CHM 110
Heat Practice Set SOLUTIONS

Solve the following problems Write the answer in the answer blank, and show work in the space provided.

1) Using standard enthalpies of formation (see your textbook), calculate the enthalpy change ΔH^o for the reaction below, as written:

$$2CH_4(g) + O_2(g) \rightarrow 2CO(g) + 4H_2(g)$$

(−74.87) (0) (−110.5) (0)

Answer: $\Delta H^o =$ −71.3 kJ

$\Delta H^o = [2(-110.5) + 4(0)] - [2(-74.87) + 1(0)]$

$= -71.26$ kJ

2) A 1.50 kg block of iron cools from a temperature of 100.0 °C to 23.5 °C. Calculate the heat, Q, associated with this change. Assume the specific heat of iron is $0.449 \frac{J}{g \cdot {}^oC}$

Answer: Q = −51500 J

$Q = 1500\,g \times 0.449 \frac{J}{g\,{}^oC} \times (23.5\,{}^oC - 100.0\,{}^oC)$

$= -51522.75$ J

3) What is the enthalpy change on burning 175 g of ammonia, NH_3, in the following reaction?

17.034

$$4NH_3(g) + 3O_2(g) \rightarrow 2N_2(g) + 6H_2O(g) \; ; \quad \Delta H = -1267\,kJ$$

Answer: −3250 kJ

$17.034\,g\,NH_3 = 1\,mol\,NH_3$ $\quad 4\,mol\,NH_3 = -1267\,kJ$

$$175\,g\,NH_3 \times \frac{1\,mol\,NH_3}{17.034\,g\,NH_3} \times \frac{-1267\,kJ}{4\,mol\,NH_3} = -3254.153458\,kJ$$

4) What volume of hydrogen gas at 125 °C and 1.05 atm pressure would be required to provide 1550 kJ of heat via the following reaction?

$$2H_2(g) + O_2(g) \rightarrow 2H_2O(g) \; ; \quad \Delta H = -484\,kJ$$

Answer: 199 L H_2

$2\,mol\,H_2 = -484\,kJ$

$$-1550\,kJ \times \frac{2\,mol\,H_2}{-484\,kJ} = 6.404958678\,mol\,H_2$$

$V = \frac{nRT}{P}$ | $n = 6.404958678\,mol\,H_2$ $\quad T = 125°C = 398\,K$

$R = 0.08206\,\frac{L\text{-}atm}{mol\cdot K}$ $\quad P = 1.05\,atm$

$$V = \frac{(6.404958678\,mol\,H_2)\left(0.08206\,\frac{L\text{-}atm}{mol\cdot K}\right)(398\,K)}{(1.05\,atm)}$$

$= 199.223982684\,L\,H_2$