

$$13.32 \text{ (a)} \quad \Delta H^\circ = \Delta H_f^\circ [\text{K}_{(s)}] - \Delta H_f^\circ [\text{K}_{(l)}] \\ = \left(89.0 \frac{\text{kJ}}{\text{mole}} - 0 \frac{\text{kJ}}{\text{mole}} \right) = 89.0 \frac{\text{kJ}}{\text{mole}} \text{ (endothermic)}$$

$$\text{(b)} \quad \Delta H^\circ = \Delta H_f^\circ [\text{MgCl}_2(s)] - \left[\Delta H_f^\circ [\text{Mg}^{2+}(aq)] + 2\Delta H_f^\circ [\text{Cl}^-(aq)] \right] \\ = \left(-641.3 \frac{\text{kJ}}{\text{mole}} \right) - \left[-464.9 \frac{\text{kJ}}{\text{mole}} + -167.2 \frac{\text{kJ}}{\text{mole}} \times 2 \right] = 160.0 \frac{\text{kJ}}{\text{mole}} \text{ (endothermic)}$$

$$\text{(c)} \quad \left(-240.1 \frac{\text{kJ}}{\text{mole}} \right) + \left(-230.0 \frac{\text{kJ}}{\text{mole}} \right) - \left(-425.6 \frac{\text{kJ}}{\text{mole}} \right) = -44.5 \frac{\text{kJ}}{\text{mole}} \text{ (exothermic)}$$

$$\text{(d)} \quad \left(-398.5 \frac{\text{kJ}}{\text{mole}} \right) + \left(-285.8 \frac{\text{kJ}}{\text{mole}} \times 2 \right) - \left\{ \left(742 \frac{\text{kJ}}{\text{mole}} \right) + \left(0 \frac{\text{kJ}}{\text{mole}} \times 2 \right) \right\} \\ = -890.3 \frac{\text{kJ}}{\text{mole}} \text{ (exothermic)}$$

$$\text{(e)} \quad \left(-461 \frac{\text{kJ}}{\text{mole}} \times 2 \right) - \left\{ 0 \frac{\text{kJ}}{\text{mole}} + \left(0 \frac{\text{kJ}}{\text{mole}} \times 3 \right) \right\} = -92.2 \frac{\text{kJ}}{\text{mole}} \text{ (exothermic)}$$

$$\text{(f)} \quad -285.8 \frac{\text{kJ}}{\text{mole}} + \left(0 \frac{\text{kJ}}{\text{mole}} \times \frac{1}{2} \right) - 187.8 \frac{\text{kJ}}{\text{mole}} \times 2 \text{ mole} = -99.0 \frac{\text{kJ}}{\text{mole}} \text{ (exothermic)}$$

$$13.34 \text{ (a)} \quad \left(-124.7 \frac{\text{kJ}}{\text{mole}} \right) - \left(-147.6 \frac{\text{kJ}}{\text{mole}} \right) = 22.9 \frac{\text{kJ}}{\text{mole}} \text{ (endothermic)}$$

$$\text{(b)} \quad -22.9 \frac{\text{kJ}}{\text{mole}} \text{ (exothermic)}$$

$$\text{(c)} \quad \left(82.9 \frac{\text{kJ}}{\text{mole}} \right) - \left(49.0 \frac{\text{kJ}}{\text{mole}} \right) = 33.9 \frac{\text{kJ}}{\text{mole}} \text{ (endothermic)}$$

$$\text{(d)} \quad -33.9 \frac{\text{kJ}}{\text{mole}} \text{ (exothermic)}$$

$$\text{(e)} \quad 62.4 \frac{\text{kJ}}{\text{mole}} - 0 \frac{\text{kJ}}{\text{mole}} = 62.4 \frac{\text{kJ}}{\text{mole}} \text{ (endothermic)}$$

$$\text{(f)} \quad -62.4 \frac{\text{kJ}}{\text{mole}} \text{ (exothermic)}$$