# Physics Final

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## 1 Orbits

Angular velocity: W = $\frac{\Delta\theta}{t}$
Angular acceleration a = $\frac{\Delta w}{\Delta T}$
W = $\frac{2\pi}{t}$
W in units rad/sec
Centripetal acceleration (towards the center)
Gravity is responsible for centripetal acceleration
Centripetal acceleration: a = $\frac{v^2}{r}$
Tangential speed v = w $\times r$
"Centripetal force" Fe = $\frac{m \times v^2}{r}$
Period of orbit w = $\frac{2\pi}{T}$
Launch velocity for circular orbit:

$$v = \sqrt{aR}$$

Launch velocity for escape:

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

## 2 Forces

Tangetial speed: v = wr
F$_g = \frac{mMG}{r^2}$
F$_g = \frac{mv^2}{r}$ when a is centripetal acceleration
PE = $\frac{-mMG}{r}$(not on Earth Surface)
PE = mgh$(onEarthSurface)$
KE = $\frac{-PE}{2}$
KE = $\frac{mMG}{2r}$
The escape velocity of an object from the surface of the Earth when KE=-PE a = $\frac{MG}{r^2}$
$\frac{1}{2}mv^2 = \frac{mMG}{r}$

# 3 Spring

$F_{spring} = -kx$

# 4 Electrostatics

Charges are align if stacked. Charge alternate if line up.

Gauss's Law

$$E * A = \frac{Q_{enclosed}}{E_0}$$

Force: Newton

Field(E): Newton/Coulumb

Potential Enery(PE): Joule

Potential(Voltage): Joule/Coulumb(Volt)

E=Sigma$\frac{}{A}$

With infinite charge plate:

$$E = \frac{Sigma}{E_0 * 2}$$

With 2 plates: E=Sigma$\frac{}{E_0}$

Separation between two points:

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

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 $F_B are opposite and the two wires attract.$

Charge moves straight through a capacitor when $F_E = F_B$

# 5 Circuit

V = IR

E = -$\Delta V_{\overline{\Delta inx}}$

C = Q$_{\overline{V}}$

I = $\Delta Q_{\overline{\Delta t}}$

P = IV

Series: Req = R1 + R2

# 6 Torques

$\tau = rFsin\Delta\theta$

| Variable | Translational | Angular |
|---|---|---|
| Displacement | $s = r\theta$ | $\theta = \frac{s}{r}$ |
| Velocity | $v = r\omega$ | $\omega = \frac{v}{r}$ |
| Acceleration | $a = r\alpha$ | $\alpha = \frac{a}{r}$ |
| Time | $t$ | $t$ |
| Force/Torque | $F_{net} = ma$ | $\tau_{net} = I\alpha$ |
| Momentum | $p = mv$ | $L = I\omega$ |
| Kinetic Energy | $KE = \frac{1}{2}mv^2$ | $KE = \frac{1}{2}I\omega^2$ |

# 7 Thermodynamics

Monatomic: KE =$\frac{3}{2}$K$_B T$

Diatomic: KE =$\frac{5}{2}$ K$_B T$

U = mCT

$\Delta v = mc\Delta T$

$\Delta U = mC_p\Delta T$

$\Delta U = mL$

L=$C_p \Delta T$
PV=nRT