Exam 2 Equations

Mechanics

$$\vec{F} = m\vec{a}$$

$$F_{centripetal} = m\frac{v^2}{R}$$

$$F_G = mg = \frac{Gm_1m_2}{r_{12}^2}$$

$$W = F_x\Delta x = \Delta KE + \Delta U$$

$$KE = \tfrac{1}{2}mv^2$$

$$PE = mgh$$

Kinematics

$$\Delta x = v_x\Delta t + \tfrac{1}{2}a_x\left(\Delta t\right)^2$$

$$\Delta x = \tfrac{1}{2}\left(v_f + v_0\right)\Delta t$$

$$v_f = v_{0x} + a_x\Delta t$$

$$v_{fx}^2 = v_{0x}^2 + 2a_x\Delta x$$

Circuits

$$I = \frac{\Delta q}{\Delta t}$$

$$V = IR$$

$$\sum V_{aroound\ loop} = 0$$

$$\sum I_{in} = \sum I_{out}$$

$$P = \frac{\Delta U_E}{\Delta t} = \frac{q\Delta V}{\Delta t}$$

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

Constants to know and love:

- $k = 9 \times 10^9$ N-m^2/C^2
- $G = 6.67 \times 10^{-11}$ N-m^2/kg^2
- $e = 1.60 \times 10^{-19}$ C
- $m_e = 9.11 \times 10^{-31}$ kg
- $m_p = 1.67 \times 10^{-27}$ kg
- $c = 3.0 \times 10^8$ m/s
- $N_A = 6.02 \times 10^{23}$ things/mole
- $\in_0 = 8.85 \times 10^{-12}$ C^2/N-m^2
- $\mu_0 = 4\pi \times 10^{-7}$ T-m/A

Electrostatics

$$F_E = qE = \frac{kQq}{r^2} \qquad E = \frac{F_E}{q} = \frac{kQ}{r^2}$$

$$\Delta V = \frac{\Delta U_E}{q} = -\frac{kQ}{r} \qquad \Delta V = -Ed$$

$$W = F_Ed = qEd = -\Delta U_E = -q\Delta V$$

$$\Delta U = -F_Er = -\frac{kQq}{r}$$

Magnetic Fields

$$\vec{F} = q\vec{v}\times\vec{B} \Rightarrow F = qvB\sin\theta$$

$$\vec{F} = I\vec{L}\times\vec{B} \Rightarrow F = ILB\sin\theta$$

$$v_{selected} = \frac{E}{B} \qquad v_{flow} = \frac{E}{B} = \frac{\Delta V/d}{B}$$

$$\tau_{loop} = NIAB\sin\theta$$

$$B_{straight\ wire} = \frac{\mu_0 I}{2\pi r}$$

$$B_{loop} = \frac{\mu_0 NI}{2r} \qquad B_{solenoid} = \frac{\mu_0 NI}{L}$$

$$\Phi = AB_\perp = A_\perp B = AB\cos\theta$$

$$\mathcal{E} = -N\frac{\Delta\Phi}{\Delta t} \qquad \mathcal{E}_{motional} = vBL$$

$$\frac{\mathcal{E}_1}{\mathcal{E}_2} = \frac{N_1}{N_2} = \frac{I_2}{I_1}$$