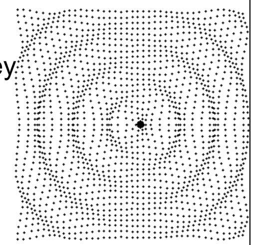
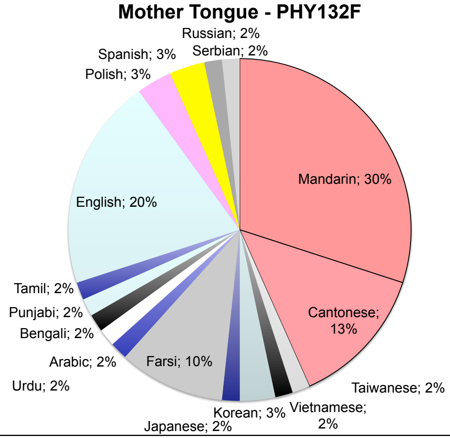
PHY132H1F Introduction to Physics II
Class 2 – **Outline:**



- Results from class survey
- How to use your clicker
- One-dimensional waves
- Sinusoidal Waves
- Waves in 2-D and 3-D
- Spherical waves and plane waves
- Power and Intensity of Waves
- The Doppler Effect

Class Survey from Day 1

- Countries your classmates may have lived in:
  - Canada, England, China, Iran, U.S.A., France, Italy, Pakistan, Saudi Arabia, South Korea, Panama, Hong Kong, Switzerland, India, Serbia, Cyprus, Kuwait, Qatar, Germany, Hungary, Guatemala, Poland, Austria, New Zealand
- Ways your classmates got to school:
  - TTC, walking, car, go bus, Brampton transit, shuttle from UTM

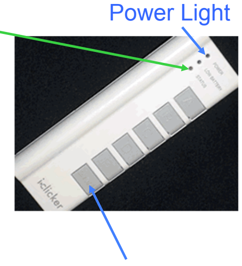


The “Clickers”

Status Light

When I start asking clicker questions:

- Will flash green when your response is registered
- Will flash red if your response is not registered



Please turn on your clicker now

4

Survey: How did the reading go that I assigned? (please be honest – this is just a survey)

A. I read all of Knight Chapter 20, fairly thoroughly.
B. I read all of Knight Chapter 20, but I was mostly “skimming”.
C. I read most of Knight Chapter 20 (more than half of it).
D. I read some of Knight Chapter 20 (less than half of it).
E. I did not do the reading.

Quick reading quiz..
The waves analyzed in chapter 20 are

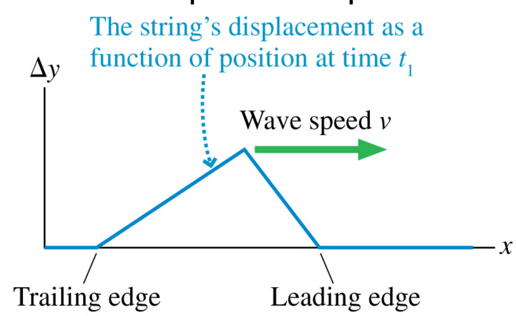
A. string waves.
B. sound and light waves.
C. sound and water waves.
D. string, sound, and light waves.
E. string, water, sound, and light waves.

Quick reading quiz…

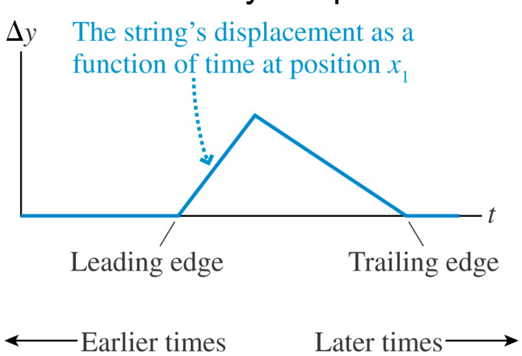
- What is the phase difference between the crest of a wave and the adjacent trough?

A. $\lambda/2$
B. π
C. $T/2$
D. $\pi/2$
E. $A/2$

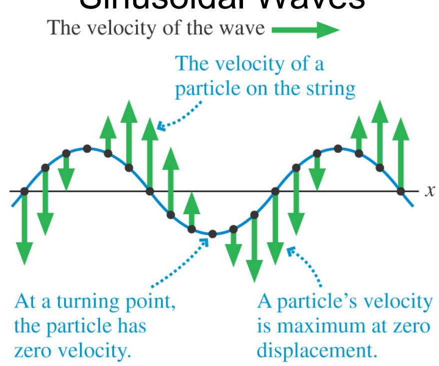
Snapshot Graph



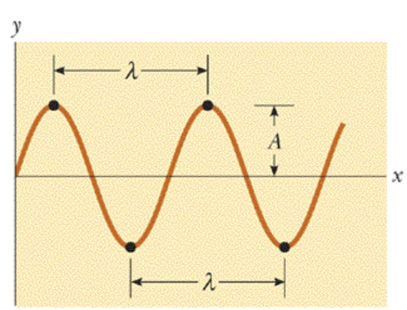
History Graph



Sinusoidal Waves

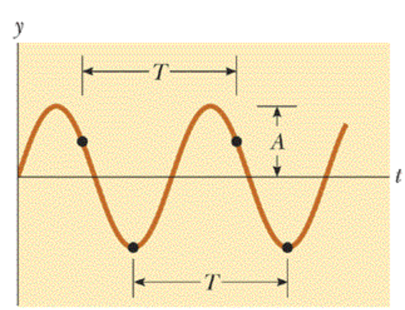


Sinusoidal Wave Snapshot Graph



$k = 2\pi/\lambda$ is the wave number

Sinusoidal Wave History Graph



$\omega = 2\pi/T$ is the angular frequency

Sinusoidal Waves Summary

- The *angular frequency* of a wave is

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

- The *wave number* of a wave is

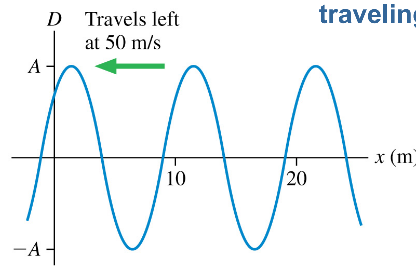
$$k = \frac{2\pi}{\lambda}$$

- The general equation for the displacement caused by a traveling sinusoidal wave is

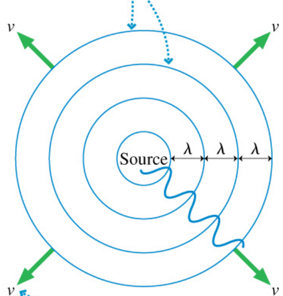
$$D(x, t) = A\sin(kx - \omega t + \phi_0)$$
(sinusoidal wave traveling in the positive x-direction)

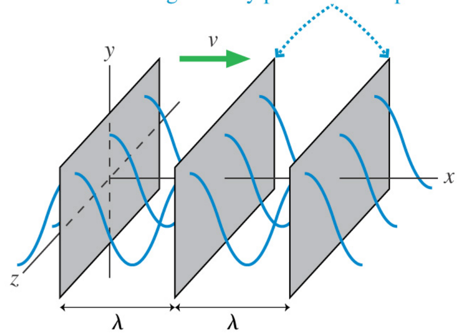
This wave travels at a speed $v = \omega/k$.

What is the frequency of this traveling wave?



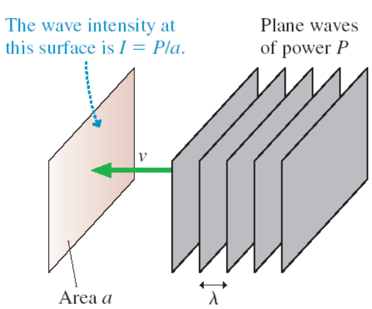
A. 0.1 Hz
B. 0.2 Hz
C. 2 Hz
D. 5 Hz
E. 10 Hz



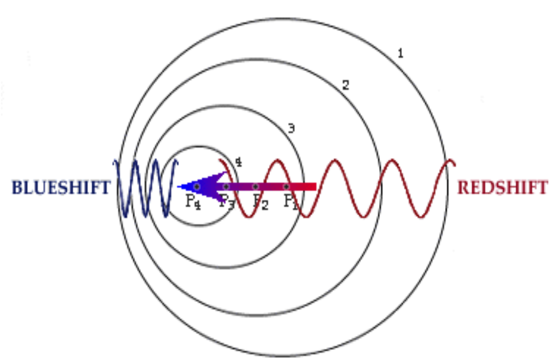


Power and Intensity

FIGURE 20.24 Plane waves of power P impinge on area a with intensity $I = P/a$.



Doppler Effect



The Doppler Effect

The frequencies heard by a stationary observer when the sound source is moving at speed v_0 are

$$f_+ = \frac{f_0}{1 - v_s/v} \quad \text{(Doppler effect for an approaching source)}$$

$$f_- = \frac{f_0}{1 + v_s/v} \quad \text{(Doppler effect for a receding source)}$$

The frequencies heard by an observer moving at speed v_0 relative to a stationary sound source emitting frequency f_0 are

$$f_+ = (1 + v_o/v)f_0 \quad \text{(observer approaching a source)}$$

$$f_- = (1 - v_o/v)f_0 \quad \text{(observer receding from a source)}$$

Which statement is true?

Valerie is standing in the middle of the road, as a police car approaches her at a constant speed, v. The siren on the police car emits a "rest frequency" of f_0.

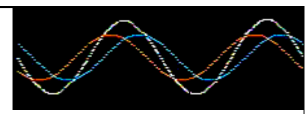
A. The frequency she hears rises steadily as the police car gets closer and closer.
B. The frequency she hears steadily decreases as the police car gets closer and closer.
C. The frequency she hears does not change as the police car gets closer.

Which statement is true?

Valerie is standing still as a police car approaches her at a constant speed, v. Daniel is in his car moving at the same constant speed, v, toward an identical police car which is standing still. Both hear a siren.

A. The frequency Daniel hears is lower than the frequency Valerie hears.
B. The frequency Daniel hears is higher than the frequency Valerie hears.
C. The frequencies that Daniel and Valerie hear are exactly the same.

Before Next Class:



- Try the Suggested End Of Chapter Problems that I assigned from Chapter 20 (they are posted under "Materials" on the course web site).
- Read Chapter 21 on Interference and Standing Waves

Have a great weekend!