Chemistry Day 66

Monday, April 20th, 2020

Do-Now: "**Thermochemistry CN B**"

1. Write down today's FLT: I will be able to calculate enthalpy changes associated with chemical reactions using heats of reaction by completing Ch. 10 CN Part B
2. Distinguish between exothermic and endothermic processes.
3. What is the specific heat of liquid water? List both values.
4. How much heat must be added to 1450 g of liquid water to raise the temperature from 5.5°C to 29.0°C? Show all work and steps.

Have a calculator and periodic table handy

Planner:

- Email Notes and WS
- Guided lab packet next lesson

Table of Contents #2:

21. Ch 10 CN Part B
22. Thermochemistry WS B

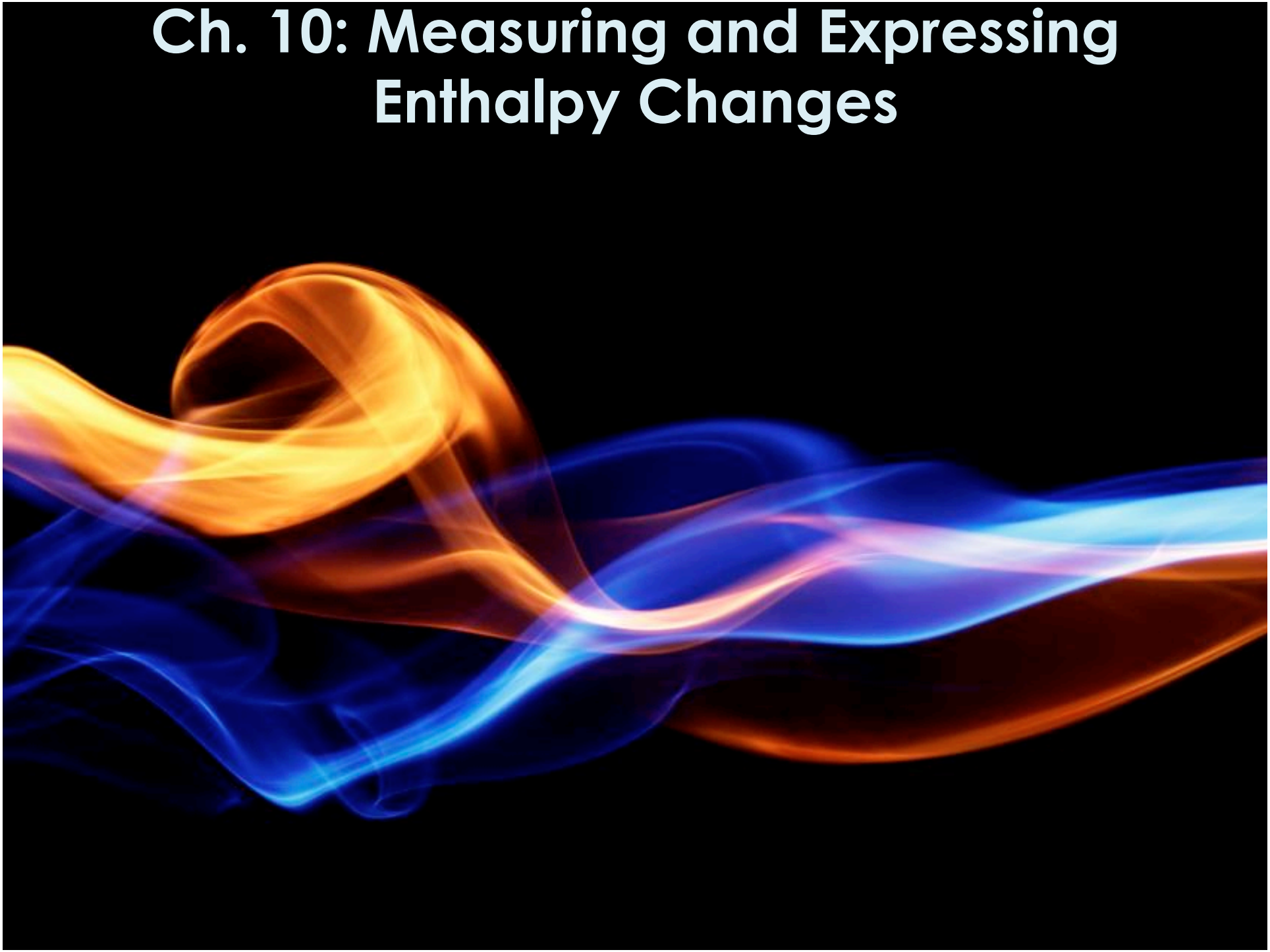
FLT

- I will be able to calculate enthalpy changes associated with chemical reactions using heats of reaction by completing Ch. 10 CN Part B

Standard

HS-PS3-1: Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known

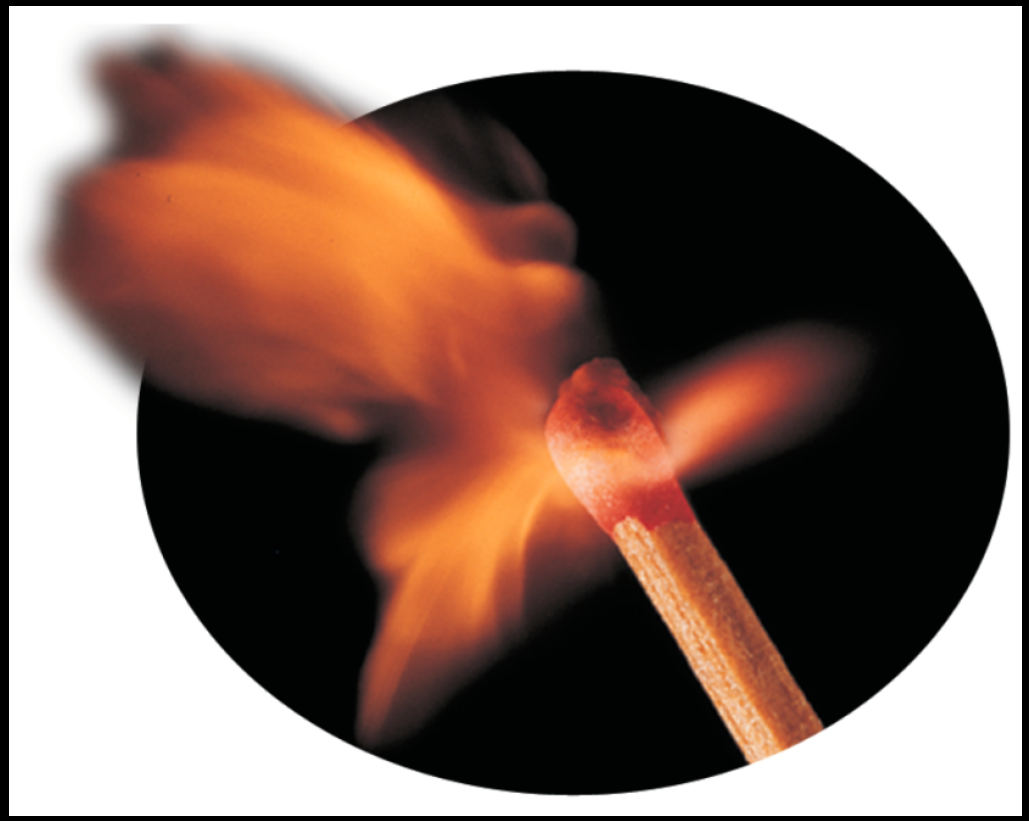
Ch. 10: Measuring and Expressing Enthalpy Changes



Introduction

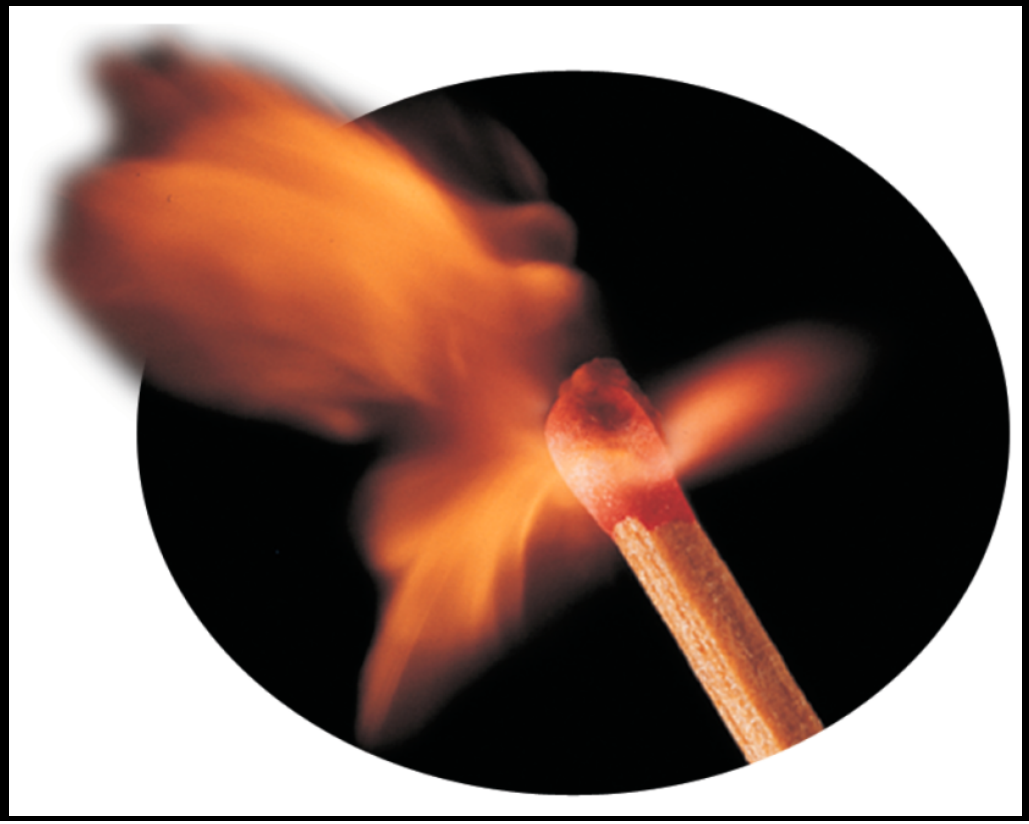
Intro

- A burning match releases heat to its surroundings in all directions.
- Is this exothermic or endothermic?



Intro

- Can we determine the *amount* of heat given off?



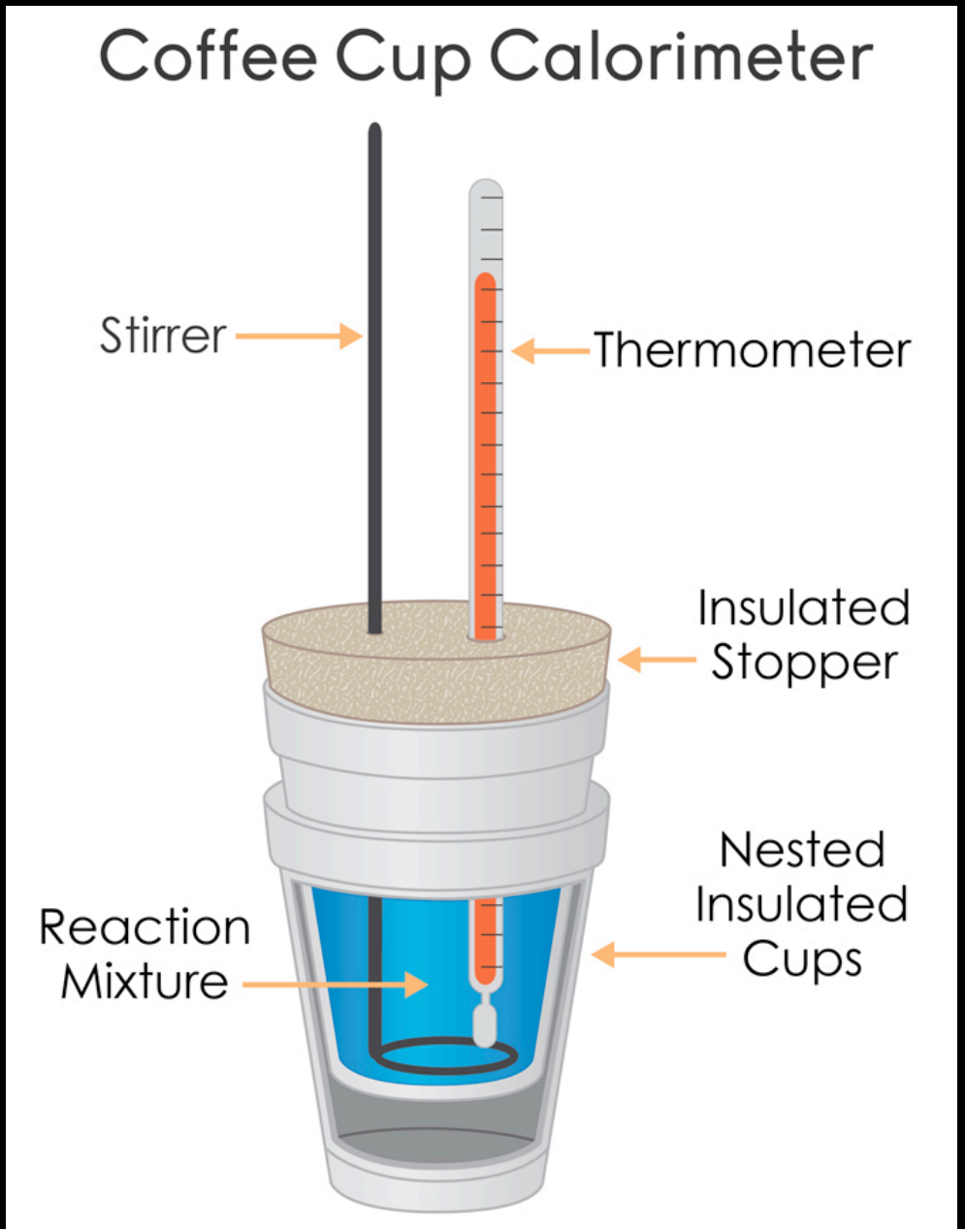
Calorimetry

Calorimetry

- **Calorimetry = process of measuring heat into or out of a system during a rxn/change**
  - Based on the fact that the heat released = the heat absorbed

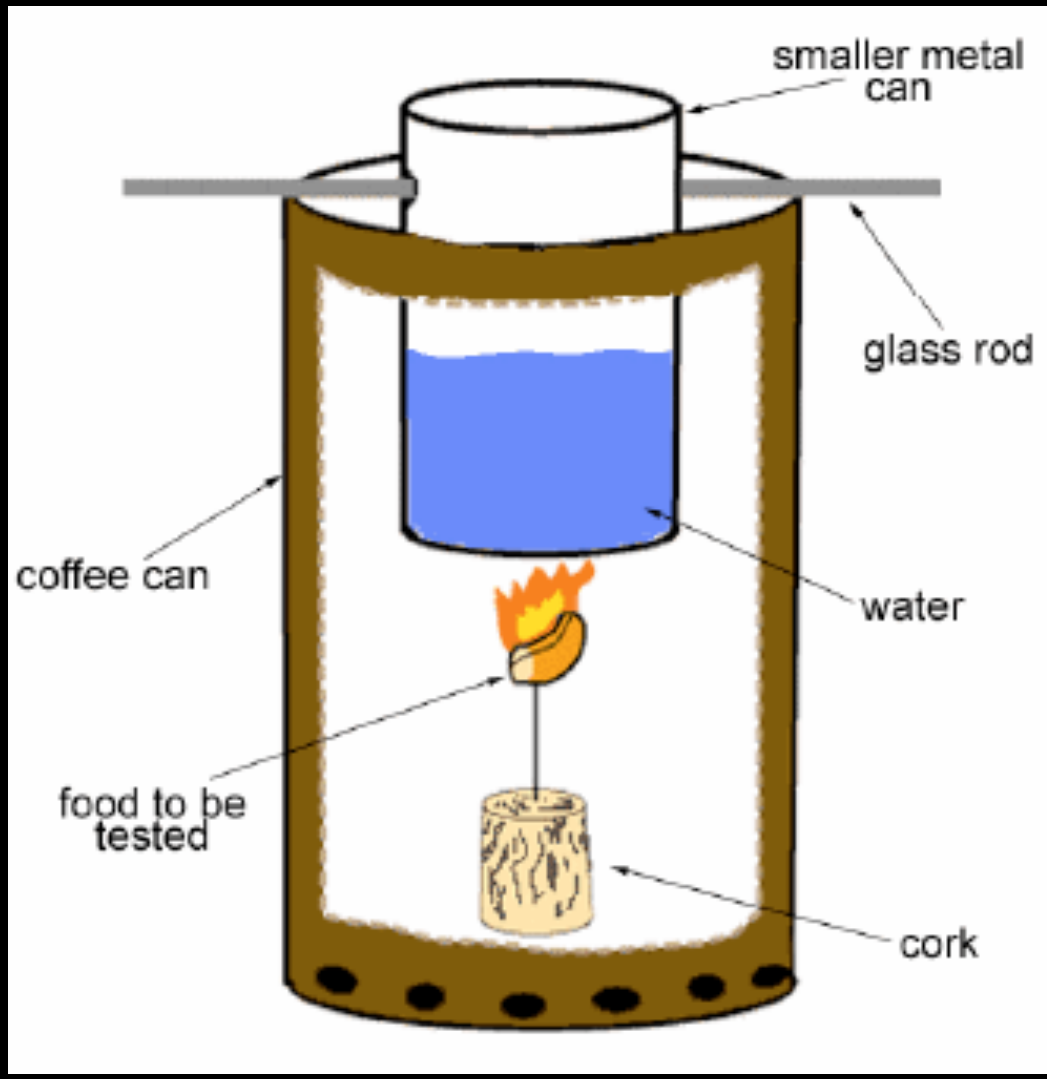
Calorimetry

- Calorimeters = used to measure the absorption or release of heat
  - Ex/ Foam Cups



Calorimetry

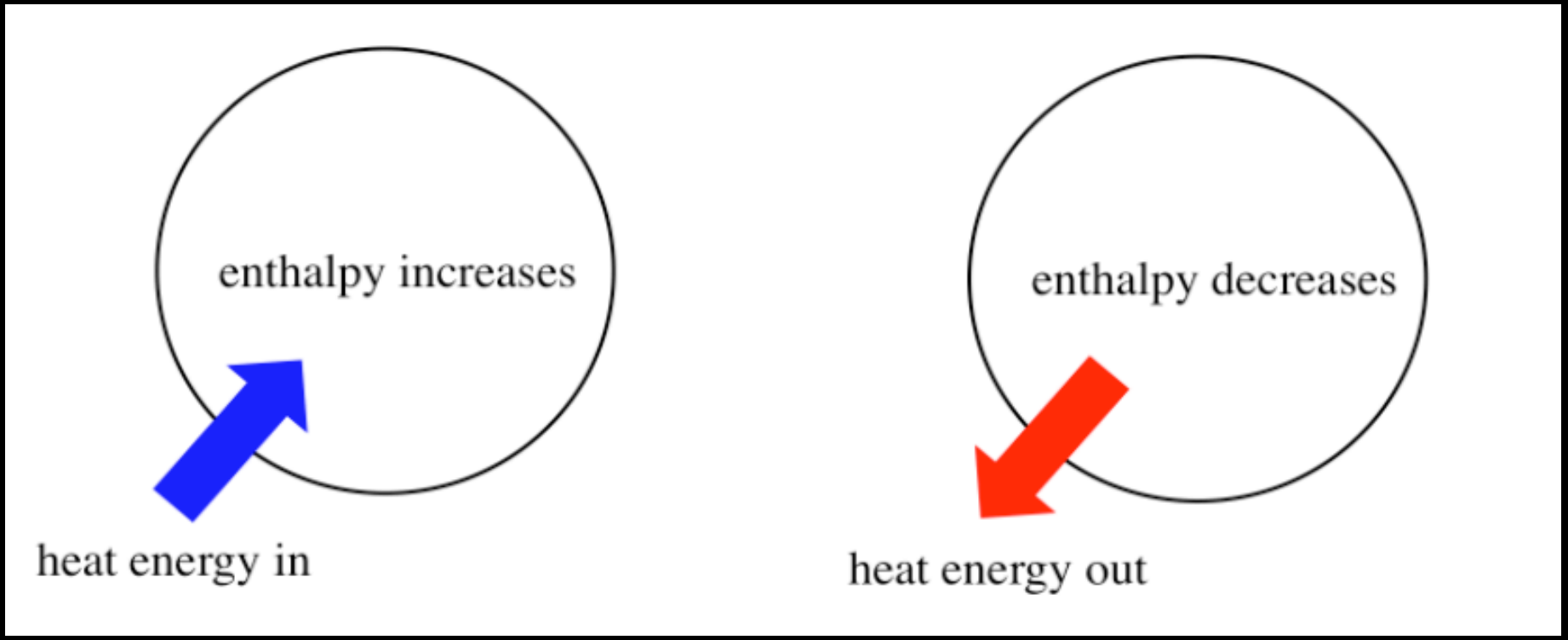
- Calorimeters are used to measure the absorption or release of heat
  - Ex/ Soda Cans



Enthalpy

Enthalpy

- Enthalpy (H) = equivalent to the total heat content of a system



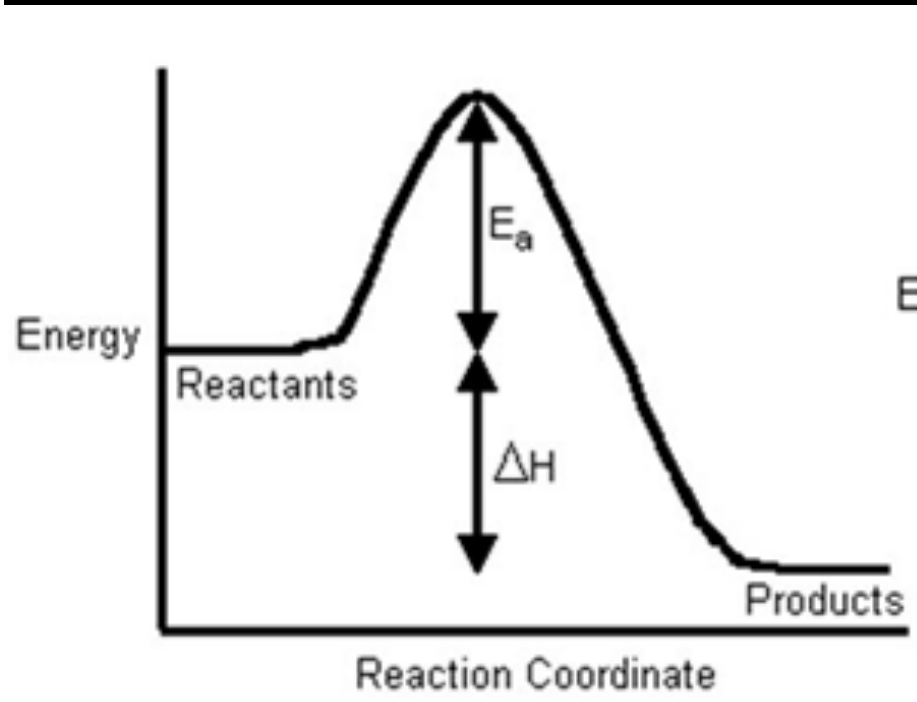
Enthalpy

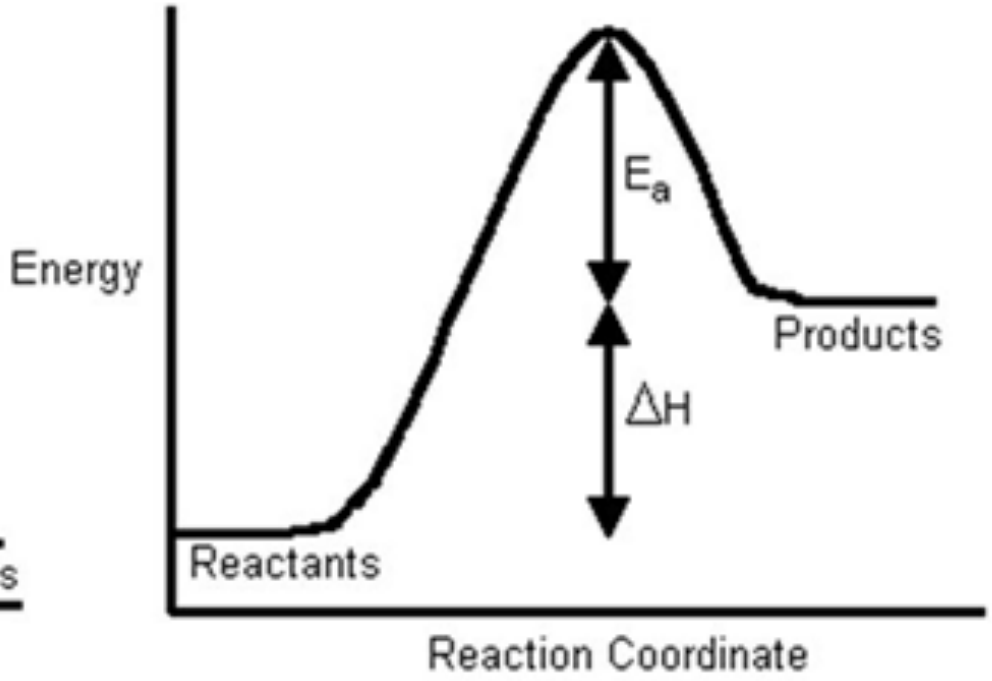
- **Change in enthalpy (ΔH) = amount of heat energy absorbed or released in a rxn**
- Can be calculated – several different formulas/ methods!

$$\Delta H^\circ = \sum \Delta H_f^\circ \text{ products} - \sum \Delta H_f^\circ \text{ reactants}$$

Enthalpy

- **Endo = + ΔH**
- **Exo = - ΔH**





Enthalpy

- **In a calorimetry experiment:**

$\Delta H = - q$ = if heat is being released

$\Delta H = + q$ = if heat is being absorbed

Note: enthalpy and heat <u>are different</u> measurements. However, under certain conditions they are equivalent.

Ex/1

- 50.0 mL of a water solution at 25.0 ^{o}C is heated in a calorimeter to 32.0 ^{o}C. Calculate the heat of this reaction if the density of the water solution is 1.00 g/mL. If heat is released, what can you say about the change in enthalpy?

Ex/1

- 50.0 mL of a water solution at 25.0 ^{o}C is heated in a calorimeter to 32.0 ^{o}C. Calculate the heat of this reaction if the density of the water solution is 1.00 g/mL. If heat is released, what can you say about the change in enthalpy?

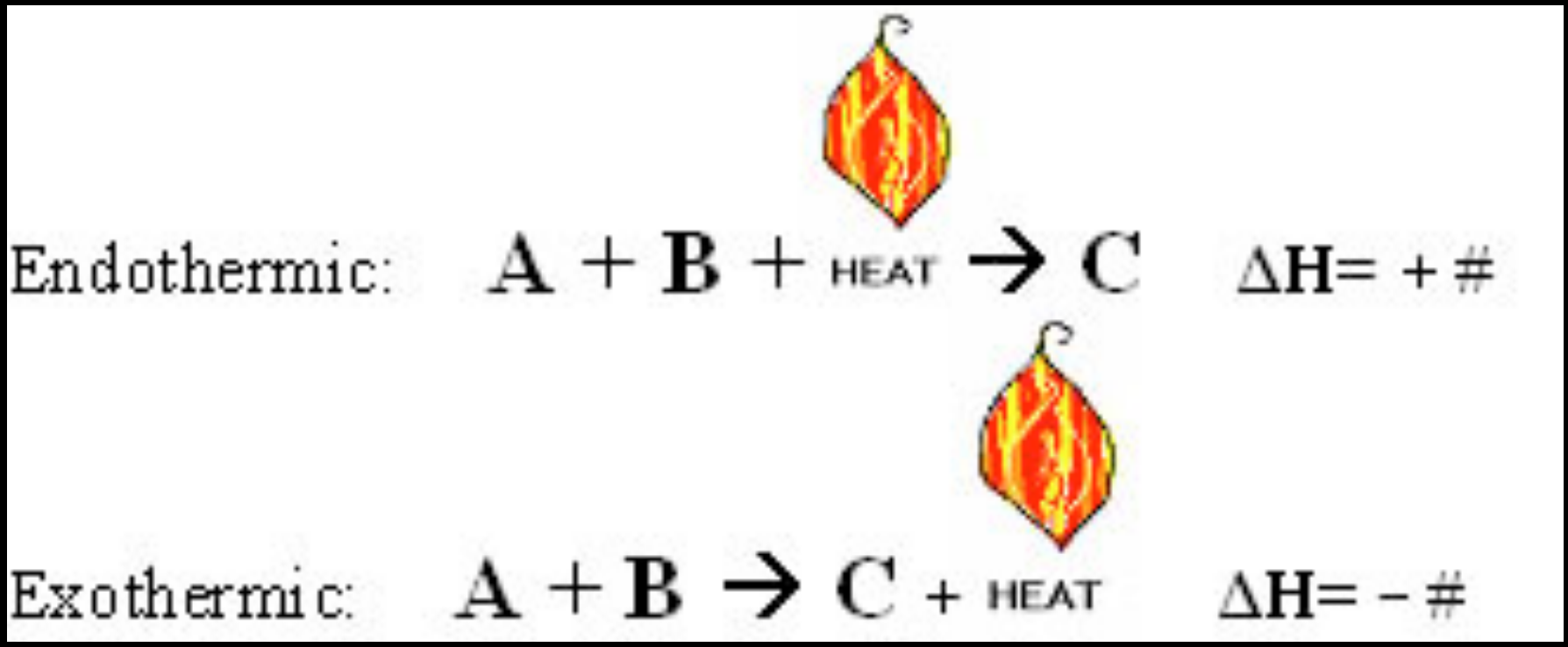
Ex/2

- When 100.0 mL of a water solution is heated from 22.50 ^{o}C to 26.00 ^{o}C, heat is released. Calculate the heat associated with this reaction.

Thermochemical Eqs

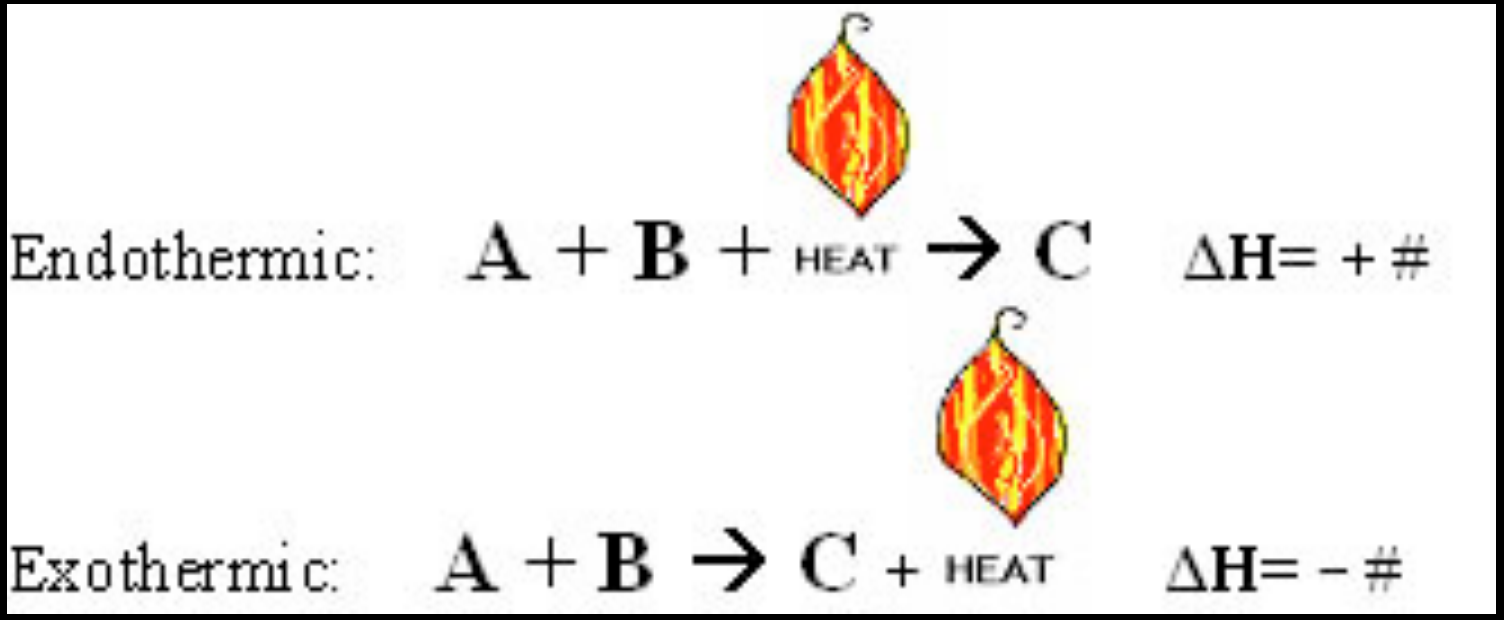
Thermochemical Eqs

- How can you express the enthalpy change for a reaction in a chemical equation?



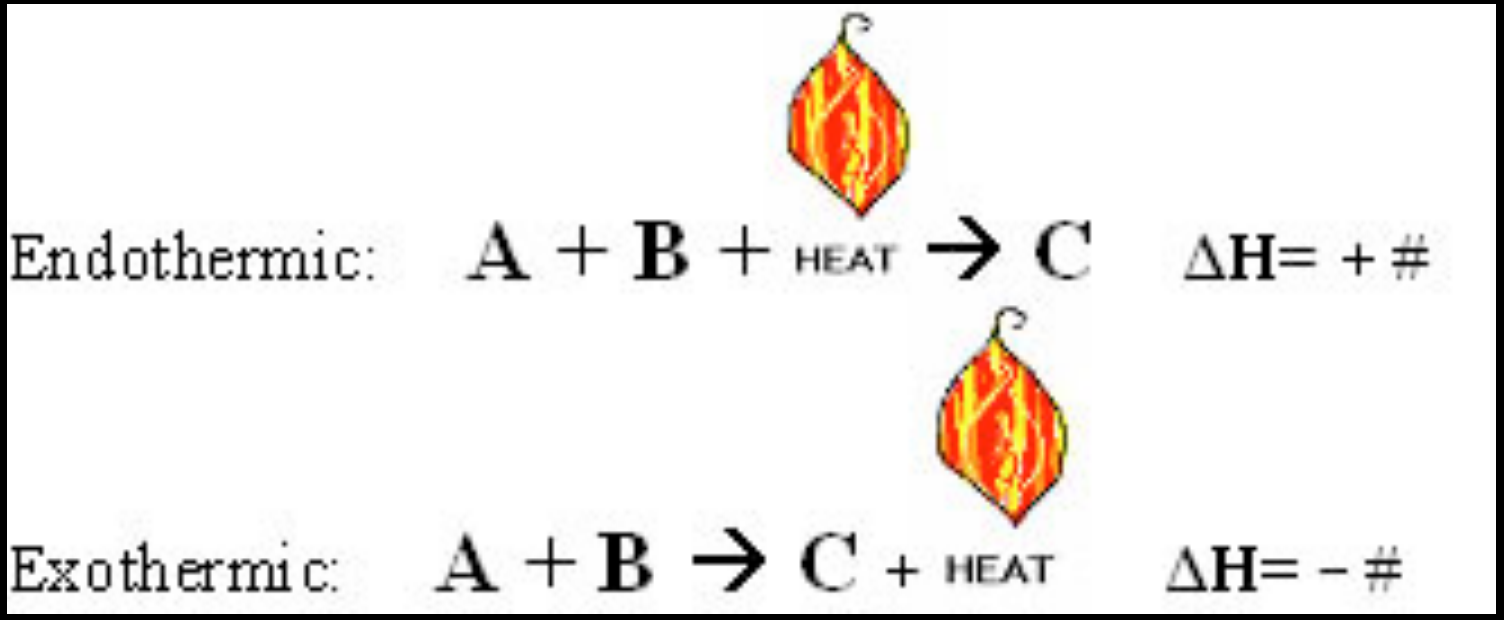
Thermochemical Eqs

- In thermochemical equations, the enthalpy change can be written as a reactant or a product
  - **Endo: ΔH is a reactant (absorbed)**
  - **Exo: ΔH is a product (released)**



Thermochemical Eqs

- In thermochemical equations, the enthalpy change can be written as a reactant or a product
  - ***Do not put negative signs when heat is IN the equation!***



Ex/3

- Write as a thermochemical equation:

$CaO + H_2O \rightarrow Ca(OH)_2$ where $\Delta H = -65.2$ kJ

Ex/ 4

- Write as a thermochemical equation:

$2NaHCO_3 \rightarrow Na_2CO_3 + H_2O + CO_2$ where $\Delta H = +129$ kJ

Ex/ 5

- When 2 mol of solid magnesium combined with 1 mole of oxygen gas, 2 moles of solid magnesium oxide is formed and 1205 kJ of heat is released. Write the thermochemical equation for this combustion reaction.

Ex/ 6

- When 4 mol of iron metal combines with 3 moles of oxygen gas, 2 moles of solid iron (III) oxide is formed and 1625 kJ of heat is released. Write the thermochemical equation for this combustion reaction.

Using Heat of Rxn

Thermochemical Eqs

- We can use balanced thermochemical equations to calculate enthalpy change
- We can convert between **<u>MOLES and KJ using our coefficients</u>**

$$4Fe + 3O_2 \rightarrow 2Fe_2O_3 + 1625kJ$$

Ex/ 7

- Given

$2NaHCO_3 + 129\ kJ \rightarrow Na_2CO_3 + H_2O + CO_2$

calculate the amount of heat (in kJ) required to decompose 2.24 mol of $NaHCO_3$.

Ex/ 8

$C + 2S + 89.3\ kJ \rightarrow CS_2$

Calculate the amount of heat (in kJ) absorbed when 5.66 g of carbon disulfide is formed. (hint: be sure to write out your set-up)

HW

- **Thermochem WS B**
  - **USE TEXTBOOK!**
- **Wednesday Zoom – use for lab help**