1st Semester Final Exam Document

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1 Orbits

Angular velocity: W = $\frac{\theta}{t}$
W = $\frac{2\pi}{t}$
W in units rad/sec
Centripetal acceleration - always towards the center
Gravity is responsible for centripetal acceleration
Tangetial speed: v = wr
$F_g = \frac{mMG}{r^2}$
$F_g = \frac{mv^2}{R}$
-PE = $\frac{-mMG}{r}$
KE = $\frac{mMG}{2r}$
a = $\frac{MG}{r^2}$
$\frac{1}{2}mv^2 = \frac{mMG}{r}$
Launch velocity for circular orbit:

$$v = \sqrt{aR}$$

Launch velocity for escape:

$$v = \sqrt{\frac{2MG}{r}}$$

Lowest rotational energy: I = $mr^2 + mr^2$
Lowest: $\frac{IW_min}{Inertia} = \frac{1.05 \times 10^-34}{8x10^-33}$

2 Electrostatics

Separation between two points:

$$-\Delta x = \frac{\Delta v}{E}$$

Force of electric field on a charge:

$$F = Eq$$

Change in PE:

$$PE = Vq$$

Power = $\frac{\Delta energy}{time}$
$F_B = q_v B$
$q_v B = qE$
I = $\frac{Q}{T}$
How capacitor functions as a battery: There is electric field in the capacitor so it can push charge to create current. The voltage in the capacitor will focus on the resistor, which will cause current flow.
Displacement current.
How parallel wires in opposite directions can define the Ampere:

Both Is are the same because they do not need to consider direction since they are in opposite directions. Therefore, the directions of the F B are opposite and the two wires attract.

3 Torque

$\tau = rFsin\Delta\theta$

4 Thermodynamics

Monatomic: KE $=\frac{3}{2}\mathrm{K}_B T$
Diatomic: KE $=\frac{5}{2}\ \mathrm{K}_B T$
U = mCT
$\Delta v = mc\Delta T$
$\Delta U = mC_p\Delta T$
$\Delta U = mL$