

# Wave Velocity

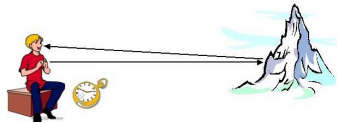
Mr. Sudbury

- ## Wave Speed (Velocity)
- ▶ The velocity of a wave depends on the **medium** through which the wave moves.
  - ▶ EM waves (light) travel at speed of light  $3 \times 10^8$  m/s
    - 300,000,000 m/s
  - ▶ Sound waves travel between 331 m/s and 350 m/s through air (depending on temperature.)
    - $(331 \text{ m/s} + (0.6 \text{ m/s/}^\circ\text{C})(\text{Temperature}))$ 
      - Velocity of sound waves fast in gas (air),
      - Faster through a liquid (i.e. 1,482 m/s @ 20 °C Water)
      - Fastest through solids (i.e. steel 6,100 m/s)
  - ▶ The MEDIUM determines the speed of the wave.

- ## Speed of Sound in Air
- ▶ What would you expect the speed of sound to be on a January day when the temperature is 8°C?
  - ▶ What would you expect the speed of sound to be on a July day when the temperature is 41°C?

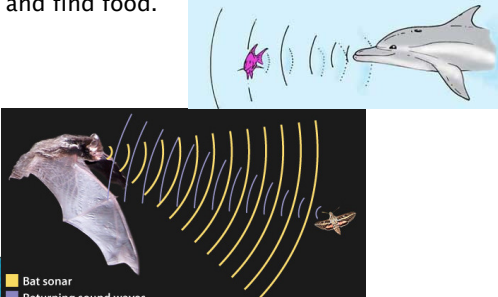
## Velocity applies to Waves

- ▶ A boy in the mountains shouts "hello" and hears his echo 4.5 seconds later. The temperature is 8°C (so *V of sound is 335.8 m/s*). How far away is the mountain that caused the echo?



## Echolocation

- ▶ Bats & dolphins use echolocation to navigate and find food.



■ Bat sonar  
■ Returning sound waves

## Wave Speed (Velocity)

wave velocity = wavelength x frequency

$$v = \lambda f$$

$$\lambda = \frac{v}{f} \qquad f = \frac{v}{\lambda}$$

## Wave Velocity Problems

- ▶ A wave with a frequency of 60.0 Hz travels through rubber with a wavelength of 0.90 m. What is the speed of this wave?

## Wave Velocity Problems

- ▶ The musical note A, above middle C, has a frequency of 440 Hz. If the speed of sound is known to be 350 m/s, what is the wavelength of this note?

## Wave Velocity Problems

- ▶ A buoy bobs up and down in the ocean. The waves have a wavelength of 2.5 m, and they pass the buoy at a speed of 4.0 m/s. What is the frequency of the waves?

## The End

- ▶ Wave Velocity

