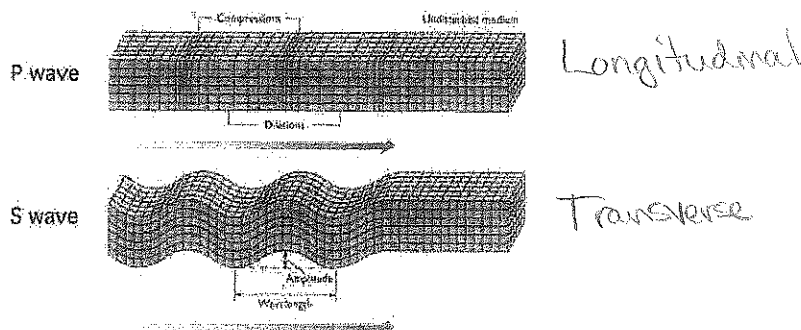


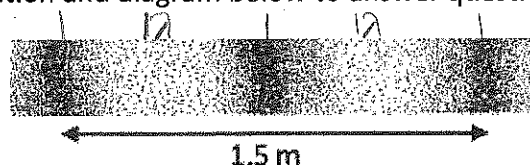
Skill 50: Mechanical Waves

99. Mechanical waves can either be transverse or longitudinal. Label the earthquake "S wave" and "P wave" as transverse or longitudinal accordingly



100. A mechanical wave is defined as a wave that requires a medium to propagate (travel)

Use the information and diagram below to answer questions 101 and 102



A sound wave with a frequency of 440 hertz is traveling through a tube.

101. What is the wavelength of the sound wave? $\frac{1.5\text{m}}{2\lambda} = .75\text{m}$ (Hint: How many wavelengths are represented?)

102. Calculate the speed of this wave.

$$\begin{aligned}
 f &= 440\text{Hz} \\
 \lambda &= .75\text{m} \\
 v &= ? \\
 v &= f\lambda \\
 &= (440\text{Hz})(.75\text{m}) \\
 &= 330\text{m/s}
 \end{aligned}$$

103. What is the frequency of a sound wave with a wavelength of 0.04 meter in air at STP? Is this a mechanical or electromagnetic wave? Is this a longitudinal or transverse wave?

Sound waves are mechanical & longitudinal

104. A bat is using sound waves to locate an insect (assume air is at STP). The bat produces sounds with a frequency of 120 kilo-hertz and notes that the sound it transmits echo's back in 0.02 second.

a. What is the total distance the sound travels in 0.02 seconds? What is the bat's distance to its prey?

$$\begin{aligned}
 d &= ? \\
 v &= 331\text{m/s} \text{ (see PRT)} \\
 t &= 0.02\text{s} \\
 d &= vt \\
 &= (331\text{m/s})(0.02\text{s}) = 6.62\text{m} \rightarrow 3.31\text{ to prey} \rightarrow \text{echo means wave traveled out \& back}
 \end{aligned}$$

b. What is the wavelength of the bat's radar?

$$\begin{aligned}
 v &= 331\text{m/s} \\
 \lambda &= \frac{v}{f} = \frac{331\text{m/s}}{1.2 \times 10^5\text{Hz}} = 2.7 \times 10^{-3}\text{m}
 \end{aligned}$$

Topic 6B: Mechanical Waves/Sound

Skill 50

105. As a longitudinal wave travels horizontally, the particles of the medium vibrate

A) in a circle

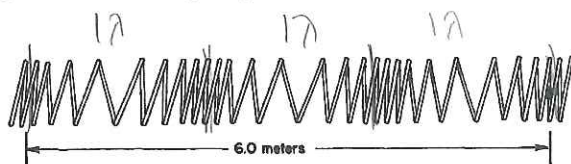
B) in a spiral

C) vertically

D) horizontally

Propagation \longleftrightarrow
particles \longleftrightarrow

106. Base your answer to the following question on the diagram below which represents waves generated in a spring.



What is the wavelength of the waves produced in the spring?

A) 1.5 m

B) 2.0 m

C) 3.0 m

D) 6.0 m

$$\lambda = \frac{\text{meter}}{\text{cycle}} = \frac{6.0 \text{ m}}{3 \text{ cycles}} = 2 \text{ m}$$

107. Which is an example of a longitudinal wave?

A) gamma ray

B) X-ray

C) sound wave

D) water wave

108. As a longitudinal wave passes through a medium, the particles of the medium move

A) in circles

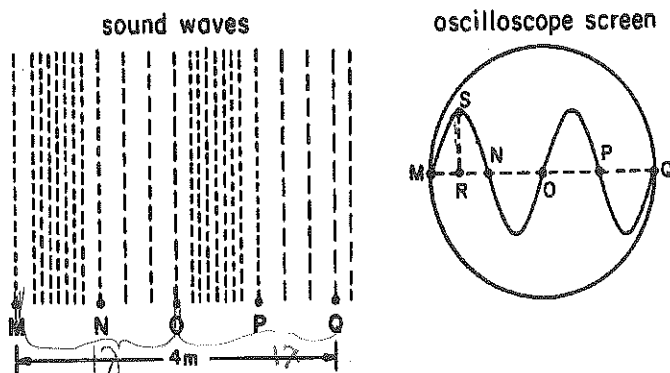
B) in ellipses

C) parallel to the direction of wave travel

D) perpendicular to the direction of wave travel

Topic 6B: Mechanical Waves/Sound

109. Base your answer to the following question on the accompanying diagram which represents a sound wave and its corresponding pattern on an oscilloscope screen.



What is the wavelength of the sound wave?

- A) 1 m B) 2 m C) 8 m D) 4 m

$$\lambda = \frac{\text{meters}}{\text{cycle}} = \frac{4\text{m}}{2\text{cycles}} = 2\text{m/cycle}$$

110. The energy of a sound wave is most closely related to the wave's

- A) frequency B) amplitude
C) wavelength D) speed

mechanical waves energy associated with amplitude

111. The energy of a water wave is most closely related to its

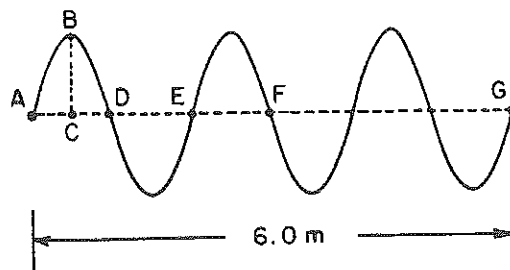
- A) frequency B) wavelength
C) period D) amplitude

mechanical wave → energy = amplitude

112. In which type of wave is the disturbance of the medium perpendicular to the direction of travel of the wave?

- A) longitudinal B) transverse
C) latitudinal D) tangential

113. Base your answer to the following question on the diagram below which represents a vibrating string with a periodic wave originating at A and moving to G a distance of 6.0 meters.

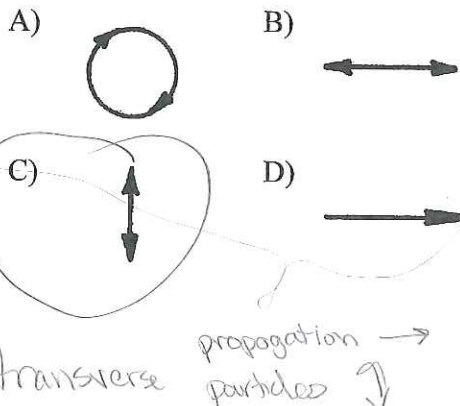


What type of wave is represented by the diagram?

- A) elliptical B) longitudinal
C) torsional D) transverse

Topic 6B: Mechanical Waves/Sound

114. A transverse wave moves to the right (\rightarrow) through a medium. Which diagram best represents the motion of the molecules of the medium due to the wave motion?



115. As the energy imparted to a mechanical wave increases, the maximum displacement of the particles in the medium

- A) decreases
B) increases
C) remains the same

mechanical wave energy = amplitude

116. If the frequency of a sound wave in air at STP remains constant, its energy can be varied by changing its

- A) amplitude B) speed
C) wavelength D) period

117. A tuning fork vibrates at a frequency of 512 hertz when struck with a rubber hammer. The sound produced by the tuning fork will travel through the air as a

- A) longitudinal wave with air molecules vibrating parallel to the direction of travel
B) transverse wave with air molecules vibrating parallel to the direction of travel
C) longitudinal wave with air molecules vibrating perpendicular to the direction of travel
D) transverse wave with air molecules vibrating perpendicular to the direction of travel

118. Which statement correctly describes one characteristic of a sound wave?

- A) A sound wave can travel through a vacuum.
B) A sound wave is a transverse wave.
C) The amount of energy a sound wave transmits is directly related to the wave's amplitude.
D) The amount of energy a sound wave transmits is inversely related to the wave's frequency.

119. A periodic wave is produced by a vibrating tuning fork. The amplitude of the wave would be greater if the tuning fork were

- A) struck more softly
B) struck harder
C) replaced by a lower frequency tuning fork
D) replaced by a higher frequency tuning fork

Topic 6B: Mechanical Waves/Sound

120. Which type of wave requires a material medium through which to travel?

- A) sound ~~mechanical~~
- B) radio ~~em~~
- C) television ~~em~~
- D) x ray ~~em~~

121. Which type of wave requires a material medium through which to travel?

- A) radio wave ~~EM~~
- B) microwave ~~EM~~
- C) light wave ~~EM~~
- D) mechanical wave

122. Increasing the amplitude of a sound wave produces a sound with

- A) lower speed
- B) higher pitch
- C) shorter wavelength
- D) greater loudness

123. A ringing bell is located in a chamber. When the air is removed from the chamber, why can the bell be seen vibrating but not be heard?

- A) Light waves can travel through a vacuum, but sound waves cannot.
- B) Sound waves have greater amplitude than light waves.
- C) Light waves travel slower than sound waves.
- D) Sound waves have higher frequency than light waves.

124. As a sound wave passes from water, where the speed is 1.49×10^3 meters per second, into air, the wave's speed

- A) decreases and its frequency remains the same
- B) increases and its frequency remains the same
- C) remains the same and its frequency decreases
- D) remains the same and its frequency increases

V of sound at STP is 331 m/s

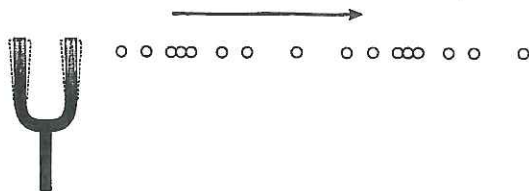
frequency doesn't change after it is produced

125. A tuning fork oscillates with a frequency of 256 hertz after being struck by a rubber hammer. Which phrase best describes the sound waves produced by this oscillating tuning fork?


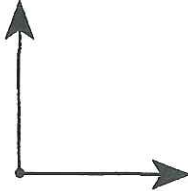


- A) ~~electromagnetic waves that require no medium for transmission~~
- B) ~~electromagnetic waves that require a medium for transmission~~
- C) ~~mechanical waves that require no medium for transmission~~
- D) mechanical waves that require a medium for transmission

Topic 6B: Mechanical Waves/Sound

126. The diagram below shows a tuning fork vibrating in air. The dots represent air molecules as the sound wave moves toward the right.



Which diagram best represents the direction of motion of the air molecules?

- A) 
- B) 
- C) 
- D) 
- Sound waves are mechanical & longitudinal*

127. The frequency of a sound wave determines its

- A) amplitude
B) loudness
C) speed
D) pitch

128. Increasing the amplitude of a sound wave will make it

- A) louder
B) have a higher pitch
C) travel faster
D) produce beats

129. A point in a sound wave at which the particles of the transmitting medium are farther apart than when at the rest position is called a

- A) compression
B) crest
C) trough
D) rarefaction

130. Sound is a form of

- A) thermal energy
B) mechanical energy
C) radiant energy
D) electrical energy

131. Compared to the speed of a sound wave in air, the speed of a radio wave in air is

- A) less
B) greater
C) the same

*Sound moves at 331 m/s
radio is EM & moves at 3.0×10^8 m/s*

132. As a sound wave passes from air into steel, its velocity

- A) decreases
B) increases
C) remains the same

particles more dense

Topic 6B: Mechanical Waves/Sound

133. In which medium does sound have the greatest speed?

A) vacuum

B) air

C) water

D) steel

134. As the temperature of air increases, the speed of sound in air

A) decreases

B) increases

C) remains the same

more particle motion = more collisions
