CH-110 Complete Formula Sheet

Speed of light:	$c = 3 \times 10^{8}\ m\ s^{-1}$
Mass of electron:	$m_e = 9.11 \times 10^{-31}\ kg$
Charge of the electron	$e = 1.60 \times 10^{-19}\ C$
Mass of proton:	$m_p = 1.673 \times 10^{-27}\ kg$
Mass of neutron:	$m_n = 1.675 \times 10^{-27}\ kg$
Conversion electronvolt to Joule:	$1\ eV = 1.602 \times 10^{-19}\ J$
Avogadro's constant:	$N_A = 6.022 \times 10^{23}\ mol^{-1}$

Wave relation:

$$c = \lambda \nu$$

Rydberg equation:

$$\upsilon = R\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)\ with\ n_1 = 1,2, \ldots, n_2 = n_1 + 1, n_1 + 2, \ldots$$
$$With\ R = 3.29 \times 10^{15}\ Hz$$

Planck-Einstein relation:

$$E_{photon} = h\nu$$
$$With\ h = 6.626 \times 10^{-34}\ J\ s$$

Einstein's photoelectric equation:

$$\frac{1}{2} m_e v^2 = h\nu - \Phi$$

De Broglie relation:

$$\lambda = \frac{h}{mv} = \frac{h}{p}$$

Heisenberg uncertainty principle:

$$\Delta p \times \Delta x \geq \frac{1}{2}\hbar$$
$$With\ \hbar = h/2\pi$$

Schrödinger equation:

$$H\psi = E\psi$$

Probability density:

$$\rho(x) = |\psi(x)|^2$$

Radial distribution function:

$$P(r) = 4\pi r^2 |\psi(r)|^2$$

Particle in a box in 1D:

$$\psi_n(x) = \left(\frac{2}{L}\right)^{\frac{1}{2}} \sin\left(\frac{n\pi x}{L}\right) \ with\ n = 1, 2, \ldots$$

Energy levels of particle in a box in 1D:

$$E_n = \frac{n^2 h^2}{8mL^2}$$

Coulomb's law:

$$V(r) = \frac{(-e) \times (+e)}{4\pi\varepsilon_0 r}$$

$$With\ \varepsilon_0 = 8.85 \times 10^{-12} C^2 N^{-1} m^{-2}$$

Energy levels in hydrogen atom:

$$E_n = -\frac{hR}{n^2}$$

Energy levels in nucleus with atomic number Z:

$$E_n = -\frac{Z^2 hR}{n^2} \ with\ n = 1, 2, \ldots$$

Wavefunction of atomic orbital:

$$\Psi(r, \theta, \phi) = R(r) \times Y(\theta, \phi)$$

Hydrogen ground state orbital ($n = 1$):

$$\Psi(r, \theta, \phi) = \left(\frac{1}{\pi a_0^3}\right)^{\frac{1}{2}} e^{-\frac{r}{a_0}}$$

$$With\ a_0 = 52.9\ pm$$

Mulliken scale of electronegativity:

$$\chi = \frac{1}{2}(I_I + E_{ea})$$

Bond order:

$$b = \frac{1}{2}(N_e - N_e^*)$$