Review: 1D + 2D Waves

① Mechanical waves need a medium, electromagnetic don't.

② Transverse - particles of the medium vibrate perpendicular to the direction of wave motion

Longitudinal - particles of the medium vibrate parallel to the direction of wave motion

③ The position is the same before and after the wave passes.

④ A pulse is a single disturbance, while a continuous wave consists of several consecutive disturbances.

⑤ Frequency is the number of waves generated per second.

· Speed is how fast the waves are travelling

⑥ They are the same.

⑦ a) No. The speed of a wave is constant within a given medium.

b) Yes, by changing the frequency of the source.

⑧ They are perpendicular to one another.

⑨ Amplitude - half of the up and down motion of the wave

Period - the time it takes to go up and down once.

Wavelength - distance between two crests.

(9) Speed - how fast the waves are travelling

Frequency - how many times you move up and down in one second.

(10) Amplitude is a measure of the maximum displacement of the medium from its rest position. It represents the energy of the wave.

(11) Upright (the same)

(12) Inverted

(13) The frequency only depends on the source frequency.

(14) Nothing. The spring does not move at the node.

(15) The reflected wave will be inverted.

(16) When two waves occupy the same position, their amplitudes are combined. This occurs for all waves.

(17) The wavelength decreases as the frequency increases.

(18) Period decreases as Frequency increases.

(19) Wavelength decreases as frequency increases.

(20) AM wavelengths are longer, so they diffract more.

(21) A fast to slow C slow to fast

B slow to fast D fast to slow

(22) $T = \frac{1}{f} = \frac{1}{0.1} = \boxed{10\ s}$

(23) $v = \frac{\lambda}{T} = \frac{10\ m}{2\ s} = \boxed{5\ m/s}$

(24) a) $v = f\lambda = (4.8)(6) = \boxed{28.8\ cm/s}$

b) $T = \frac{1}{f} = \frac{1}{4.8} = \boxed{0.21\ s}$

(25) a) $v = \frac{d}{t} = \frac{4.4\ m}{1.8\ s} = \boxed{2.4\ m/s}$

b) $v = \frac{\lambda}{T}$

$\lambda = v \cdot T = (2.4)(1.2) = \boxed{2.9\ m}$

(26) $v = f\lambda$

$\lambda = \frac{v}{f} = \frac{3 \times 10^8}{5 \times 10^{14}} = \boxed{6 \times 10^{-7}\ m}$

(27) a) $\lambda = \frac{v}{f} = \frac{3 \times 10^8}{550\,000} = 545\ m$

$\lambda = \frac{v}{f} = \frac{3 \times 10^8}{1\,600\,000} = 188\ m$

AM Range is $\boxed{188\ m - 545\ m}$

(27) b) $\lambda = \frac{v}{f} = \frac{3 \times 10^8}{88\,000\,000} = 3.4 \text{ m}$

$\lambda = \frac{v}{f} = \frac{3 \times 10^8}{108\,000\,000} = 2.8 \text{ m}$

FM Range is $\boxed{2.8 \text{ m} - 3.4 \text{ m}}$

(28) a) $v = f\lambda$

$= (1.0 \times 10^6)(0.0015)$

$v = 1500 \text{ m/s}$

b) $T = \frac{1}{f}$

$= \frac{1}{1 \times 10^6}$

$T = 1.0 \times 10^{-6} \text{ s}$

c) $T = 1.0 \times 10^{-6} \text{ s}$

(f doesn't change ∴ T doesn't either.)

(29) $\lambda = 6$ m (crest to crest = 2 × crest to trough)

$f = \frac{\#\text{ of waves}}{\text{time}} = \frac{14}{20} = 0.7$ Hz

$v = f\lambda = (0.7)(6) = \boxed{4.2 \text{ m/s}}$

(30)

	Transverse	Longitudinal
speed	8.9 Km/s	5.1 Km/s
distance	d	d
time	t	$t + 73$

$d = vt$ $\qquad$ $d = vt$

$d = 8.9t$ $\qquad$ $d = (5.1)(t+73)$

$8.9t = 5.1(t+73)$

$8.9t = 5.1t + 372.3$

$3.8t = 372.3$

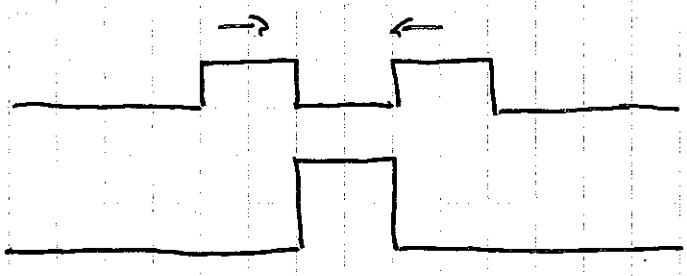
$t = 98$ s $\qquad$ (see next page)

(30) $d = vt$

$= (8.9)(98)$

$d = \boxed{872 \text{ Km}}$

(31) ①

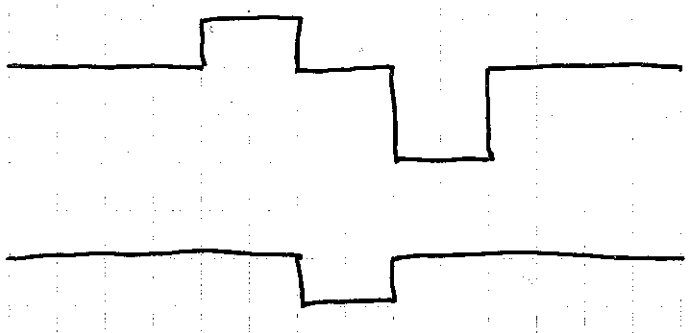


← answer

②

← answer

③



← answer

(32) a) $\frac{\sin\theta_1}{\sin\theta_2} = \frac{v_1}{v_2}$

$\frac{\sin 40}{\sin\theta_2} = \frac{24}{15}$

$\theta_2 = \sin^{-1}\left(\frac{15}{24}\sin 40\right)$

$\theta_2 = \boxed{23.7^\circ}$

(32) b) $\lambda_1 \text{ (deep)} = \frac{v}{f} = \frac{24}{4} = 6 \text{ cm}$

$$\frac{\lambda_1}{\lambda_2} = \frac{v_1}{v_2}$$

$$\frac{6}{\lambda_2} = \frac{24}{15}$$

$$\lambda_2 = \frac{6(15)}{24} = \boxed{3.75 \text{ cm}}$$

(33) Deep $v_1 = f\lambda_1$

$= (11)(2)$

$v_1 = \boxed{22 \text{ cm/s}}$

Shallow

$$\frac{\sin\theta_1}{\sin\theta_2} = \frac{v_1}{v_2}$$

$$\frac{\sin 60}{\sin 30} = \frac{22}{v_2}$$

$$v_2 = \frac{22 \sin 30}{\sin 60}$$

$v_2 = \boxed{12.7 \text{ cm/s}}$

(34) $v_A = f\lambda_A = (6)(2) = \boxed{12 \text{ cm/s}}$

$$\frac{\sin\theta_A}{\sin\theta_B} = \frac{v_A}{v_B}$$

$$\frac{\sin 30}{\sin 20} = \frac{12}{v_B}$$

$$v_B = 12\,\frac{\sin 20}{\sin 30}$$

$$v_B = \boxed{8.2 \text{ cm/s}}$$