

Practice Problems



$$\Delta H_{\text{comb}}^{\circ} O_2 = \frac{-3509.0 \text{ kJ}}{1 \text{ mol } C_5H_{12}} \times \frac{1 \text{ mol } C_5H_{12}}{8 \text{ mol } O_2}$$

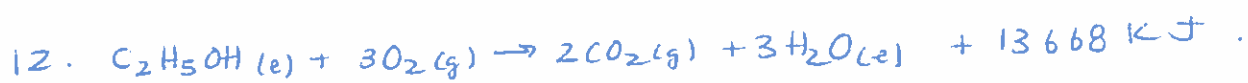
$$= -438.62 \text{ kJ/mol } O_2. \quad (-438.63 \text{ is ok for this course})$$

$$\Delta H_{\text{comb}}^{\circ} CO_2 = \frac{-3509.0 \text{ kJ}}{1 \text{ mol } C_5H_{12}} \times \frac{1 \text{ mol } C_5H_{12}}{5 \text{ mol } CO_2}$$

$$= -701.80 \text{ kJ/mol } CO_2.$$

$$\Delta H_{\text{comb}}^{\circ} H_2O = \frac{-3509.0 \text{ kJ}}{1 \text{ mol } C_5H_{12}} \times \frac{1 \text{ mol } C_5H_{12}}{6 \text{ mol } H_2O}$$

$$= -584.83 \text{ kJ/mol } H_2O.$$

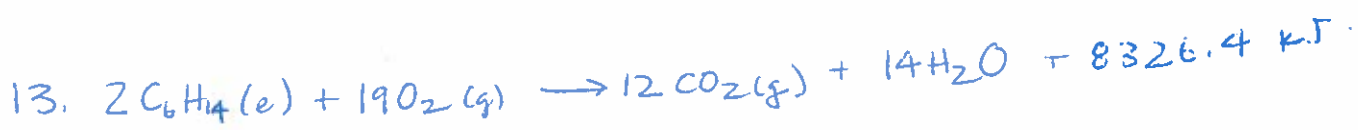


m 4.608 g

M 46.069 $\frac{g}{\text{mol}}$

$$\Delta H_f C_2H_5OH = 4.608 \text{ g} \times \frac{1 \text{ mol}}{46.069 \text{ g}} \times \frac{-13668 \text{ kJ}}{1 \text{ mol}}$$

$$= -1367 \text{ kJ}$$



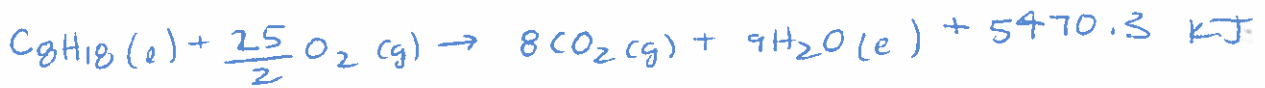
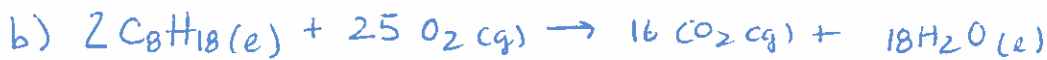
m 56.78 g

M 86.178 g/mol

$$\Delta H_{\text{comb}}^{\circ} = -4163.2 \text{ kJ/mol} \quad \times 2$$

$$\Delta H_{\text{comb}} = 56.78 \text{ g} \times \frac{1 \text{ mol}}{86.178 \text{ g}} \times \frac{-8326.4 \text{ kJ}}{2 \text{ mol}}$$

$$= -2743 \text{ kJ}$$



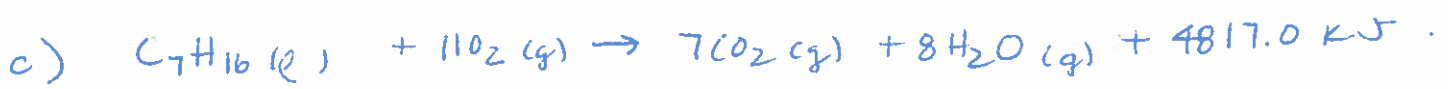
$$m \quad 1360 \text{ g}$$

$$M \quad 114.232 \frac{\text{g}}{\text{mol}}$$

$$\Delta H_{\text{comb}} C_8H_{18} = \frac{1360 \text{ g}}{114.232 \text{ g}} \times \frac{1 \text{ mol}}{1 \text{ mol}} \times \frac{-5470.3 \text{ kJ}}{1 \text{ mol}}$$

$$= -65127 \text{ kJ}$$

$$= -65100 \text{ kJ} \cdot \text{or} \quad -6.51 \times 10^{-4} \text{ kJ}$$

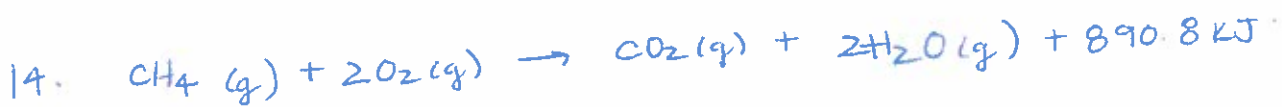


$$m \quad 2.344 \times 10^4 \text{ g}$$

$$M \quad 100.667 \frac{\text{g}}{\text{mol}}$$

$$\Delta H_{\text{comb}} C_7H_{16}(l) = 2.344 \times 10^4 \text{ g} \times \frac{1 \text{ mol}}{100.667 \text{ g}} \times \frac{-4817.0 \text{ kJ}}{1 \text{ mol}}$$

$$= 1.122 \times 10^6 \text{ kJ}$$



$$m \quad 1.00 \text{ g}$$

$$M \quad 16.043 \frac{\text{g}}{\text{mol}}$$

$$\Delta H_{\text{comb}} CH_4 = 1.00 \text{ g} \times \frac{1 \text{ mol}}{16.043 \text{ g}} \times \frac{-890.8 \text{ kJ}}{1 \text{ mol}}$$

$$= -55.5 \text{ kJ}$$



$$m = ?$$

$$M = 128.174 \frac{\text{g}}{\text{mol}}$$

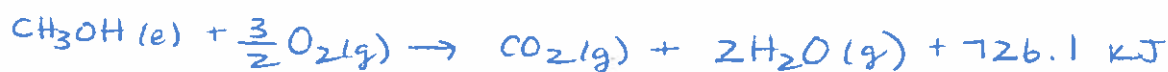
$$\Delta H_r = n \Delta H^{\circ}_{\text{comb}}$$

$$-500.0 \text{ kJ} = n (5156 \text{ kJ/mol})$$

$$n = 0.09697 \text{ mol}$$

$$m_{C_{10}H_8} = 0.09697 \text{ mol} \times \frac{128.174 \text{ g}}{\text{mol}}$$

$$= 12.43 \text{ g}$$



$$m = ? \text{ (kg)}$$

$$M = 32.042 \frac{\text{g}}{\text{mol}}$$

$$\Delta H_r = n \Delta H_{\text{comb}}^\circ$$

$$-5.39 \times 10^5 \text{ kJ} = n (-726.1 \text{ kJ/mol})$$

$$n = 742.32 \text{ mol}$$

$$m_{\text{CH}_3\text{OH}} = 742.32 \text{ mol} \times \frac{32.042 \text{ g}}{\text{mol}}$$

$$= 23.8 \text{ kg}$$



a) $\Delta H_{\text{comb}}^\circ = \frac{-4116.0 \text{ kJ}}{2 \text{ mol}} = -2058.0 \text{ kJ/mol}$



$$m = 5.00 \text{ g}$$

$$M = 42.081 \frac{\text{g}}{\text{mol}}$$

$$\Delta H_r = 5.00 \text{ g} \times \frac{1 \text{ mol}}{42.081 \text{ g}} \times \frac{-4116.0 \text{ kJ}}{2 \text{ mol}}$$

$$= -245 \text{ kJ (released)}$$

+245 kJ is available

18. a) $\Delta H_r = n \Delta H_{\text{comb}}^\circ$

$$-110.95 \text{ kJ} = 0.050 \text{ mol} \Delta H_{\text{comb}}^\circ$$

$$\Delta H_{\text{comb}}^\circ = -2219 \text{ kJ/mol}$$

$$= -2.2 \times 10^3 \text{ kJ/mol}$$

$$\text{OR } -2200 \text{ kJ/mol}$$

b) propane



$$m = ?$$

$$M = 58.124 \frac{\text{g}}{\text{mol}}$$

$$1.00 \text{ MJ} = 1.00 \times 10^6 \text{ J} \\ = 1.00 \times 10^3 \text{ kJ}$$

$$\Delta H_r = n \Delta H^\circ_{\text{comb}} \\ 1.00 \times 10^3 \text{ kJ} = n (2877.6 \text{ kJ/mol})$$

$$n = \frac{1.00 \times 10^3 \text{ kJ}}{2877.6 \text{ kJ/mol}} \\ = 0.3475 \text{ mol}$$

$$m_{\text{C}_4\text{H}_{10}} = 0.3475 \text{ mol} \times \frac{58.124 \text{ g}}{\text{mol}} \\ = 20.2 \text{ g}$$



$$m = 25.00 \text{ g}$$

$$M = 18.015 \frac{\text{g}}{\text{mol}}$$

$$\Delta H_r = 25.00 \text{ g} \times \frac{1 \text{ mol}}{18.015 \text{ g}} \times \frac{-2006 \text{ kJ}}{4 \text{ mol}}$$

$$= -695.9 \text{ kJ}$$