Simple Harmonic Motion Lab

Preliminary Questions

Data/Observations

- sample graphs → equilibrium (STATS)
  motion graphs (d-t, v-t)
  STATS
- data table

Analysis

Extension 1. ⇒ data for 50 → 100g, T = ?
GA graph

$$T = 2\pi\sqrt{\frac{m}{k}}$$

$$T^2 = \frac{4\pi^2}{k} m$$ ← Plot T^2 vs m

← slope

slope = $\frac{4\pi^2}{k}$

TEST - Chapters 11, 12 + 13

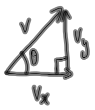
Chapter 11

Projectile Motion

Horizontally v is constant $v = \frac{\Delta d}{\Delta t}$

Vertically a is constant ($a = -9.81\ m/s^2$)

$a = \frac{\Delta v}{\Delta t}$ $v_{ave} = \frac{\Delta d}{\Delta t}$ (where $v_{ave} = \frac{v_1 + v_2}{2}$)



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

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

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

Projectiles Returning to Same Level:

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

$H = \frac{v^2 \sin^2\theta}{2g}$ → $(\sin\theta)^2$

Centripetal Acceleration:

- always to the centre

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

$\vec{F}_{net} = m\vec{a}$

This is the centripetal force .... use your FBD to create an expression for F_{net}.

Chapter 12 - Planetary Mechanics (Law of Gravitation)

Kepler's Laws: ① elliptical
② equal areas
③ $K = \frac{r^3}{T^2}$ ← unique for each central body.

$\frac{r_A^3}{T_A^2} = \frac{r_B^3}{T_B^2}$ ← for 2 objects orbiting the same central body

Newton's Law of Universal Gravitation:

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

Newton's Hypothesis:

$F_g = F_c$ ← $F_{net} = ma$ ← mass of orbiting object.

Geosynchronous | Geostationary ⇒ T = 24 h

Chapter 13 - SHM

harmonic oscillator: $T = 2\pi\sqrt{\frac{m}{k}}$

$E_e = \frac{1}{2}kx^2$ $E_{total} = E'_{total}$

$E_k = \frac{1}{2}mv^2$

$F_a = kx$

Simple pendulum: $T = 2\pi\sqrt{\frac{l}{g}}$

$E_g = mgh$

$E_k = \frac{1}{2}mv^2$ $E_{total} = E'_{total}$

Graphs: d-t, v-t, a-t, KE-t, PE-t, TE-t