PSC2121 Exam IV Review

Chemical Formula and Equations \( \text{H}_2\text{O}_2 \)

Molecular/Formula Mass (amu) - each element + total

% Composition

Gram Atomic/Molecular/Formula Mass

mass in gm \( \Rightarrow \) mole = Avogadro's Number \( N_A = 6.02 \times 10^{23} \)

like dozen

36 gm \( \text{H}_2\text{O} \) has how many molecules? atoms

Chemical Equations \( \text{Reactants} \rightarrow \text{Products} \)

Conservation of Mass
same # of atoms on each side
balance equation

Reaction Rates \( \text{A} + \text{B} \rightarrow \text{C} \quad k_f[A][B] \)

to increase rate:
powder - increase surface area
increase Temperature
activation energy
more high E collisions
increase concentration
better chance of finding partner
catalyst
enzyme - organic molecules

Equilibrium Reactions \( \text{A} + \text{B} \Leftrightarrow \text{C} + \text{D} \)

Dynamic Equilibrium
simultaneous forward and reverse reactions

\[ K = \frac{k_f}{k_b} = \frac{[C][D]}{[A][B]} \]

Le Châtelier's Principle
\( K = \) constant
when stress imposed on an equilibrium system,
equilibrium shifts to minimize effect of the stress

Solutions
solvent - solute polar molecules
dilute - concentrated

Colloid
small particles, collections of molecules
remain suspended

**Suspension**
larger particles
eventually settle out

various combinations of solid, liquid, gas

identify:
- pure air, salt water, brass,
  - paint, blood, milk, ink,
  - dental amalgam, soda water

**ACIDS** - excess \( H^+ \)

**BASES** - excess \( OH^- \)

\[
[H^+][OH^-] = 10^{-14} \text{ mole}^2/\text{l}iters^2
\]

Base \( pH > 7 \)  \[ H^+ < [OH^-] \]
Neutral \( pH = 7 \)  \[ [H^+] = [OH^-] = 10^{-7} \text{ M} \]
Acid \( pH < 7 \)  \[ [H^+] > [OH^-] \]

**EARTH**  \( R \sim 6400 \text{ km} \)

- **Crust**  O 47%  Si 28%  density 2.8 gm/cc
- **Mantle**
- **Outer Core** liquid iron + Ni
- **Inner Core** solid iron + Ni  \( \sim 13 \text{ gm/cc} \)

**Vibrations - Earthquakes - Seismograph**

- **Body Waves:**  \( P \) longitudinal - fast
- **S** transverse - slow (not in liquid)

- **Surface Waves:**  \( L \) sideways
  - \( R \) elliptic

**ROCK** mixture of minerals

- **Igneous** from molten magma
  - sedimentary deposits, contains fossils
  - metamorphic heat + pressure inside Earth

**Volcanos - magma - lava**

**Plate Tectonics** modern theory explains

- **Continental Drift** 250 MYA  Pangea  Panthalassa
  - Laurasia in north  Gondwana in south
- **Seafloor Spreading - Mid-Atlantic ridge**

plate boundaries

- divergent Mid-Atlantic ridge
- convergent Himalayan mountains
- transcurrent/transform San Andreas fault

**Age of Earth** 4.6 billion years

- pre-Cambrian Eon from 3800 to 570 Million Years Ago
ended when 1st visible fossils found

**OCEAN** 71% of Earth’s surface 1350 million km$^3$
- Pacific: largest, 1/3 of Earth’s surface
- Atlantic: growing, most coastline
- average depth 4km, deepest 11.5 km in trenches
- temperature 1-3°C worldwide below 2 km
- seawater 3.5% salt NaCl
  - ions: Cl$^-$ 55% Na$^+$ (31%)

**Tides** - Moon’s gravity elongates Earth and oceans
  - 2 high and 2 low tides each day
  - biggest: Moon-Earth-Sun in line, Spring Tide
  - lowest: Moon-Earth-Sun right angle, Neap Tide

**ATMOSPHERE**
- Exosphere
  - 500 km
- Thermosphere
  - 80 km
- Mesosphere
  - 50 km, Ionosphere: upward, ions reflect radio
- Stratosphere: ozone layer
  - 10 km
- Troposphere
  - 78% N$_2$, 21% O$_2$, 1% Ar

**Greenhouse Effect** regulates surface temperature
  - CO$_2$ and H$_2$O transparent to visible radiation
  - block IR, trap heat

**Ozone Layer** 30 km, blocks harmful UV radiation
  - CFC’s ChloroFluoroCarbons
  - with UV $\Rightarrow$ free Cl
  - Cl + O$_3$ $\rightarrow$ ClO + O$_2$ transparent to UV

**Wind** from high to low pressure
  - warm air expands $\Rightarrow$ low pressure
  - cool air contracts $\Rightarrow$ high pressure
  - near shore: heat capacity of water 4× land
  - Day: land warmer, wind onshore, from sea, sea breeze
  - Night: land cooler, wind offshore, toward sea, land breeze