# Solutions to In-Class Problems, Spring 2008

① done in class.

② done in class

③ done in class

④ $\Delta S_{TOT} = \Delta S_{hot\,w.} + \Delta S_{cold\,w.} = \Delta S_h + \Delta S_c$

$$\Delta S_h = n_h C_{pmw} \ln\left(\frac{T_f}{T_h}\right) \qquad \Delta S_c = n_c C_{pmw} \ln\left(\frac{T_f}{T_c}\right)$$

$T_h = 373K$, $T_c = 278K$

To find $T_f$ we make use of the fact that the water is mixed in an insulated container, $q = 0$, but heat can be exchanged between the hot water and the cold water. $q = 0 = q_c + q_h$ and $q_h = -q_c$

$$n_h C_{pmw}(T_f - T_h) = -n_c C_{pmw}(T_f - T_c)$$
$$n_h(T_f - T_h) = -n_c(T_f - T_c)$$

$$T_f(n_h + n_c) = n_h T_h + n_c T_c$$

$$T_f = \frac{n_h T_h + n_c T_c}{n_h + n_c}$$

$$n_h = 60.0g \times \frac{1mol}{18.0g} = 3.33\,mol$$
$$n_c = 90.0g \times \frac{1mol}{18.0g} = 5.00\,mol$$

$$T_f = \frac{(5.00 \times 278) + (3.33 \times 373)}{5.00 + 3.33} = 316\,k$$

$$\Delta S_{TOT} = C_{pmw}\left[n_h \ln \frac{T_f}{T_h} + n_c \ln \frac{T_f}{T_c}\right]$$

$$= \frac{75.3\,J}{K\,mol}\left[3.33\,mol \ln \frac{316\,k}{373k} + 5.00\,mol \ln \frac{316\,k}{278k}\right]$$

$$= 6.65\,J/k$$

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