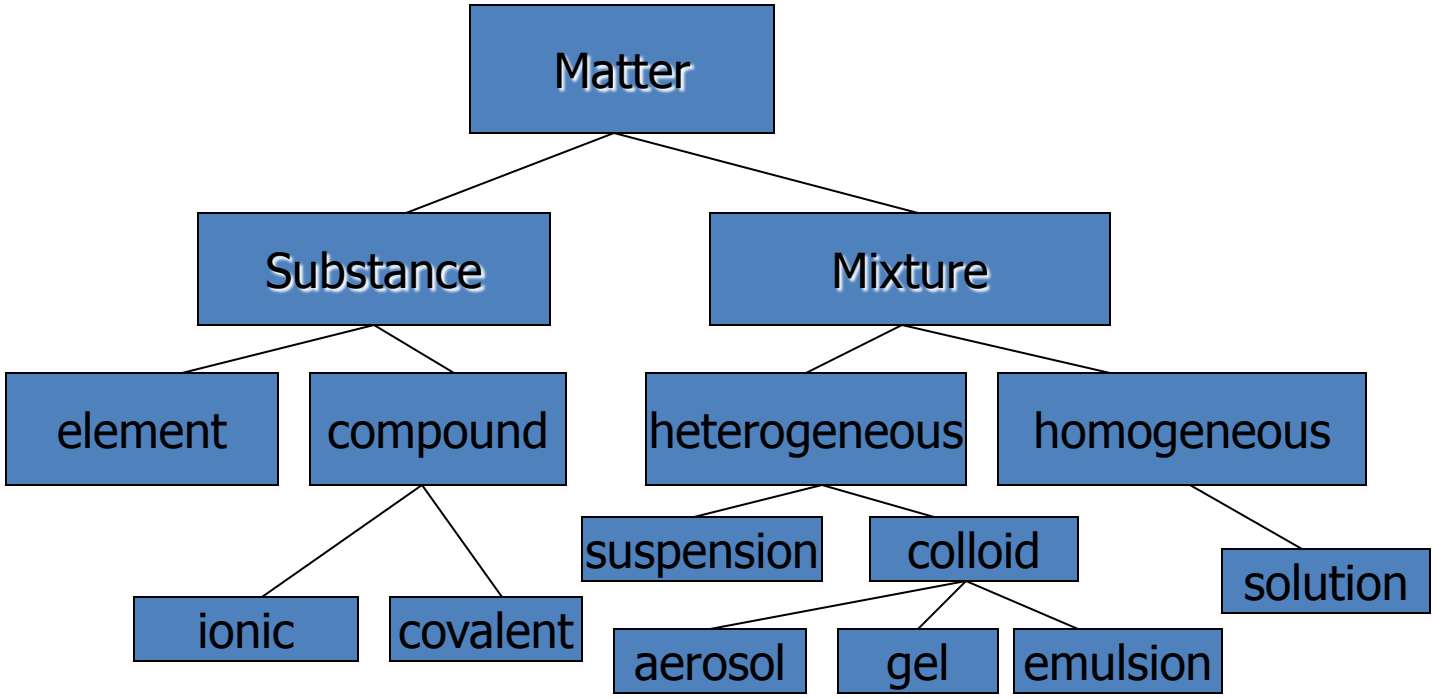
Matter

- **Has mass and takes space**

Types of matter

- Substances
- Mixtures



What are the two main groups that make up all matter?*

Mixtures

- **contain more than one type of material**

Heterogeneous material

- **Material that is composed of more than one phase**
  - **A phase is a region of uniform properties**
- **Different phases in a heterogeneous are separated by definite boundaries called interfaces**

Homogenous materials –

- material that consist of only one phase
  - If you break homogenous materials down each piece will have the same properties
  - Interfaces don't exist in homogenous, because they are attracted toward other part of mixture
  - Solution is a homogeneous material consisting of two parts
    - Solute - dissolved material
    - Solvent - dissolving material

Pure Substance –

- matter that is held together by chemical bonds or elements
- Elements
  - Contain only one type of atom
  - Compound two or more elements held together by electrical chemical bonds

Physical Properties

- **Extensive properties - depend on the amount of matter present**
  - **mass, length, volume, etc. . .**
- **Intensive properties - do not depend on the amount of matter present**
  - **Density, malleability, ductility, conductivity, melting, freezing, boiling, and color**
- **Physical change - in a physical change the same substance is there before and after**
  - **examples: melting, boiling, cutting, solubility**

Chemical properties -

- **how substances respond in the presents of other substances**
  - **Chemical change is the change that takes place after a substance reacts with another substance.**
    - **Examples burning, digestion, fermenting, rusting**

Energy transfer

- **Physical and chemical changes are all accompanied by energy changes.**
- **Energy transferred due to temperature difference is called heat (q)**

THERMODYNAMICS

THE HEAT ENERGY OF A REACTION

What is the difference between heat and temperature?

Temperature is the measure of heat.

Heat is the energy caused by kinetic molecular motion.

HEAT OF A REACTION

- SYMBOL= ΔH
- + ENERGY IS ENDOTHERMIC
- - ENERGY IS EXOTHERMIC
- ex. ENDO…..A COLD PACK
- ex. EXO. …A MATCH

SYMBOLS

- **Q = quantity of heat**
- **WHEN Q< 0,then the reaction is exothermic.**
- **WHEN Q > 0,then the reaction is endothermic.**

TERMS TO KNOW:

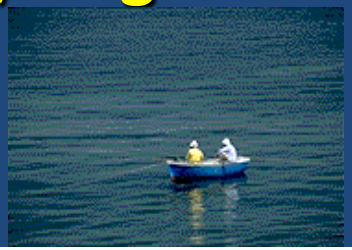
- **Specific heat-**
- **Joule-**
- **Heat of fusion-**
- **Heat of vaporization-**

Constants

- Specific heat of water= 4.18J/g^{o}C
- Heat of fusion of water= 340. Joules/gram
- Heat of vaporization= 2260 Joules/gram

Calculating the heat of a system

- **$Q = mC_p\Delta T$**
- **Q= quantity of heat in a reaction / joules**
- **m=mass of the substance/ grams**
- **Cp= specific heat/ Joules/gram-degree Celsius**
- **ΔT = change in temperature/ degrees Celsius**



PRACTICE

- **How much heat is gained when 56.0 grams of water at 33.0°C rises to 83.0°C?? Round off!!**

Yet more:

- **How much heat is lost when 15.0 grams of water at 65.0°C cools to 15.0°C?**

Using a different variable

- **The quantity of heat gained by water when it rises from 12.0°C to 86.0°C is 12,000 Joules. Find the mass of the water.**

Yet another variable:

- **$Q = mCp\ (T_f - T_i)$**
- **Do the algebra**
- **What is final temperature of a system when 35.0 grams of water at 12.0^0C uses 1150 Joules to raise its temperature?**

Work this problem:

- **125 grams of water loses -21,200 Joules heat and falls to 15.0°C. Find its initial temperature.**

Review:

- **How much heat is gained when**

  68.3 grams of water rises from 15.0^0C to 89.0^0C?

- **Find the initial temperature of 14.8 grams water if –565 joules of energy are lost and the final temperature is 22.0^0C.**

Solution,Equations,and Constants For Phase Change Problems

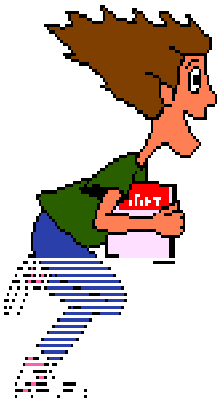
- **Constants:**
- **H_f = 340. Joules/gram**
- **H_v = 2260 Joules/gram**
- **0.00^oC, 273 K =freezing/melting point of water**
- **100.^oC, 373K = boiling point of water**
- **Specific heat of ice/steam = 2.10 J/g^0C**
- **Equations:**
- **$Q = mC_p\Delta T$ for a temperature change**

  $Q = mH_f$ for a phase change or

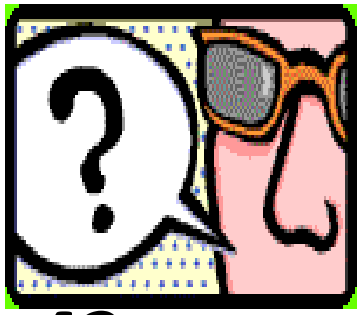
  $Q = mH_v$ for a phase change

ANOTHER TYPE OF PROBLEM

- **How much heat is gained when 35.0 grams of ice at –55.0°C changes to steam at 145°C?**
- **This is a phase change problem and must be done in steps.**



Yet another one!!



- **How much energy is needed to raise 42 grams of ice at –5.00°C to water at 85.0°C??**
- **FP = 0.00°C**
- **Hf = 340. j/g**
- **S.H. = 2.10J/g°C for ice**

Another example

- **How much heat is lost when 78.0 grams of steam at 150.^{o}C cools and solidifies to ice at 0.0^{o}C?**
- **List the steps that occur.**
- **H_v = 2260 J/g**
- **Boiling point/condensing point = 100.0^{o}C**
- **Specific heat of steam and ice = 2.10 J/g^{o}C**

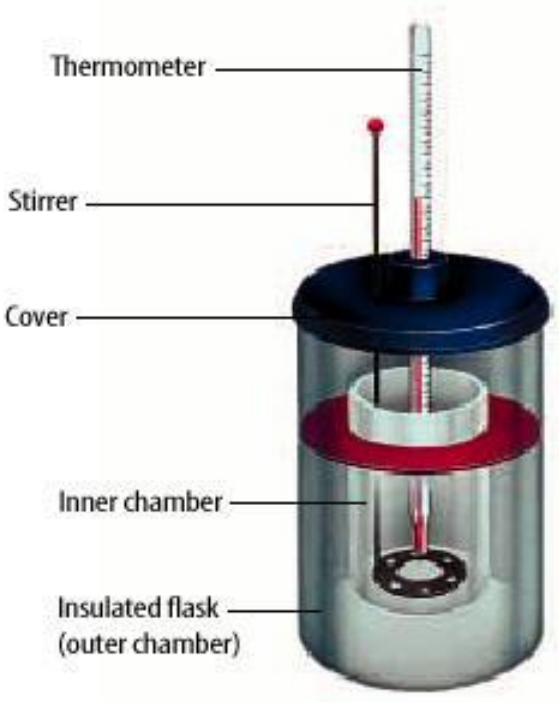
Solution

A non-water problem

- **What is the total heat needed to take**
- **55.0 grams of solid iron at 22.0°C to molten iron at 1600.°C.**
- **Melting point = 1535°C**
- **Specific heat – all phases =.448J/g°C**
- **Heat of fusion =266 J/g**

Calorimeter

- Purpose to measure heat change
  - Uses water and calculates heat change because heat gained is equal to heat lost.



More:

- **Suppose a piece of iron with a mass of 21.5 grams at a temperature of 100.0^0C is dropped into an insulated container of water. The mass of water is 132 grams and its temperature before adding the the iron is 20.0^0C. What will be the final temperature of the system?**
  - **Solving process:**
    - **We know that heat lost must equal the heat gained. Since iron is at a higher temperature the the water, the iron will lose energy. The water will gain an equivalent amount of energy.**
- **Specific heat of iron is 0.448 J/g^{o}C**

Solution

- **Heat gained is equal to heat lost**
- **$Q_1 = -Q_2$**
- **$(m_1)(Cp_1)(\Delta T_1) = -(m_2)(Cp_2)(\Delta T_2)$**
- **Use algebra and solve for temperature final**