857)(0.0714)$$

$$= 2.0407 \times 10^{-3}$$

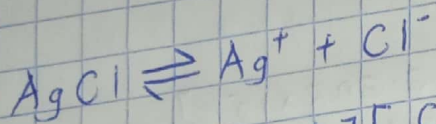
$$K_{sp} = 8.1 \times 10^{-9}$$

$Q > K_{sp}$. Therefore, $BaCO_3$ will precipitate

6. $\text{CaCl}_2, \text{ moles} = \frac{\text{Mass}}{\text{molar mass}} = \frac{10}{110.98} = 0.090106 \text{ mol}$

$\text{Cl}_2, \text{ moles} = 2 \times 0.090106 = 0.18021 \text{ mol}$

$\text{CaCl}_2, \text{ molarity} = \frac{\text{Moles}}{\text{Volume}} = \frac{0.18021}{1} = 0.18021 \text{ M} = 0.18 \text{ M}$



$K_{sp} = \frac{[\text{Ag}^+][\text{Cl}^-]}{[\text{AgCl}]} = s(0.18 + s)$

$0.18 + s \approx 0.18$

$1.6 \times 10^{-10} = s(0.18) = 0.18s$

$s = 8.889 \times 10^{-10} \text{ M}$

7.

	Mg(OH)_2	Mg^{2+}	2OH^-
I	—	0	0
C	-s	+s	+2s
E	—	s	2s

$K_{sp} = [\text{Mg}^{2+}][\text{OH}^-]^2$

$1.2 \times 10^{-11} = (s)(2s)^2$

$1.2 \times 10^{-11} = 4s^3$

$s = \sqrt[3]{\frac{1.2 \times 10^{-11}}{4}}$

$= 1.44 \times 10^{-4} \text{ mol/L}$
 $= 1.44 \times 10^{-4} \text{ M}$

$\text{pOH} = 14 - \text{pH} = 14 - 9 = 5$

$\text{pOH} = -\log[\text{OH}^-]$
 $5 = -\log[\text{OH}^-]$

$[\text{OH}^-] = 10^{-5} = 1 \times 10^{-5} \text{ M}$

$$K_{sp} = [Mg^{2+}][OH^{-}]^2$$

$$1.2 \times 10^{-11} = [Mg^{2+}][1 \times 10^{-5}]^2$$

$$[Mg^{2+}] = \frac{1.2 \times 10^{-11}}{(1 \times 10^{-5})^2} = 0.12 M$$

Molar solubility in buffer is higher than the molar solubility in water