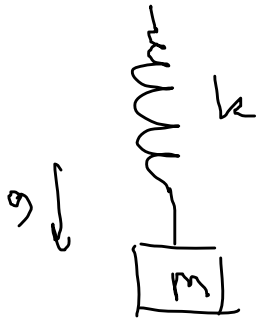
Phys 2110-4 11/18/11

Note Title 11/18/2011

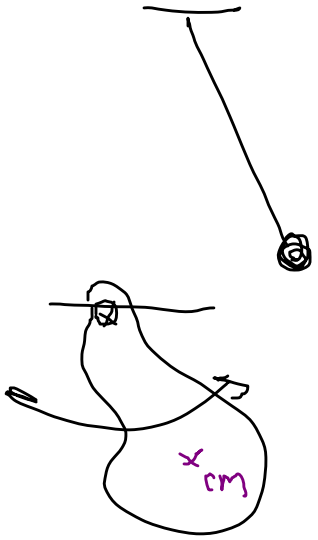
Chap 13 Oscillations



$\omega = \sqrt{\frac{k}{m}}$

etc.

$f, T, \ldots$



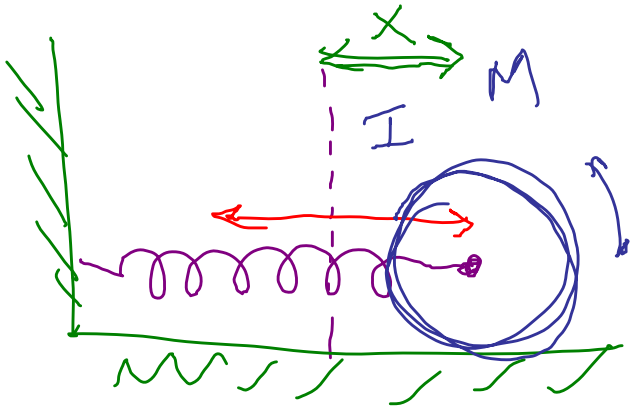
$\omega = \sqrt{\frac{g}{L}}$

etc.

$\omega = \sqrt{\frac{mgL}{I}}$

$\frac{d^2x}{dt^2} = -(\quad)x \rightarrow \omega^2 \quad f = \frac{\omega}{2\pi} \quad T = \frac{1}{f}$

13.63 A solid cylinder mass M, radius R mounted on axle. Attached to horiz. spring constant k, cylinder rolls back & forth w/o slipping. Write statement of energy conservation. Differentiate it to get the osc. equation. ⟹ Find ang frequency of motion.



Cons of energy $E = U + K$

$= \frac{1}{2}kx^2 + \frac{1}{2}Mv^2 + \frac{1}{2}I\omega^2$

trans rotn

$$E = \frac{1}{2}kx^2 + \frac{1}{2}Mv^2 + \frac{1}{2}\left(\frac{1}{2}MR^2\right)\left(\frac{v}{R}\right)^2$$

$$= \frac{1}{2}kx^2 + \frac{3}{4}Mv^2$$

$$\frac{dE}{dt} = 0 = \frac{1}{2}k(2x)\frac{dx}{dt} + \frac{3}{4}M(2v)\frac{dv}{dt}$$

(v)

$$0 = kxv + \frac{3}{2}Mv\frac{dv}{dt}$$

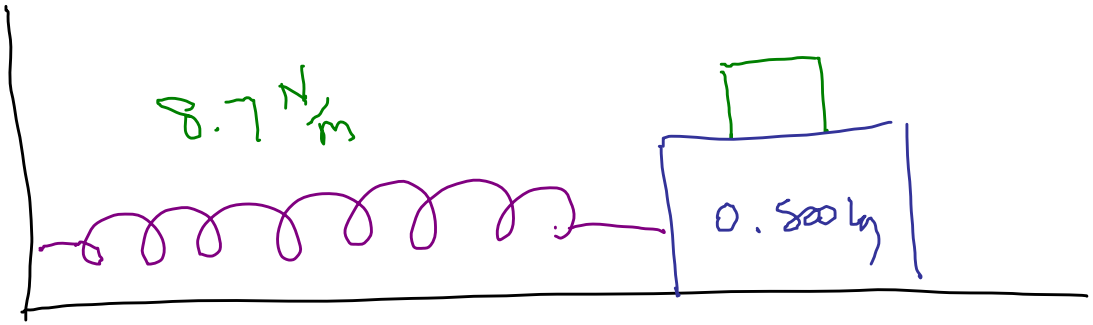
$$\frac{3}{2}M\frac{d^2x}{dt^2} = -kx$$

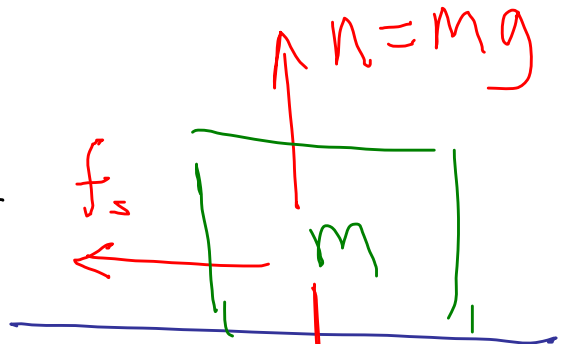
$$\frac{d^2x}{dt^2} = -\frac{2k}{3M}x$$

(w)

$$\omega^2 = \frac{2k}{3M} \qquad \boxed{\omega = \sqrt{\frac{2k}{3M}}}$$

13.74 A 500 g block on a frictionless horiz. surface attached to limp spring w/ $k = 8.7 \frac{N}{m}$. A second block rests on first & whole system exec's simple harmonic motion w/ period 1.8 s. When the amp is inc'd to 35 cm upper block begins to slip. What is coeff of static friction.





$T = 1.8\,s$

$f, \omega \qquad \omega = 3.49\ s^{-1}$

magnitudes

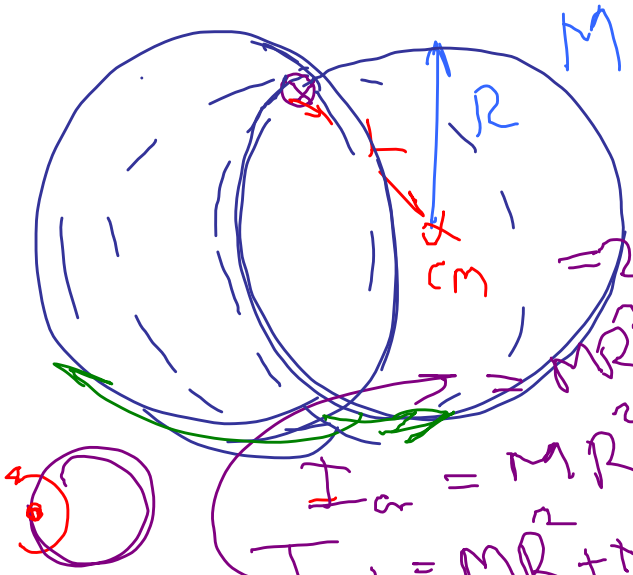
$f_s^{max} = \mu_s n = \mu_s mg$

$= F_{net}^{max} = ma_{max} = m\omega^2 A$

$\mu_s mg = m\omega^2 A$

$\mu_s = \dfrac{\omega^2 A}{g} = 0.435$

13.58 A thin uniform hoop of mass M and radius R is suspended from horiz rod & set oscillating w/ small amp Show that period of osc. is $2\pi\sqrt{2R/g}$



Physical pendulum

$I_{cm} = MR^2$

$I_{ed} = MR^2 + MD^2$

$= 2MR^2$

$= MR^2 + MR^2$

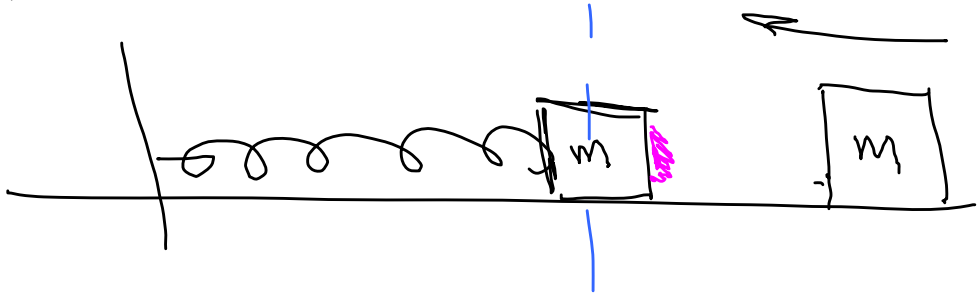
$T = \sqrt{\frac{MgL}{I}}$

$= \sqrt{\frac{MgR}{2MR^2}}$

$$w = \sqrt{\frac{g}{2R}}$$

$$T = \frac{1}{f} = \frac{2\pi}{w} = \boxed{2\pi\sqrt{\frac{2R}{g}}}$$

Others



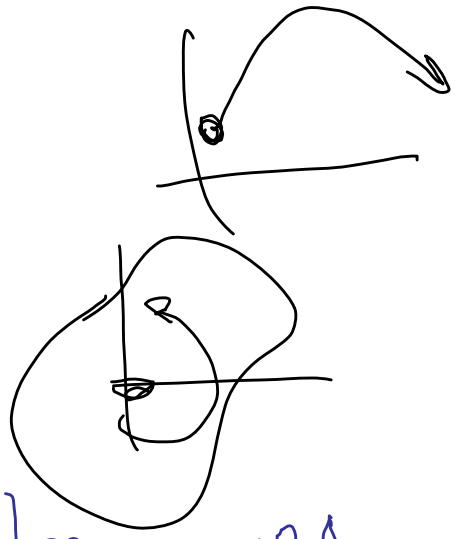
Chap 14 Waves

Lots of matl in one chapter

Before:

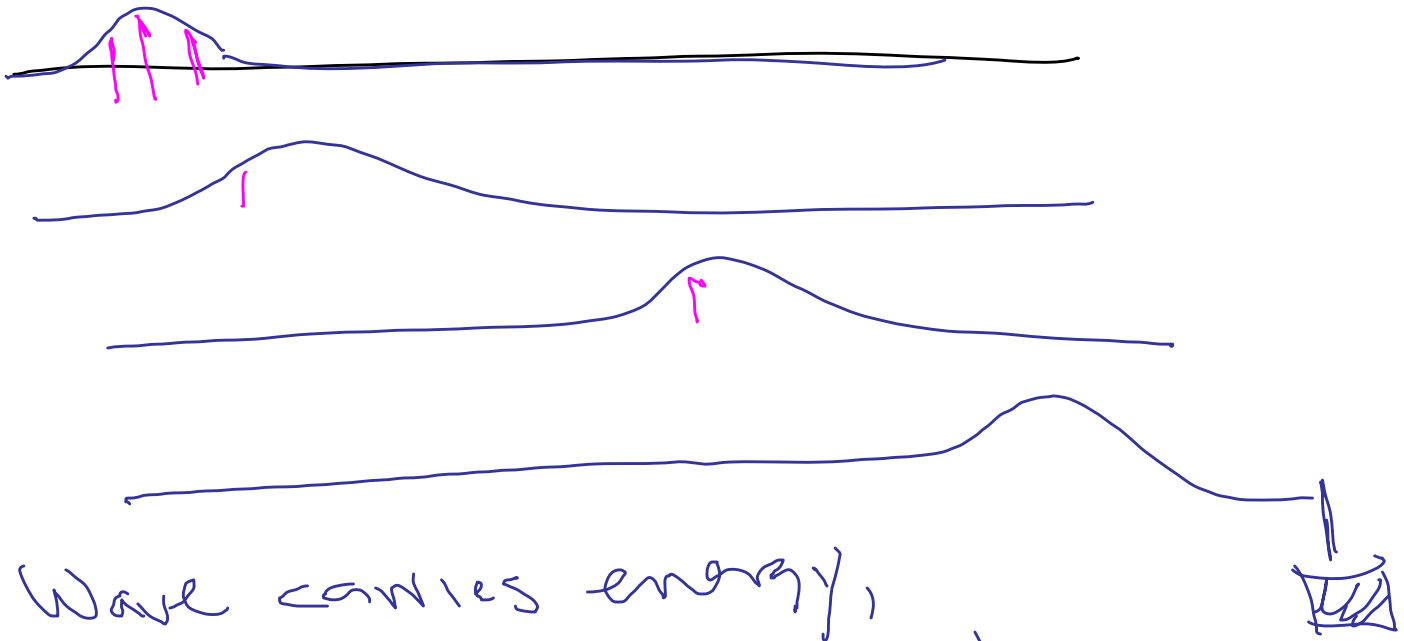
Particles: Motion, trajectories

Systems of particles
extended objects

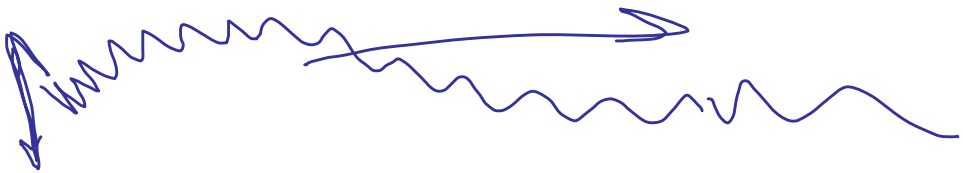


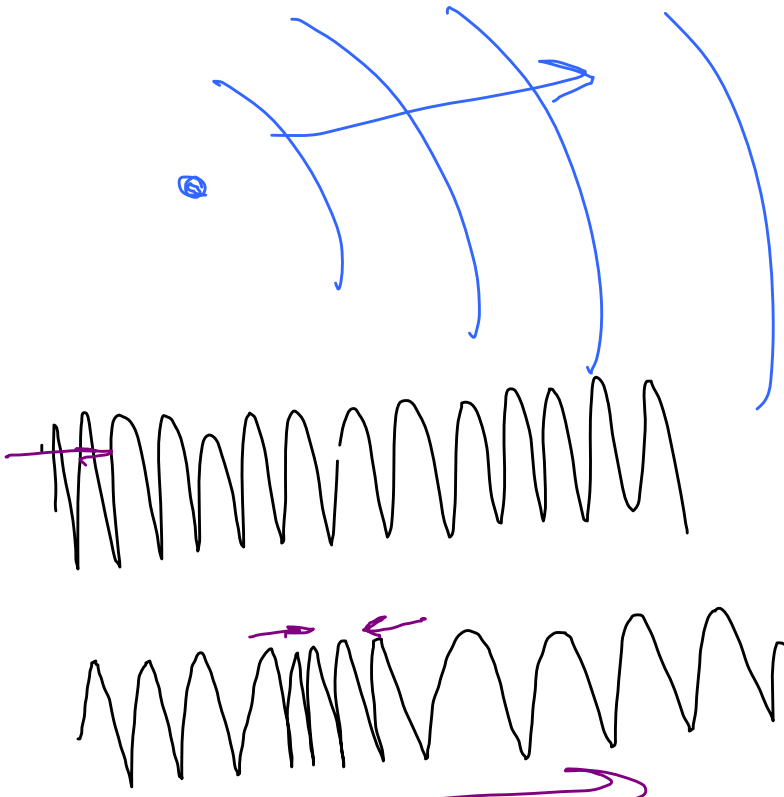
Waves Class of phenomena:

A wave is a traveling disturbance
transports energy but not matter. p. 429

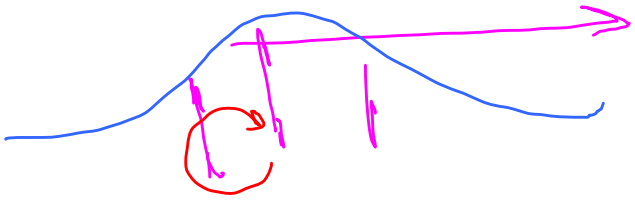


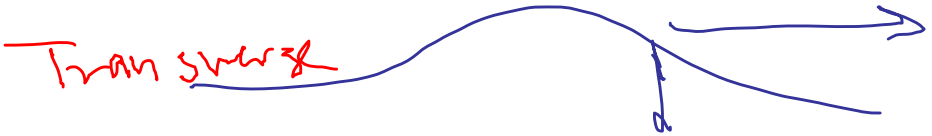
Wave carries energy,
but no large-scale motion.

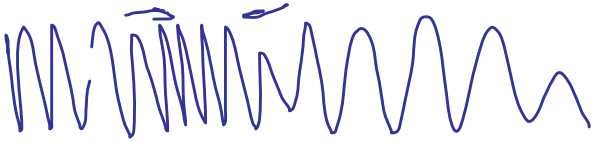




Bit of slinky has a small motion parallel to dir of propagation.







Longitudinal

Sound