Homework - Worksheet

$H_{2(g)} + \frac{1}{2}O_{2(g)} \longrightarrow H_2O_{(g)}$

$CH_3OH_{(\ell)} + \frac{3}{2}O_{2(g)} \longrightarrow CO_{2(g)} + 2H_2O_{(g)}$

$m = 1.00\,kg$

Step 1: H_r (general)

$\Delta H_r = \Sigma n H_{fp} - \Sigma n H_{fr}$

$\Delta H_r = \left[(1\,mol)\left(-393.5\frac{kJ}{mol}\right) + (2\,mol)\left(-241.8\frac{kJ}{mol}\right)\right] - \left[(1\,mol)\left(-239.1\frac{kJ}{mol}\right) + \left(\frac{3}{2}\,mol\right)\left(0\frac{kJ}{mol}\right)\right]$

$\Delta H_r = -638\,kJ$

$\Delta H_r = nH_r$

$H_r = \frac{\Delta H_r}{n} = \frac{-638\,kJ}{1\,mol} = -638\,kJ/mol$

Step 2: n (specific)

$1000.g\,CH_3OH \times \frac{1\,mol\,CH_3OH}{32.05g\,CH_3OH} = 31.20\,mol$

Step 3: ΔH_r (specific)

$\Delta H_r = nH_r$

$\Delta H_r = (31.20\,mol)(-638\,kJ/mol)$

$\Delta H_r = -19\,906.36\,kJ$

$\boxed{\Delta H_r = -19.9\,MJ}$

$$CH_{4(g)} + 2O_{2(g)} \longrightarrow CO_{2(g)} + 2H_2O_{(g)}$$

Step 1: ΔH_r (general)

$$\Delta H_r = \sum n\Delta H_{fp} - \sum n\Delta H_{fr}$$

$$\Delta H_r = \left[(1\,mol)\left(-393.5\tfrac{kJ}{mol}\right) + (2\,mol)\left(-241.8\tfrac{kJ}{mol}\right)\right] - \left[(1\,mol)\left(-74.4\tfrac{kJ}{mol}\right) + (2\,mol)\left(0\tfrac{kJ}{mol}\right)\right]$$

$$\Delta H_r = -802.7\,kJ$$

$$\Delta H_r = nH_r$$

$$H_r = \frac{\Delta H_r}{n} = \frac{-802.7\,kJ}{1\,mol} = -802.7\tfrac{kJ}{mol}$$

Step 2: n (specific)

$$\Delta H_r = -q$$

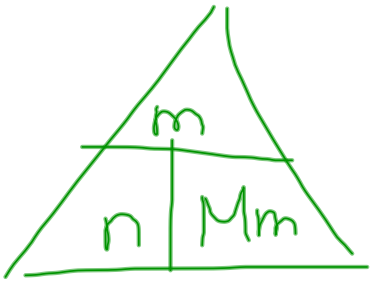
$$nH_r = -vC\Delta T$$

$$n\left(-802.7\tfrac{kJ}{mol}\right) = -(100.L)\left(4.19\tfrac{kJ}{L\cdot{}^\circ C}\right)(65^\circ C)$$

$$n = 33.93\,mol$$

Step 3: m (specific)

$$33.93\,mol\,CH_4 \times \frac{16.05\,g\,CH_4}{1\,mol\,CH_4} = \boxed{540\,g\,CH_4}$$


m
n
Mm

Multi-Step Energy Calculations Worksheet