

Phys 2110-4 4/11/12

Note Title

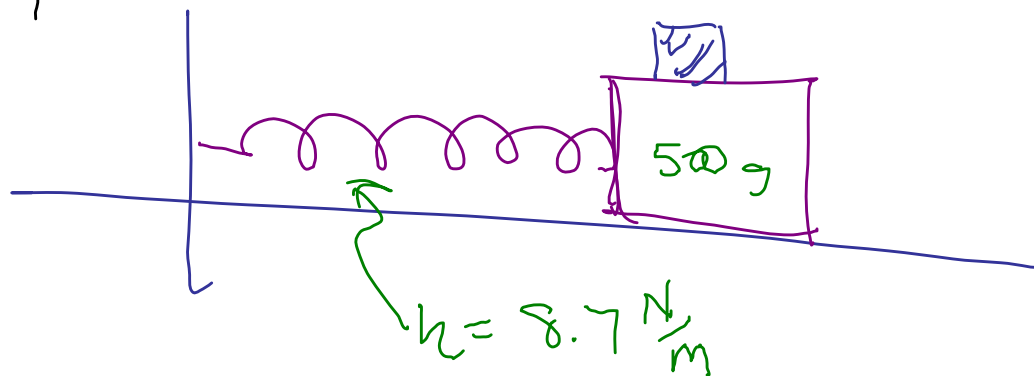
4/11/2012

# Oscillations

$$\frac{d^2x}{dt^2} = -(\omega^2)x$$

$$x = A \cos(\omega t + \phi)$$

13.74

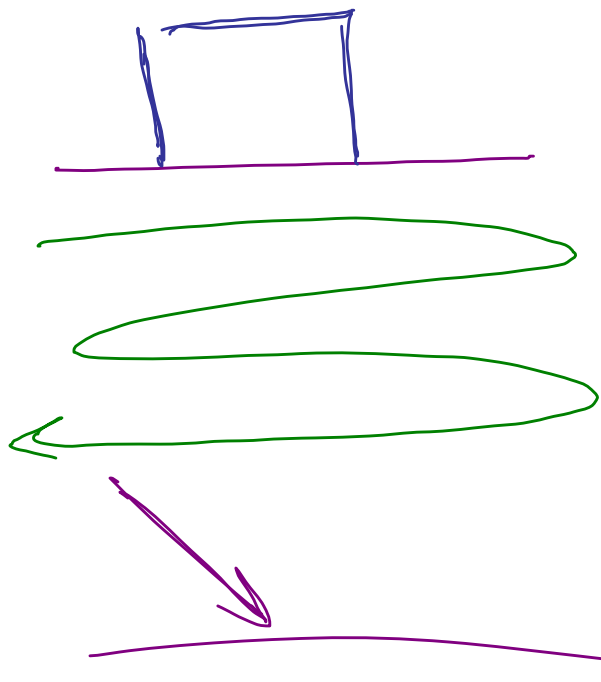


When they move together

$$T = 1.8 \text{ s}$$

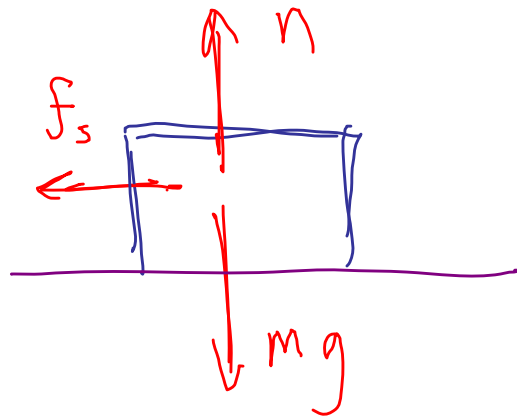
When

$A = 35 \text{ cm}$  upper block begins to slip



$$\omega^2 A = \mu_s g$$

$$a_{\max} = A\omega^2 \quad (\text{magnitude})$$

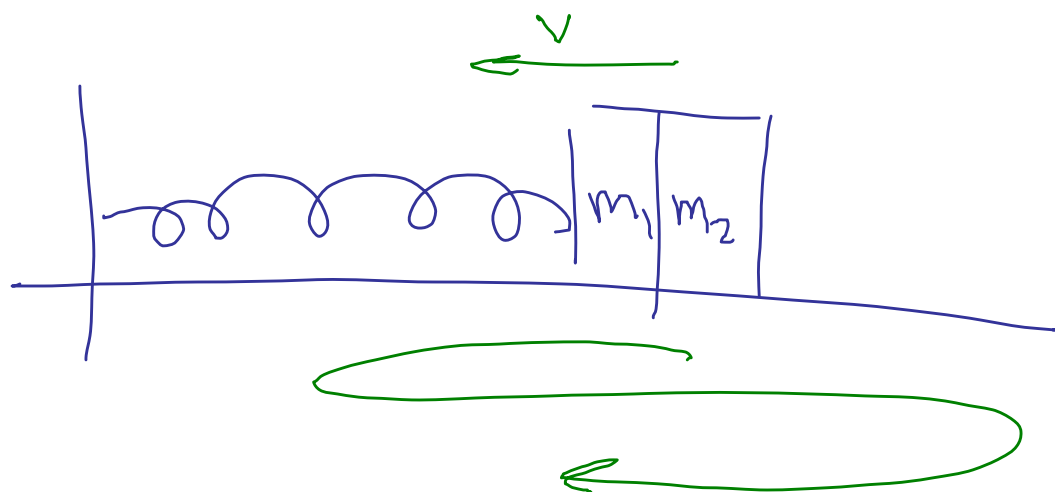
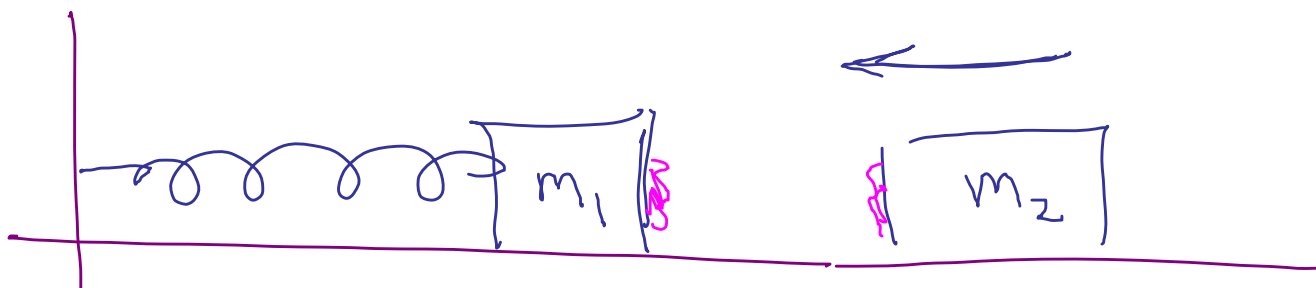


$$f_s^{\max} = \mu n$$

~~$$ma_{\max} = \mu mg$$~~

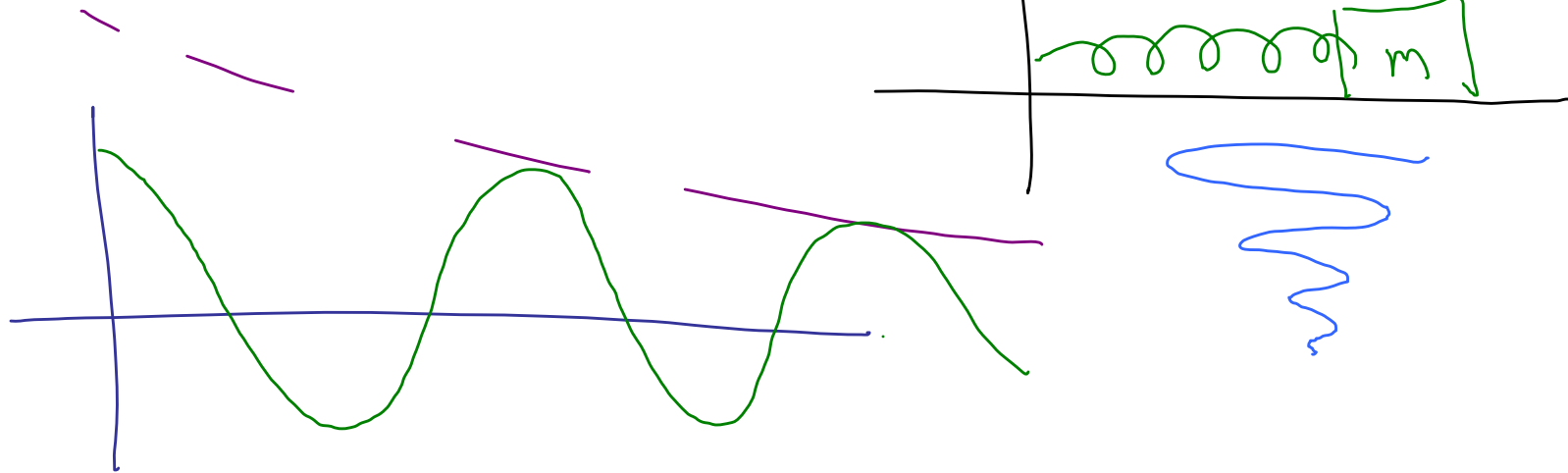
$$a_{\max} = \mu g$$

$$\mu_s = \frac{\omega^2 A}{g} = 0.43$$



$$\frac{1}{2}(m_1 + m_2)v^2 = \frac{1}{2}kA^2$$

Lots more to learn



Usually consider  $f_k \propto \text{speed}$   
$$f_k = -\alpha v = -\alpha \frac{dx}{dt}$$

$$F_{\text{net}} = m a_x = m \frac{d^2 x}{dt^2} = -kx - \alpha \frac{dx}{dt}$$

DE

$$m \frac{d^2 x}{dt^2} + \alpha \frac{dx}{dt} + kx = 0$$



$x(t)$   
 $t$

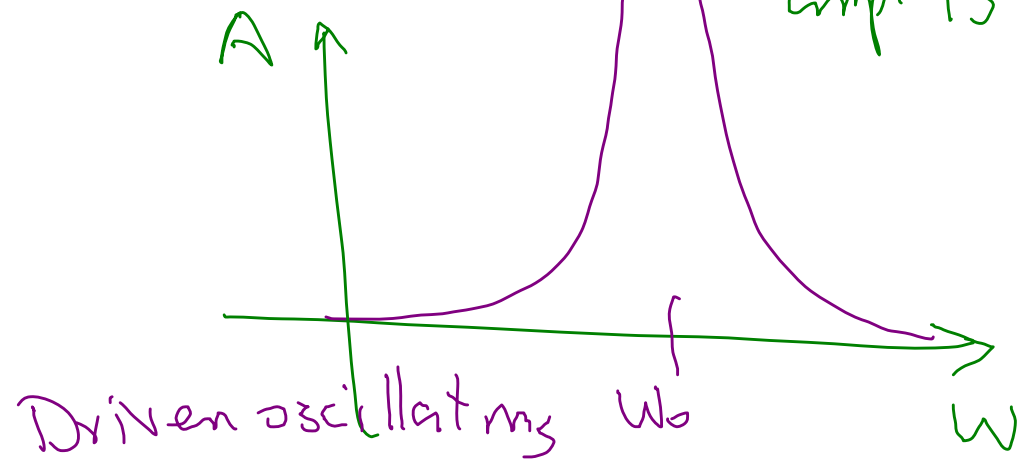
$$x(t) = A e^{-\alpha t / 2m} \cos(\omega t + \phi)$$

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Driving force, oscillates in time



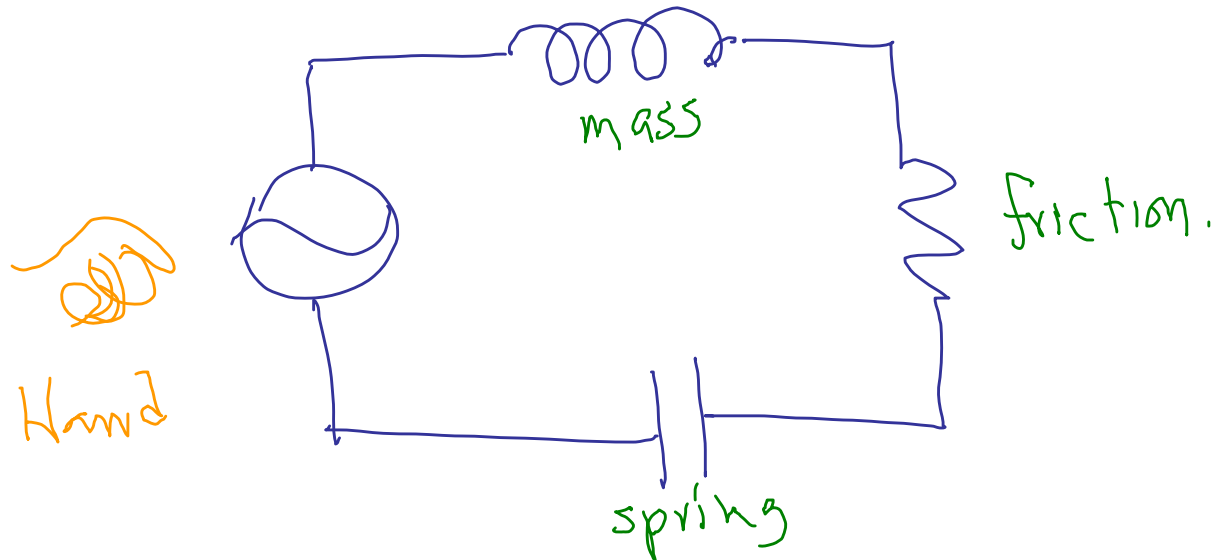
Resonance



$\omega$  special value, amp. is big

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Analogy w/ electrical circuit



Ch 12/

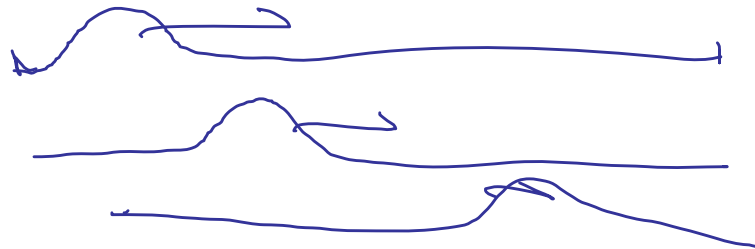
# Wave Motion, Ch 14

Class of phenomena.

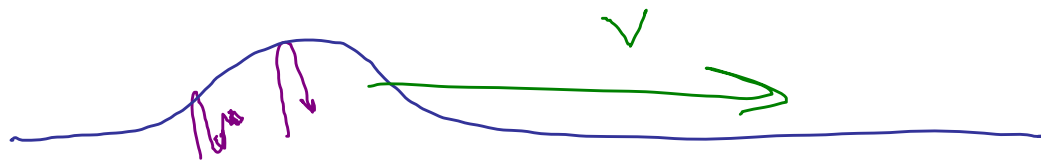
Elastic medium, distorts

Transmits motions of distortions.

Wave motion.







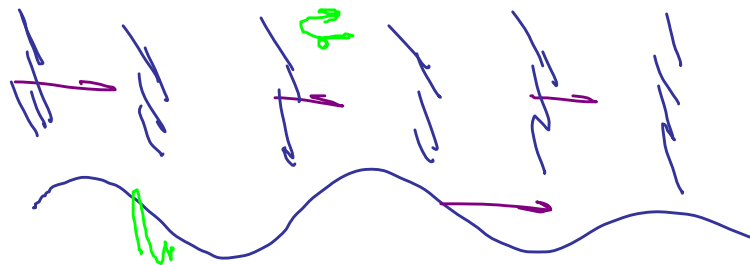
String  
Spring  
Water  
Air  $\rightarrow$  Sound.

Much of what we say  
applies to

Light waves

Not the same, don't travel thru elastic  
medium.

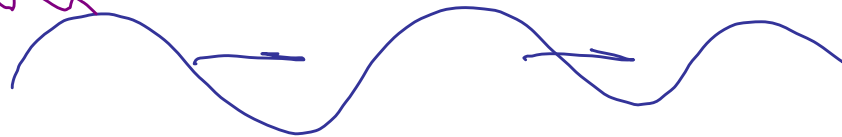
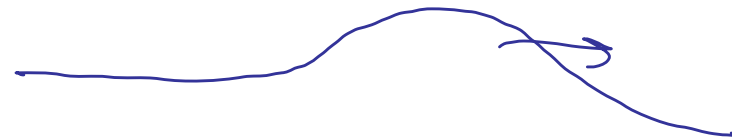
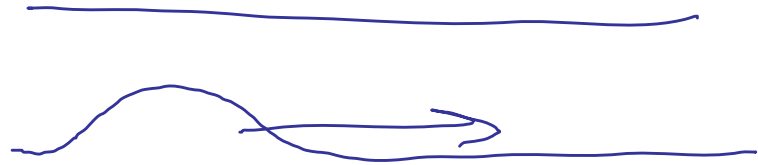
Longitudinal  
Transverse



# Assumptions

No energy loss

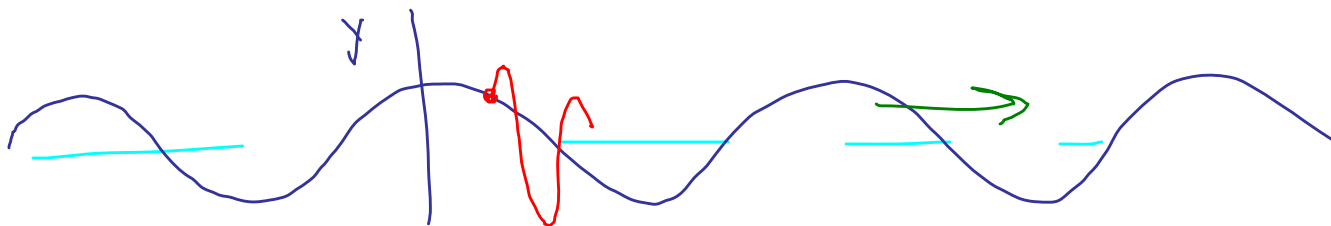
Pulse keeps same shape



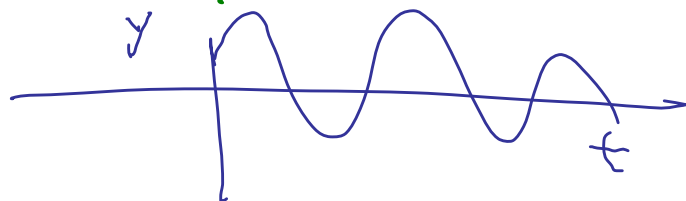


→ Wave packets

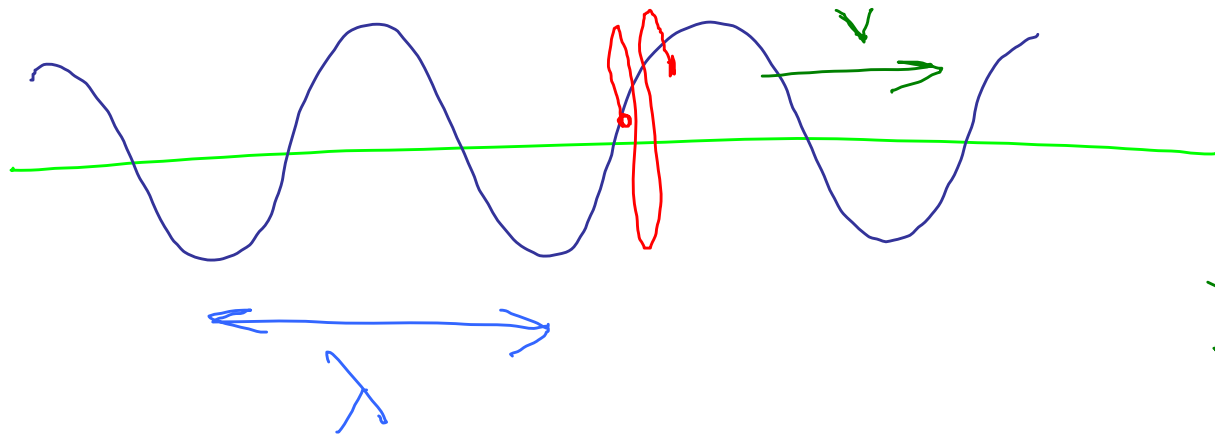
Harmonic Wave.



Snapshot: Spatial pattern repeats  
in a cosinney way.



Time picture.



Wave travels  
at speed  $v$ .

Non-dispersive  
medium

Wavelength.

Every tiny piece of wave works like  
oscillator.

frequency  $f$