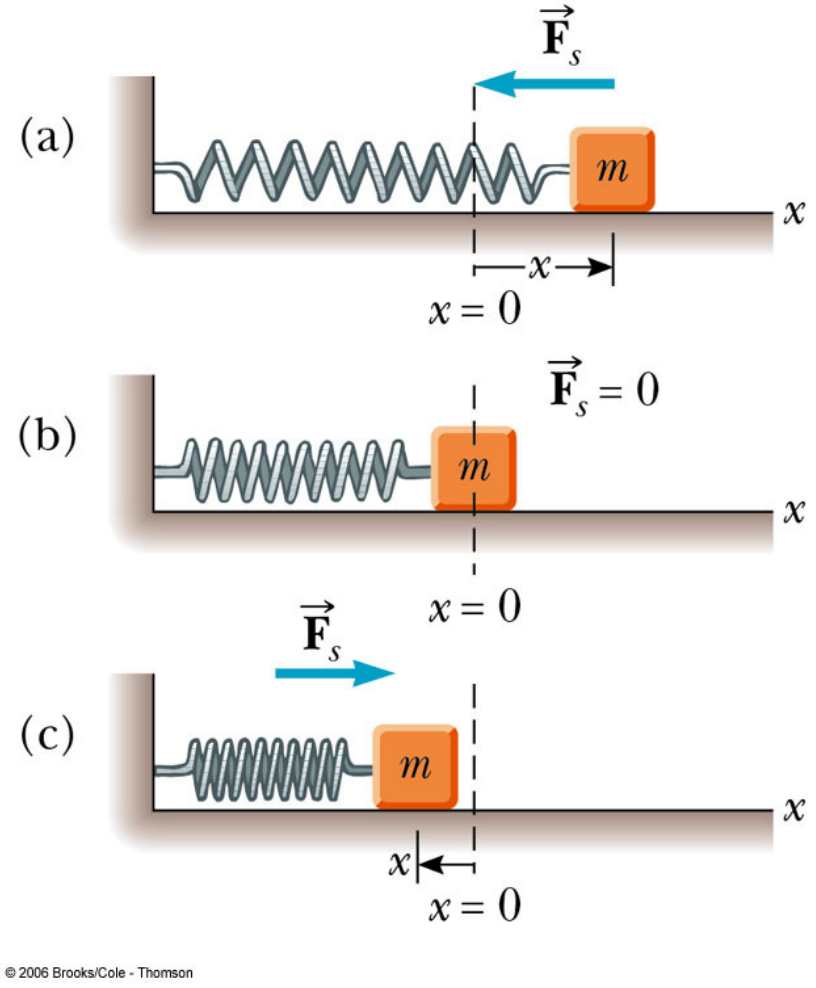
Physics 105 Class 20
VIBRATIONS

Review of springs (force and energy)



Simple harmonic motion occurs if the force on a mass is **spring-like**

What does simple harmonic motion look like?

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

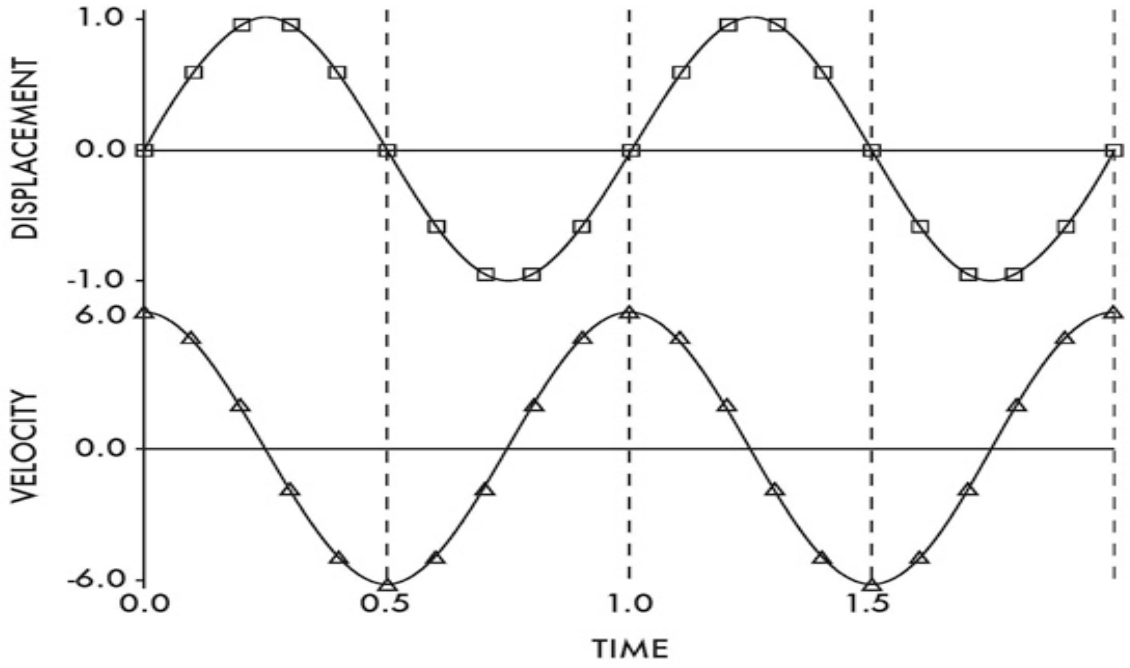
$$f=\frac{\omega}{2\pi} \qquad T=\frac{1}{f}=\frac{2\pi}{\omega}$$

Amplitude A= _____.

Period T = _____ sec

Frequency f = _____ cycles/sec (Hz)

Angular frequency $\omega=2\pi f=$_____ rad/sec



What does the acceleration look like?

Is ω the same here as for uniform circular motion?

Mass and spring

f =

T =

Pendulum (small angles)

f =

T =

P1. *Does period depend on amplitude?*

The position of a mass vibrating on a spring is given in centimeters as:

x(t)= 4 *cos (8 t).

Find f, T, A, ω

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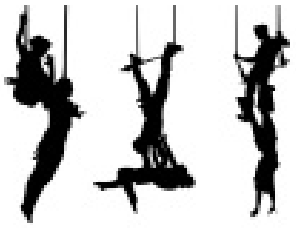
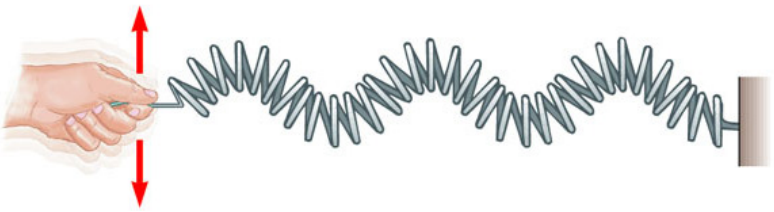


A 70 kg trapeze artist swings on a long trapeze and takes 5 seconds to return to his starting spot.

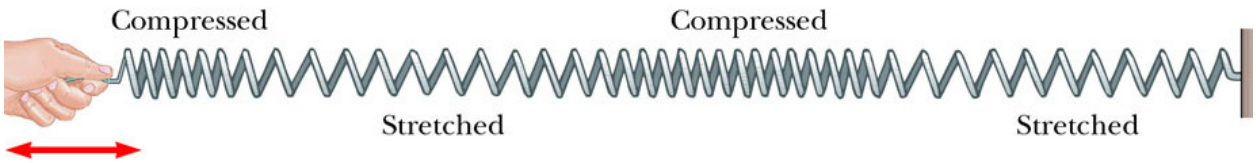
How long will it take a woman of mass 50kg to make the same swing? _____ sec

How long will it take for the 70 kg man to swing from his starting place to when he first reaches the bottom? _____ sec

How long is the rope? _____ m



(a) Transverse wave



(b) Longitudinal wave

Waves

Transverse—The disturbance is perpendicular to the direction of the wave.

Longitudinal—The disturbance is in the same direction as the direction of the wave

Some examples

- slinky
- rope
- sound
    - gas
    - solid
- light
- water

Speed, wavelength, and frequency

Bill's favorite radio station is at 103.5 MHz. Radio waves travel at the speed of light (3×10^8 m/s). What is the wavelength of these radio waves? What is the period?

A boy shakes a rope 3 times per second. He sees the waves move away with a distance between *crests* of 15 cm. The speed of the wave is _____ cm/sec

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*Why do some waves go **faster** than others?*

Wave speeds in matter always are of the form:

Wave speed on string, rope or cable:

Tension = *T* (book uses F)

P2. Two guitar strings of the same length have the same tension, but one has four times the mass of the other. The speed of a wave on the heavier guitar string is _____ than the lighter string.

1. smaller
2. the same
3. larger

P3.Pulses traveling down a rope are examples of _____ waves

1. longitudinal
2. transverse
3. circular

P4. Surface water waves are examples of _____ waves

1. longitudinal
2. transverse
3. circular

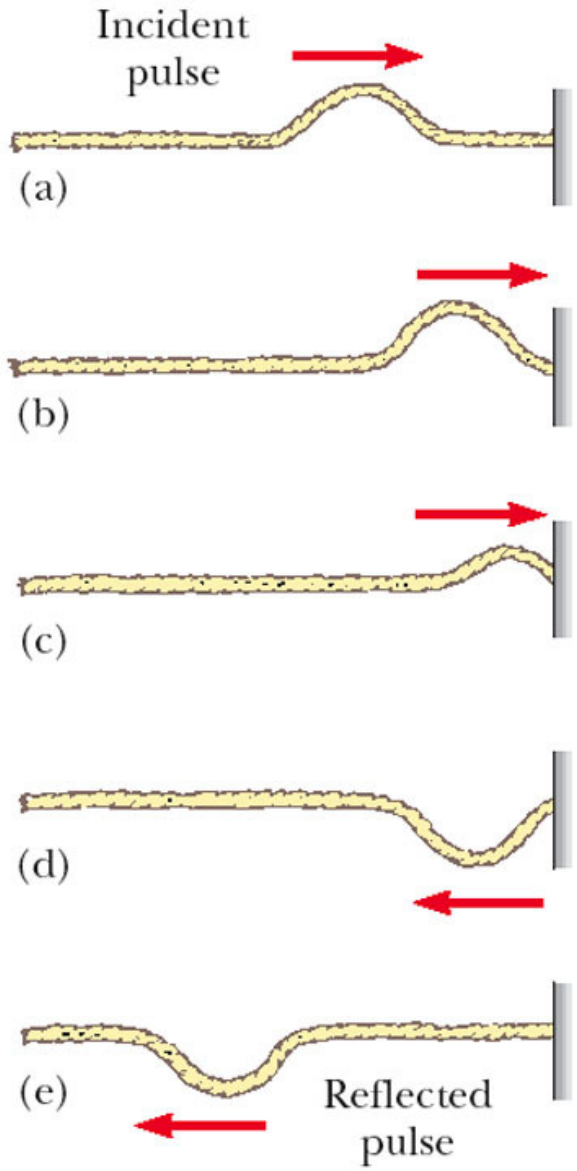
Superposition

What happens if two pulses, one from each end, meet in the middle? Do they pass through or reflect back when they meet?

Constructive and Destructive Interference

Reflection

What happens when a pulse hits the end and turns around? Does it return on the same side of the rope or does it invert?



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HOMEWORK HINTS: