

1. A reaction done in a bomb calorimeter involves the reaction of sodium metal and chlorine gas. 200 mL of water in the calorimeter has an initial temperature of 24.6°C and the final temperature is 28.4°C.
- a. What mass of sodium would be required to react to cause this temperature change? [2 marks]  
(Start by writing the reaction occurring)

$$\Delta_r H_m = -411.2 \text{ kJ/mol}$$

$$n = ?$$

$$\Delta_r H = Q$$

$$n \Delta_r H_m = m c \Delta t$$

$$n (411200 \text{ J/mol}) = (200 \text{ g}) (4.19 \text{ J/g}\cdot\text{C}) (3.8 \text{ C})$$

Q

$$\begin{cases} m = 200 \text{ g} \\ c = 4.19 \text{ J/g}\cdot\text{C} \\ \Delta t = 3.8 \text{ C} \end{cases}$$

$$n = 0.007744 \dots \text{ mol}$$

$$m = nM$$

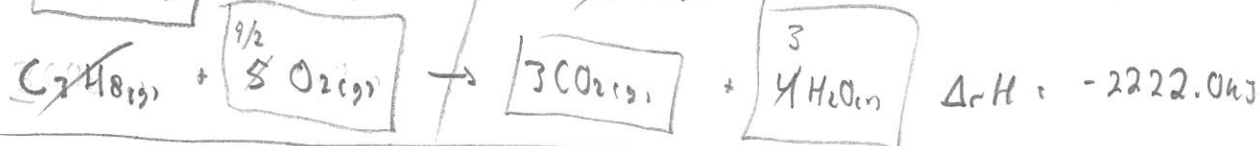
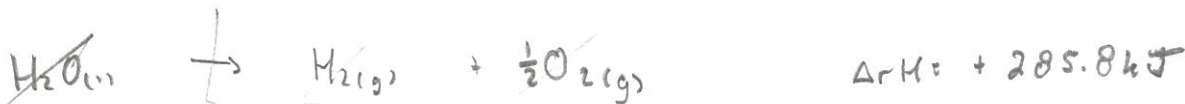
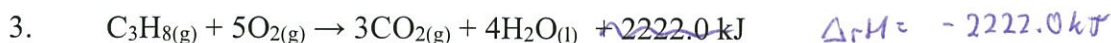
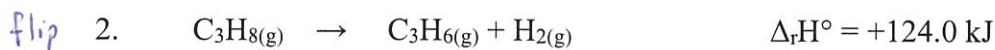
$$= 0.17803 \dots \text{ g}$$

$$= \boxed{0.18 \text{ g}}$$

- b. Write a chemical equation representing the reaction occurring in the bomb, including energy as a term in the equation.



2. Use Hess's Law and the 3 reactions provided below to calculate the molar enthalpy for the combustion of propene. Assume liquid water is produced. [2 marks]



$$\Delta_r H_m^\circ = -2060.2 \text{ kJ/mol}$$



3. a. Use the information above to calculate the molar enthalpy of combustion for ethyne. [1 mark]

$$\Delta_r H = [(4 \text{ mol} \times -393.5 \text{ kJ/mol}) + (2 \text{ mol})(-241.8 \text{ kJ/mol})] - [(2 \text{ mol})(+227.4 \text{ kJ/mol})]$$

$$\Delta_r H = -2512.4 \text{ kJ}$$

$$\Delta_r H_{\text{m}} = \frac{-2512.4 \text{ kJ}}{2 \text{ mol}} = -1256.2 \text{ kJ/mol}$$

- b. Calculate the enthalpy change for the combustion of 10.5 g of ethyne. [2 marks]

$$\Delta_r H = n \Delta_r H_{\text{m}} = \left( \frac{10.5 \text{ g}}{26.04 \text{ g/mol}} \right) (-1256.2 \text{ kJ/mol}) = -506.53 \dots \text{ kJ}$$

$$= -507 \text{ kJ}$$

- c. Draw a potential energy diagram for the combustion of ethyne. (2 marks)

