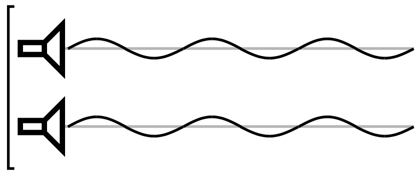
Pairs of coherent transmitters (in phase or out of phase) are set up side by side, emitting waves of the same wavelength.

1.


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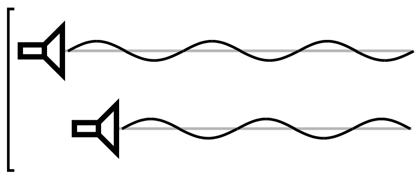

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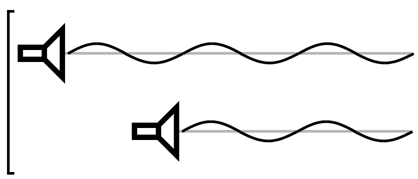

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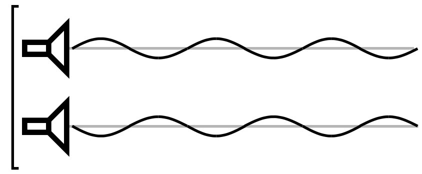

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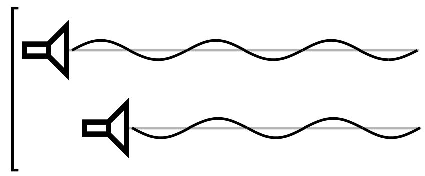

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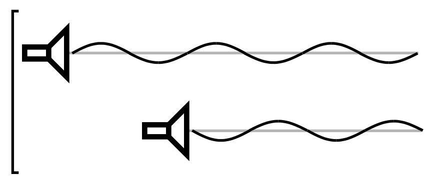


For each of these transmitter pairs, label them as:

(A) in phase sources; whole wavelength path difference; constructive interference.
(B) in phase sources; half wavelength path difference; destructive interference.
(C) out of phase sources; whole wavelength path difference; destructive interference.
(D) out of phase sources; half wavelength path difference; constructive interference.
(E) (Unsure/lost/guessing/help!)

7. Identify transmitter pair(s) (if any) that start in phase, but interfere destructively with each other. Explain how this is possible.

In-phase transmitter pair(s) with destructive interference: _____.

Explanation:

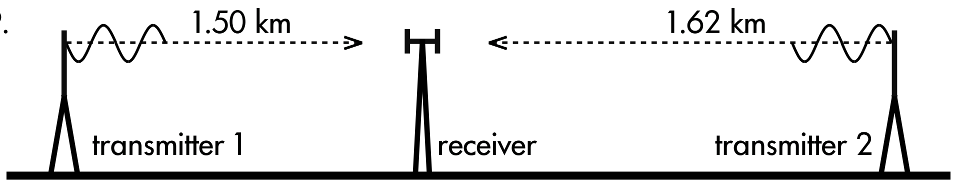
8. Identify transmitter pair(s) (if any) that start out of phase, but interfere constructively with each other. Explain how this is possible.

Out of-phase transmitter pair(s) with constructive interference: _____.

Explanation:

A radio receiver simultaneously receives signals of the same 240 m wavelength from two coherent transmitters (in phase or out of phase). These diagrams are not drawn to scale.

9.



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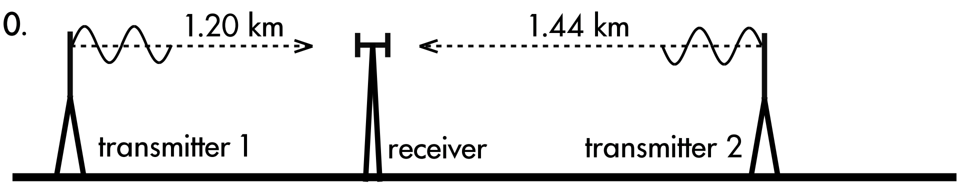

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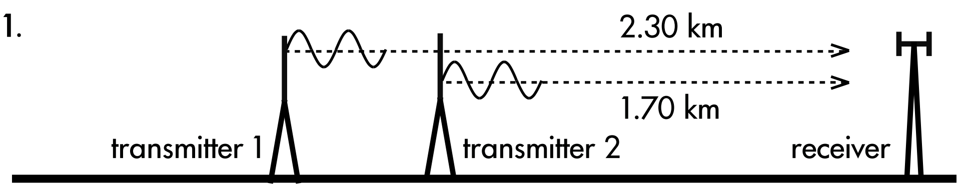

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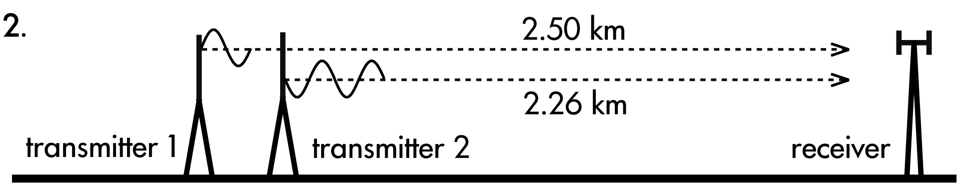
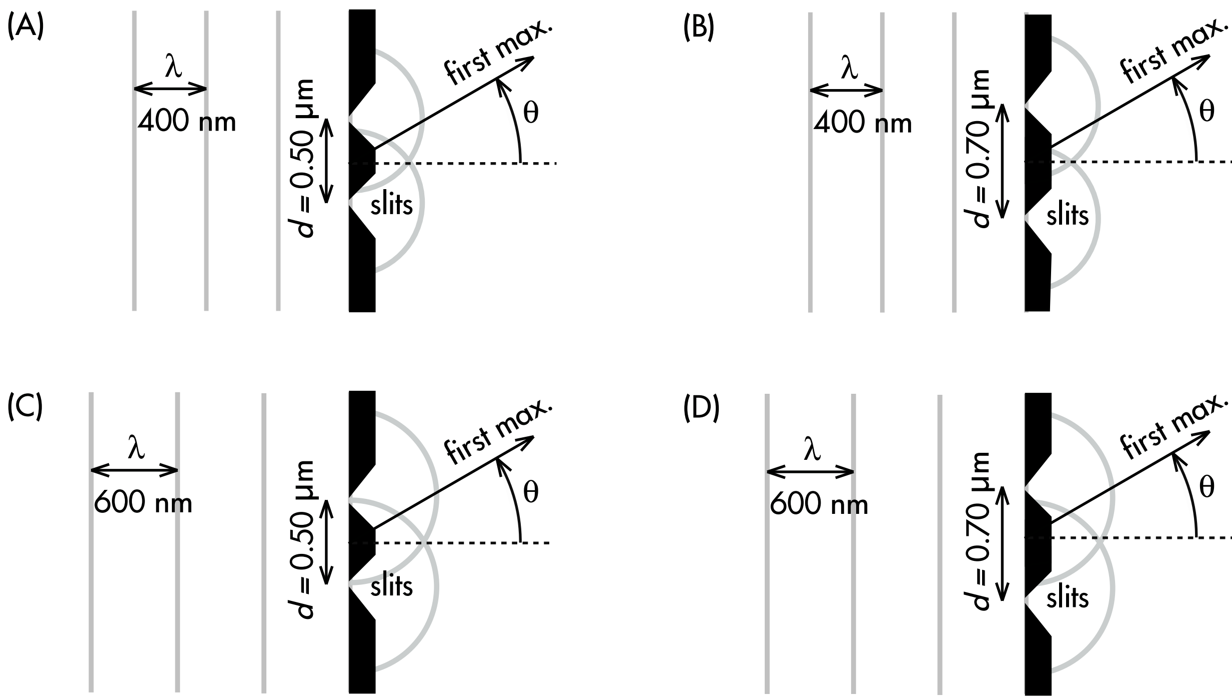


For each of these transmitter pairs, label them as:

(A) in phase sources; whole wavelength path difference; constructive interference.
(B) in phase sources; half wavelength path difference; destructive interference.
(C) out of phase sources; whole wavelength path difference; destructive interference.
(D) out of phase sources; half wavelength path difference; constructive interference.
(E) (Unsure/lost/guessing/help!)

Light of different wavelengths passes through two narrow slits of different separation distances (not drawn to scale).



13. Rank the angles (if any) between the central maximum and first maximum, from smallest to largest. Indicate ties, if any. (You may not need to use all the blank spaces below).

_________ _________ _________ _________

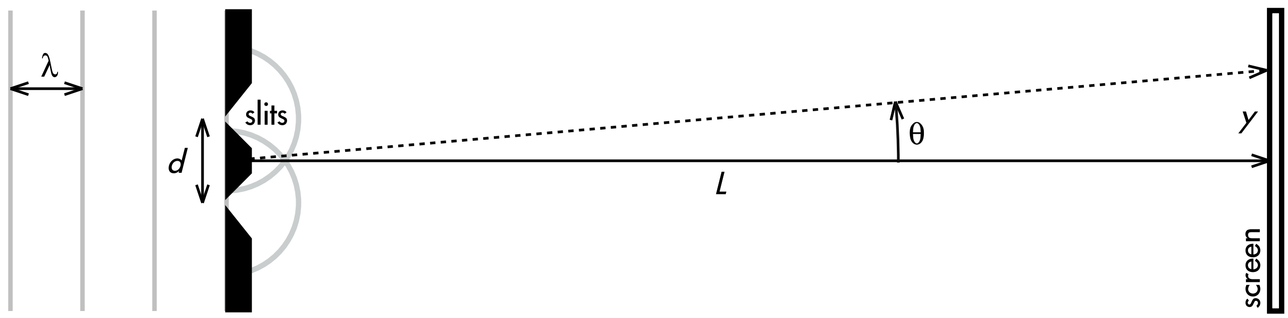
(smallest) (largest)

14. Identify the case(s) (if any) where there would be no first maximum fringe. Briefly describe what would then appear on a distant screen.

Case(s) with no first maximum fringe: ________.

Description:

Light of wavelength λ passes through two slits separated by a distance *d*, producing an interference pattern of maxima and minima on a distant screen located *L* away from the slits.



15. If the wavelength λ is $\begin{bmatrix}\text{increased}\\\text{decreased}\end{bmatrix}$, the spacing of the interference pattern maxima and minima on the screen will:

(A) increase.
(B) remain the same.
(C) decrease.
(D) (Unsure/guessing/lost/help!)

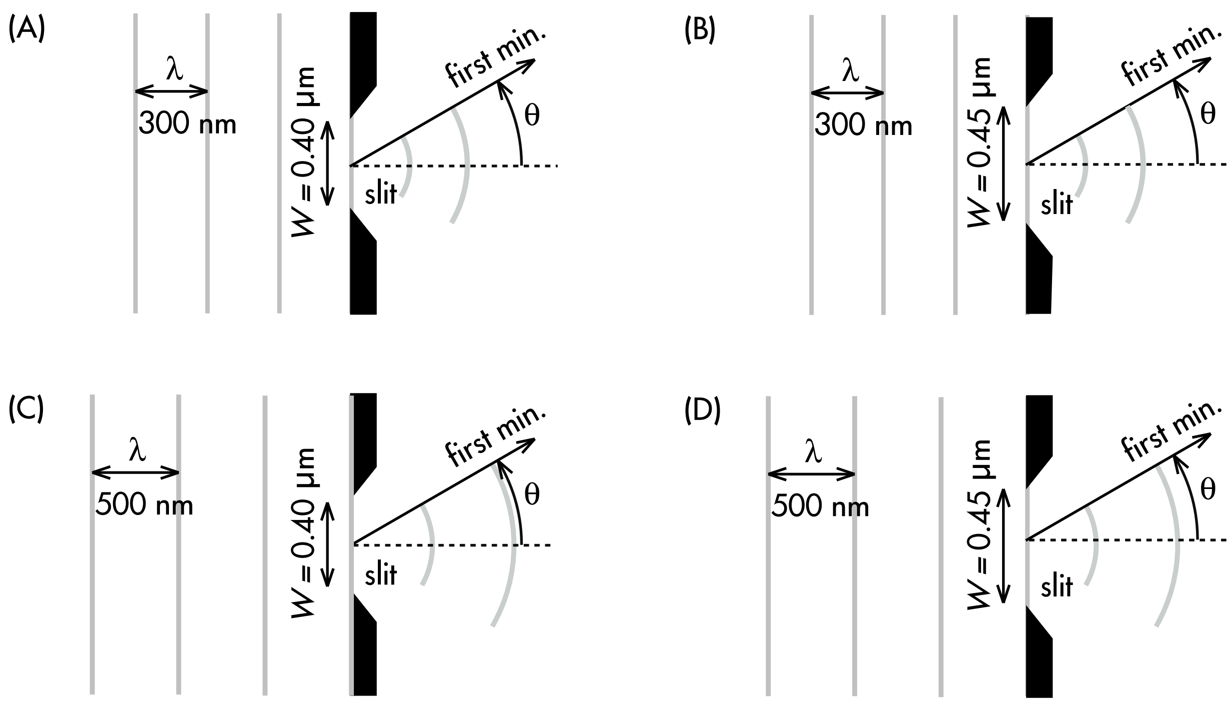
16. If the distance *d* between the slits is $\begin{bmatrix}\text{increased}\\\text{decreased}\end{bmatrix}$, the spacing of the interference pattern maxima and minima on the screen will:

(A) increase.
(B) remain the same.
(C) decrease.
(D) (Unsure/guessing/lost/help!)

17. If the distance *L* from the slits to the screen is $\begin{bmatrix}\text{increased}\\\text{decreased}\end{bmatrix}$, the spacing of the interference pattern maxima and minima on the screen will:

(A) increase.
(B) remain the same.
(C) decrease.
(D) (Unsure/guessing/lost/help!)

Light of different wavelengths passes through single slits of different widths (not drawn to scale).



18. Rank the angles (if any) between the central maximum and first minimum, from smallest to largest. Indicate ties, if any. (You may not need to use all the blank spaces below).

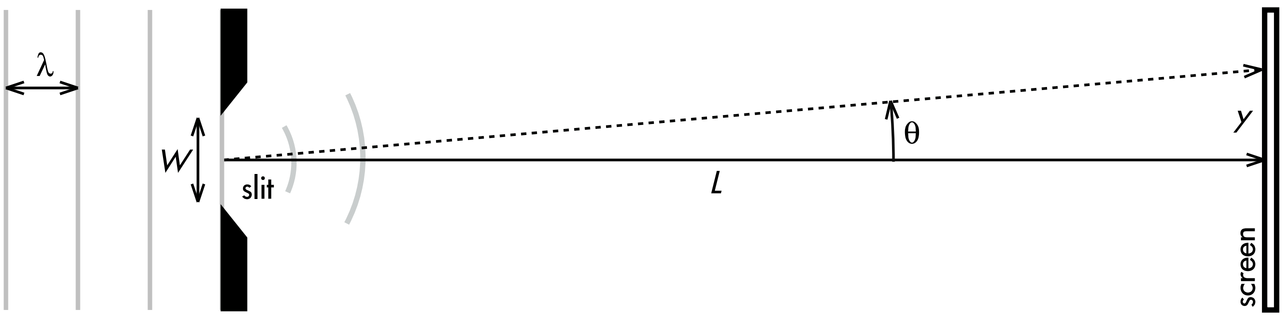
________ (smallest) ________ ________ ________ (largest)

19. Identify the case(s) (if any) where there would be no first minimum fringe. Briefly describe what would then appear on a distant screen.

Case(s) with no first minimum fringe: ________.

Description:

Light of wavelength λ passes through a single slit of width W, producing a central maximum (between first minimum to first minimum) on a distant screen located L away from the slits.



20. If the wavelength λ is $\begin{bmatrix}\text{increased}\\ \text{decreased}\end{bmatrix}$, the width of the central maximum on the screen will:

(A) increase.
(B) remain the same.
(C) decrease.
(D) (Unsure/guessing/lost/help!)

21. If the width W of the slit is $\begin{bmatrix}\text{increased}\\ \text{decreased}\end{bmatrix}$, the width of the central maximum on the screen will:

(A) increase.
(B) remain the same.
(C) decrease.
(D) (Unsure/guessing/lost/help!)

22. If the distance L from the slit to the screen is $\begin{bmatrix}\text{increased}\\ \text{decreased}\end{bmatrix}$, the width of the central maximum on the screen will:

(A) increase.
(B) remain the same.
(C) decrease.
(D) (Unsure/guessing/lost/help!)

23. A Physics 205B student touches a $\begin{bmatrix}\text{positively}\\ \text{negatively}\end{bmatrix}$ charged metal rod to an isolated, uncharged conducting sphere. As a result electrons are __________ the sphere, such that the sphere becomes __________ charged.

(A) removed from; positively.
(B) removed from; negatively.
(C) added to; positively.
(D) added to; negatively.
(E) neither transferred to/from; neutrally.
(F) (Unsure/guessing/lost/help!)

24. A Physics 205B student holds a $\begin{bmatrix}\text{positively}\\ \text{negatively}\end{bmatrix}$ charged plastic rod near a neutral $\begin{bmatrix}\text{plastic}\\ \text{metal}\end{bmatrix}$ rod, hanging from a string attached to its center. As a result the hanging rod will be __________ the rod held by the student.

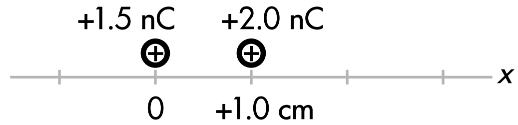
(A) attracted to.
(B) repelled by.
(C) neither attracted to, nor repelled by.
(D) (Not enough information is given.)
(E) (Unsure/guessing/lost/help!)

25. A Physics 205B student holds a $\begin{bmatrix}\text{positively}\\ \text{negatively}\end{bmatrix}$ charged plastic rod near (but not touching) a small metal ball with a net $\begin{bmatrix}\text{positive}\\ \text{negative}\\ \text{neutral}\end{bmatrix}$ charge, which hangs from an insulating string. (Both sphere and rod are electrically isolated from the environment.)

The plastic rod will __________ the metal ball.

(A) attract.
(B) repel.
(C) neither attract nor repel.
(D) (Not enough information is given.)
(E) (Unsure/guessing/lost/help!)

Two point charges are held at fixed locations.
A +1.5 nC charge is at the origin, and a +2.0 nC charge is at x = +1.0 cm.

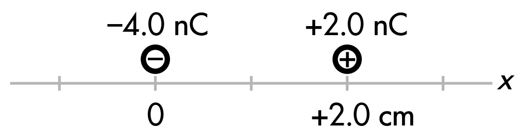


26. The electric force on the $\left[\begin{array}{c}+1.5\text{ nC}\\+2.0\text{ nC}\end{array}\right]$ charge is directed to the:

(A) left.
(B) right.
(C) (There is no direction, as the electric force is zero.)
(D) (Unsure/guessing/lost/help!)

27. The __________ charge has a greater electric force magnitude exerted on it.
(A) +1.5 nC.
(B) +2.0 nC.
(C) (There is a tie.)
(D) (Unsure/guessing/lost/help!)

Two point charges are held at fixed locations.
A –4.0 nC charge is at the origin, and a +2.0 nC charge is at x = +2.0 cm.

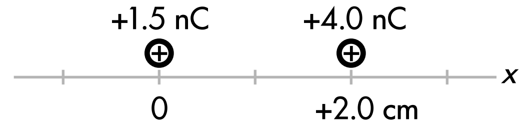


28. The electric force on the $\left[\begin{array}{c}-4.0\text{ nC}\\+2.0\text{ nC}\end{array}\right]$ charge is directed to the:

(A) left.
(B) right.
(C) (There is no direction, as the electric force is zero.)
(D) (Unsure/guessing/lost/help!)

29. The __________ charge has a greater magnitude electric force exerted on it.
(A) –4.0 nC.
(B) +2.0 nC.
(C) (There is a tie.)
(D) (Unsure/guessing/lost/help!)

Two point charges are held at fixed locations. A +1.5 nC charge is at the origin, and a +4.0 nC charge is at $x = +2.0$ cm.



A +2.0 nC test charge can be placed at each of these locations.

(A) $x = -1.0$ cm (to the left of the two charges).
(B) $x = +1.0$ cm (between the two charges).
(C) $x = +3.0$ cm (to the right of the two charges).

30. Identify the locations where the electric force on the +2.0 nC test charge points to the left or to the right.

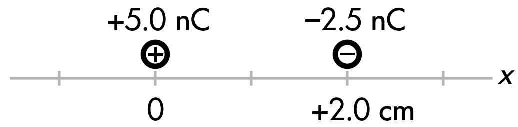
Location(s) where electric force points to the left: _________.

Location(s) where electric force points to the right: _________.

31. Rank the magnitudes of the electric force on the +2.0 nC test charge at each location, from smallest to largest. Indicate ties, if any.

_________ _________ _________
(smallest) (largest)

Two point charges are held at fixed locations.
A +5.0 nC charge is at the origin, and a –2.5 nC charge is at $x = +2.0$ cm.



The electric field can be measured at each of these locations.

(A) $x = -1.0$ cm (to the left of the two charges).
(B) $x = +1.0$ cm (between the two charges).
(C) $x = +3.0$ cm (to the right of the two charges).

32. Identify the locations where the electric field points to the left or to the right.

Location(s) where electric field points to the left: _________.

Location(s) where electric field points to the right: _________.

33. Rank the magnitudes of the electric field at each location, from smallest to largest. Indicate ties, if any.

_________ _________ _________
(smallest) (largest)

Equations and constants:

$$c = 3.00\times10^{8}\ \frac{\text{m}}{\text{s}};\ \ n = \frac{c}{v};\ \ \lambda = \frac{v}{f};\ \ \Delta\ell = \begin{Bmatrix} m\lambda \\ \left(m+\frac{1}{2}\right)\lambda \end{Bmatrix}, m = 0, \pm1, \pm2, \ldots;$$

$$d\sin\theta = \begin{Bmatrix} m\lambda \\ \left(m+\frac{1}{2}\right)\lambda \end{Bmatrix}, m = 0, \pm1, \pm2, \ldots;\ \ W\sin\theta = (1)\lambda\,.$$

$$F = k\frac{|q_1||q_2|}{r^2};\ \ k = 8.99\times10^{9}\ \frac{\text{N}\cdot\text{m}^2}{\text{C}^2};\ \ \vec{\mathbf{F}}_E = q\vec{\mathbf{E}};\ \ E = k\frac{|Q|}{r^2}.$$