1. Octane (C_8H_{18}) is a main component of gasoline used in cars.

   A) Write a balanced chemical equation for the combustion of octane with oxygen.

   B) Using the following standard enthalpies of formation, determine the standard change in enthalpy (ΔH^o_{rxn}) for the combustion reaction of octane.

$$\Delta H_f^o[C_8H_{18}\,(l)] = -249.9\,\frac{kJ}{mol} \qquad \Delta H_f^o[CO_2\,(g)] = -393.5\,\frac{kJ}{mol} \qquad \Delta H_f^o[H_2O\,(g)] = -241.8\,\frac{kJ}{mol}$$

   C) How much CO_2 gas is produced if 1.25 L of octane (density 0.703 g/mL) are combusted?

2. A total of 1411 kJ of heat is applied to 500. mL of liquid water, originally 25.0 °C, to convert it all to water vapor. What is the final temperature of the gaseous water?

$$c_P[H_2O(s)] = 37.1\,\frac{J}{mol\cdot °C} \qquad \Delta H_{fus}[H_2O] = 6.01\,\frac{kJ}{mol}$$

$$c_P[H_2O(l)] = 75.3\,\frac{J}{mol\cdot °C} \qquad \Delta H_{vap}[H_2O] = 40.67\,\frac{kJ}{mol}$$

$$c_P[H_2O(g)] = 33.6\,\frac{J}{mol\cdot °C}$$

3. Consider the following reaction:

$$\mathrm{ClF}\,(g) + \mathrm{F_2}\,(g) \rightarrow \mathrm{ClF_3}\,(g)$$

Calculate ΔH_{rxn} for the above reaction given the following reactions.

(i)	$2\ \mathrm{OF_2}\,(g) \rightarrow \mathrm{O_2}\,(g) + 2\ \mathrm{F_2}\,(g)$	$\Delta H_{\mathrm{rxn}} = -49.4\ \mathrm{kJ}$
(ii)	$2\ \mathrm{ClF}\,(g) + \mathrm{O_2}\,(g) \rightarrow \mathrm{Cl_2O}\,(g) + \mathrm{OF_2}\,(g)$	$\Delta H_{\mathrm{rxn}} = +205.6\ \mathrm{kJ}$
(iii)	$2\ \mathrm{ClF_3}\,(g) + 2\ \mathrm{O_2}\,(g) \rightarrow \mathrm{Cl_2O}\,(g) + 3\ \mathrm{OF_2}\,(g)$	$\Delta H_{\mathrm{rxn}} = +533.4\ \mathrm{kJ}$