Heats of Reactions:

Heat:
Chemical reactions or changes in physical state generally involve either the absorption (_____) or the release (_____) of heat. In studying energies, you can define **system** _____ _____. Everything else make up the surroundings. This includes the immediate area around the system. There are two directions for energy transfer (_____) to occur. Either INTO or OUT of a system. Heat is measured in units called joules, calories, and Calories. Here are some general conversions:

- 1 calories (cal) =4.18joules (J)
- 1000calories (cal) =1 Calorie = 1kilocalorie (kcal)

Endothermic and Exothermic Processes:
In **endo**thermic processes and reactions the system _____ heat as the surrounding loses heat this is defined as a _____change in heat.
In **exo**thermic process and reactions is one that _____ heat to its surroundings. This system loses heat (or flows out) as the surroundings gain heat is defined as _____.

Thermochemical Equation: This is a regular chemical equation, however, it _____ _____.

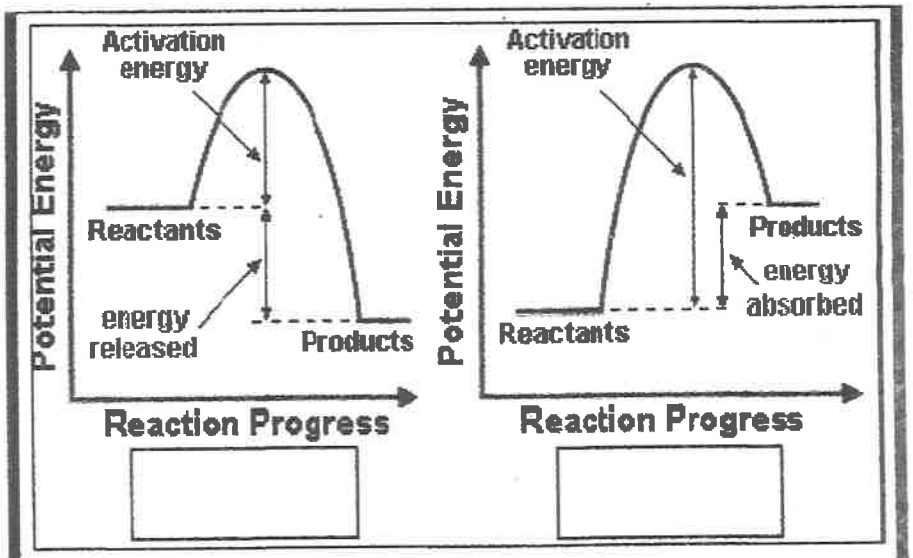
Hess's Law of heat Summation: a law states that if you add two or more thermochemical equations to give you a final equation, _____ _____.

Standard Heats of Formation (ΔH_f^O) of a compound is the _____ _____ that accompanies the formation of one mole of a compound from its elements with all substances in their standard states. For a reaction that occurs at a standard conditions, you can calculate the heat of reaction by using standard heats of formation:

$$\Delta H^O = \Delta H_f^O \text{ (products)} - \Delta H_f^O \text{ (reactants)}.$$

Steps for calculating the the standard heat of reaction:

1. Write the balanced chemical equation, if not already done.
2. Find and add the ΔH_f^O of all of the **reactants** (use chart and mols)
3. Find and add the ΔH_f^O of all of the **products** (use chart and mols)
4. Use Standard Heat of formation formula and subtract the ΔH^O



The diagram above shows two different graphs that portray an exothermic and endothermic reaction. If you look at the graphs can you determine which one exo and endo? Thank about what is happening and the x and y axis.

In Summary: _____
_____
_____
_____
_____

You MUST use this chart as a reference for the standard Heats of Formation:

Standard Heats of Formation ΔH_f^O

Substance	ΔH_f^O (kJ/mol	Substance	ΔH_f^O (kJ/mol	Substance	ΔH_f^O (kJ/mol
$Al_2O_3(s)$	-1676.0	$F_2(g)$	0.0	NO(g)	90.37
Br_2 (g)	30.91	Fe(s)	0.0	$NO_2(g)$	33.85
Br_2 (l)	0.0	$Fe_2O_3(s)$	-822.1	NaCl(s)	-411.12
C (s, diamond)	1.9	$H_2(g)$	0.0	$O_2(g)$	0.0
C(s, graphite)	0.0	$H_2O(g)$	-241.8	$O_3(g)$	142.0
$CH_4(g)$	-74.86	$H_2O(l)$	-285.8	P(s, white)	0.0
CO(g)	-110.5	$H_2O_2(l)$	-187.8	P(s, red)	-18.4
$CO_2(g)$	-393.5	$I_2(g)$	62.4	S(s, rhombic)	0.0
$CaCO_3(s)$	-1207.0	$I_2(s)$	0.0	S(s, mono)	0.30
CaO(s)	-635.1	$N_2(g)$	0.0	$SO_2(g)$	-296.8
$Cl_2(g)$	0.0	$NH_3(g)$	-46.19	$SO_3(g)$	-395.7

Practice Problems:

1. When 435J of heat is added to 3.4g of olive oil at 21 ^{o}C, the temperature increases to 85 ^{o}C. What is the specific heat of the olive oil?

2. How much heat is required to raise the temperature of 250.0g of mercury 52 ^{o}C? (the specific heat of Hg is 0.14J/g·^{o}C)

3. A chunk of silver has a heat capacity of 42.8J/ ^{o}C and a mass of 181g. Calculate the specific heat of silver.

4. Using calories, calculate how much heat 32.0g of water absorbs when it is heated from 25.0 ^{o}C to 80.0 ^{o}C?

5. A 1.55g piece of stainless steel absorbs 141J of heat when its Temperature increases by 178 ^{o}C. Determine the specific heat of the stainless steel.

Types of Energy and Specific Heat:

Thermochemistry is the study of _____

_____.

Every substance has energy. We need to be able to understand energy and all of its different forms:

- Kinetic Energy: _____
- Potential Energy: _____
- Chemical Energy: _____
- Thermal Energy: _____

Heat capacity: _____

_____.

The heat capacity of an object depends on both the _____ and its chemical _____. The greater the mass of the object the greater its heat capacity.

Specific Heat (or specific heat capacity): of a substance is the _____ _____ it takes to raise the _____ of 1g of the substance 1°C. To calculate the specific heat (C) of a substance, you can use this formula:

$$C = \frac{q}{(m \times \Delta T)}$$

q= heat (J or cal)
m= mass (g)

C= Specific heat
ΔT = Change in temperature (^{o}C)
→ $\Delta T = T_f - T_i$

In summary: _____

_____

_____

_____

Example Problem: The temperature of a 95.4g piece of copper increases from 25.0°C to 48.0°C when the copper absorbs 849J of heat. What is the specific heat of copper?

48 - 25 = (23°C) = ΔT
F - I

$$C = \frac{849\,J}{(95.4\,g)(23^{\circ}C)} = 0.32\,J/g\text{-}C$$