

(1) The intensity of a wave is given by the wave's

- (a) amplitude
- (b) frequency
- (c) period
- (d) wavelength

- (b) frequency
- (d) wavelength

(2) What is the process by which light waves bend when they enter water from the air?

- (a) Diffraction
- (b) Doppler effect
- (c) Reflection
- (d) Refraction

- (b) Doppler effect
- (d) Refraction

(3) Which of the following will a light-emitting object (such as a star) appear to be if it is moving towards an observer?

- (a) blue shifted
- (b) green shifted
- (c) red shifted
- (d) yellow shifted

- (b) green shifted
- (d) yellow shifted

(4) If the sun were to disintegrate and disappear right now, we wouldn't know about it for 8 minutes because:

- (a) It would take 8 minutes for the sun to destroy itself.
- (b) It takes 8 minutes for the light to travel from the sun to the earth
- (c) The bright image of the explosion would affect our retinas for 8 minutes.
- (d) The burning gases would continue to emit light for 8 minutes.

(5) An ocean wave passes a buoy once every 3.4 seconds. A bystander sees a second buoy on the crest of a wave and counts 5 wave crests between that buoy and the original, also on a crest. If the buoys are separated by 12.0 m determine the speed of the wave.

- (a) 3.5 m/s
- (b) 1.7 m/s
- (c) 0.71 m/s
- (d) 0.59 m/s

- (b) 1.7 m/s
- (d) 0.59 m/s

(6) Which of the following is the correct dispersion order for light in a rainbow.

- (a) Red, Orange, Yellow, Green, Blue, Violet
- (b) Green, Blue, Violet, Red, Orange, Yellow
- (c) Red, Orange, Blue, Violet, Yellow, Green
- (d) Red, Yellow, Green, Blue, Violet, Orange

(7) If the speed of light in a particular kind of glass is 2.08×10^8 m/s determine the index of refraction of the glass.

- (a) 6.24×10^{16}
- (b) 6.24
- (c) 1.44
- (d) 0.69

- (b) 6.24
- (d) 0.69

(8) A ray of light is incident on a piece of plastic with an angle of 21° (in air). What will be the resultant angle of light inside the plastic be if the index of refraction for plastic is 2.00?

- (a) 10°
- (b) 21°
- (c) 42°
- (d) 45°

- (b) 21°
- (d) 45°

(9) At what angle is the light reflected above?

- (a) 10°
- (b) 21°
- (c) 42°
- (d) 45°

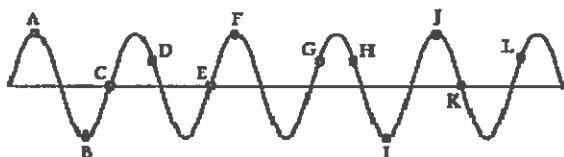
- (b) 21°
- (d) 45°

(10) A standing wave is set up in a guitar string with 3 nodes. What harmonic is this wave in?

- (a) 1st
(b) 2nd
(c) 3rd
(d) 4th

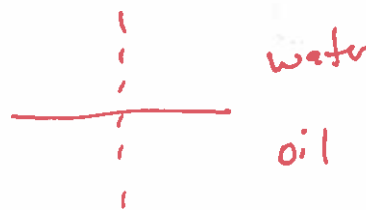
(11) Find the wavelength of a wave that has a period of 10.5 s when travelling at 251 m/s (2)

(12) A wave is traveling in a rope. The diagram below represents a snapshot of the rope at a particular instant in time.



Determine the number of wavelengths which is equal to the horizontal distance between points

- ...
a. ... C and E on the rope. 1λ
b. ... C and K on the rope. $3\frac{1}{2}\lambda$
c. ... A and J on the rope. 4λ
d. ... B and F on the rope. $1\frac{1}{2}\lambda$
e. ... D and H on the rope. 2λ
f. ... E and I on the rope. $1\frac{3}{4}\lambda$



(13) A beam of light moves through water ($n = 1.45$) until it hits a bubble of vegetable oil at an angle of 33° . If light moves at 2.21×10^7 m/s in vegetable oil, draw a diagram of this situation including the ray's reflection and refraction angles. Please show all calculations. (5)

(14) A leaky faucet is dripping water into a filled tub with 93 drops hitting the water each minute. If this causes ripples that are 1.3 mm apart, at what speed are the waves moving? (3)

(15) A police officer is hiding behind a donut shop sign with his radar gun trained at a car moving towards him on the TCH. If his gun emits waves at 9.0×10^9 Hz and detects waves differing by 2500 Hz, is the car speeding? Show all calculations. (3)

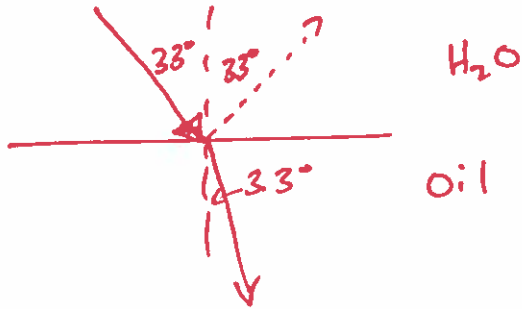
(16) A 144 cm long rope undergoes exactly 64 complete vibrational cycles in 17.6 seconds when vibrating in the third harmonic (in three equal-length sections). Determine the speed of the waves in the rope.

(17) In a physics lab, a rope is observed to make 240 complete vibrational cycles in 15 seconds. The length of the rope is 2.8 meters and the measurements are made for the 6th harmonic (with six equal length sections). Determine the speed of the waves in the rope.

(18) A 350 Hz tuning fork is sounded at the end of a variable height air column at 25°C . Calculate the length of the air column when you hear the first and second harmonic resonant sounds.

Sample Test Key

13.



$$n_{oil} = \frac{c}{v} = \frac{3 \times 10^8 \text{ m/s}}{2.21 \times 10^7 \text{ m/s}} = 13.6$$

$$n_1 \sin \theta_1 = n_2 \sin \theta_2$$

$$(1.45) \sin 33^\circ = 13.6 \sin \theta_2$$

$$\theta_2 = 3.3^\circ$$

$$14. f = \frac{93 \text{ drops}}{60 \text{ s}} = 1.55 \text{ Hz}$$

$$\lambda = 1.3 \text{ mm} = 0.0013 \text{ m}$$

$$v = \lambda f = (0.0013 \text{ m})(1.55 \text{ Hz}) = 0.0020 \text{ m/s}$$

$$15. v_r = \frac{\Delta f}{2f_i} c = \frac{2500 \text{ Hz}}{2(9.0 \times 10^9 \text{ Hz})} (3.00 \times 10^8 \text{ m/s}) = 41.7 \text{ m/s} = 150 \text{ km/h} \quad \text{Yes speeding.}$$

$$16. f = \frac{64 \text{ cycles}}{17.6 \text{ s}} = \frac{3.6 \text{ Hz}}{4.3 \text{ Hz}}$$

$$\lambda = \frac{2L}{n} = \frac{2(1.44 \text{ m})}{3} = 0.96 \text{ m}$$

$$v = \lambda f = (0.96 \text{ m})(3.6 \text{ Hz}) = 3.5 \text{ m/s}$$

$$17. f = \frac{240 \text{ cycles}}{15 \text{ s}} = 16 \text{ Hz}$$

$$\lambda = \frac{2L}{n} = \frac{2(2.8 \text{ m})}{6} = 0.93 \text{ m}$$

$$v = \lambda f = (0.93 \text{ m})(16 \text{ Hz}) = 14.9 \text{ m/s}$$

$$18. v_s = 332 + 0.6T = 347 \text{ m/s}$$

$$\text{1st: } \lambda = \frac{v_s}{f} = \frac{347 \text{ m/s}}{350 \text{ Hz}} = 0.99 \text{ m}$$

$$\text{2nd: } L = \frac{3\lambda}{4} = \frac{3(0.99 \text{ m})}{4} = 0.75 \text{ m}$$

$$L = \frac{1}{4}\lambda = \frac{1}{4}(0.99 \text{ m}) = 0.25 \text{ m}$$

$\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

8.



கோணம் $2x$, $2x$, $2x$
கோணம் $2x$, $2x$, $2x$
 $2x + 2x + 2x = 360$

$6x = 360$
 $x = 60$

கோணம் $2x = 120$
கோணம் $2x = 120$

கோணம் $2x = 120$
கோணம் $2x = 120$
கோணம் $2x = 120$

$\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

கோணம் $2x = 120$
கோணம் $2x = 120$

கோணம் $2x = 120$
கோணம் $2x = 120$

$\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

கோணம் $2x = 120$
கோணம் $2x = 120$

கோணம் $2x = 120$
கோணம் $2x = 120$

கோணம் $2x = 120$
கோணம் $2x = 120$

கோணம் $2x = 120$
கோணம் $2x = 120$

கோணம் $2x = 120$
கோணம் $2x = 120$

கோணம் $2x = 120$
கோணம் $2x = 120$

கோணம் $2x = 120$
கோணம் $2x = 120$