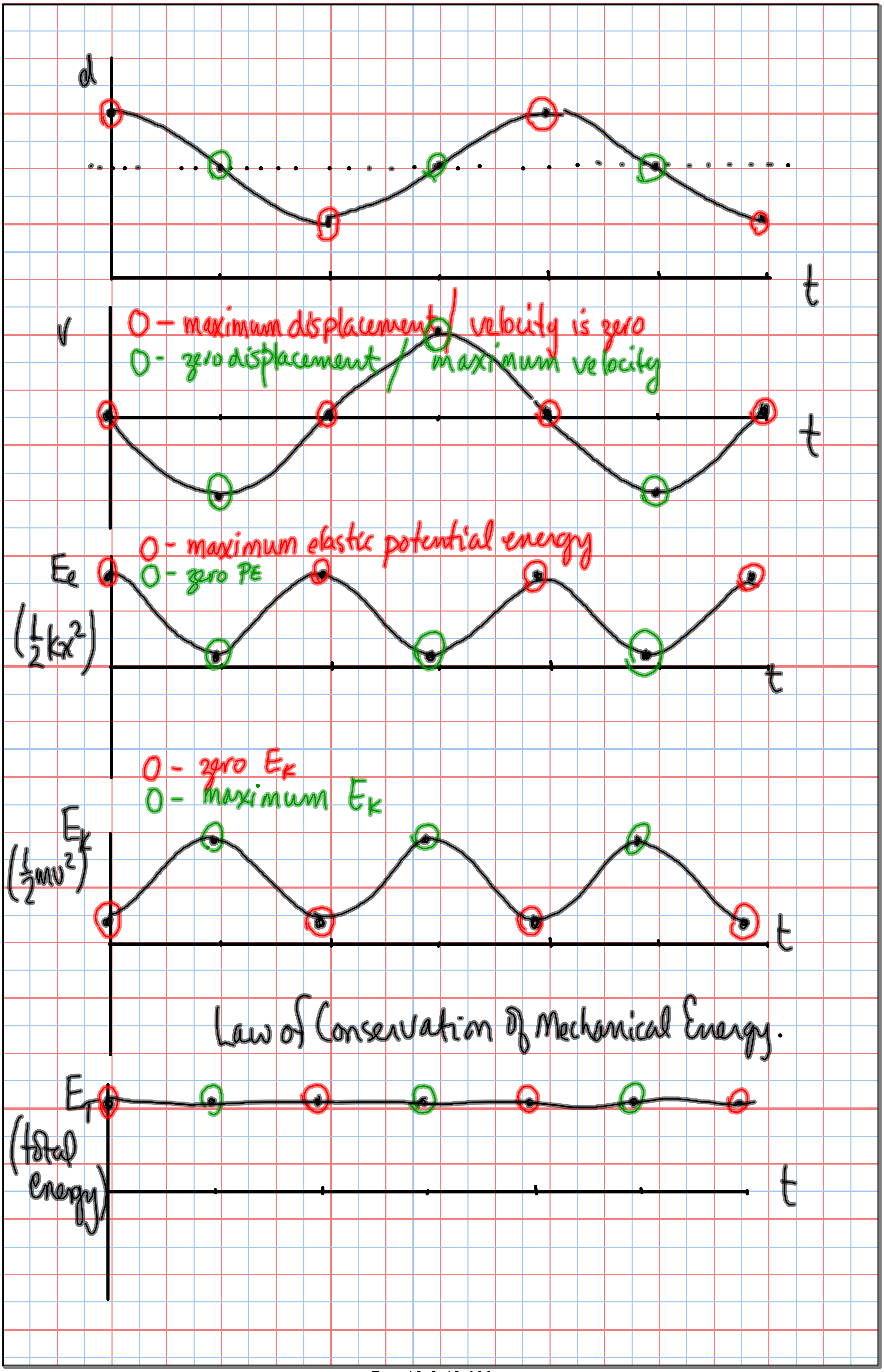

d
t
v
O – maximum displacement / velocity is zero
O - zero displacement / maximum velocity
t
O - maximum elastic potential energy
O - zero PE
Ee
(1/2 kx²)
t
O - zero Ek
O - maximum Ek
Ek
(1/2 mv²)
t
Law of Conservation of Mechanical Energy.
ET
(total energy)
t

TEST

Chapter 11

Projectile Motion

horizontally – velocity is constant $v = \frac{\Delta d}{\Delta t}$

vertically – constant acceleration

$a = \frac{\Delta v}{\Delta t}$ $(\Delta v = v_2 - v_1)$

$v_{ave} = \frac{\Delta d}{\Delta t}$ $\left(v_{ave} = \frac{v_1 + v_2}{2}\right)$

maybe useful: $\Delta d = v_1 t + \frac{1}{2}at^2$

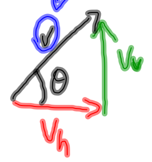
$\Delta d = v_2 t - \frac{1}{2}at^2$

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

for a projectile returning to the same level:

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

$\sin 2\theta = 2\sin\theta\cos\theta$



* velocity is a vector / direction is wrt tail of the vector.
* you NEED to be able to solve quadratics!!

Centripetal Acceleration

$a_c = \frac{v^2}{r} = \frac{4\pi^2 r}{T^2} = 4\pi^2 r f^2$ $\left(T = \frac{time}{cycles}, \quad f = \frac{cycles}{time}\right)$

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

DRAW a FBD! Do not draw F_c in the FBD as it is really your net force.

- horizontal circular paths
- vertical circular paths
- banked curves

Chapter 12 - Planetary Motion

Kepler's Laws ..... specifically $K = \frac{r^3}{T^2}$ (unique for a central body)

Newton's Law of Universal Gravitation:

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

$$F_g = mg$$

Newton's Hypothesis:

$$F_g = F_c$$

example: $\frac{Gm_{sat}m_{earth}}{r^2} = \frac{m_{sat}v^2}{r}$ $\quad v = \frac{2\pi r}{T}$

Satellites → remember r includes the altitude AND the radius of the central body

Geosynchronous / geostationary ⇒ T = 24h

Chapter 13 - SHM

Pendulum - $E_g | E_k$ → conservation

$E_g = mgh$

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

$T = 2\pi\sqrt{\frac{l}{g}}$ $\quad T \propto \sqrt{l}$ $\quad T^2 \propto l$

Harmonic Oscillator $E_e | E_k$ → conservation

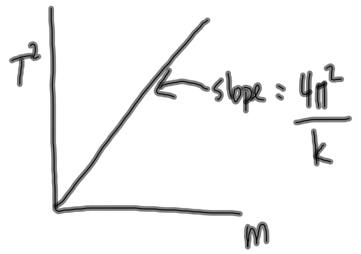
$E_e = \frac{1}{2}kx^2$ $\quad (F_a = kx)$

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

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

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

$T^2 = \frac{4\pi^2}{k}m$ (slope)



Review:

p624 | 1-6

p627 | 39, 40, 42, 43, 44, 46