Chapter 7

Demo
Atmosphere Bar

Gases, Liquids, and Solids

Pressure Atm 760 ~~.18~~ mmHg
760.~~18~~ torr
14.7 psi
101,325 PA

Kinetic Molecular Theory

Gas Laws

$R = 0.0821 \frac{L\,atm}{mol\,K}$

STP 0°C (273 K), 1 atm

Pressure units

~~BSt~~

Development of $PV = nRT$

Combined gas Law $\frac{P_1 V_1}{T_1 n_1} = \frac{P_2 V_2}{T_2 n_2}$

Molar Volume @ STP

Daltons Law of Partial Pressure

Intermolecular Forces

London Dispersion Forces

Dipole-Dipole

Hydrogen Bonding

Boiling Point and Melting Point
— & Vapor pressure

Liquid State

Vapor Pressure — evaporation

Viscosity and Surface Tension

The Solid State

Specific Heat

The amount of energy required to increase the temperature of 1g of material by 1°C

$C = \frac{cal}{g \cdot °C}$ $4.186\,J = 1\,cal$

$H_2O_{(g)}$ 2.080 J/gK = 0.4969 cal/g°C

$H_2O_{(l)}$ 4.1813 J/gK = 1.01 cal/g°C

$H_2O_{(s)}$ 2.05 J/gK = 0.4897 cal/g°C

$Air_{(g)}$ 1.012 J/gK = 0.2419 cal/g°C

$Ar_{(g)}$ 0.5203 J/gK = 0.1243 cal/g°C

$Cu_{(s)}$ 0.385 J/gK = 0.09197 cal/g°C

Polyethylene 2.9308 J/gK = 0.6285 cal/g°C

To change the temperature of a cup of tea from 25°C to 100°C would require how much energy if the cup contained 300. mL?

$300\,mL \times \frac{1\,g}{1\,mL} \times 1.01\,\frac{cal}{g\,°C} \times 75\,°C = \boxed{22,725\,cal}$

Phase Change

Gas → Liquid

Solid → Liquid

$H_2O_{(l)} \rightarrow H_2O_{(g)}$ requires energy to overwhelm the intermolecular attractive forces

Liquid → gas H_v Heat of Vaporization

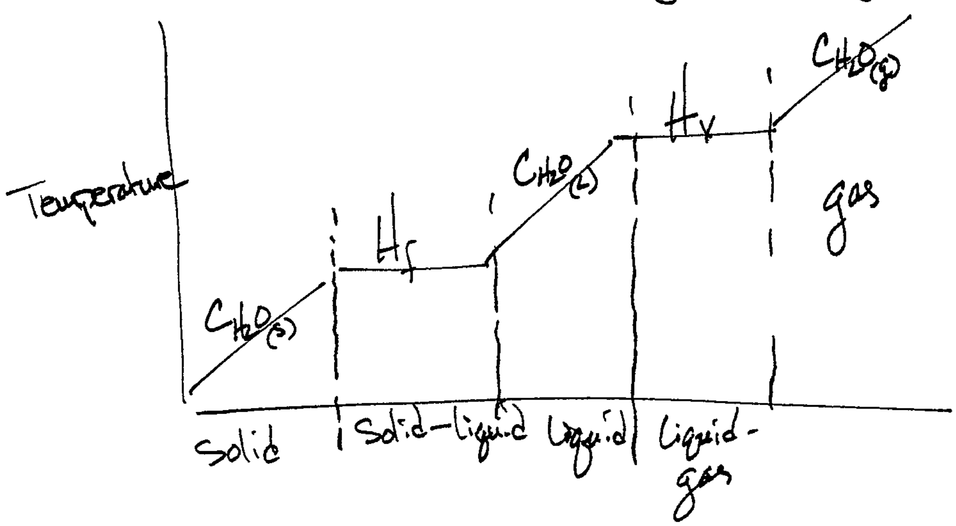
H_2O H_v = 540 cal/g° ← Note No temperature change

This is the energy required to overcome the attractive forces. There is no change in temperature while work is being done to pull the molecules away from each other.

Same is true for Melting Solid → Liquid

H_2O H_f = Heat of fusion = 79.7 cal/g ← Note No Temperature change

Phase Change Diagram



Energy = $\Delta T \times g \times C$ + Phase Change

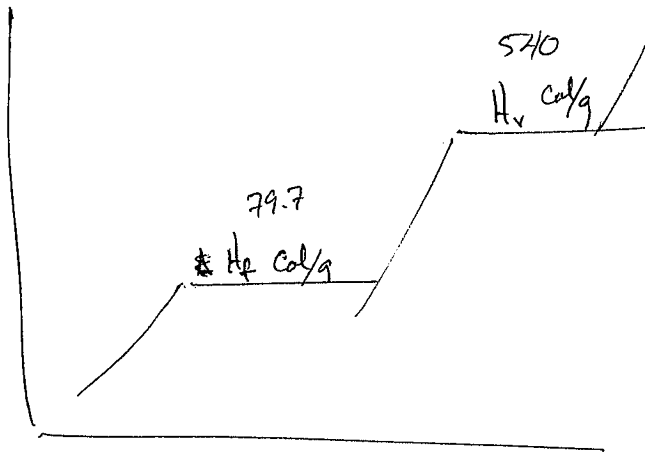
Energy and Phase Changes

Specific Heat H_2O ~~1 cal~~ 1 $\frac{cal}{g\,°C}$

Solid $\rightleftharpoons$ Liquid

Liquid $\rightleftharpoons$ Gas

Solid $\rightleftharpoons$ Gas



Homework

45, 47, 51, (52), 59, 63, 69, 73, 75, (78), 79,

81, 87, 89, 93, (98), 109, 111, 117, 121, 127

① How many moles of gas are in a breath

0.45 L

747 mmHg

37°C

② If a cylinder contains 10.0 g CO_2 10.0 L @ 325 K

P = ?

③ What is the ~~temp~~ temp of a cylinder w/ volume 2 L

4.02 moles & Pressure of 2.6 atm

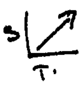
④

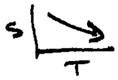
Chapter 8

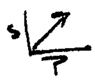
Solutions

Homogeneous uniform composition
Heterogeneous
Solution Homogeneous
Colloid Homogeneous w/ large particles
Solubility - General Like dissolves Like

Solubility Ionic Compounds
General Rules pg 234
Double Displacement Rules ← ~~Not in book~~

Solubility Effects
Temperature 

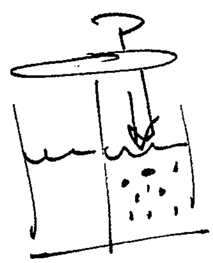
gas 

Pressure gas 

Concentration
w/v % g solute / mL solution × 100
v/v % mL solute / mL solution × 100
PPM g solute / g solution × 10^6 or mL solute / mL solution × 10^6
Molarity mols solute / L solution

Dilution $C_1V_1 = C_2V_2$
Colligative Properties ← Depend on [ ] but not identity of solute
Boiling Point Elevation 0.51°C/mole kg
Freezing Point Depression -1.86°C/mole kg

Osmosis
Dialysis
Osmotic Pressure

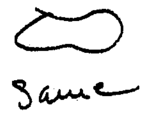


Homework

35, 39, 41, (46), 47, 49, 55, (56), 61, 63, 65,
67, (70), 73, 75, 77, 81, 83, 86, 89, 91,
101, 107, 117, (118), 119

Osmotic Pressure

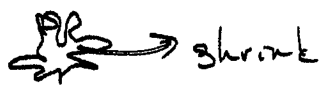
Isotonic ⟹ Same osmotic pressure or same <u>OsM</u>



OsM = Osmolarity = moles particles / L solution

hypotonic = lower

hypertonic = higher



0.92% NaCl w/v%

0.15 <u>M</u> NaCl

~~0.5~~ 5.0% (w/v) glucose

Chapter 9

Acids and Bases

Arrhenius

Bronsted-Lowry

Proton Transfer

Acid / Base Strength

Strong

Weak

Conjugates

using strength to predict direction of Equilibrium

Equilibrium & Dissociation Constant

$$K = \frac{[H_3O^+][A:^-]}{[HA][H_2O]}$$

$$K_a = K[H_2O] = \frac{[H_3O^+][A:^-]}{[HA]}$$

$K_a \uparrow$ Strong Acid

$\nearrow K_a$

H_2SO_4	1×10^9
HCl	1×10^7
HNO_3	$1 \times 10^{1.3} = 2 \times 10^1$
$HC_2H_3O_2$	1.8×10^{-5}
H_2CO_3	4.3×10^{-7}
H_2O	2×10^{-16}

Auto dissociation of H_2O

K_w

pH

Neutralization Reactions

Chemical

Ionic

Net ionic

pH

Lemon juice	2.3
Tomatoe juice	4.0
milk	6.5
ammonia	11
Bleach	12

Reactions w/ Carbonate base

Acidity/Basicity of Salt Solutions

Titration

Buffers

Calculating pH of buffer

Homework

41, 43, 45, 47, (50), 51, 53, 55, 59, 61,
65, 67, 71, (74), 75, 77, 81, 83, 87, 91,
93, 95, 97, 99, (100), 107, 109, (112), 119, (124)

Chapter 10

Nuclear Chemistry

Isotopes
Types of Radiation
Effects of Radioactivity
Nuclear Reactions
α
β
γ
Positron
Half life
- RadioCarbon dating -
Measuring radioactivity
Medical Use
Nuclear Fision/Fusion

Homework

23, 25, 29, 33, 35, 37, 39, 41, 43, 49, 73, 75