PSC2121 Exam III Review

Electricity and Magnetism

Electric Charge - unit: coulomb, positive or negative
Charge is conserved.
Like charges repel, unlike attract.
Inverse square law (like gravity)

$F = K\, q_1 q_2 / r^2$ $K = 9\times10^9\ Nm^2/C^2$

$q_{proton} = -q_{electron} = 1.6\times10^{-19}\ C$

Electroscope measures static charge.
Electric current $I = q/t$ ampere = coulomb/sec
Electrons move in solids - flow is opposite to direction of current.
insulators glass, plastic, rubber, diamond
semiconductors silicon, germanium
conductors metals, graphite
superconductors lead, tin, mercury (when T < 4 K) no resistance
Electric potential $V = W/q$ volt = joule/coulomb $W = qV$
Resistance $R = V/I$ ohm = volt/amp $\Omega = V/A$
Power $P = V\ I = V^2/R = I^2R$ watt = volt-amp
Energy $W = Pt$ kilowatt-hour
Magnetism caused by moving electric charge
applies force to moving charge

Quantum Theory

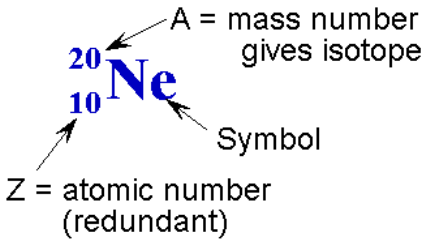
X-rays electromagnetic radiation $\lambda \sim 1\ Å = 0.1\ nm = 10^{-10}\ m$
γ-rays electromagnetic radiation $\lambda \sim 10^{-4}\ Å = 10^{-5}\ nm$
α-particles heavy, positive charge, He nucleus 2p + 2n
β-particles light, negative charge, electrons = cathode rays
which ones are deflected by electric or magnetic fields?
energy of quantum: $E = hf = hc/\lambda$
h = Planck's constant = 6.6×10^{-34} joule-sec
Photoelectric Effect - explained by Einstein
dim Blue light (high f) $\Rightarrow$ ejects electrons from metal
bright Red light (low f) $\Rightarrow$ no electron emission
Duality - sometimes wave-like
sometimes particle-like
Matter waves: De Broglie wavelength $\lambda = h/mv$

Periodic Table

element - elementary substance
atom - smallest unit
nucleus

protons, p + charge
neutrons, n neutral
p and n = nucleons mass 1.67×10^{-27} kg
electron cloud mass 9.1×10^{-31} kg

atomic number Z
= # of protons
= # of electrons
mass number A
= # of nucleons
= p + n



isotope - same element (Z), different mass (A)
atomic mass - amu - based on abundance of isotopes
standard: carbon-12 = 12.00000
Periodic Table
row Period - increasing atomic number
column Group - related chemical properties
outer (valence) electrons
Quantum (wave) mechanics explains Periodic Table
Schrödinger Equation - wave properties of particles
Heisenberg Uncertainty Principle -
can not know both position AND momentum exactly
Pauli Exclusion Principle - only ONE electron in each state
4 quantum numbers - specify electron state in atom
n - level ⇒ period
l - orbital ⇒ group
m - magnetic - suborbital
s - spin ±

Chemical Bonding
Group VIII - Noble gasses inert - no bonding
attempt to complete shell, achieve inert gas configuration
Lewis diagram - try for 8 dots (2 for Group I)

	ionic	polar covalent	non-polar covalent	metallic
electron	transfer	unequal share	equal share	share all
electrical	insulators			conductors
electronegativity difference	> 1.7	0-1.7	0	