Physics Final Exam

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1 Orbits

Definition: orbit, in astronomy, path in space described by a body revolving about a second body where the motion of the orbiting bodies is dominated by their mutual gravitational attraction. Within the solar system, planets, dwarf planets, asteroids, and comets orbit the sun and satellites orbit the planets and other bodies.

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

Definition: A force is a push or pull upon an object resulting from the object's interaction with another object. Whenever there is an interaction between two objects, there is a force upon each of the objects. When the interaction ceases, the two objects no longer experience the force. Forces only exist as a result of an interaction.

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)

$$PE = mgh$$

(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

Definition: A force is a push or pull acting upon an object as a result of its interaction with another object. There are a variety of types of forces.

$F_{spring} = -kx$
k: Spring constant
x: Amount of compression

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)

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

With infinite charge plate:

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

With 2 plates:

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

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

$$E = -\frac{\Delta V}{\Delta inx}$$

$$C = \frac{Q}{V}$$

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

P = IV
Series:

$$Req = R1 + R2$$

Parallel:

$$\frac{1}{Req} = \frac{1}{R1} + \frac{1}{R2}$$

R: Resistance
V: voltage

6 Torques

Definition: Torque is a measure of how much a force acting on an object causes that object to rotate.

$\tau = rFsin\Delta\theta$

7 Thermodynamics

Definition: Thermodynamics is a branch of physics concerned with heat and temperature and their relation to energy and work. It defines macroscopic variables, such as internal energy, entropy, and pressure, that partly describe a body of matter or radiation.

Monatomic: KE $=\frac{3}{2}\mathrm{K}_B T$
Diatomic: KE $=\frac{5}{2}\ \mathrm{K}_B T$
U = mCT

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

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

$$\Delta U = mL$$

$$L = C_p\Delta T$$

$$PV = nRT$$