Peak Sheet
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1 Circular Motion

$$a_{cent} = \frac{v_{tan}^2}{r}$$

$$v_{tan} = \frac{2\pi r}{T} = \omega r$$

Universal Law of Gravity Gravity spreads out over a sphere, the pull of the object depends on an density of those rays on a sphere

$$F_g = \frac{mMG}{r^2}$$

Relationship between radius of orbit and its period

$$\frac{MG}{r} = \frac{4\pi^2 r^2}{T^2}$$

$$T^2 = \frac{4\pi^2 r^3}{MG}$$

Potential and Kinetic Energy

$$\Delta PE$$

is physically meaningful
PE itself is arbitrary up to contrast

$$PE = -\frac{mMG}{r}$$

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

$$PE = KE + PE = -\frac{mMG}{2r}$$

$$PE = -2KE$$

Circular Orbit For circular r=const

Elliptical orbit r is changing but object still returns

For object to escape earth's gravity, it must have positive TE

for v_{esc} on surface of earth TE=0

Harmonic Oscillations

$$F_{spring} = -kx$$

$$\omega_{const} = \sqrt{\frac{k}{m}}$$

Kepler's 3rd law Geosynchronous orbit

$$r^3 = \frac{MGT^2}{4\pi^2}$$

2 Electrostatics

Charge substance responsible for electric force - unit=Coulomb

$$\text{electron charge} = 1.6 \times 10^-19\text{Coulombs}$$

$$F_e = \frac{k_e q_1 q_2}{r^2}$$

$$k_e = 9.0 \times 10^9$$

Charge can move until there is electric force

Electric field possibility of a force

$$E = \frac{F_2}{q} = \frac{k_e Q}{r^2} = \frac{\sigma}{2\epsilon}$$

field lines come out of + charge

$$PE = \frac{kq_1q_2}{r^2} = \frac{qQ}{4\pi\epsilon r}$$

Gauss's law

$$E \times A = \frac{q_{enc}}{\epsilon_/}$$

Electric fields lines are perpendicular ti lines of equal potential

E field is stronger when lines of equal potential are close

Capacitor

$$\lambda = \frac{Q}{l}$$

$$\epsilon = 8.84 \times 10^-12$$

$$c = 2\mu F = \frac{Q}{V}$$

Point Charge

$$E = \frac{Q}{4\pi\epsilon r^2}$$

$$V = \frac{Q}{4\pi\epsilon r}$$

Current flow of charge

Ohmic (Ohm's law)

$$V = IR$$

paralell resistors

$$\frac{1}{R_{eq}} = \frac{1}{R_1} = \frac{1}{R_2}$$

power - rate of change in E over unit time

$$P = IV$$

$$PE = qV$$

3 Magnetic Fields

Lodestone-natural magnet

$$F_b = qv \times B = ILB$$

In order to cancel each other magnetic and electric forces must equal each other, therefore

$$E = vB$$

!!!Magnetic charge does not exist!!!

Ampere - amount of current that we should put through each wire to get specific force
Ampere's law

$$BS(circumference) = \mu I_{enc}$$

$$B\pi r = \mu I_{enc}$$

When external B field acts on a circuit it forces inner B field align with the external one
Currents encourage other current to align with them

$$\mu = 4\pi \times 10^-7$$

4 Moment of Inertia

Moment of Inertia is a relationship between torque and angular acceleration

$$Torque = rFsin\theta$$

$$I = \Sigma mr^2 = (forhoop)MR^2 = (fordisk)\frac{MR^2}{2}$$

When $F_{net} = 0$ torques are called pure torque "couple"
then Torque is independent of the point of rotation

5 Angular Momentum

if rope is shortened, angular momentum is conserved

$$\lambda = r \times p = I\omega = nh$$

$$h = 1.05 \times 10^-34$$

6 Parallel axis theorem

Moment of inertia calculation depends in a choice of a center
Center of mass will minimize I
When the axis of rotation is moved away from the center of mass, the moment of inertia increases
For another axis of rotation

$$I = I_- + mD^2$$

D is distance between I and I_$I = \frac{MR^2}{2} + MD^2 Whenrolling, pontoftouchwithgroundstaysthesame$

$\omega isassociatedwithpurerotation$

7 Thermodynamics

$$P = \frac{F}{A}$$

$$F_net = -\frac{mv^2}{L}$$

$$F_wall = \frac{mv^2}{3L}$$