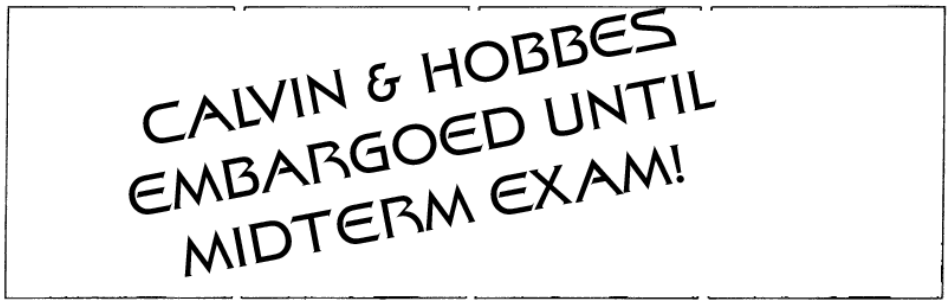
PHYS 2020: College Physics II
Midterm Number 1, Spring Semester 2008



You may find some of the following formulae useful:

Charge, Forces & Fields

$$F_{coul} = k\frac{|q_1|\ |q_2|}{r^2} \qquad E = \frac{F_{coul}}{|q_2|} = k\frac{|q_1|}{r^2} \qquad E_{tot} = E_1 + E_2 + \ldots$$

$$\Phi = E \cdot A \cdot \cos\theta \quad (Electric\ Flux) \qquad \Phi = \frac{q_{enc}}{\epsilon_o} \quad (Gauss'\ Law)$$

Electric Potential

$$U_E = k\frac{|q_1|\ |q_2|}{r} \qquad V = \frac{U_E}{|q_2|} = k\frac{|q_1|}{r} \qquad V = E \cdot d$$

$$C = \frac{Q}{V} \qquad C = \epsilon_o\frac{A}{d} \qquad C = \kappa C_o \qquad E = \frac{E_o}{\kappa}$$

$$U_E = \frac{1}{2}QV = \frac{1}{2}CV^2 = \frac{1}{2}\frac{Q^2}{C}$$

Circuits

$$I = \frac{\Delta Q}{\Delta t} \qquad V = I \cdot R \qquad R = \rho\left(\frac{L}{A}\right)$$

$$P = I \cdot V \qquad P = I^2R \qquad P = \frac{V^2}{R}$$

$$R_{eq} = R_1 + R_2 + \ldots \qquad \frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots$$

$$C_{eq} = C_1 + C_2 + \ldots \qquad \frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + \ldots$$

$$I_{in} = I_{out} \quad (Junction\ Rule) \qquad \mathcal{E} = \sum \Delta V \quad (Loop\ Rule)$$

$$q(t) = C\mathcal{E}\left(1 - e^{-t/\tau}\right) = Q\left(1 - e^{-t/\tau}\right) \qquad I(t) = \left(\frac{\mathcal{E}}{R}\right)e^{-t/\tau} \qquad \tau = RC$$

Some useful unit conversions and constants may be:

$e = 1.60 \times 10^{-19}$ C	$k = 8.99 \times 10^{9}$ N m^2/C^2	$\epsilon_o = 1/(4\pi k) = 8.85 \times 10^{-12}$ C^2/(N m^2)

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

- ▷ Compute forces, E fields, potentials and potential energies for distributions of point charges. This includes *directions* for vector quantities
- ▷ Sketch electric field lines and equipotentials
- ▷ Sketch potentials as a function of distance
- ▷ Compute potentials or charges on parallel plate capacitors
- ▷ Compute electric flux Φ through a surface.
- ▷ Use Gauss' Law to find enclosed charge or electric fields.
- ▷ Describe how the Force is an energy field created by all living things, and how it surrounds us, penetrates us and binds the galaxy together.
- ▷ Evaluate energy and work for charges moving in potentials.
- ▷ Draw a sequence of reduced circuits by combining resistors and capacitors.
- ▷ Take *crazy* circuits (diagonal resistors, for example) and redraw them as *reasonable* circuits.
- ▷ Circuit analysis using Kirchoff's rules
- ▷ Compute equivalent resistances or capacitances for circuits.
- ▷ Compute currents or potential drops in circuits
- ▷ Compute time behaviour of RC circuits