## Name: Period:

## Hess's Law

Hess's Law is used to calculate the enthalpy changes for reactions that might be difficult or inconvenient to measure directly in a calorimeter.

Directions: Show all of your work as you solve the following problems. Include units, labels and circle your answer.

1. Calculate $\Delta H$ for the following reaction:	$\Delta H = ?$
$2Cu(s) + O_2(g) \rightarrow 2CuO(s)$	
Given the following data	
$4CuO(s) \rightarrow 2Cu_2O(s) + O_2(g)$	$\Delta H = +288 kJ$
$Cu_2O(s) \rightarrow Cu(s) + CuO(s)$	$\Delta H = +11 \text{ kJ}$

2. Calculate $\Delta H$ for the following reaction:	
$4Al(s) + 3MnO_2(s) \rightarrow 2Al_2O_3(s) + 3Mn(s)$	$\Delta H = ?$

Given the following reactions	
$4Al(s) + 3O_2(g) \rightarrow 2Al_2O_3(s)$	$\Delta H = -3352 \text{ kJ}$
$Mn(s) + O_2(g) \rightarrow MnO_2(s)$	$\Delta H = -521 kJ$

3. Determine $\Delta H$ for the reaction:	
$NO(g) + O(g) \rightarrow NO_2(g)$	$\Delta H = ?$
Given the following reactions	
$O_2(g) \rightarrow 2O(g)$	$\Delta H = +495 kJ$
$2O_3(g) \rightarrow 3O_2(g)$	$\Delta H = -427 kJ$
$NO(g) + O_3(g) \rightarrow NO_2(g) + O_2(g)$	$\Delta H = -199 kJ$

4. The enthalpy of combustion of solid carbon to form carbon dioxide is -393.7 kJ/mol C, and the enthalpy of combustion of carbon monoxide to form carbon dioxide is -283.3 kJ/mol CO. Using these data, calculate the change in enthalpy for the reaction:  $2C(s) + O_2(g) \rightarrow 2CO_{(g)}$