Joe Crandall's Grade A ModernPhysics constants Sheet, covers special relativity and basic quantum mechanics

Quantum Theory of Light

e_{total} = is the power per unit area per unit frequency emitted by the black body
a = black body coefficient between 0 and 1, 1 is ideal
Bragg equation
n = the order of the intensity maximum
λ = the x-ray wavelength
θ = angle of intensity maximum measured form plane A
d = the spacing between planes
X-ray photon emission
V = x-ray tube voltage
e = elementary charge

Particle Nature of Matter

Rydberg Constant $R_\infty = \frac{m_e e^4}{8\epsilon_0^2 h^3 c} = 1.097x10^7 m^{-1}$
n = positive integer values
λ = wavelength of the emitted or absorbed light
coulomb constant $k_e = \frac{1}{4\pi\epsilon_0} = 8.987x10^9 Nm^2C^{-2}$

The Particle Nature of Matter $R = 1.0973732x10^7 m^{-1}$ Rydberg constant $K_B = 1.38064852x10^{-23} m^2 Kgs^-2K^-1$ Boltzman Constant $h = 6.626x10^{-34} Js$ Plank Constant $c = 2.998x10^8 ms^{-2}$ Speed of light

The Wave Nature of Matter $m_e = 9.10938356x10^{-31} Kg$ Mass of an Electron $\hbar = \frac{h}{2\pi} = 1.054571x10^{-34} Js$ Reduced Plank constant, also called Dirac Constant $m_e = 9.1x10^{-31} Kg$ Mass of an Electron $h = 6.62x10^{-34} Js$ $m_p = 1.6726219x10^{-27} Kg$ mass of a proton $m_n = 1.674927x10^{-27} Kg$ mass of a neutron

Quantum Mech in 1D $\langle x \rangle$ = Average position of a particle $\langle p \rangle$ = Average momentum of a particle $\langle Q \rangle$ =Operators in quantum mechanics $\langle U \rangle$ = Average potential energy $\langle K \rangle$ = Average kinetic energy $\langle E \rangle = \langle K \rangle + \langle U \rangle$ total energy for a particle

If a measurement of position is made with precision Δx and a simultaneous measurement of momentum in the x direction is made with precision Δp_x, then the product of the two uncertainties can never be smaller than $\frac{\hbar}{2}$

Quantum Mech in 1D

Tunneling

Quantum Mech in 3D

Rydberg Energy = $\frac{Ke^2}{2a_0} = 13.6$ eV
The Bohr radius = $a_0 = \frac{\hbar}{m_e K e^2}$
Bohr magneton = $\mu_B = \frac{e\hbar}{2m} = 9.274x10^{-24} J/T$

Atomic Structure

Modern Physics Constants

Weins Displacement = $\lambda_{max} T = 2.898x10^{-3} mK$
Stefans-Boltzmann constant= $\sigma = 5.67x10^{-8} Wm-2K^{-4}$
Gravitational Constant = $G = 6.674x10^{-34} m^2 Kgs^{-1}$
Planks Constant $h = 6.626x10^{-34} m^2 kgs^{-1}$
Mass of Electron $m_e = 9.109x10^{-31} kg$
Charge of Electron $q_e = -1.602x10^{-19} C$
Charge of Proton $q_p = 1.602x10^{-19} C$
Elementary charge $e = 1.602x10^{-19} C$
mass of proton $m_p = 1.6727x10^{-27} kg$
mass of neutron $m_n = 1.6727x10^{-27} kg$
mass of electron $m_e = 9.109x10^{-31} kg$
Rydberg Constant $R_\infty = \frac{m_e e^4}{8\epsilon_0^2 h^3 c} = 1.097x10^7 m^{-1}$
Bohr radius $a_0 = \frac{4\pi\epsilon_0 \hbar^2}{m_e e^2} = 5.292x10^{-11} m$
permittivity of free space $\epsilon_0 = 8.854x10^{-12} s^4 A^2 m^{-3} kg^{-1}$
reduced plank constant $\hbar = 1.054x10^{-34} Js$
coulomb constant $k_e = \frac{1}{4\pi\epsilon_0} = 8.987x10^9 Nm^2C^{-2}$
electron orbital filling levels

$$1s_2^2 2s_4^2 2p_{10}^6 3s_{12}^2 3p_{18}^6 4s_{20}^2 3d_{30}^{10} 4p_{36}^6 5s_{38}^2$$
$$4d_{48}^{10} 5p_{54}^6 6s_{56}^2 4f_{70}^{14} 5d_{80}^{10} 6p_{86}^6 7s_{88}^2 5f_{102}^{14} 6d_{112}^{10} 7p_{118}^6$$