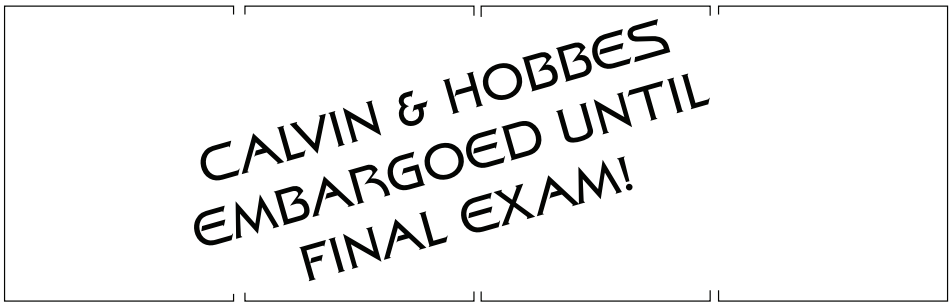
PHYS 2020: College Physics II
Final Exam, Spring Semester 2007



You may find some of the following formulae useful:

Light

$$c = \lambda \cdot f \qquad E_\gamma = h \cdot f \qquad p_\gamma = \frac{E_\gamma}{c} = \frac{hf}{c} = \frac{h}{\lambda} \qquad I = \frac{P}{A} = \frac{\Delta E}{\Delta t \cdot A}$$

The Quantum Hypothesis

$f_{peak} = (5.88{\times}10^{10}\mathrm{s}^{-1}{\cdot}\mathrm{K}^{-1})\,T$ (Wien′s Displacement Law) $E_n = nhf$ (PlanckHypothesis)

$K_E^{max} = hf - \phi$ (Photoelectric Effect) $\Delta x \cdot \Delta p \gtrsim \hbar$ (Heisenberg Uncertainty Principle)

Photons, Waves & Particles

$\Delta\lambda = \lambda_f - \lambda_i = \dfrac{h}{m_e c}(1-\cos\theta)$ (Compton Scattering) $\lambda = \dfrac{h}{p} = \dfrac{h}{mv}$ (DeBroglie Wavelength)

The Bohr Atom

$$\frac{1}{\lambda} = R_\infty \left(\frac{1}{n_f^2} - \frac{1}{n_i^2} \right) \qquad R_\infty = 1.097 \times 10^7 \mathrm{m}^{-1}$$

$$r_n = \frac{a_o n^2}{Z} \qquad L = mvr = n\hbar$$

$$E_n = -\frac{ke^2}{2a_o}\frac{1}{n^2} = -\frac{13.6\text{ eV}}{n^2} \qquad E_n = -(13.6\text{ eV})\frac{Z^2}{n^2}$$

Atomic & Nuclear Physics

$${}^A_Z X \qquad A = N + Z$$

${}^A_Z X \longrightarrow {}^{A-4}_{Z-2} Y + {}^4_2\alpha$ (Alpha decay)

$$^1_0n \longrightarrow {}^1_1p + e^- + \bar{\nu}_e \qquad \text{(Beta decay)}$$
$$^1_1p + e^- \longrightarrow {}^1_0n + \nu_e \qquad \text{(Inverse Beta decay)}$$

$$N = N_o e^{-\lambda t} = N_o e^{-0.693(t/\tau_{1/2})}$$

$$R = \left|\frac{\Delta N}{\Delta t}\right| = \lambda N \qquad\qquad R = R_o e^{-\lambda t} = R_o e^{-0.693(t/\tau_{1/2})}$$

Some useful unit conversions and constants may be:

$e = 1.60 \times 10^{-19}$ C	$1eV = 1.602 \times 10^{-19}$ J	$k = 8.99 \times 10^9$ N m^2/C^2
$c = 2.998 \times 10^8$ m/s	$\hbar = h/(2\pi) = 1.055 \times 10^{-34}$ J·s	$\hbar = h/(2\pi) = 6.582 \times 10^{-16}$ eV·s
1 u = 931.5 MeV/c^2	1 u = 1.6605×10^{-27} kg	$a_o = 5.292 \times 10^{-11}$ m

A list of some things you should be able to do — there are many other things, but these are some important ones:

- ▷ Compute wavelengths and energies of different spectral line series
- ▷ Compute work functions
- ▷ Compute size of atomic orbits, atomic energy levels
- ▷ Compute the color of light emitted from hydrogen powered stormtrooper blasters
- ▷ Determine the amount of energy released in fusion and fission reactions
- ▷ Use the uncertainty principle in calculations of position and momentum
- ▷ Use the photoelectric effect to compute kinetic energies, work functions, or photon energies
- ▷ Compute half lives or activities of radioactive samples
- ▷ Analyze a Compton scattering problem