## Dougherty Valley HS Chemistry - AP Thermochemistry – Hess's Law

## Name:

Period:

Seat#:

Worksheet #1

**Directions:** Show all work in a way that would earn you credit on the AP Test! This is always the rule! Some answers are provided at the end in italics and underlined. If you need more space, use binder paper and staple to your worksheet.

**1)** Calculate the standard enthalpy change, ΔH<sup>o</sup>, for the formation of 1 mol of strontium carbonate (the material that gives the red color in fireworks) from its elements.

Sr (s) + C(graphite) +  $\frac{3}{2}O_2(g) \rightarrow SrCO_3(s)$ 

(1) Sr (s) $+\frac{1}{2}O_2(g) \to SrO(s)$	$\Delta H^{\circ} = -592 \text{ kJ}$
(2) SrO (s) + CO <sub>2</sub> (g) $\rightarrow$ SrCO <sub>3</sub> (s)	$\Delta H^\circ = -234 \text{ kJ}$
(3) C(graphite) + $O_2(g) \rightarrow CO_2(g)$	$\Delta H^\circ = -394 \text{ kJ}$

		<u>–1220 KJ</u>

2) The combination of coke and steam produces a mixture called coal gas, which can be used as a fuel or as a starting material for other rxns. If we assume coke can be represented by graphite, the eq. for the production of coal gas is
 2 C (s) + 2 H<sub>2</sub>O (g) → CH<sub>4</sub> (g) + CO<sub>2</sub> (g)

l.3 kJ
l.2 kJ
5.1 kJ

1	$\Delta H^{\circ} = 206.1 \text{ kJ}$
	$\Delta H^{\circ} = -41.2 \text{ kJ}$
	$\Delta H^{\circ} = 131.3 \text{ kJ}$

**3)** One reaction involved in the conversion of iron ore to the metal is FeO (s) + CO (g)  $\rightarrow$  Fe (s) + CO<sub>2</sub> (g)

(1) 3 Fe <sub>2</sub> O <sub>3</sub> (s) + CO (g) $\rightarrow$ 2 Fe <sub>3</sub> O <sub>4</sub> (s) + CO <sub>2</sub> (g)	$\Delta H^{\circ} = -47 \text{ kJ}$
(2) $\operatorname{Fe}_2O_3(s) + 3 \operatorname{CO}(g) \rightarrow 2 \operatorname{Fe}(s) + 3 \operatorname{CO}_2(g)$	$\Delta H^{\circ} = -25 \text{ kJ}$
(3) Fe <sub>3</sub> O <sub>4</sub> (s) + CO (g) $\rightarrow$ 3 FeO (s) + CO <sub>2</sub> (g)	$\Delta H^{\circ} = 19 \text{ kJ}$

		441.1
		<u>– 11 kJ</u>

**4)** Find the  $\Delta H$  for the reaction below, given the following reactions and subsequent  $\Delta H$  values: PCl<sub>5</sub> (g)  $\rightarrow$  PCl<sub>3</sub> (g) + Cl<sub>2</sub> (g)

$P_4(s) + 6Cl_2(g) \rightarrow 4PCl_3(g)$	$\Delta H = -2439 \text{ kJ}$
$4PCl_{5}\left(g\right) \rightarrow P_{4}\left(s\right) + 10Cl_{2}\left(g\right)$	$\Delta H = 3438 \text{ kJ}$

<u>249.8 kJ</u>

**5)** Find the  $\Delta H$  for the reaction below, given the following reactions and subsequent  $\Delta H$  values:

$2CO_2(g) + H_2O(g) \rightarrow C_2H_2(g) + \frac{5}{2}O_2(g)$	Ũ
$C_{2}H_{2}\left(g\right)+2H_{2}\left(g\right)\rightarrow C_{2}H_{6}\left(g\right)$	$\Delta H = -94.5 \text{ kJ}$
$H_2O(g) \rightarrow H_2(g) + \frac{1}{2}O2(g)$	$\Delta H = 71.2 \text{ kJ}$
$C_{2}H_{6}\left(g\right)+\frac{7}{2}O_{2}\left(g\right)\rightarrow2CO_{2}\left(g\right)+3H_{2}O(g)$	$\Delta H = -283 \text{ kJ}$

**6)** Find the  $\Delta H$  for the reaction below, given the following reactions and subsequent  $\Delta H$  values: N<sub>2</sub>H<sub>4</sub> (*l*) + H<sub>2</sub> (g)  $\rightarrow$  2NH<sub>3</sub> (g)

$N_{2}H_{4}\left(l\right) + CH_{4}O\left(l\right) \rightarrow CH_{2}O\left(g\right) + N_{2}\left(g\right) + 3H_{2}\left(g\right)$	$\Delta H = -37 \text{ kJ}$
$N_{2}\left(g ight)+3H_{2}\left(g ight) ightarrow2NH_{3}\left(g ight)$	$\Delta H = -46 \text{ kJ}$
$CH_4O(l) \rightarrow CH_2O(g) + H_2(g)$	$\Delta H = -65 \text{ kJ}$

## **7)** Find the $\Delta H$ for the reaction below, given the following reactions and subsequent $\Delta H$ values: H<sub>2</sub>SO<sub>4</sub> (*I*) $\rightarrow$ SO<sub>3</sub> (g) + H<sub>2</sub>O(g)

$\Pi_{2}SO_{4}(l) \rightarrow SO_{3}(g) + \Pi_{2}O(g)$	
$\mathrm{H_2S}(\mathrm{g}) + \mathrm{2O_2}\left(\mathrm{g}\right) \to \mathrm{H_2SO_4}\left(l\right)$	$\Delta H = -235.5 \text{ kJ}$
$H_{2}S(g) + 2O_{2}\left(g\right) \rightarrow SO_{3}\left(g\right) + H_{2}O(l)$	$\Delta H = -207 \text{ kJ}$
$H_2O(l) \rightarrow H_2O(g)$	$\Delta H = 44 \text{ kJ}$

<u>–18 kJ</u>

**8)** Find the  $\Delta H$  for the reaction below, given the following reactions and subsequent  $\Delta H$  values: 2C<sub>2</sub>H<sub>4</sub>O(*l*) + 2H<sub>2</sub>O(*l*)  $\rightarrow$  2C<sub>2</sub>H<sub>6</sub>O(*l*) + O<sub>2</sub> (g)

$C_2H_6O(l) + 3O_2(g) \rightarrow 2CO_2(g) + 3H_2O(l)$	$\Delta H = -685.5 \text{ kJ}$
$C_2H_4O(l) + 5/2 O_2(g) \rightarrow 2CO_2(g) + 2H_2O(l)$	$\Delta H = -583.5 \text{ kJ}$