Final test note

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1 Orbits

Force that causes circuit
Force that causes centripital
"Centripetal force"

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

Period of orbit T

$$w = \frac{2\pi}{T}$$

Launch velocity for circular orbit
Launch velocity for escape
Elliptical orbits

2 Circular motion

Polar coordinates r, theta
Angular velocity

$$w = \frac{\Delta\theta}{\Delta T}$$

Angular acceleration

$$a = \frac{\Delta w}{\Delta T}$$

Centripetal acceleration

$$a = \frac{v^2}{r}$$

Tangential speed

$$v = w \times r$$

3 Gravity

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

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

4 Bfield

$$Fb = q \times v \times B$$

$$Fb = I \times L \times B$$

5 Force

$$Fnormal + Fgravity = m \times \frac{v^2}{2}$$

$$Fnormal = \frac{mv^2}{r} - Fgravity$$

$$Fnormal = \frac{mv^2}{r} - mg$$

- Throw a ball into the verizon at such a speed so that it's in a low attitude orbit. What is the speed of the ball ?

$$Fnet = ma$$

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

(no normal force)

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

$$g = \frac{v^2}{r}$$

$$v^2 = gr$$

- Acceleration due to the surface of the earth

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

$$G = \frac{r^2 \times g}{M}$$

- Find KE for 10 kg

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

- PE for surface of the earth

$$PE = mgh$$

- PE away from earth's surface

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

- For object to escape the earth's gravity, it must have positive total energy E = 0

$$KE + PE = 0$$

$$\frac{-mMG}{r} + \frac{mv^2}{2} = 0$$

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

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

- Consider the earth moving around the sun

a. Determine the orbital angular velocity of the earth.

$$\omega = \frac{2\pi}{T}$$

$$\omega = \frac{2 * 3.14}{365.24 * 24 * 60 * 60}$$

$$\omega = 1.99 \times 10^{-7} \frac{rad}{sec}$$

b. Determine the speed of the earth relative to the sun.

$$ma = \frac{GmM}{r^2}$$

$$a = \frac{6.67 * 10^{-11} * 5.98 * 10^{14}}{1.50 * 10^{11}}$$

$$a = 1.77 \times 10^{-8}$$

$$v = \sqrt{r \times a}$$

$$v = \sqrt{1.50 \times 10^{11} \times 1.77 \times 10^{-8}}$$

$$v = 2.655 \times 10^{11}$$

c. Determine centripetal acceleration of the earth relative to the sun.

$$a = \frac{v^2}{r}$$

$$a = \frac{(1.7 * 10000)^2}{1.5 * 10^{11}}$$

$$a = 19.5$$

d. Determine the net force on the earth considering this acceleration.

$$Fg = m \times a$$

$$Fg = 5.98 * 10^{24} \times 1.77$$

$$Fg = 1.05846 \times 10^{25} N$$

e. Determine the mass of the sun from the above.

$$\frac{GmM}{r} = 1.05846 \times 10^{25}$$

$$m = \frac{1.05846 * 10^{25} * 1.50 * 10^{11}}{6.67 * 10^{-11} * 5.98 * 10^{24}}$$

$$m = 3.98 \times 10^{21} Kg$$

- Consider gravitation at the surface of the moon

a. Determine the acceleration due to gravity on the surface of the moon.

$$Fnet = ma$$

$$Fg = ma$$

$$ma = \frac{GmM}{r^2}$$

$$a = \frac{MG}{r^2}$$

b. Determine the launch velocity for circular orbit.

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

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

$$v^2 \times r^2 = rMG$$

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

c. Determine the launch velocity for escape from the moon's gravity.

$$PE + KE = 0$$

$$\frac{mMG}{r} + \frac{mv^2}{2} = 0$$

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

d. Determine the result of launching an object at 2000 m/s into the moon's horizon.

- Consider a capacitor. Two very large parallel conducting plates are connected to the leads of a 9 Volt battery.

a. Determine the separation between the plates to generate a 30.0 $\frac{N}{C}$ electric field.

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

b. Determine the force of this electric field on a 0.012 Coulomb charge.

$$Fe = \frac{kqQ}{r^2}$$

$$Fe = Eq$$

c. Determine the change in potential energy for the 0.012 C charge moving from the 9V plate to the 0V plate.

d. Draw the parallel plates and the electric field between them.

6 Current

$$V = IR$$
$$E = -\frac{\Delta V}{\Delta inx}$$
$$C = \frac{Q}{V}$$
$$I = \frac{\Delta Q}{\Delta t}$$
$$P = IV$$
$$Parallel: \frac{1}{Req} = \frac{1}{R1} + \frac{1}{R2}$$
$$Series: Req = R1 + R2$$