Chapter 11 (Projectiles + Circular Motion)

Projectiles

Horizontally - velocity is constant

$$v = \frac{\Delta d}{\Delta t}$$

Vertically - constant accelaration

$$a = \frac{\Delta v}{\Delta t} \qquad v_{ave} = \frac{\Delta d}{\Delta t}$$

$$\Delta d = v_1 \Delta t + \frac{1}{2}a(\Delta t)^2$$

$$\Delta d = v_2 \Delta t - \frac{1}{2}a(\Delta t)^2$$

$$v_2^2 = v_1^2 + 2a\Delta d$$

For projectiles returning to the same level:

$$\Delta t = \frac{2v\sin\theta}{g} \qquad \Delta d_h = \frac{v^2\sin 2\theta}{g} \qquad H = \frac{v^2\sin^2\theta}{2g}$$

Circular Motion

$$a_c = \frac{v^2}{r} = \frac{4\pi^2 r}{T^2} = 4\pi^2 r f^2$$

FBD_s are important to see what expression you will use for Fnet (centripetal force)

Chapter 12 (Planetary Mechanics)

Kepler's Laws: 1. elliptical orbits

2. sweep equal areas in equal times

3. $K = \frac{r^3}{T^2}$ (unique for any central body)

Graphing r^3 vs T^2
slope = K

Newton's Law of Universal Gravitation

$$F_g = \frac{Gm_1m_2}{r^2}$$

Newton's Hypotheses (and applications)

$$F_g = F_c$$

m_2 is the orbiting mass

$$\frac{Gm_1m_2}{r^2} = m_2 a_c$$

where

$$a_c = \frac{v^2}{r} = \frac{4\pi^2 r}{T^2} = 4\pi^2 r f^2$$

Geostationary | Geosynchronous (T = 24 h for a satellite)

Chapter 13 (SHM)

- d-t, v-t, a-t, F-t graphs + how they relate to each othe
- d-t, v-t, PE-t, KE-t, TE-t graphs + how they relate to each other.
- Period of a pendulum: $T = 2\pi\sqrt{\frac{l}{g}}$

Graphing T^2 vs l: $T^2 = \frac{4\pi^2}{g} l$

slope

- Period of a mass-spring system: $T = 2\pi\sqrt{\frac{m}{k}}$

Graphing T^2 vs m: $T^2 = \frac{4\pi^2}{k} m$

slope

- Conservation of Energy: $E_{total} = E'_{total}$

Pendulum

$E_k = \frac{1}{2}mv^2$ + $E_g = mgh$

mass-spring system

$E_k = \frac{1}{2}mv^2$ + $E_e = \frac{1}{2}kx^2$

$F_a = kx$