

I. Energy and Heat

A. Definitions:

1. Temperature
2. Heat:
 - a. (temperatures temperatures)
3. System:
4. Surroundings:
5. Measuring energy:
 - a. Units: or
 - b. $1 \text{ cal} = 4.184 \text{ J}$
 - c. is a difference in energy
- 6.
- 7.

II. Specific Heat

A. Specific Heat (c or C_p):

Units: (Water:)

1. Good heat conductors have
2. Equation to determine heat transfer: or
 - a.
 - b.
 - c.
 - i.
3. Example: How much heat (in kJ) is needed to warm 250.0 mL of water from 25.0°C to 95.0°C. (1g water=1mL water)
4. Example: 2010 calories of heat is added to 50.0g of water. If the temperature of the water was initially 25.0°C, what is the final temperature?

B. Measuring Heat Transfer

1. insulated container caused by another object.
2. Heat of the reaction is
3. Thus, you can measure the heat of a reaction by
- 4.
5. Example: A calorimeter contains 100.00 g of water at 22.4°C. A 75.25 g sample of Al at 99.3°C is placed in a calorimeter. The substances reach a final temp of 32.9°C. Find the specific heat of Al.

III. Phase Changes

A. Phase Change

1. Energy is used to

involved.

- 2.
- 3.
- 4.
- 5.

B.

1.

from the surface of the liquid and

a.

2.

a. Molecules of vapor become liquid by

b. Liquid molecules that

c. In a closed container, the

will eventually become

3.

a.

b.

as

(more gas particles present).

4. Boiling Point:

a.

C.

1. Freezing point:

2. Melting point is the

3. Not affected by external pressure.

4. FYI:

D.

1. Sublimation:

a. Examples:

b. In this case,

2. Deposition:

a. Ex:

IV. Energy changes during a change of state

A. During a change in state, the

B. You can calculate it using the following equations:

1. Between the solid and liquid phases, use:

a. ()

b. (= 334 J/g or 80.0 cal/g)

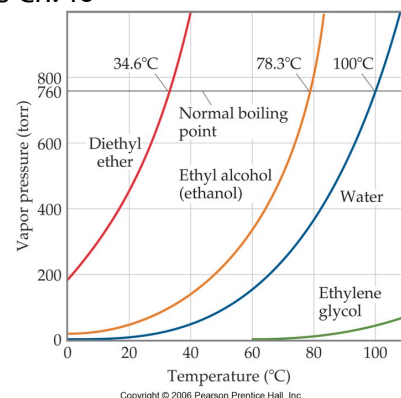
c. Since freezing is for freezing.

2. Between the liquid and gas phases, use:

a. ()

b. (= 2260 J/g or 540. cal/g)

c. Since condensing is for condensing.



V. Ways to Show Phase Changes

A. Every substance has different:

- 1.
- 2.
- 3.

B. Graphs are used to show phase changes

C.

1. Plots (y-axis) v. (x-axis)
2. You can label the phases and phase changes based on the slopes!

a. (for heating).

i.

b. (for heating).

i.

c. For cooling, it's the opposite!

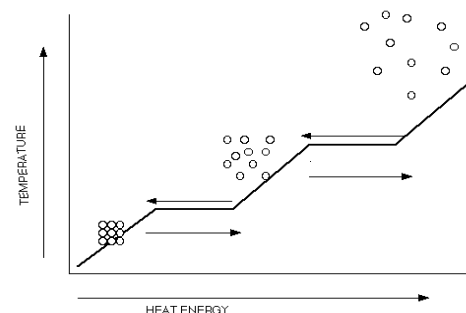
D. PUTTING IT ALL TOGETHER!!!

1. If the temperature change includes a phase change, include energy of the phase change in the calculation

- a. Find the steps that you need to take (how many times does the slope change?)
- b. Calculate q for EACH step!
- c. Add them together!

2. Example: How much energy is required to change 30.0 g of water vapor at 109°C to water at 28.0°C?
How many steps are there? ($c_{\text{steam}}=2.01\text{J/g}^\circ\text{C}$ and $c_{\text{ice}}=2.03\text{J/g}^\circ\text{C}$)

PHASE CHANGE DIAGRAM



VI. Thermochemistry

ΔH depends on the initial and final enthalpy.

A. Thermochemistry: the study of

B.

1. Exothermic reactions:
 - a. NOTE:
2. Endothermic reactions:

C.

D.

1.
 - a.
 - b. Spontaneous when

E.

1. Uses enthalpy and entropy to do so.
- 2.
- 3.

Table: