Name Key Hour _____

Summary of Circular Motion and Gravity

motion in a straight line

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

motion in a circle

$v = \frac{2\pi r}{T}$

T = Period = time to make 1 revolution

Sometimes you know T without it being stated

Ex. Earth around sun

$a = \frac{v_f - v_i}{\Delta t}$

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

a_c = centripetal acceleration

Objects accelerate by changing speed or changing direction.

An object that is traveling at a constant speed in a circle is accelerating. Why? changing direction

$F = m \cdot a$

$F_c = m \cdot a_c$

F_c = centripetal force

You can also make another equation for F_c by combining the last 2 equations.

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

centripetal force- the force needed to keep an object moving in a circle

centrifugal force- inertia (not a force)

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GRAVITY

$F_g = m \cdot g$ or $w = mg$ (Weight is a force!!!!)

g = acceleration due to gravity (m/s^2)

F_g = gravitational force (N)

The Universal Law of Gravitation

This equation shows us that everything attracts everything else.

$F_g = \frac{Gm_1m_2}{r^2}$ $G = 6.67 \times 10^{-11} \frac{Nm^2}{kg^2}$

The force of the attraction depends on the mass and the distance of the objects

To find the acceleration due to gravity at any distance from any object

$F_g = F_g$

$mg = \frac{Gmm_2}{r^2}$

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

m= mass of object creating gravity (Earth usually)

r= distance from CENTER of object

For orbiting objects

In order for an object to orbit, what two forces must equal each other?

$F_g = F_c$

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

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

Pendulums:

The length **affects the period (T) of a pendulum but** mass **does NOT.**

$T^2 = \frac{4\pi^2 L}{g}$