

Physics Final exam

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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" $F_c = \frac{m \times v^2}{r}$

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

Tangential 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)

$PE = mgh$ (on Earth Surface)

$$KE = \frac{-PE}{2}$$

$$KE = \frac{mMG}{2r}$$

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 align if stacked. Charge alternate if line up.

Gauss's Law

$$E * A = \frac{Q_{enclosed}}{\epsilon_0}$$

Force: Newton

Field(E): Newton/Coulomb

Potential Energy(PE): Joule

Potential(Voltage): Joule/Coulomb(Volt)

$E = \frac{\sigma}{\epsilon_0}$

With infinite charge plate:

$$E = \frac{\sigma}{\epsilon_0 * 2}$$

With 2 plates: $E = \frac{\sigma}{\epsilon_0}$

Separation between two points:

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

Force of electric field on a charge:

$$F = Eq$$

Change in PE:

$$PE = Vq$$

$$\text{Power} = \frac{\Delta \text{energy}}{\text{time}}$$

$$F_B = q_v B$$

$$q_v B = qE$$

$$I = \frac{Q}{T}$$

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 I s 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

$$V = IR$$

$$E = -\Delta V_{\Delta in x}$$

$$C = Q_{\overline{V}}$$

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

$$P = IV$$

$$\text{Series: } R_{eq} = R1 + R2$$

6 Torques

$$\tau = rF \sin \Delta \theta$$

7 Thermodynamics

$$\text{Monatomic: } KE = \frac{3}{2} K_B T$$

$$\text{Diatomic: } KE = \frac{5}{2} K_B T$$

$$U = mCT$$

$$\Delta v = mc\Delta T$$

$$\Delta U = mC_p \Delta T$$

$$\Delta U = mL$$

$$L = C_p \Delta T$$

$$PV = nRT$$