Answer on Question #70907, Chemistry / General Chemistry : Completed

Mothballs are composed primarily of the hydrocarbon naphthalene ($C_{10}H_8$). When 1.025 g of naphthalene is burned in a bomb calorimeter, the temperature rises from 24.25 ◦C to 32.33 ◦C. Find ΔErxn for the combustion of naphthalene. The heat capacity of the calorimeter, determined in a separate experiment, is 5.11kJ/◦C.

Solution.

$m\left(C_{10}H_8\right)=1.0252g$

$M\left(C_{10}H_8\right)=128g/mol$

$t_1=24.25^oC$

$t_2=32.33^oC$

$C=5.11kJ/^oC$

$\Delta E_{rxn}-?$

The temperature difference:

$\Delta t=t_2-t_1=32.33^oC-24.25^oC$

$\Delta t=8.08^oC$

And:

$Q=C\cdot\Delta t$

$Q=8.08^oC\cdot5.11kJ/^oC$

$Q=41.2888kJ$

ΔErxn for the combustion of naphthalene:

$$\Delta E_{rxn}=\frac{Q}{m\left(C_{10}H_8\right)}\cdot M\left(C_{10}H_8\right)$$

$$\Delta E_{rxn}=\frac{41.2888kJ}{1.0252g}\cdot128g/mol$$

$$\Delta E_{rxn}=5155.06kJ/mol$$

$$\Delta E_{rxn}=\frac{Q}{m\left(C_{10}H_8\right)}$$

$$\Delta E_{rxn}=\frac{41.2888kJ}{1.0252g}$$

$$\Delta E_{rxn}=40.27kJ/g$$

Answer: $\Delta E_{rxn}=5155.06kJ/mol$, $\Delta E_{rxn}=40.27kJ/g$.