AP Unit 4 Test Review Key

#4.) $\underbrace{6B}_{3\text{ mol}} + \underbrace{2D}_{2\text{ mol}} \rightarrow 3A + 188\text{ kJ}$

$\frac{3\text{ mol B}}{6} = 0.5 \leftarrow \text{smaller!} \Rightarrow \text{B limiting}$

$\frac{2\text{ mol D}}{2} = 1$

$3\text{ mol B} \times \frac{-188\text{ kJ}}{6\text{ mol B}} = \frac{-188}{2} = \boxed{-94\text{ kJ}}$

#7.) $q = n\Delta H \Rightarrow \Delta H = \frac{q}{\text{mol}} = \frac{12.8\text{ kJ}}{3.2\text{ mol}} \approx \frac{12}{3} = \boxed{+4\ \frac{\text{kJ}}{\text{mol}}}$

#9.) $2H_2O(g) \rightarrow 2H_2(g) + O_2(g)$

$\Delta S^\circ = \Sigma S^\circ(\text{prod}) - \Sigma S^\circ(\text{react.}) = [2\cdot H_2 + O_2] - [2\cdot H_2O]$

$= [2(131) + 205] - 2(189) \approx 2(130) + 200 - 2(200) = \boxed{+60\ ^{J}/_{\text{mol}\cdot K}}$ (+89)

#11.) $CH_4 + NH_3 \rightarrow HCN + 3H_2$

Given:

flip $\times$ ½ $(N_2 + 3H_2 \rightarrow 2NH_3)$ $\Delta H = -92 \times -\frac{1}{2} = +46$

flip $(C + 2H_2 \rightarrow CH_4)$ $\Delta H = -75 \times -1 = +75$

$\times \frac{1}{2}(H_2 + 2C + N_2 \rightarrow 2HCN)$ $\Delta H = +270 \times \frac{1}{2} = +135$ +

$\Delta H = \boxed{256\text{ kJ/mol}}$

#13.) $q_{\text{sol'n}} = -q_{\text{cal}} = -mC\Delta T$

$= -(\underbrace{300.\text{ g}}_{180+120})(4.2)(\underbrace{18.8 - 25.0}_{-6.2})$

$\approx (300)(4)(6) = 7{,}200\text{ J} = 7.2\text{ kJ}$ (7.8)

$\text{mol}_{\text{rxn}} = \text{mol}_{NaCl} = \frac{120.\text{ g}}{58\text{ g/mol}} \approx \frac{120}{60} = 2\text{ mol}$ (2.05)

$\Delta H_{\text{sol'n}} = \frac{7.2\text{ kJ}}{2\text{ mol}_{\text{rxn}}} = \boxed{3.6\text{ kJ/mol}}$ (3.9)

#15.) $\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ = -93 \frac{kJ}{mol} - (298\ K)(-0.198 \frac{kJ}{mol \cdot K})$

↑ b/c 25°C = Std. Conditions

$\approx -93 + (300)(0.2) = -93 + 60$

$= \boxed{-33\ kJ/mol}$

(-34)

#17.) $N_2 + 3H_2 \rightarrow 2NH_3$

$:N \equiv N: + 3(H-H) \rightarrow 2\ (H-\overset{\overset{H}{|}}{\underset{\cdot\cdot}{N}}-H)$

$\Delta H_{rxn} = \Sigma BE\ (broken) - \Sigma BE\ (formed)$

$= [(N \equiv N) + 3(H-H)] - [6(N-H)]$

$-92.2 = [960 + 3(430)] - 6x$

$6x = 960 + 1290 + 92.2 \approx 2340$

$x \approx \frac{2400}{6} = 400\ kJ/mol$

(390)

#19.) $3\,C_2H_2 \rightarrow C_6H_6 \quad \Delta H_{rxn} = -607\ kJ/mol$

↑ $\Delta H_f = 230 \frac{kJ}{mol}$ ↑ $\Delta H_f = ?$

$\Delta H_{rxn} = \Sigma \Delta H_f\ (prod) - \Sigma \Delta H_f\ (react)$

$= [C_6H_6] - [3(C_2H_2)]$

$-607 = x - 3(230)$

$x = 3(230) - 607 = 690 - 607 = \boxed{83\ kJ/mol}$