

Week 1 IPSET

Question 1

(i) At marker 1:

VI

VII

VIII

(ii) At marker 2:

Liquid

(iii) At marker 3:

Liquid

V

(iv) $\text{Liquid} < VI < VII = VIII$

Question 2:

For both:

Almost insoluble due to different types of bonding.

Question 3

Write the equation

$$(3.091 \cdot 10^{-9} \text{ m}^3) = 4[\text{Pn}^{2+}]^3$$

$$\Downarrow$$
$$[\text{Pn}^{2+}] = 9.18 \cdot 10^{-4}$$

Question 4

For reference, we have molar weight $PbCl_2 = 278.1 \text{ g/mol}$ and solubility $4.4 \text{ g/L} \approx 0.01597 \text{ mol/L}$; thus since

$$K_{sp} = [Pb^{2+}] [Cl^-]^2 = 1.627 \cdot 10^{-5} \text{ M}^3$$

Question 5

We have that

$$\begin{aligned}K_{sp} &= [Al^{3+}] [F^-]^3 \\&= [Al^{3+}] [3Al^{3+}]^3 \\&= (3.091 \cdot 10^{-4}) (3 \cdot 3.091 \cdot 10^{-4})^3 \\&= 2.46 \cdot 10^{-8}\end{aligned}$$

Question 6

We are given that

$$K_{sp} = 3.091 \cdot 10^{-9} \text{ M}^3, \text{ thus}$$

$$K_{sp} = [Pn^{2+}] [CO_3^{2-}]^2$$

$$= [1.1 \text{ M} + x] [2x]^2$$

and, for small x ,

$$3.091 \cdot 10^{-9} \text{ M}^3 = [1.1 \text{ M}] [CO_3^{2-}]^2$$

\Downarrow

$$[CO_3^{2-}] = 2 [Pn]$$

\Downarrow

$$\text{Solubility} = 2.639 \text{ M/L}$$

(a) Recall the formula for the enthalpy of mixing:

$$\Delta \bar{H}_{\text{soln}} = \frac{Z}{2} X_A X_B \Delta w = \frac{12}{2} \cdot \frac{1}{10} \cdot \frac{2}{15} \cdot (-4.250 \text{ kJ/mole}) = -2.285 \text{ kJ/mole}$$

(b) Enthalpy is negative, thus the reaction is exothermic.

Question 8

~~once again recall~~

$$\Delta \bar{H}_{\text{soln}} = \frac{2}{2} \chi_A \chi_B \Delta w$$

~~by plugging in~~

$$= \frac{6}{2} \cdot \frac{4}{10} \cdot \frac{6}{10} \cdot (2 \times \dots)$$

$$\Delta w = 2 w_{AB} - w_{AA} - w_{BB}$$

$$62 \text{ kJ/mol} = 2 w_{AB} - (-245) - (-191)$$

↓

$$w_{AB} = -187 \text{ kJ/mol.}$$