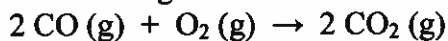


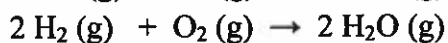
1) What is the ΔH_{RXN} for the reaction to make carbon monoxide, CO (g) , and hydrogen gas $\text{H}_2 \text{ (g)}$ from water, $\text{H}_2\text{O (l)}$, and methane gas, $\text{CH}_4 \text{ (g)}$; Show your work! (6 pts)



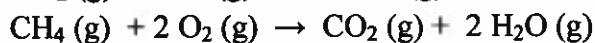
Given the following reactions:



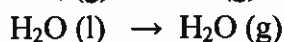
$$\Delta H_{\text{RXN}} = -566.0 \text{ kJ (Rxn 1)}$$



$$\Delta H_{\text{RXN}} = -483.6 \text{ kJ (Rxn 2)}$$



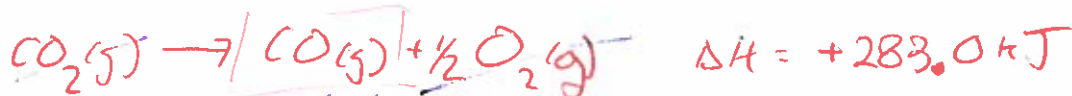
$$\Delta H_{\text{RXN}} = -836.3 \text{ kJ (Rxn 3)}$$



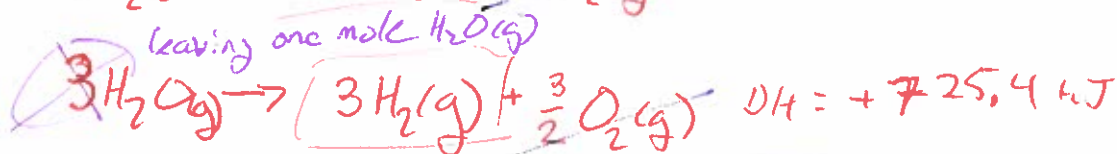
$$\Delta H_{\text{VAP}} = +44.0 \text{ kJ/mol (Rxn 4)}$$

$$\Delta H_{\text{RXN}} = \underline{+216.1 \text{ kJ}}$$

Reverse $\frac{1}{2}$ Rxn 1



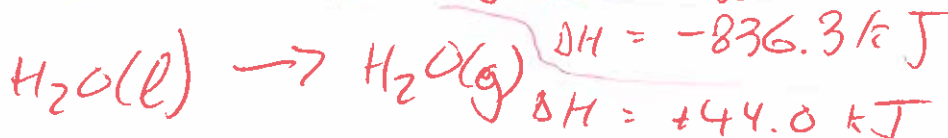
Reverse $\frac{3}{2}$ Rxn 2



Forward 1 Rxn 3



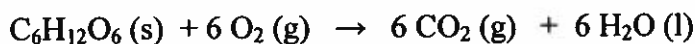
Forward 1 Rxn 4



$$\Delta H_{\text{RXN}} = +216.1 \text{ kJ}$$

KEY

2) A 2.095 g sample of glucose, $C_6H_{12}O_6$, which has a molar mass of 180.16 g/mol, is analyzed in a bomb calorimeter at constant volume in order to measure its heat of combustion. The heat flows from the reaction into the calorimeter and the water. (9 pts)



The calorimeter alone has a heat capacity (also called calorimeter constant) of 839 J/°C.

It also contains 1062 g of water which has a specific heat of 4.184 J/g °C.

The initial temperature of the calorimeter and water is 25.267 °C.

After the sample is combusted, the final temperature rises to 31.416 °C.

For Parts A and B

$$\Delta T = 31.416^\circ C - 25.267^\circ C$$

$$= 6.145^\circ C$$

A) Find the heat flow, q_{water} , to or from the water. Be sure to include the correct sign for q .

$$q_{\text{water}} = C m \Delta T = 4.184 \frac{J}{g^\circ C} \times 1062 g \times 6.145^\circ C$$

$$= 27,304.74216 J \xrightarrow{\text{unrounded}} 27.30 \times 10^4 J \text{ or } 27.30 kJ$$

Round to 4 sig. figs

B) Find the heat flow, $q_{\text{calorimeter}}$, to or from the calorimeter. Be sure to include the correct sign for q .

$$q_{\text{calorimeter}} = C \Delta T = 839 \frac{J}{^\circ C} \times 6.145^\circ C = 5266.265 J$$

unrounded

$$\text{Round to 3 sig. figs } 5270 J \text{ or } 5.27 kJ$$

C) Find the heat flow, q_{combust} , to or from the combustion reaction of the sample of glucose.

Combustion is the system; water and calorimeter are the surroundings.

$$q_{\text{system}} = -q_{\text{surround}}$$

negative 4 sig. figs

$$q_{\text{combustion}} = -(27.30 kJ + 5.27 kJ) = -32.57 kJ$$

D) Find the heat of combustion in kilojoules (kJ) per mole of glucose combusted.

$$2.095 g \text{ glucose} \times \frac{1 \text{ mol}}{180.16 g} = 0.01163 \text{ mol glucose}$$

$$\frac{q_{\text{comb}}}{n_{\text{glucose}}} = \frac{-32.57 kJ}{0.01163 \text{ mol}} = -2801 kJ/mol$$

better answer

E) Which state function corresponds to the answer from part D? (Circle one)

ΔH_{RXN}

ΔU_{RXN}

Because $\Delta n = 0$, the number of moles of gas remain the same and therefore $\Delta P = 0$

$\Delta H = \Delta U + P\Delta V$

Because at Const V , $\Delta V = 0$

$$\Delta U = q - P\Delta V$$

ΔU is the better answer