South Pasadena • AP Chemistry

Name _____
Period ___ Date ___/___/___

6 • Energy and Chemical Reactions

Station 1 – EXOTHERMIC AND ENDOTHERMIC

Classify each statement as talking about an [EXO]thermic or [ENDO]thermic reaction:

_____ surroundings get hot

_____ PE diagram is uphill

_____ energy is a product

_____ ΔH is positive

_____ reactants have more energy

_____ ΔH is negative

_____ PE diagram is downhill

_____ surroundings get cold

_____ products have more energy

_____ energy is a reactant

South Pasadena • AP Chemistry

6 • Energy and Chemical Reactions

Station 2 – HEAT CALCULATIONS

A 45.0 mL sample of water is heated from 15.0°C to 35.0°C. How many joules of energy have been absorbed by the water? (Show work)

If 5430 J of energy is used to heat 1.25 L of room temperature water (23.0°C), what is the final temperature of the water?

6 • Energy and Chemical Reactions

Station 3 – HOT AND COLD OBJECTS

A 100. gram sample of aluminum (specific heat = 0.900 $J \cdot g^{-1} \cdot °C^{-1}$) in boiling water is added to an insulated cup containing 50.0 grams of water at 5.00°C. What will the final temperature of the mixture be? The specific heat of water is 4.184 $J \cdot g^{-1} \cdot °C^{-1}$.

South Pasadena • AP Chemistry

6 • Energy and Chemical Reactions

Station 4 – WORK, HEAT, AND ENERGY

Determine the change in energy, ΔE, for each system:

A system gives off 25.0 kJ of heat and has 15.0 kJ of work done on it. _____

A system takes in 75.0 kJ of heat and has 25.0 kJ of work done on it. _____

A system does 45.0 kJ of work and loses 80.0 kJ of heat. _____

6 • Energy and Chemical Reactions

Station 5 – HEATS OF FUSION & VAPORIZATION

Knowing that the ΔH_{fus} for water is 6.02 $kJ \cdot mol^{-1}$, calculate the following:

How much energy (in kJ) is absorbed by 45.0 g of ice as it melts?

What mass of ice can be melted with 75.0 kJ of energy?

South Pasadena • AP Chemistry

6 • Energy and Chemical Reactions

Station 6 – ΔH FROM DATA

When 10.0 grams of C_5H_{12} is burned, 453 kJ of energy is released.

What is the $\Delta H_{combustion}$ for C_5H_{12}?

When 10.0 grams of aluminum melts, 3.929 kJ of energy is required. What is the ΔH_{fus} of Al?

6 • Energy and Chemical Reactions

Station 7 – HESS'S LAW—LONG VERSION

Iron ore can be converted to iron metal with CO gas.

$FeO(s) + CO(g) \rightarrow Fe(s) + CO_2(g)$

Calculate the standard enthalpy change for this reaction from these reactions of iron oxides with CO:

(1) $3\,Fe_2O_3(s) + CO(g) \rightarrow 2\,Fe_3O_4(s) + CO_2(g)$ $\quad \Delta H° = -47\ kJ$

(2) $Fe_2O_3(s) + 3\,CO(g) \rightarrow 2\,Fe(s) + 3\,CO_2(g)$ $\quad \Delta H° = -25\ kJ$

(3) $Fe_3O_4(s) + CO(g) \rightarrow 3\,FeO(s) + CO_2(g)$ $\quad \Delta H° = 19\ kJ$

South Pasadena • AP Chemistry

6 • Energy and Chemical Reactions

Station 8 – HESS'S LAW--SHORTCUT

chemical	$CO_2(g)$	$H_2O(g)$	$C_5H_{12}(l)$	$C_2H_5OH(l)$
$\mathbf{\Delta H_f}$	$-393.5\ kJ\cdot mol^{-1}$	$-241.8\ kJ\cdot mol^{-1}$	$-173.1\ kJ\cdot mol^{-1}$	$-277.6\ kJ\cdot mol^{-1}$

Given the above $\Delta H_f°$'s, calculate the $\Delta H_{combustion}$ of pentane, C_5H_{12}.

Calculate the $\Delta H_{combustion}$ of ethyl alcohol, $C_2H_5OH(l)$

6 • Energy and Chemical Reactions

Station 9 – MORE HESS'S LAW

chemical	$CO_2(g)$	$H_2O(g)$	$C_8H_{18}(l)$
$\mathbf{\Delta H_f}$	-393.5 $kJ \cdot mol^{-1}$	-241.8 $kJ \cdot mol^{-1}$	??? $kJ \cdot mol^{-1}$

Knowing that the $\Delta H_{combusion}$ of octane, C_8H_{18}, is -5508.9 $kJ \cdot mol^{-1}$ calculate the ΔH_f of octane.

South Pasadena • AP Chemistry

6 • Energy and Chemical Reactions

Station 9 – MORE HESS'S LAW

chemical	$CO_2(g)$	$H_2O(g)$	$C_8H_{18}(l)$
$\mathbf{\Delta H_f}$	-393.5 $kJ \cdot mol^{-1}$	-241.8 $kJ \cdot mol^{-1}$	??? $kJ \cdot mol^{-1}$

Knowing that the $\Delta H_{combusion}$ of octane, C_8H_{18}, is -5508.9 $kJ \cdot mol^{-1}$ calculate the ΔH_f of octane.