ΔH Practice Quiz

1. A calorimeter containing 765 mL of water at 19.4°C shows the temperature rising to 27.0°C as 2.55 g of iron burn in the presence of oxygen in the sample chamber. Find the energy released per mole of iron burned. (Assume all the energy when into the water!)

① $Q = mc\Delta T$

$= 765(4.19)(27.0-19.4)$

$Q_w = 24.36066 \text{ kJ}$

$Q_{Fe} = -24.36066$

② $\dfrac{1 \text{ mol } Fe}{x} = \dfrac{55.85g \ Fe}{2.55g}$

$x = 0.045658 \text{ mol } Fe$

③ $\Delta H = \dfrac{Q}{n}$

$= \dfrac{-24.36066}{0.045658}$

$\Delta H = -533.546 \text{ kJ/mol } Fe$

$\boxed{534 \text{ kJ/mol released}}$

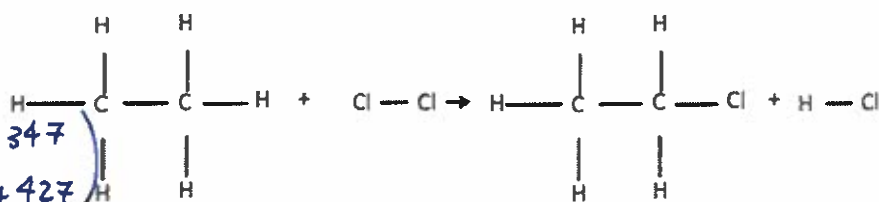**2.** Use this table of bond energies to estimate the enthalpy of the following reaction.

$\Delta H_{rxn} = \text{broken} - \text{formed}$

$= (6(413) + 347 + 239) - (5(413) + 347 + 339 + 427)$

$= 3064 - 3178$

$\Delta H_{rxn} = -114 \text{ kJ}$

Bond	Enthalpy (kJ/mol)
C—H	413
C—C	347
Cl—Cl	239
H—Cl	427
C—Cl	339

3. Find the ΔH$_{rxn}$ involved in reacting nitrogen gas with carbon dioxide gas to produce nitrogen dioxide gas and carbon(graphite) (just C$_{(s)}$).
Is this reaction an exothermic or endothermic process? *(using the blue table of ΔH°$_f$)*

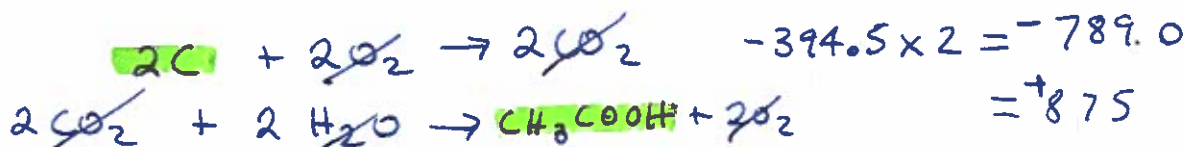$N_2 + 2CO_2 \rightarrow 2NO_2 + 2C$

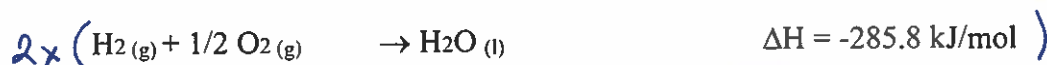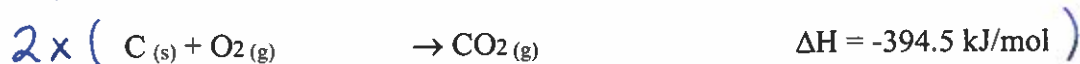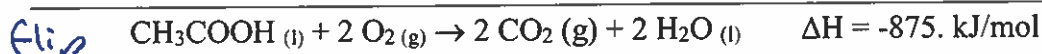$\Delta H = \text{products} - \text{reactants}$

$= (2(33.9) + 0) - (0 + 2(-393.5))$

$= 67.8 - (-787.0)$

$\Delta H = +854.8 \text{ kJ/mol}$

ENDOTHERMIC

4. Find ΔH$_f$° for acetic acid, CH$_3$COOH, using the following thermochemical data.

2 C$_{(s)}$ + 2 H$_2$ $_{(g)}$ + O$_2$ $_{(g)}$ → CH$_3$COOH $_{(l)}$ ΔH = ?

flip   CH$_3$COOH $_{(l)}$ + 2 O$_2$ $_{(g)}$ → 2 CO$_2$ (g) + 2 H$_2$O $_{(l)}$ ΔH = -875. kJ/mol

2× (C $_{(s)}$ + O$_2$ $_{(g)}$ → CO$_2$ $_{(g)}$ ΔH = -394.5 kJ/mol)

2× (H$_2$ $_{(g)}$ + 1/2 O$_2$ $_{(g)}$ → H$_2$O $_{(l)}$ ΔH = -285.8 kJ/mol)

2C + 2O$_2$ → 2CO$_2$ $-394.5 \times 2 = -789.0$

2CO$_2$ + 2H$_2$O → CH$_3$COOH + 2O$_2$ $= +875$

2H$_2$ + O$_2$ → 2H$_2$O $-285.8 \times 2 = -571.6$

_____ $\overline{-485.6 \text{ kJ}}$

2H$_2$ + O$_2$ → CH$_3$COOH

$\boxed{-486 \text{ kJ}}$