Physics 20 - Lesson 30
Two-Dimensional Waves – Answer Key

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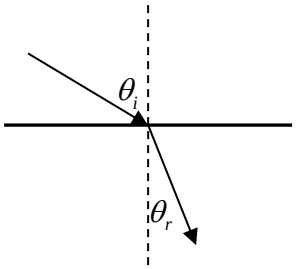
1) Angle of Incidence = Angle of Reflection
/1 $\theta_i = \theta_r$

2) When a wave passes from one medium into another, its speed, wavelength and angle to
/1 the normal change.

3) Low speed > High Speed

/2

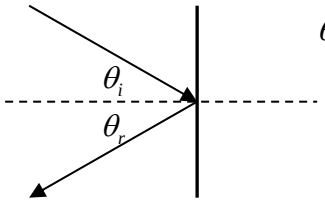


4) a) Wave slows down
Wavelength is shorter
/4 b) Wave is faster
Wavelength is longer

5) 1) The energy is being spread over a larger area
/2 2) Energy is lost as heat as it travels through a medium

6) $\theta_i = \theta_r$

/2



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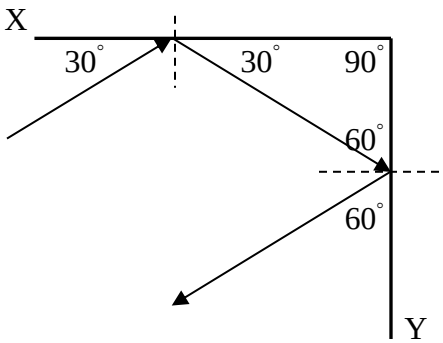

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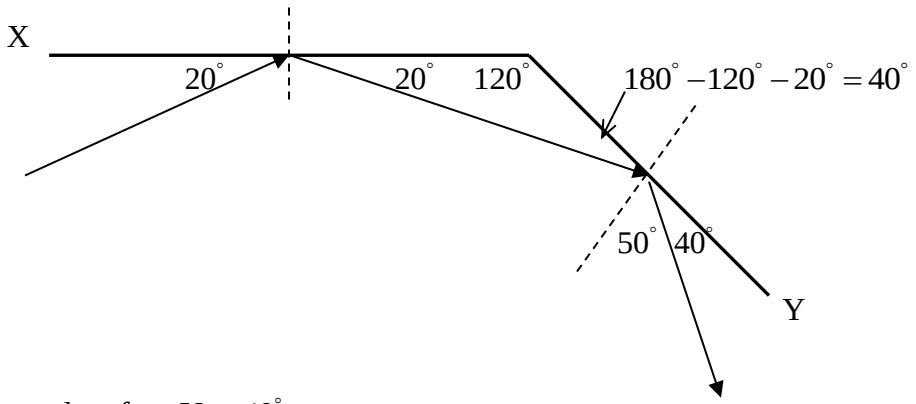

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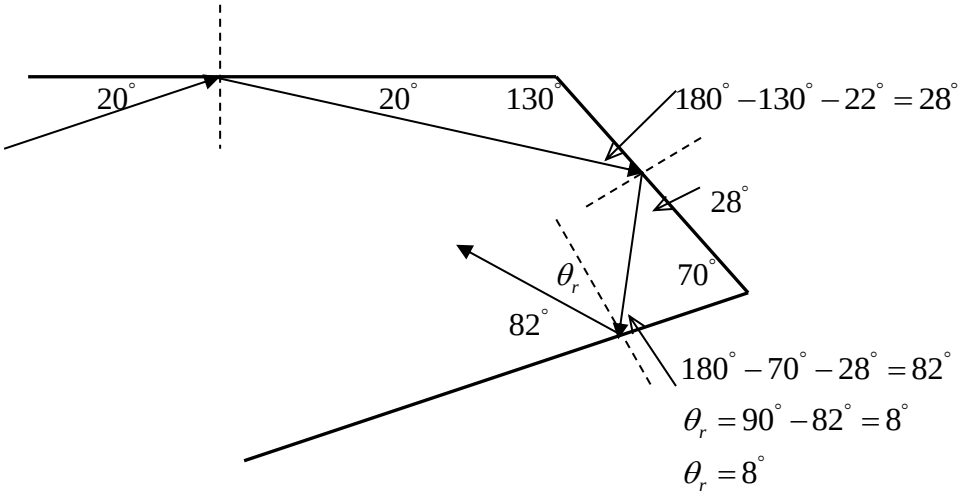
Ray and surface Y = 40°

Angle of Reflection from Y = 50°

9)



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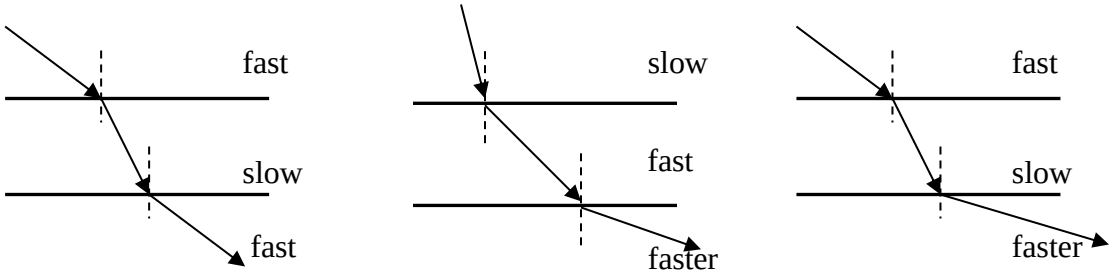
10)



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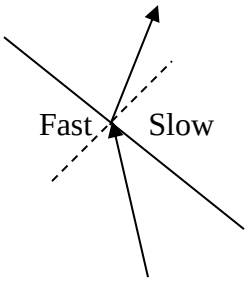
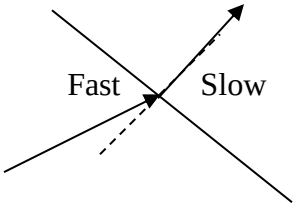
11)





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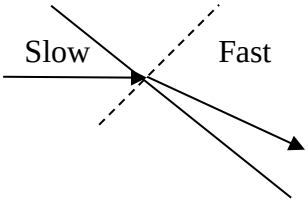

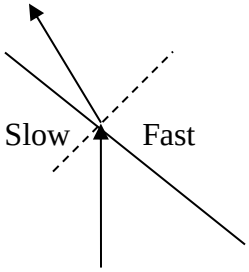

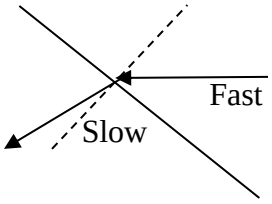

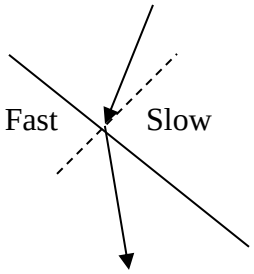

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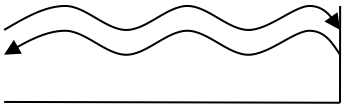

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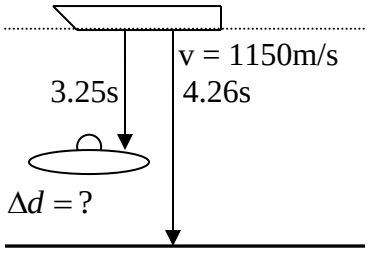
Two way time = 2.50s

$$t = \frac{2.50s}{2} = 1.25s$$

$$\Delta d = v\Delta t = 340m/s(1.25s)$$

$$\boxed{\Delta d = 425m}$$

13)



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<u>Bottom</u>

$$\Delta d_b = v\Delta t = 1150m/s\left(\frac{4.26s}{2}\right)$$

$$\Delta d_b = 2450m$$

<u>Sub</u>

$$\Delta d_s = v\Delta t = 1150m/s\left(\frac{3.25s}{2}\right)$$

$$\Delta d_s = 1869m$$

$$\Delta d = \Delta d_b - \Delta d_s = 2450m - 1869m = \boxed{581m}$$

14) $\theta_i = 45^\circ$ $\quad \frac{\lambda_r}{\lambda_i} = \frac{\sin\theta_r}{\sin\theta_i}$

$\theta_r = 30^\circ$

/3 $\lambda_i = 1.20cm$ $\quad \lambda_r = \left(\frac{\sin\theta_r}{\sin\theta_i}\right)\lambda_i$

$\lambda_r = ?$

$$\lambda_r = \left(\frac{\sin 30}{\sin 45}\right)(1.20cm)$$

$$\boxed{\lambda_r = 0.85cm}$$

15) $v_d = 0.30m/s$ $\quad \sin\theta_s = \frac{v_s}{v_d}(\sin\theta_d)$

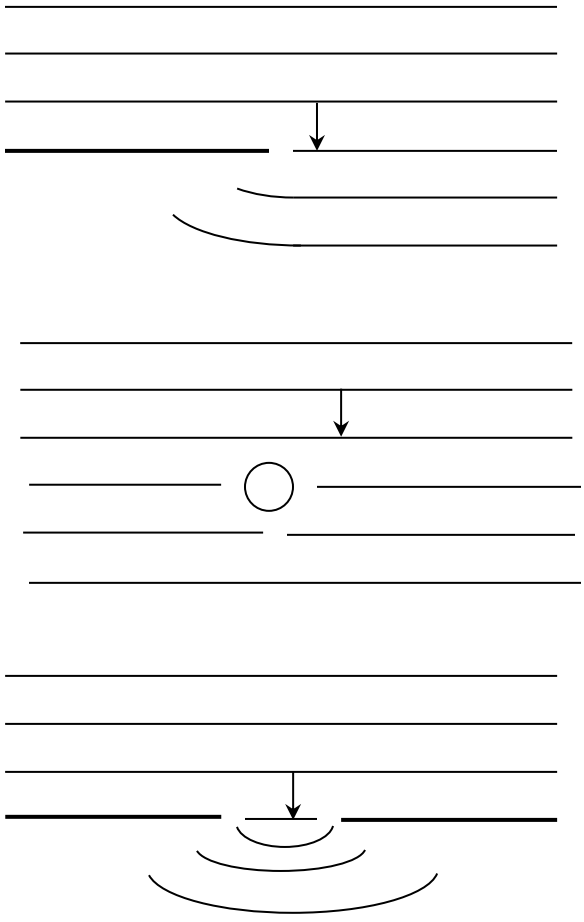
$v_s = 0.20m/s$

/3 $\theta_d = 40^\circ$ $\quad \theta_s = \sin^{-1}\left(\frac{0.20m/s}{0.30m/s}(\sin 40)\right)$

$\theta_s = ?$

$$\boxed{\theta_s = 25^\circ}$$

16)



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17) /12

a) $A - \frac{20}{8} = 2.5\lambda \quad B - \frac{20}{10} = 2\lambda$ Destructive

b) $A - \frac{40}{8} = 5\lambda \quad B - \frac{40}{10} = 4\lambda$ Constructive

c) $A - \frac{80}{8} = 10\lambda \quad B - \frac{70}{10} = 7\lambda$ Constructive

d) $A - \frac{40}{8} = 5\lambda \quad B - \frac{75}{10} = 7.5\lambda$ Destructive

18) /8

a) $\frac{6.0}{6.0} = 1$ $\therefore$ *constructive*

b) $\frac{9.0}{6.0} = 1.5$ $\therefore$ *destructive*

c) $\frac{18.0}{6.0} = 3$ $\therefore$ *constructive*

d) $\frac{21}{6.0} = 3.5$ $\therefore$ *destructive*