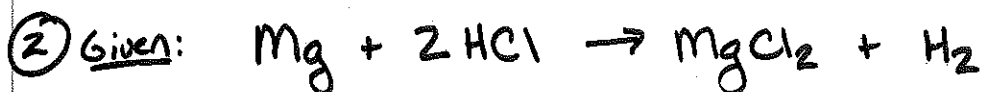


$$\Delta H_{\text{comb}} = ?$$

Soln: $(8.90 \text{ g P}_4) \left(\frac{1 \text{ mole P}_4}{123.88 \text{ g P}_4} \right) = 0.0718 \text{ mole P}_4$

$$\Delta H_{\text{comb}} = \frac{-216.3 \text{ kJ}}{0.0718 \text{ mol}} = \boxed{-3010 \text{ kJ/mol}}$$



$$\Delta H = ? \quad \begin{array}{l} \text{kJ/mol} \\ 0.7500 \text{ g} \\ 150.00 \text{ g} \\ 1.0 \text{ M} \end{array}$$

$$C_{\text{p water}} = 4.184 \text{ J/g}^\circ\text{C}$$

$$C_{\text{p calor}} = 2.90 \text{ J/g}^\circ\text{C}$$

$$M_{\text{exp}} = 4.4 \text{ g}$$

$$T_1 = 22.2^\circ\text{C} \quad \Delta T = 44.8 - 22.2$$

$$T_2 = 44.8^\circ\text{C} \quad = 22.6^\circ\text{C}$$

Soln: $q = m_{\text{H}_2\text{O}} C_{\text{p}} \Delta T + m_{\text{cal}} C_{\text{p cal}} \Delta T$

$$= (150.75 \text{ g})(4.184 \text{ J/g}^\circ\text{C})(22.6^\circ\text{C})$$

$$+ (4.4 \text{ g})(2.90 \text{ J/g}^\circ\text{C})(22.6^\circ\text{C})$$

$$= 14300 \text{ J} + 290 \text{ J}$$

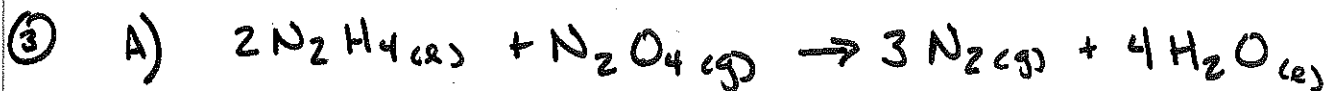
$$= 14590 \text{ J} = 14.6 \text{ kJ}$$

$$\left(\frac{0.7500 \text{ g Mg}}{1} \right) \left(\frac{1 \text{ mole Mg}}{24.30 \text{ g Mg}} \right) = 0.0309 \text{ mole Mg}$$

$$\Delta H = -q$$

$$\frac{14.6 \text{ kJ}}{0.0309 \text{ mol}}$$

$$= \boxed{-472 \text{ kJ}}$$



Given: ΔH_f° 51 KJ 10. KJ -286 KJ

B) $\Delta H_{\text{Rxn}}^\circ$ per mole N_2H_4

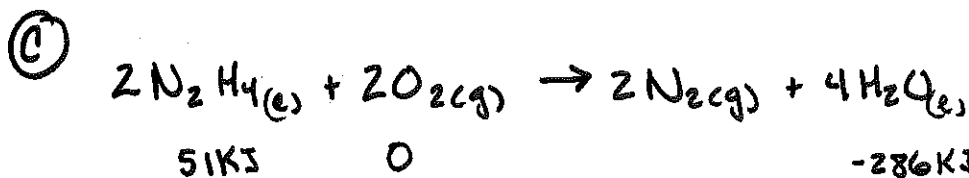
$$\begin{aligned}\Delta H_{\text{Rxn}}^\circ &= \sum H_{\text{fp}}^\circ - \sum H_{\text{fr}}^\circ \\ &= 4(-286 \text{ KJ}) - [2(51 \text{ KJ}) + (10. \text{ KJ})] \\ &= -1144 \text{ KJ} - [-112 \text{ KJ}]\end{aligned}$$

$$\Delta H_{\text{Rxn}}^\circ = -1256 \text{ KJ}$$

But per mole
Egn has coeff 2

$$\frac{-1256 \text{ KJ}}{2 \text{ mol}}$$

$$\Delta H_{\text{Rxn}}^\circ \text{N}_2\text{H}_4 = -628 \text{ KJ/mol}$$



51 KJ

0

-286 KJ

Less Heat of formation since O_2 is 0 KJ while N_2O_4 had been 10 KJ

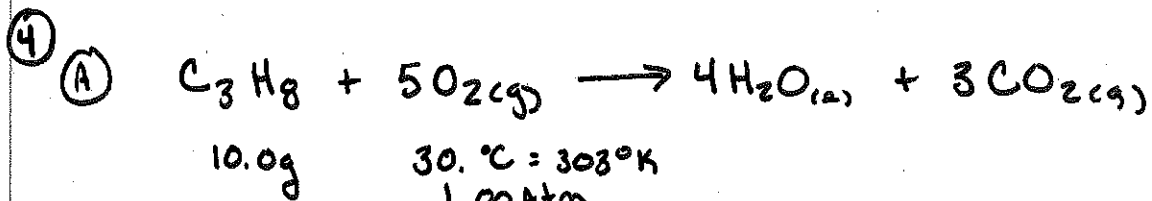
⑤

$$\begin{aligned}\Delta H_{\text{Rxn}}^\circ &= \sum H_{\text{fp}}^\circ - \sum H_{\text{fr}}^\circ \\ &= 4(-286 \text{ KJ}) - [2(51 \text{ KJ})] \\ &= -1246 \text{ KJ}\end{aligned}$$

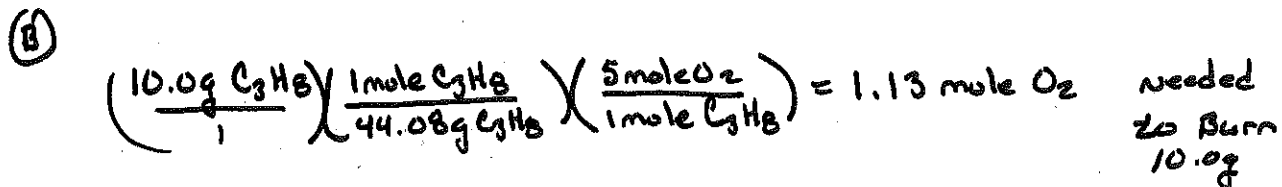
Per mole $\therefore \div 2$

$$\Delta H_{\text{Rxn}}^\circ = \frac{-1246 \text{ KJ}}{2}$$

$$\Delta H_{\text{Rxn}}^\circ \text{N}_2\text{H}_4 = -623 \text{ KJ/mol}$$



$$V_{O_2} = 21.0\% V_{Air}$$



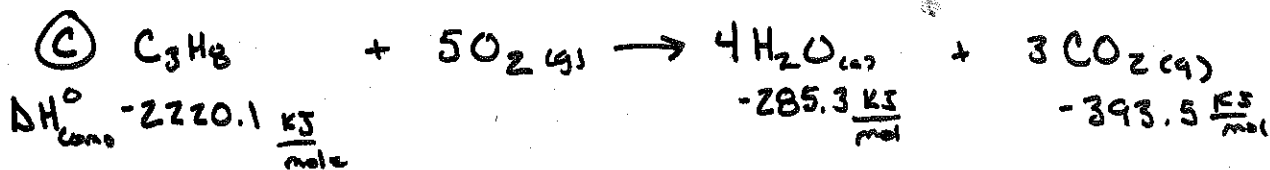
$$PV = nRT$$

$$V_{O_2} = \frac{nRT}{P} = \frac{(1.13 \text{ mole } O_2) \left(0.08206 \frac{L \cdot \text{atm}}{\text{mol} \cdot K}\right) (303K)}{1.00 \text{ atm}}$$

$$V_{O_2} = 28.1 \text{ L}$$

$$V_{O_2} = 21.0\% V_{Air}$$

$$V_{Air} = \frac{V_{O_2}}{0.210} = \frac{28.1 \text{ L}}{0.210} = 134 \text{ L}$$



$$\Delta H_f^\circ C_3H_8 = ?$$

$$H_{comb}^\circ = \sum H_{fp}^\circ - \sum H_{fr}^\circ$$

$$H_{f C_3H_8}^\circ = \sum H_{sp}^\circ - H_{comb}^\circ$$

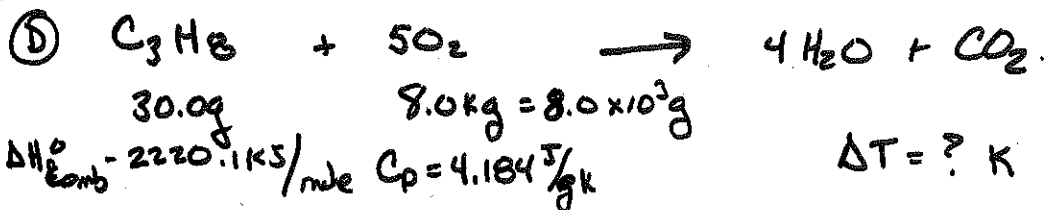
$$H_{f C_3H_8}^\circ = [4(-285.3 \frac{kJ}{\text{mol}}) + 3(-393.5 \frac{kJ}{\text{mole}})] - (-2220.1 \frac{kJ}{\text{mol}})$$

$$= -2321.7 \frac{kJ}{\text{mol}} + 2220.1 \frac{kJ}{\text{mol}}$$

$$H_{f C_3H_8}^\circ = -101.6 \frac{kJ}{\text{mol}}$$



④



$$\left(\frac{30.0\text{g C}_3\text{H}_8}{44.09\text{g C}_3\text{H}_8} \right) \left(\frac{1\text{mole C}_3\text{H}_8}{1\text{mole C}_3\text{H}_8} \right) = .680 \text{ mole C}_3\text{H}_8$$

$$\left(\frac{-2220.1 \text{ kJ}}{\text{mole}} \right) (.680 \text{ mole C}_3\text{H}_8) = -1510 \text{ kJ}$$

$$= -1.51 \times 10^6 \text{ J}$$

$$q = m C_p \Delta T$$

$$\Delta T = \frac{q}{m C_p} = \frac{+1.51 \times 10^6 \text{ J}}{(8.00 \times 10^3 \text{ g}) (4.184 \text{ J/gK})}$$

$$\Delta T = 45.1 \text{ K}^\circ$$

$$\Delta H = -q$$

⑤

A) goggles
 Graduated cylinders
 Coffee Cup Calorimeters
 Thermometers
 Balance / scale

B) Volume of Acid used
 Volume of Base used
 MASS of final soln in coffee cup calorimeter
 MASS of empty & dry coffee cup calorimeter
 Initial temp of Acid soln
 Initial Temp of Base soln
 Final Temp of the final soln

C) Use the volume of Acid & Base used to determine the limiting Rn & then the moles of Reaction

② find $q = m c p \Delta T$
 \int mass of Final soln Δ in temp of Acid / Base soln to its initial temp

③ divide q by the moles of Reaction to obtain final answer

d) Since the students obtained an Avg value less than the expected, Indicates that some heat was not accounted for in the Experiment.

① heat could have been lost to the surroundings resulting in a lower than correct temp change

② The other reason could be the heat lost to the calorimeter & temperature probe would also result in a lower correct temp change

