

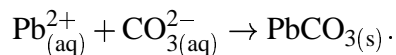
Chemistry 2720 Fall 2001 Assignment 1

Solutions

- BaF₂
 - Na₂CO₃
 - H₂CO₃
 - Pb(CH₃COO)₂ · 10H₂O
 - Na⁺
 - NH₃
 - Cl₂O₇
- CH₃OH + $\frac{3}{2}$ O₂ → CO₂ + 2H₂O
 - NaCl_(s) → Na⁺_(aq) + Cl⁻_(aq)
 - CO_{2(g)} + H₂O_(l) → H₂CO_{3(aq)}
 - 2Bi³⁺_(aq) + 3S²⁻_(aq) → Bi₂S_{3(s)}
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$$n = \frac{m}{M} = \frac{1.3 \times 10^{-9} \text{ g}}{207.2 \text{ g/mol}} = 6.3 \times 10^{-12} \text{ mol}$$
$$\therefore c = \frac{n}{V} = \frac{6.3 \times 10^{-12} \text{ mol}}{20.5 \times 10^{-3} \text{ L}} = 3.1 \times 10^{-10} \text{ mol/L} \equiv 0.31 \text{ nmol/L}$$

4. The reaction is



$$n_{\text{Pb}^{2+}} = n_{\text{CO}_3^{2-}} = (1.4 \text{ L})(0.034 \text{ mol/L}) = 0.048 \text{ mol}$$
$$\therefore V_{\text{solution}} = \frac{0.048 \text{ mol}}{0.5 \text{ mol/L}} = 0.10 \text{ mol/L}$$

5. I like to solve these problems using SI units. That reduces the potential confusion over units.

$$V = \frac{600 \times 10^{-3} \text{ L}}{1000 \text{ L/m}^3} = 6.00 \times 10^{-4} \text{ m}^3$$

$$P = (0.80 \text{ atm})(101325 \text{ Pa/atm}) = 8.1 \times 10^4 \text{ Pa}$$

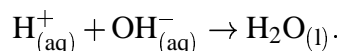
$$T = 20 + 273.15 \text{ K} = 293 \text{ K}$$

$$\therefore n_{\text{N}_2} = \frac{PV}{RT} = \frac{(8.1 \times 10^4 \text{ Pa})(6.00 \times 10^{-4} \text{ m}^3)}{(8.314510 \text{ J K}^{-1} \text{ mol}^{-1})(293 \text{ K})} = 0.020 \text{ mol}$$

The molar mass of $\text{N}_{2(\text{g})}$ is 28.014 g/mol, so the mass is

$$m_{\text{N}_2} = (2 \times 10^{-2} \text{ mol})(28.014 \text{ g/mol}) = 0.6 \text{ g.}$$

6. The reaction is



$$\begin{aligned} \Delta \bar{H}^\circ &= \Delta \bar{H}_{f(\text{H}_2\text{O})}^\circ - \left(\Delta \bar{H}_{f(\text{H}^+)}^\circ + \Delta \bar{H}_{f(\text{OH}^-)}^\circ \right) \\ &= -285.830 - [0 + (-230.015)] \text{ kJ/mol} \\ &= -55.815 \text{ kJ/mol} \end{aligned}$$

7. There are three parts to consider:

- (a) Heating the liquid water to 100°C.
- (b) Vaporizing the water.
- (c) Heating the steam to the final temperature.

$$q_a = m\tilde{C}_P\Delta T = (1.2 \text{ g})(4.184 \text{ J K}^{-1} \text{ g}^{-1})(80 \text{ K}) = 0.40 \text{ kJ}$$

$$q_b = m\tilde{H}_{\text{vap}} = (1.2 \text{ g})(2257 \text{ J/g}) = 2.7 \text{ kJ}$$

$$n_{\text{steam}} = \frac{1.2 \text{ g}}{18.02 \text{ g/mol}} = 0.067 \text{ mol}$$

$$q_c = n\tilde{C}_P\Delta T = (0.067 \text{ mol})(33.76 \text{ J K}^{-1} \text{ mol}^{-1})(20 \text{ K}) = 0.045 \text{ kJ}$$

$$\therefore q_{\text{total}} = q_a + q_b + q_c = 3.2 \text{ kJ}$$

8. (a) $\frac{d}{dx}(3x^3 + 2x^2 + x + 1) = 9x^2 + 4x + 1$

(b) $\int_4^5 \frac{dx}{x} = \ln x \Big|_4^5 = \ln 5 - \ln 4 = \ln(5/4)$

(c)

$$\begin{aligned} \int_1^2 \frac{2x^2+1}{x^2} dx &= \int_1^2 \left(2 + \frac{1}{x^2}\right) dx \\ &= \int_1^2 (2 + x^{-2}) dx \\ &= [2x - x^{-1}]_1^2 \\ &= \left[2(2) - \frac{1}{2}\right] - [2(1) - 1] = \frac{5}{2}. \end{aligned}$$