TEST - Tuesday

Chapter 11 - Projectile Motion + Centripetal Force

Projectiles

Horizontally → velocity is constant.

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

Vertically → constant acceleration

$a = \frac{\Delta v}{\Delta t}$ ← vertical vs

vertical vs → $v_{ave} = \frac{\Delta d}{\Delta t}$

vertical
$\Delta d = v_1 t + \frac{1}{2}at^2$
$\Delta d = v_2 t - \frac{1}{2}at^2$
$v_2^2 = v_1^2 + 2a\Delta d$

For a projectile returning to the same level:

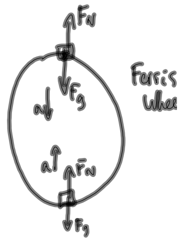
$\Delta t = \frac{2v\sin\theta}{g}$ $\quad \Delta d_x = \frac{v^2\sin 2\theta}{g}$ $\quad H = \frac{v^2\sin^2}{g}$

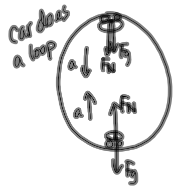
Centripetal Force

$a_c = \frac{v^2}{r} = \frac{4\pi^2 r}{T^2} = 4\pi^2 r f^2$ $\quad \vec{F}_{net} = m\vec{a}$

FBD!!

- horizontal circles
- vertical circles
- banked curves.





Chapter 12 - Universal Gravitation + Planetary Mech

Kepler's Laws ① elliptical orbits

② Sweep equal areas in equal times (faster closer to the sun)

③ $K = \frac{r^3}{T^2}$ (unique constant f every central bo for an o

Newton's Law of Universal Gravitation

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

Apply proportional for vari equ

Newton's Hypothesis

$F_g = F_c$

(rearrange for whatever?)

Geosynchronous | Geostationary ⇒ $T = 24h$

Chapter 13 - Simple Harmonic Motion

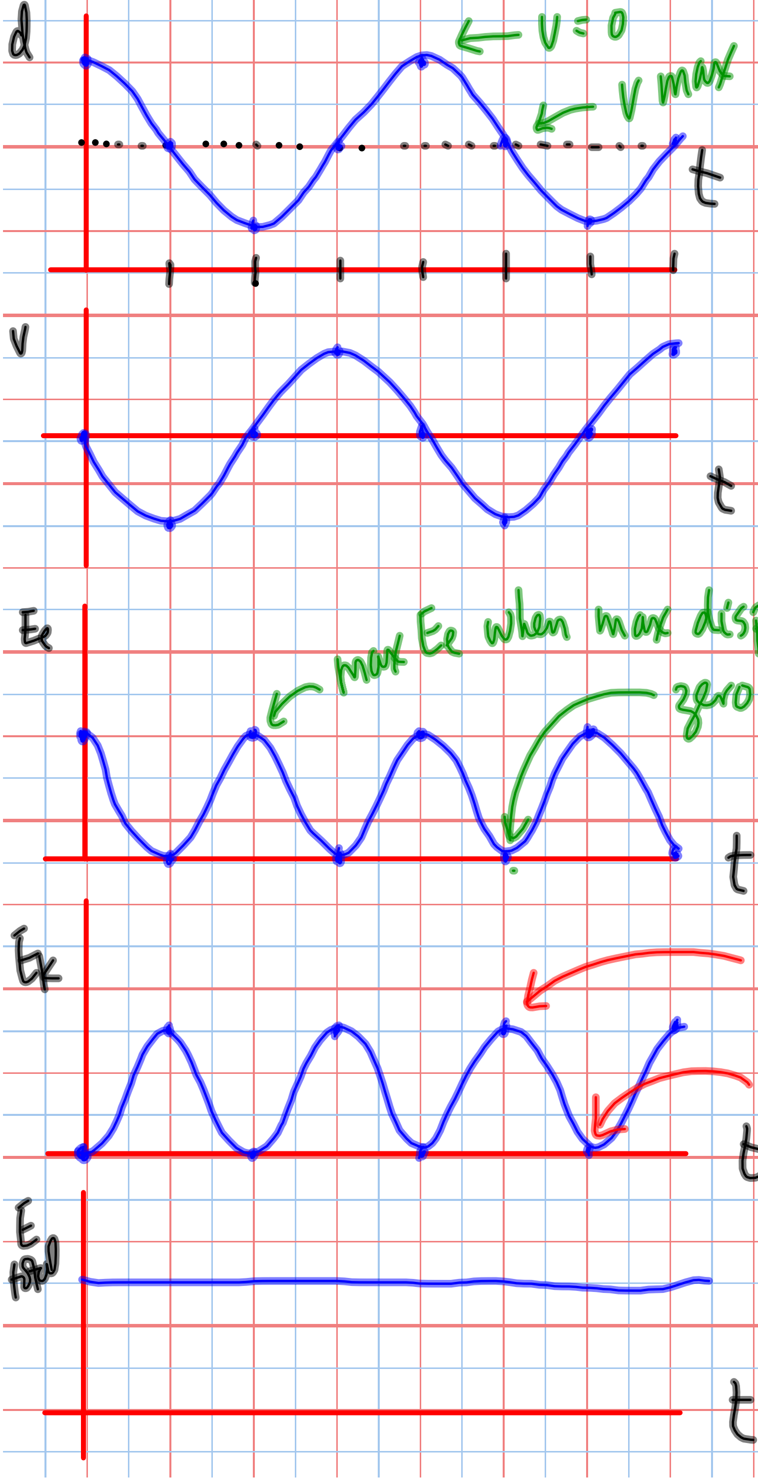
- graphs (d-t, v-t, a-t, F-t, KE-t, PE-t,
- period equations

pendulum: $T = 2\pi\sqrt{\frac{l}{g}}$ $\quad (E_g + E$

oscillating mass: $T = 2\pi\sqrt{\frac{m}{k}}$ $\quad (E_e +$

- energy conservation ($E_{total} = E'_{total}$)

Energy in Simple Harmonic Motion



← v = 0

v max at equilibrium

max E_e when max displacement from eq. (v = 0)

zero E_e when at equilib (v is max)

E_k is max when at eq ($E_e = 0$)

E_k is zero at max displ. (E_e = max)

Total Energy is constant (neglecting friction)

MP|606

$x = 12.0\,cm$

$m = 125\,g$

20.0 cycles in 15.5 s

a) $T = ?$

b) $k = ?$

c) $E_{total} = ?$

d) $V_{max} = ?$

e) $v = ?,\ x = 10.0\,cm$

a) $T = \dfrac{15.5\,s}{20.0\text{ cycles}}$

$T = 0.775\ s/cycle$

b) $T = 2\pi\sqrt{\dfrac{m}{k}}$

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

$\dfrac{T^2}{4\pi^2} = \dfrac{m}{k}$

$k = \dfrac{m4\pi^2}{T^2}$

$k = \dfrac{(0.125\,kg)\,4\pi^2}{(0.775\,s)^2}$

$k = 8.22\,\dfrac{N}{m}$

c) $E_{total} = \overset{0\ \leftarrow \text{max displace.}}{\cancel{E_k}} + E_e$

$E_{total} = \frac{1}{2}kx^2$

$E_{total} = \frac{1}{2}\left(8.22\frac{N}{m}\right)(0.120\,m)^2$

$\boxed{E_{total} = 0.0592\,J}$

d) At equilibrium, all the energy is E_k!

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

$0.0592\,J = \frac{1}{2}(0.125\,kg)\,v^2$

$\boxed{V = \pm 0.973\,m/s}$ ← max velocity.

e) At 10.0 cm: $E_{total} = E_k + E_e$

$0.0592\,J = \frac{1}{2}(0.125\,kg)\,v^2 + \frac{1}{2}\left(8.22\frac{N}{m}\right)(0.100\,m)^2$

⋮

you finish.

TO DO:

1. PP|608
2. mp|613 + pp|614