

Answer on Question #55343 - Chemistry - General chemistry

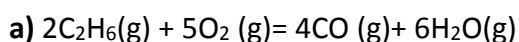
Question:

a.) Write the balanced incomplete combustion reaction for ethane (C₂H₆), producing CO and water vapour. Make sure to include phases. Also, make sure that the stoichiometric coefficients are whole numbers and are not fractions.

b.) What is the enthalpy of the reaction ($\Delta H^{\circ}_{\text{rxn}}$), in kJ, for the process in part (a)?

c.) Calculate the total heat (q), in kJ, produced by 250.0 g of ethane when 9.00% by mass of it burns incompletely and the remainder burns completely.

Solution



b) $\Delta H^{\circ}_{\text{rxn}} = 4\Delta H^{\circ}(\text{CO}) + 6\Delta H^{\circ}(\text{H}_2\text{O}) - 2\Delta H^{\circ}(\text{C}_2\text{H}_6) - 5\Delta H^{\circ}(\text{O}_2)$

$$\Delta H^{\circ}_{\text{rxn}} = 4\Delta H^{\circ}(\text{CO}) + 6\Delta H^{\circ}(\text{H}_2\text{O}) - 2\Delta H^{\circ}(\text{C}_2\text{H}_6) - 5\Delta H^{\circ}(\text{O}_2)$$

$$\Delta H^{\circ}_{\text{rxn}} = 4 \times (-110.5) + 6 \times (-241.8) - 2 \times (-84) - 5 \times (0) = \mathbf{-1724.8 \text{ kJ}}$$

c) Burns incompletely $250 \times 0.09 = 22.5$ g of ethane, it corresponds to the amount of

$$M(\text{C}_2\text{H}_6) = 30.1 \text{ g/mol}, n = 22.5/30.1 = 0.748 \text{ mol}$$

2 mol of ethane make 1724.8 kJ of heat

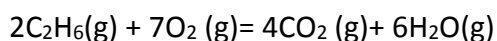
0.748 mol of ethane make x kJ of heat

$$X = 0.748 \times 1724.8 / 2 = \mathbf{645.1 \text{ kJ}}$$

Burns completely $250 - 22.5 = 227.5$ g of ethane, it corresponds to the amount of

$$M(\text{C}_2\text{H}_6) = 30.1 \text{ g/mol}, n = 227.5/30.1 = 7.56 \text{ mol}$$

For total combustion of ethane:



$$\Delta H^{\circ}_{\text{rxn}} = 4 \times (-393.5) + 6 \times (-241.8) - 2 \times (-84) - 7 \times (0) = \mathbf{-2960.8 \text{ kJ}}$$

2 mol of ethane make 2960.8 kJ of heat

7.56 mol of ethane make x kJ of heat

$$X = 7.56 \times 2960.8 / 2 = \mathbf{11191.8 \text{ kJ}}$$

Answer: 1724.8 kJ; 645.1 kJ; 11191.8 kJ