1. (4) a) CuBr₂ and Na₂CO₃ are strong electrolytes. Specify how each of these ionic compounds dissociate when dissolved in water.

\[ \text{CuBr}_2(\text{s}) \rightarrow \text{Cu}^{2+}(\text{aq}) + 2\text{Br}^- (\text{aq}) \]

\[ \text{Na}_2\text{CO}_3(\text{s}) \rightarrow 2\text{Na}^+(\text{aq}) + \text{CO}_3^{2-} (\text{aq}) \]

(4) b) Write a balanced net ionic equation for the reaction that occurs when aqueous solutions of CuBr₂ and Na₂CO₃ are mixed together.

\[ \text{Cu}^{2+}(\text{aq}) + \text{CO}_3^{2-} (\text{aq}) \rightarrow \text{CuCO}_3 (\text{s}) \]

2. HCl and NaCl are both strong electrolytes. One is a strong acid and the other is not.

(4) a) Which one of these compounds is a strong acid? HCl

(4) b) Why? \[ \text{H}^+ \]

3. (6) If a chemical system releases 100 kJ of heat to the surroundings, then the reaction is

(A) Exothermic

(B) Endothermic

(C) Neither exothermic or endothermic

(D) Not enough information to know
4.(6) Enthalpy is

(A) Heat transferred at constant volume conditions
(B) Heat transferred at constant pressure conditions
(C) Work performed by the system on the surroundings
(D) Work performed by the surroundings on the system
(E) None of the above

5.(8) If you prepared 100 mL of a 0.1 M solution of NaCl, then accidentally spilled 50 mL of that solution, what is the concentration of the remaining 50 mL?

0.1 M

6.(12) a) How would you prepare 250 mL of a 0.50 M solution of CaCl₂ starting with solid CaCl₂?

\[
\frac{0.125 \text{ mol} \times 0.50 \text{ mol}}{\text{mol}} = 0.125 \text{ mol CaCl}_2
\]

\[
0.125 \text{ mol CaCl}_2 \times \frac{39.098 \text{ g}}{\text{mol CaCl}_2} = 30.874 \text{ g CaCl}_2
\]

Take 30.874 g CaCl₂ and dissolve in sufficient water such that the total solution volume = 250 mL.

b) Assuming you have prepared the solution in Part A successfully, find the concentration of the two ions present in this solution.

\[
\text{Ca}^{2+} = 0.50 \text{ M}
\]

\[
\text{Cl}^- = 1.00 \text{ M}
\]

(8) b) Assuming you have prepared the solution in Part A successfully, find the concentration of the two ions present in this solution.

\[
\text{Ca}^{2+} = 0.50 \text{ M}
\]

\[
\text{Cl}^- = 1.00 \text{ M}
\]

(10) c) How would you prepare 100 mL of a 0.250 M solution of CaCl₂ starting with the solution in Part A of this problem?

\[
(0.50 \text{ M})(\text{L}) = (0.250 \text{ M})(0.100 \text{ L})
\]

\[
\text{L} = \frac{(0.250 \text{ M})(0.100 \text{ L})}{0.50 \text{ M}} = 0.05 \text{ L}
\]

Take 50 mL of the concentrated solution in Part A and dilute that 50 mL to a total volume of 100 mL.
7.(10) Consider the following reaction

\[ \text{C}_6\text{H}_12\text{O}_6(\text{s}) + 6\text{O}_2(\text{g}) \rightarrow 6\text{CO}_2(\text{g}) + 6\text{H}_2\text{O}(\text{l}) \quad \Delta H_{\text{rxn}} = -2803 \text{ kJ} \]

Calculate the amount of heat transferred when 80.0 g of \text{C}_6\text{H}_12\text{O}_6(\text{s}) are reacted at constant pressure.

\[
80.0 \text{ g C}_6\text{H}_12\text{O}_6 \times \frac{1 \text{ mol C}_6\text{H}_12\text{O}_6}{180 \text{ g C}_6\text{H}_12\text{O}_6} = 0.444 \text{ mol C}_6\text{H}_12\text{O}_6
\]

\[ \Delta H_{\text{rxn}} = \frac{-2803 \text{ kJ}}{1 \text{ mol C}_6\text{H}_12\text{O}_6} \times 0.444 \text{ mol C}_6\text{H}_12\text{O}_6 = -1244 \text{ kJ} \text{ for 80.0 g} \]

8.(12) From the following enthalpies of reaction

\[ 2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{H}_2\text{O}(\text{g}) \quad \Delta H = -483.6 \text{ kJ} \]
\[ 3\text{O}_2(\text{g}) \rightarrow 2\text{O}_3(\text{g}) \quad \Delta H = +284.6 \text{ kJ} \]

Calculate the heat of the reaction

\[ 3\text{H}_2(\text{g}) + \text{O}_3(\text{g}) \rightarrow 3\text{H}_2\text{O}(\text{g}) \]

\[
\begin{align*}
\text{H}_2(\text{g}) & \quad \frac{3}{2} \text{O}_3(\text{g}) \quad 3\text{H}_2\text{O}(\text{g}) \quad \Delta H = -725.4 \text{ kJ} \\
0.5 \text{O}_3(\text{g}) & \quad \frac{3}{2} \text{O}_2(\text{g}) \quad \Delta H = -146.3 \text{ kJ} \\
\hline
3\text{H}_2(\text{g}) & \quad 0.5 \text{O}_3(\text{g}) \quad 3\text{H}_2\text{O}(\text{g}) \quad \Delta H = -871.7 \text{ kJ}
\end{align*}
\]
Using data from the table provided calculate the enthalpy change for the combustion of one mole of propane.

\[ \text{C}_3\text{H}_8(g) + 5\text{O}_2(g) \rightarrow 3\text{CO}_2(g) + 4\text{H}_2\text{O}(l) \]

\[ \Delta H_{\text{rxn}} = \sum m \Delta H_f (\text{prod}) - \sum m \Delta H_f (\text{react}) \]

\[ = \left( 3 \left( -393.5 \ \text{kJ/mol} \right) + 4 \left( -285.8 \ \text{kJ/mol} \right) \right) - \left( 1 \left( -103.85 \ \text{kJ/mol} \right) + 5 \left( 0 \right) \right) \]

\[ \Delta H_{\text{rxn}} = (-1180.5 \ \text{kJ}) - (-103.85 \ \text{kJ}) \]

\[ \Delta H_{\text{rxn}} = -1076.65 \ \text{kJ} \]

\[ \Delta H_{\text{rxn}} = -2219.8 \ \text{kJ} \]