Clicker Question

Point P is at a perpendicular distance x from each wire carry current I in the directions indicated. What is the magnetic field B at point P?

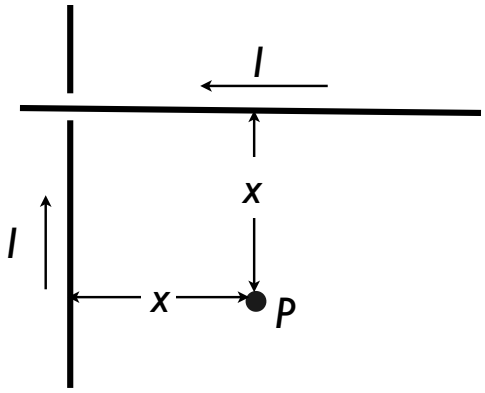
a. 0

b. $B_P = \mu_O I / (2\pi x)$

c. $B_P = \mu_O I / (\pi x)$

d. $B_P = \mu_O I / (4\pi x)$

e. $B_P = \mu_O I / (\sqrt{2}\pi x)$



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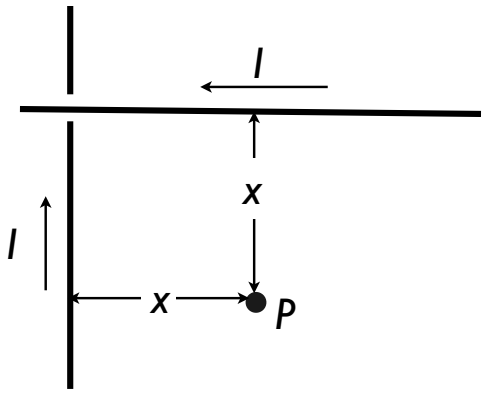
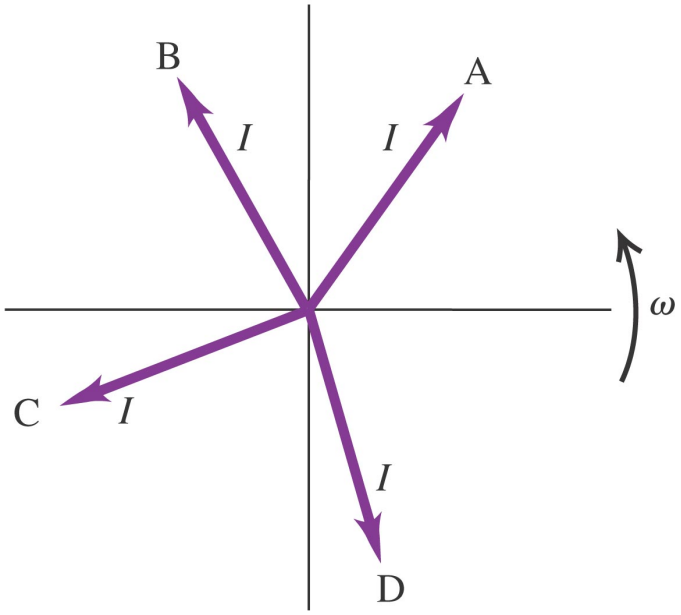


Clicker Question

Which phasor shows current that is positive and increasing with time?



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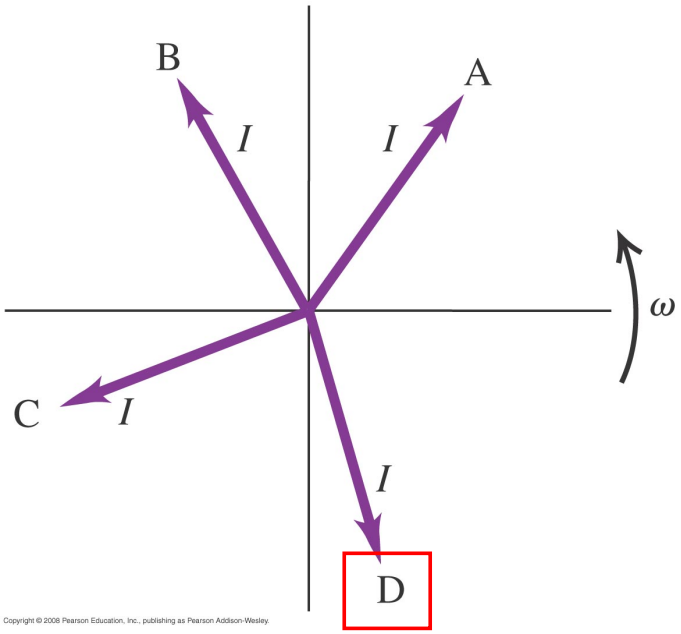
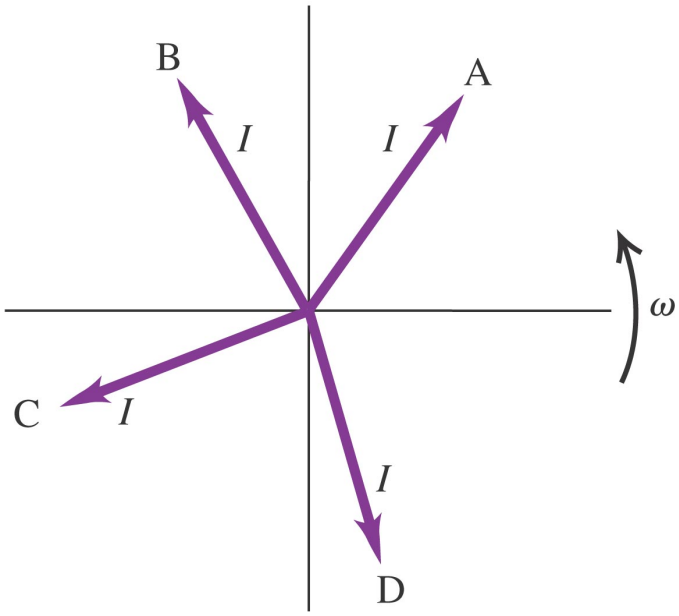


Clicker Question

Which phasor shows a current that is negative with an increasing magnitude (i.e. getting more negative?)



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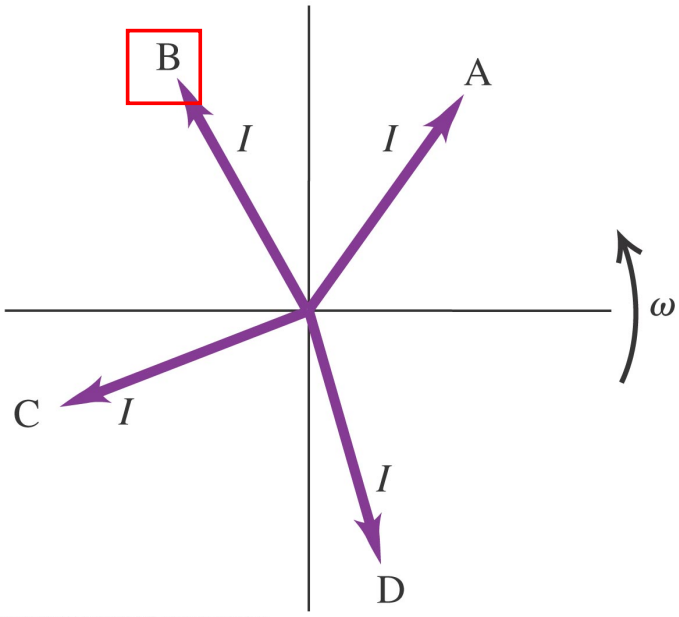
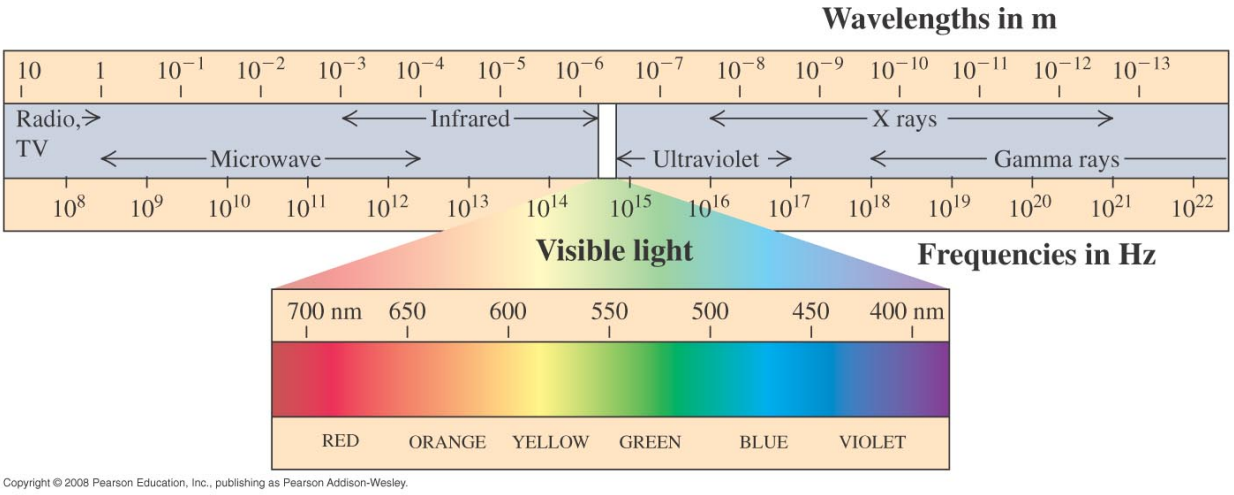




Clicker Question

wavelength x frequency = speed of light

$$\lambda f = c$$

In a vacuum, red light has a wavelength of 700 nm and violet light has a wavelength of 400 nm.
This means that in a vacuum, red light

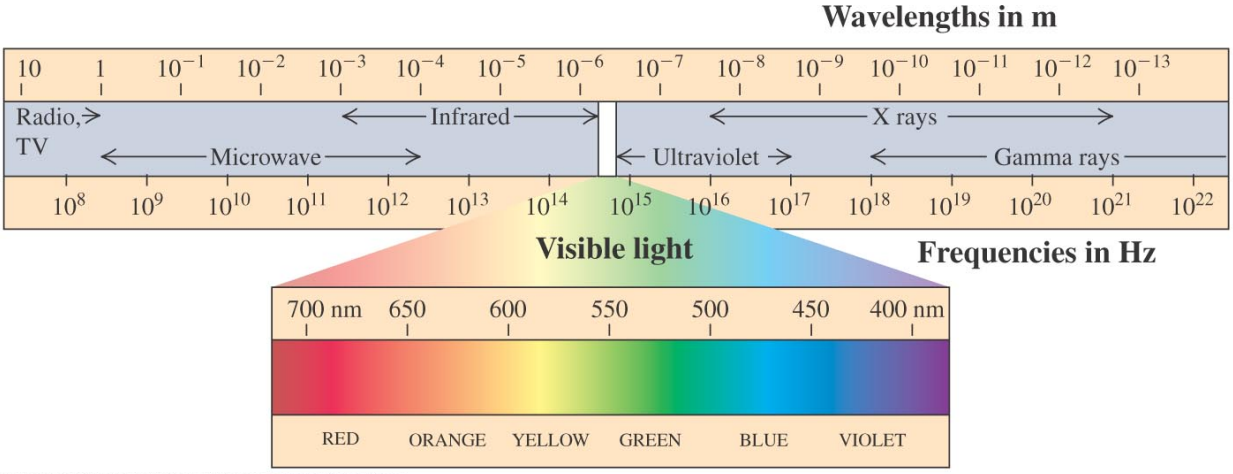
A) has higher frequency and moves faster than violet light.

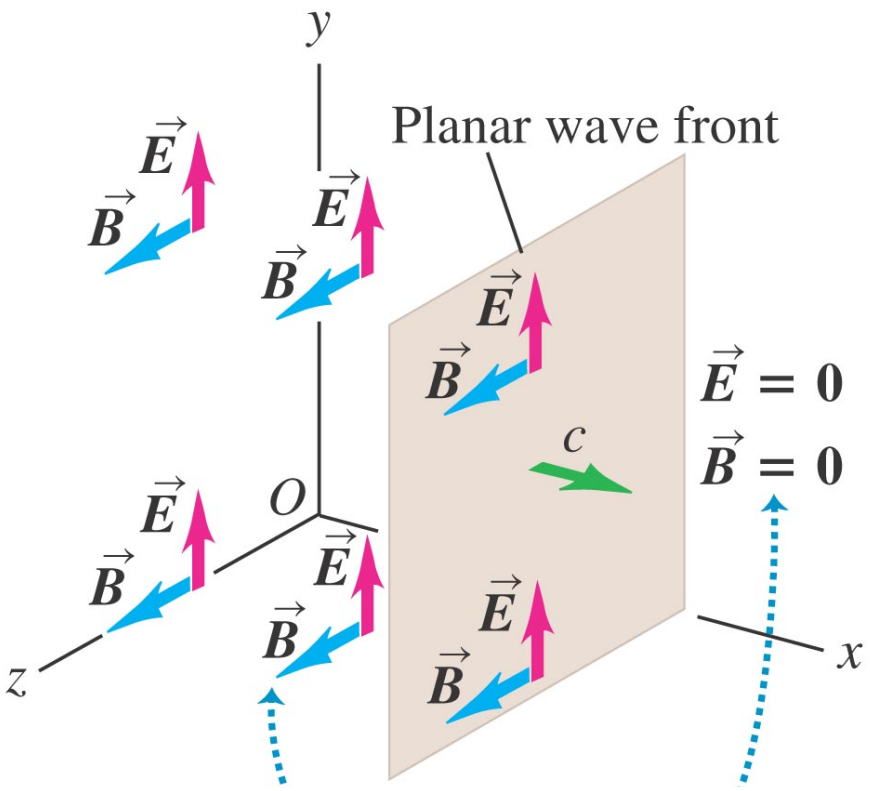
B) has higher frequency and moves slower than violet light.

C) has lower frequency and moves faster than violet light.

D) has lower frequency and moves slower than violet light.

E) none of the above





Clicker Question

Which equation describes a wave moving in the negative x direction?

(a) $y(x,t)=A\cos(kx-\omega t)$

(b) $y(x,t)=A\cos(-kx-\omega t)$

(c) $y(x,t)=A\cos(kx+\omega t)$

(d) $y(x,t)=-A\cos(kx-\omega t)$

(e) both (b) and (c)

Clicker Question

If an EM wave has an electric field

$$\vec{\mathbf{E}}(x,t)= -\hat{\mathbf{j}}\, E_{max}\cos\left(kx-\omega t\right)$$

What is the B field?

A) $\vec{\mathbf{B}}(x,t)= \hat{\mathbf{i}}\, B_{max}\cos\left(kx-\omega t\right)$

B) $\vec{\mathbf{B}}(x,t)= \hat{\mathbf{j}}\, B_{max}\cos\left(kx-\omega t\right)$

C) $\vec{\mathbf{B}}(x,t)= -\hat{\mathbf{k}}\, B_{max}\cos\left(kx-\omega t\right)$

D) $\vec{\mathbf{B}}(x,t)= \hat{\mathbf{k}}\, B_{max}\cos\left(kx+\omega t\right)$

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Clicker Question

"No Physicist Left Behind"

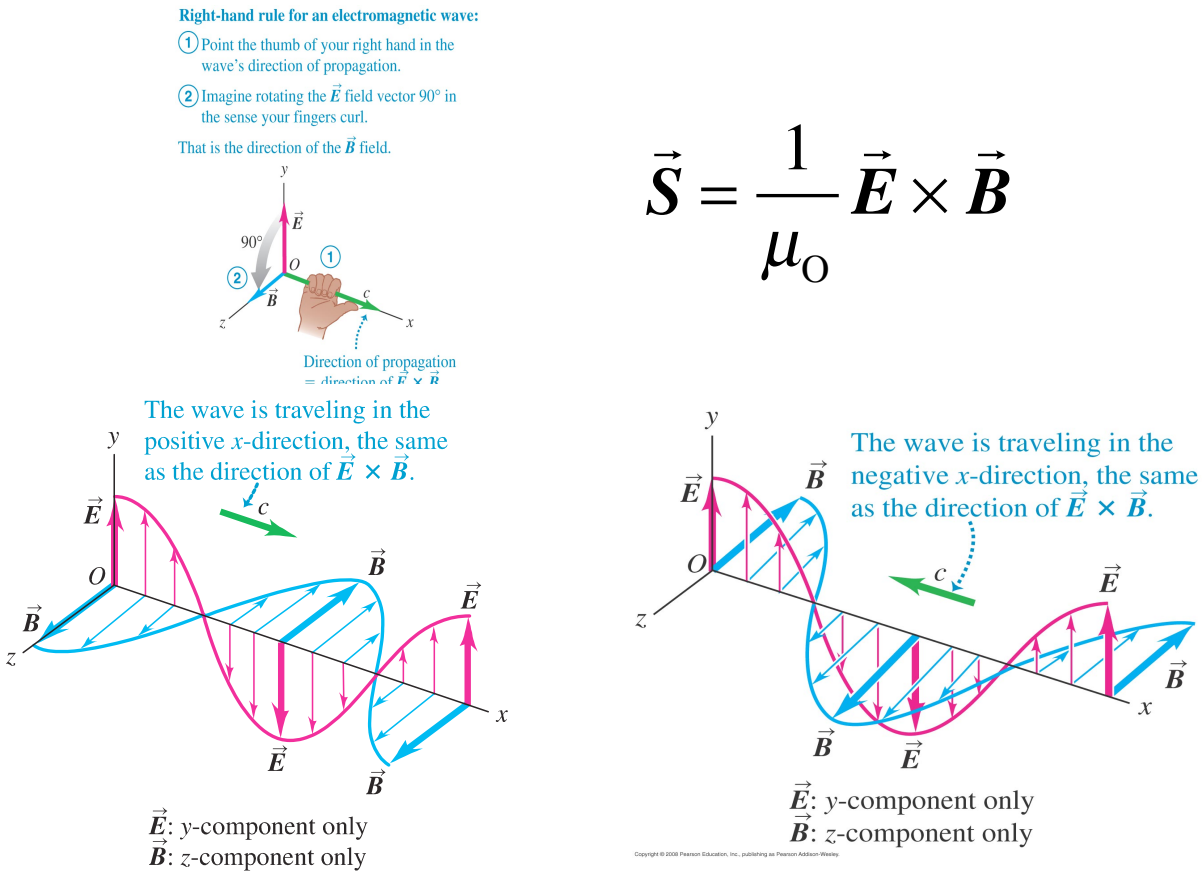
A wave can be defined as:

A) A self-propagating periodic disturbance that transports matter through space and time.

B) A self-propagating non-periodic disturbance that transports matter through space and time.

C) An evanescent periodic disturbance that transports electromagnetic energy through space and time.

D) A self-propagating periodic disturbance that transports energy and momentum through space and time



Clicker Question

Mathematical modeling of wave phenomena involves the solution of a "wave equation." Which of the following, if any, linear partial differential equations can be used to model wave propagation: (Y,K,P constants; x,t location and time; u amplitude)

A) $\frac{\partial^2 u}{\partial x^2} = K^2 \frac{\partial^2 u}{\partial t^2}$

B) $\frac{\partial^2 u}{\partial x^2} = Y^2 \frac{\partial u}{\partial t} + K^2 \frac{\partial^2 u}{\partial t^2}$

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Clicker Question

The y-component of an electromagnetic wave propagating in free space is described by:

$$E_y(y,t) = E_O \cos(kx - \omega t)]$$

This wave is known as a plane wave because:

A) It is the simplest mathematical description of a propagating wave.

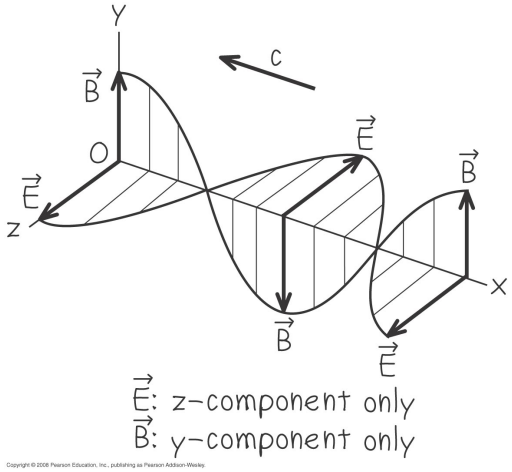
B) The amplitude is constant.

C) The surface of constant phase at any instant of time is planar.

D) The displacement direction is perpendicular to the propagation direction.

Clicker Question

The drawing shows a sinusoidal electromagnetic wave in a vacuum at one instant of time at points between $x = 0$ and $x = \lambda$. At this instant, at which values of x does the instantaneous Poynting vector have its maximum magnitude?



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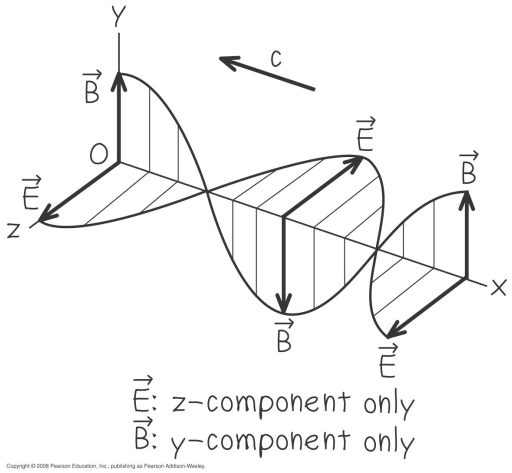

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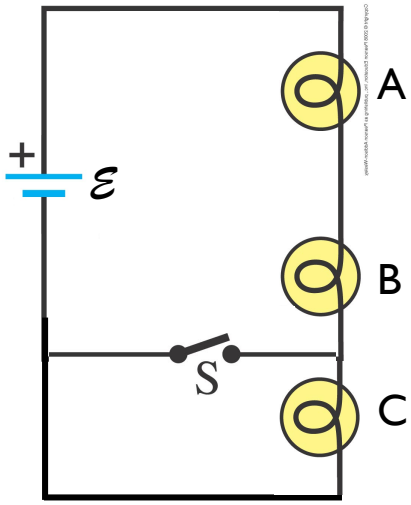

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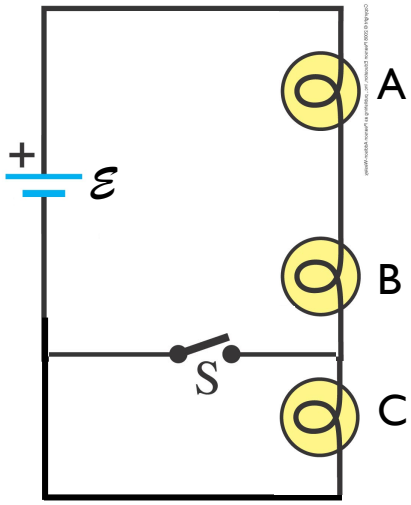

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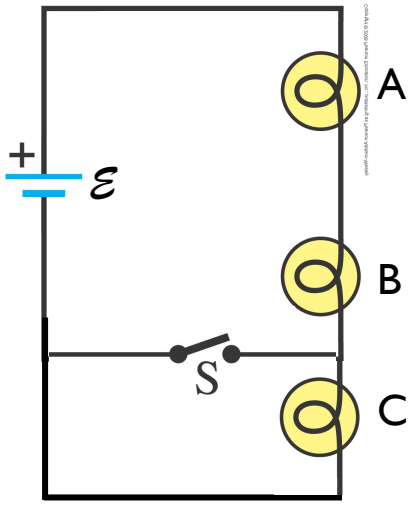

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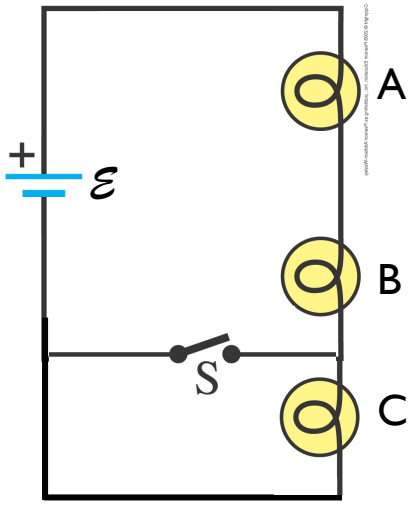

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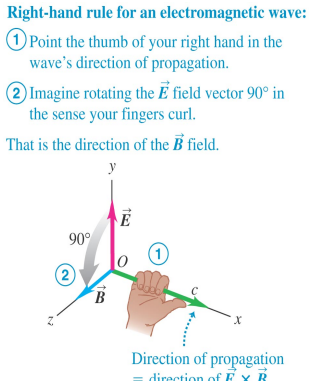
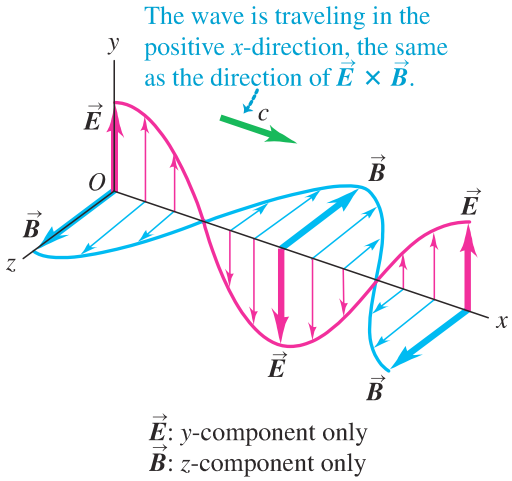
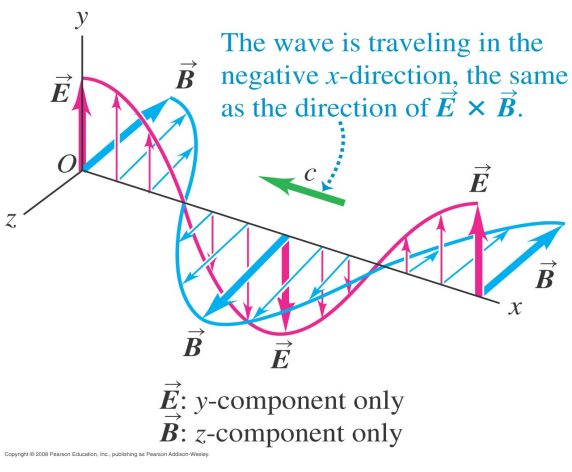


$$\vec{S} = \frac{1}{\mu_O}\vec{E} \times \vec{B}$$





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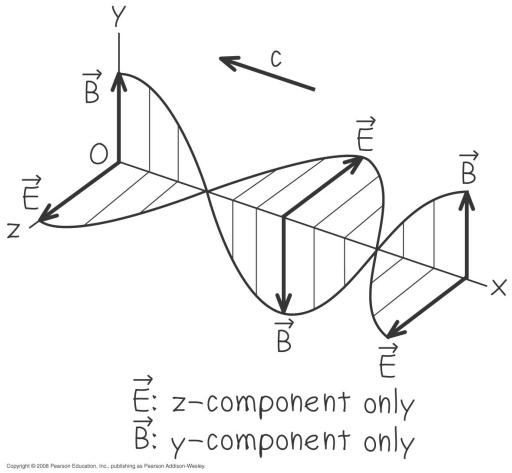

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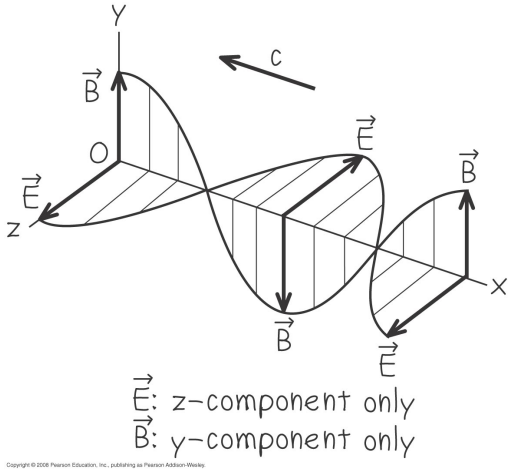

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Clicker Question

The Intensity of an EM wave is:

A) the average energy in a wave

B) the instantaneous energy in a wave

C) the average momentum flowing through a unit area per unit time

D) the average energy flowing through a unit area per unit time

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Clicker Question

What is the radiation pressure on a surface if light where the magnitude of the time averaged Poynting Vector *I* is reflected by the surface?

A) 0

B) I/c

C) -*I/c*

D) 2*I/c*

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Clicker Question

If an EM wave has electric field

$$E_y\left(x,t\right)=E_{\max}\cos\left(kx+\omega t\right)$$

is the Poynting vector ever zero?

A) Yes

B) No

Clicker Question

If an EM wave has an electric field described by

$$E_y\left(x,t\right)=E_{\max}\cos\left(kx+\omega t\right)$$

what is the direction of the Poynting vector?

A) +x

B) +y

C) +z

D) -x

E) -z

Clicker Question

If an EM wave has an electric field described by

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what is the direction of the Poynting vector?

A) +x

B) +y

C) +z

D) -x

E) -z

Clicker Question

Given the plane wave described by:

$E_x(z,t)=E_{max}\cos(kz-\omega t)$

$B_y(z,t)=B_{max}\cos(kz-\omega t)$

In which direction does energy flow?

A) There is no energy flow

B) x

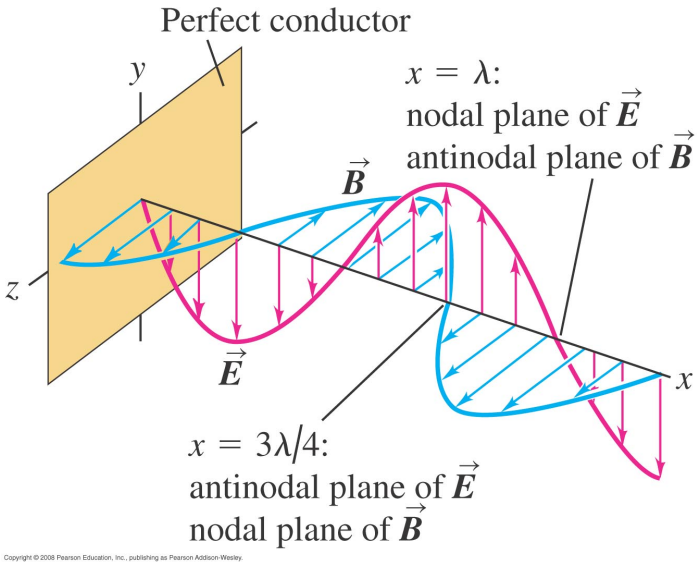
C) y

D) -y

E) z

Clicker Question

The drawing shows a sinusoidal electromagnetic standing wave. The average Poynting vector in this wave



A) points along the x-axis.
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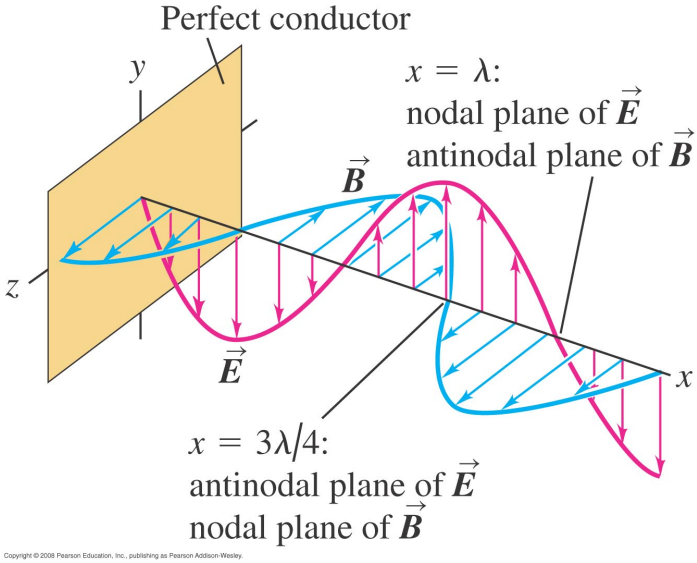

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Clicker Question

At a fixed point, P, the electric and magnetic field vectors in an electromagnetic wave oscillate at angular frequency ω. At what angular frequency does the Poynting vector oscillate at that point?

A) 2 ω

B) ω

C) ω/2

D) 4 ω

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A) 2 ω

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Clicker Question

In a material with index of refraction n>1, the wavelength is :

A) a) the same as in vacuum

B) greater than in vacuum

C) less than in vacuum

Clicker Question

A series circuit consists of three identical light bulbs connected to a battery as shown here. When the switch S is closed, do the following increase, decrease, or stay the same?

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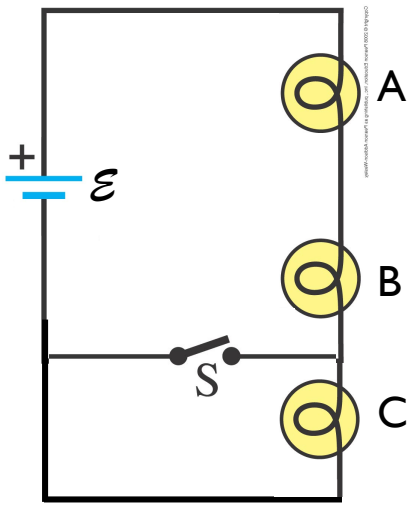

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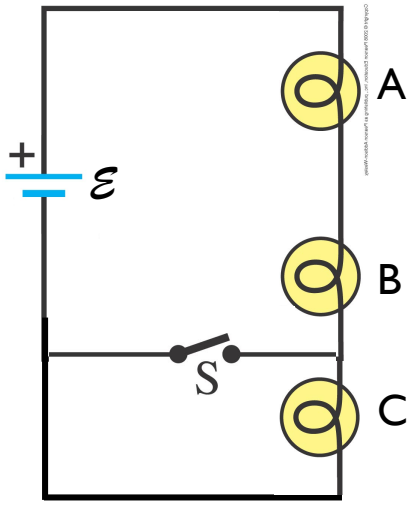

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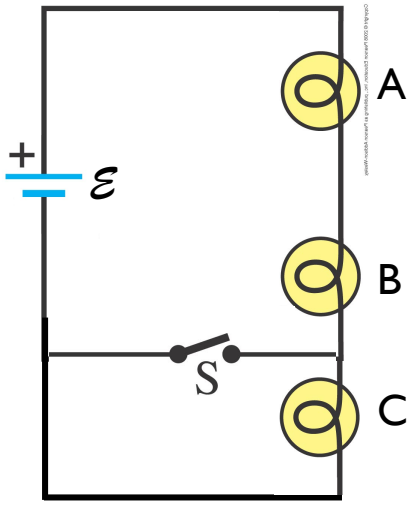

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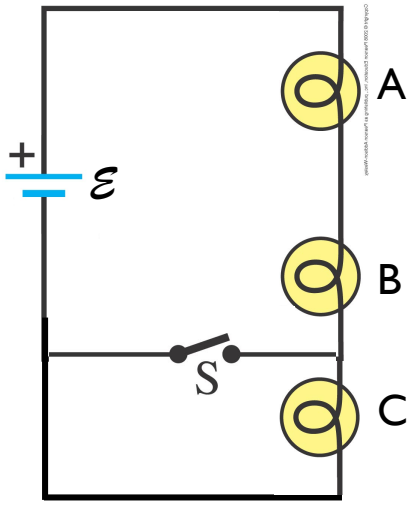

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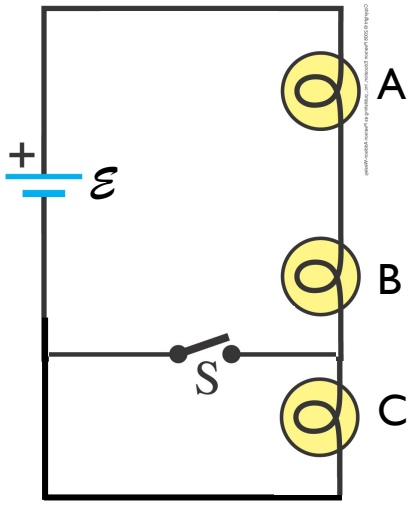

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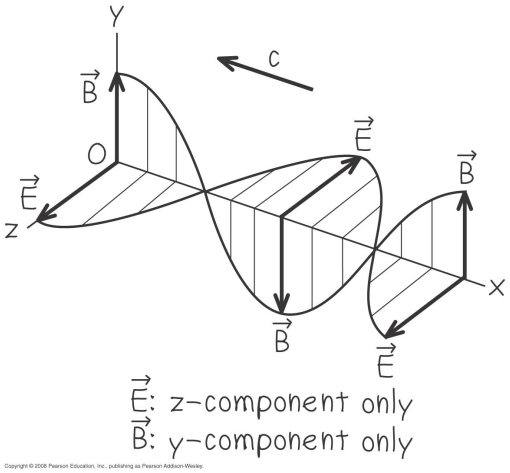

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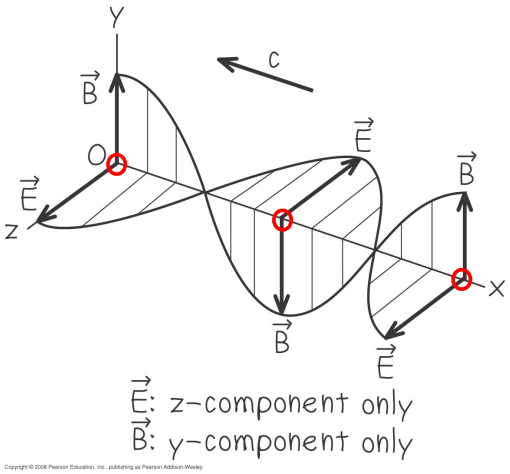


A. x = 0 and x = λ only

B. x = λ/4 and x = 3λ/4 only

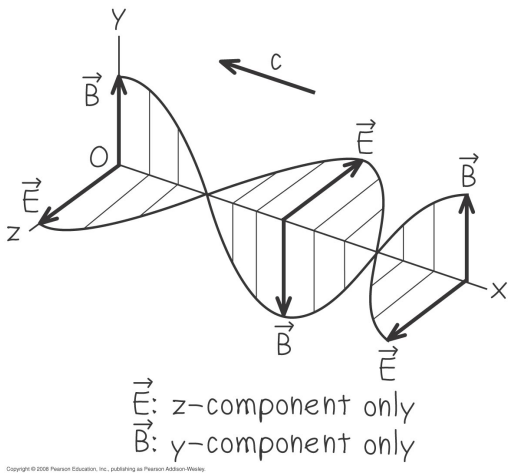
C. x = λ/2 only

D. x = 0, x = λ/2, and x = λ

Clicker Question

The drawing shows a sinusoidal electromagnetic wave in a vacuum at one instant of time at points between x = 0 and x = λ.

For this instant, at which values of x does the instantaneous Poynting vector have its **minimum** magnitude?



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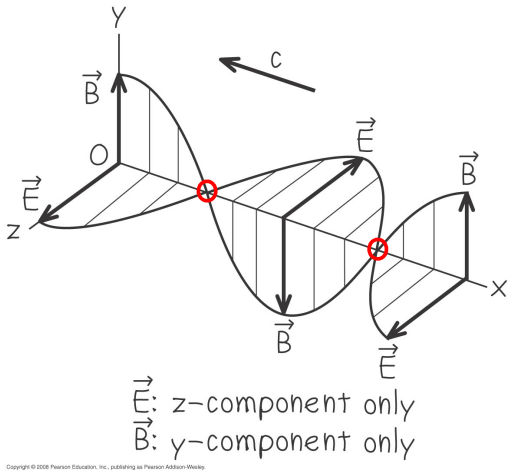

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Clicker Question

At a fixed point, P, the electric and magnetic field vectors in an electromagnetic wave oscillate at angular frequency ω. At what angular frequency does the Poynting vector oscillate at that point?

A) 2 ω

B) ω

C) ω/2

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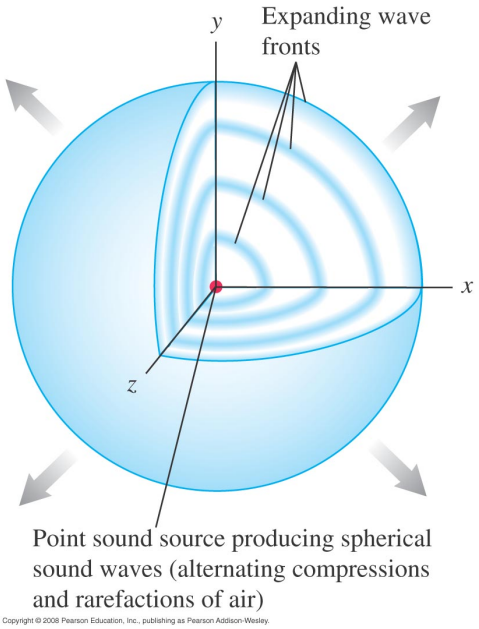
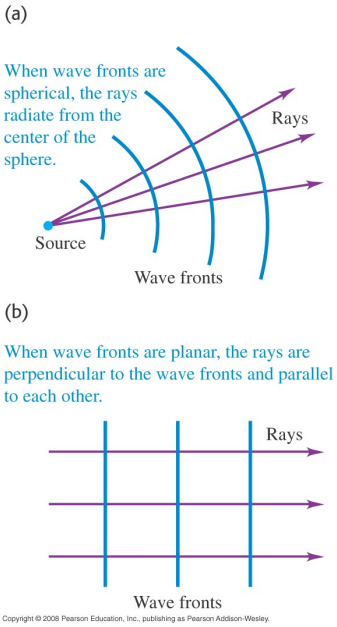
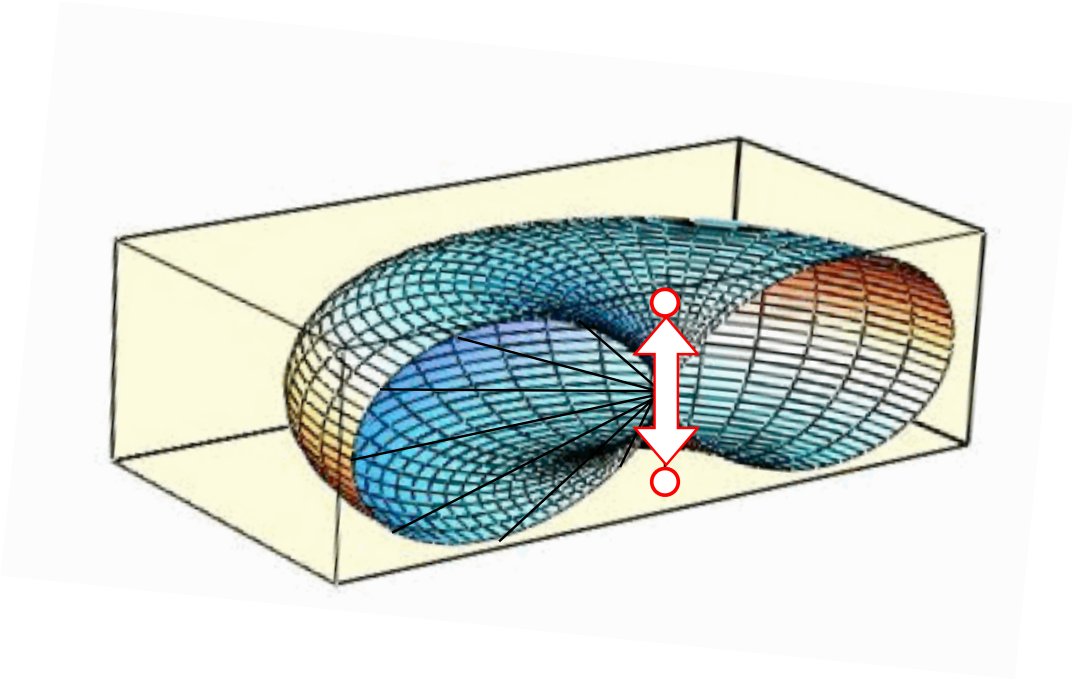
Wave Front/Phase Front: Plane of constant φ

in cos(φ)=cos(kx-ωt)

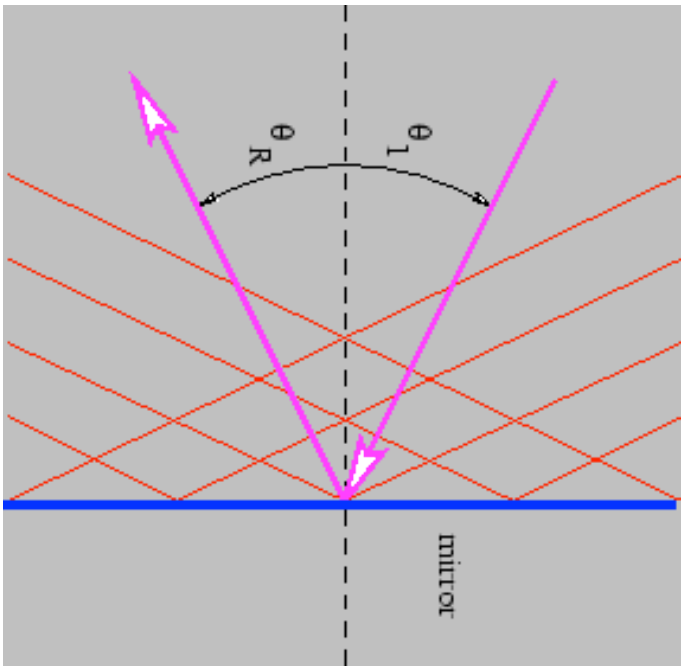




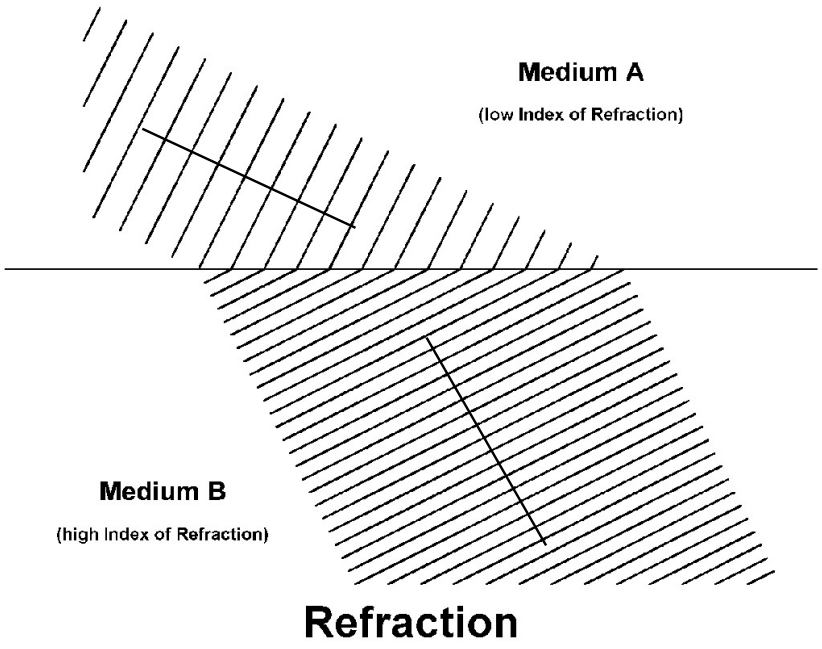
Dipole and dipole radiation pattern



Phase fronts match in reflection:



Phase fronts match in refraction:



Clicker Question

In vacuum, which color of light travels with the highest speed:

A. green

B. red.

C. blue

D. x-rays

E. They all have the same speed

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Clicker Question

In a material with index of refraction n>1, the wavelength of light is:

A. the same as the wavelength in vacuum.

B. greater than the wavelength in vacuum.

C. less than the wavelength in vacuum.

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Clicker Question

When light passes from vacuum (index of refraction n = 1) into water (n = 1.333),

A. the wavelength increases and the frequency is unchanged.

B. the wavelength decreases and the frequency is unchanged.

C. the wavelength is unchanged and the frequency increases.

D. the wavelength is unchanged and the frequency decreases.

E. both the wavelength and the frequency change.

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Wave Front/Phase Front: Plane of constant φ

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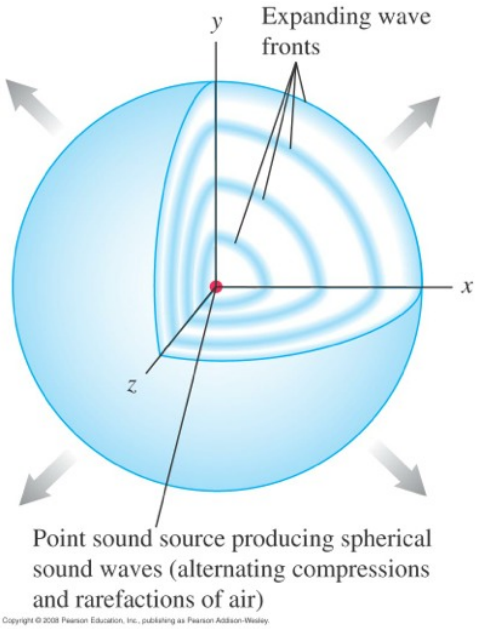
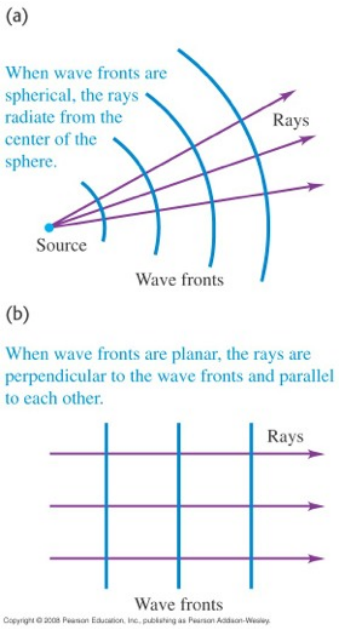
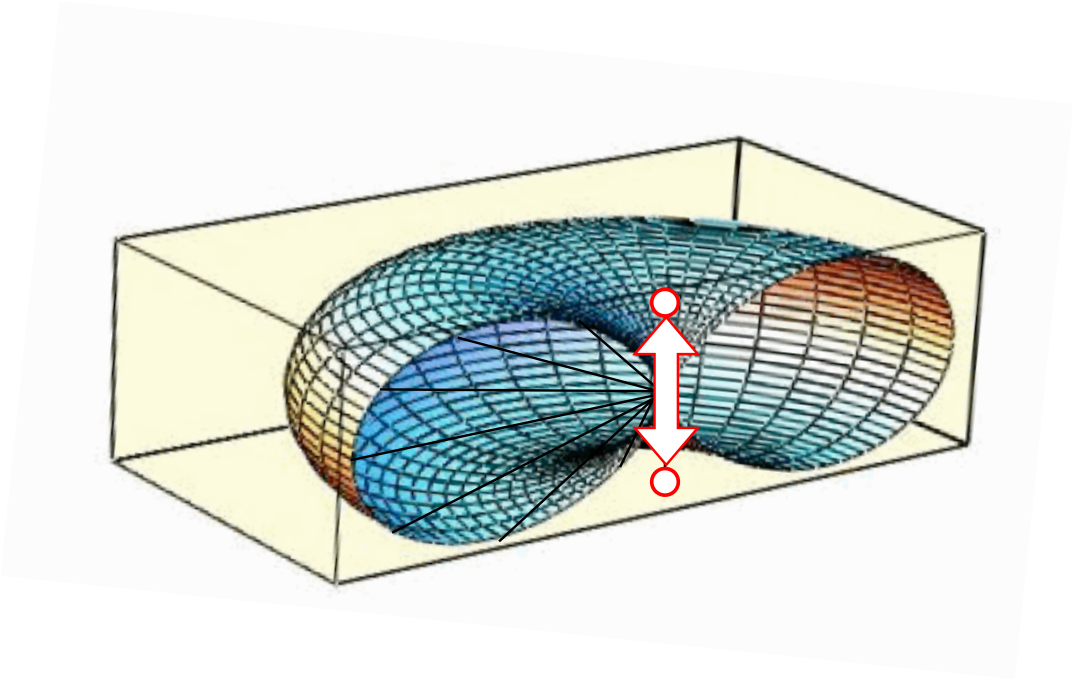




Dipole and dipole radiation pattern



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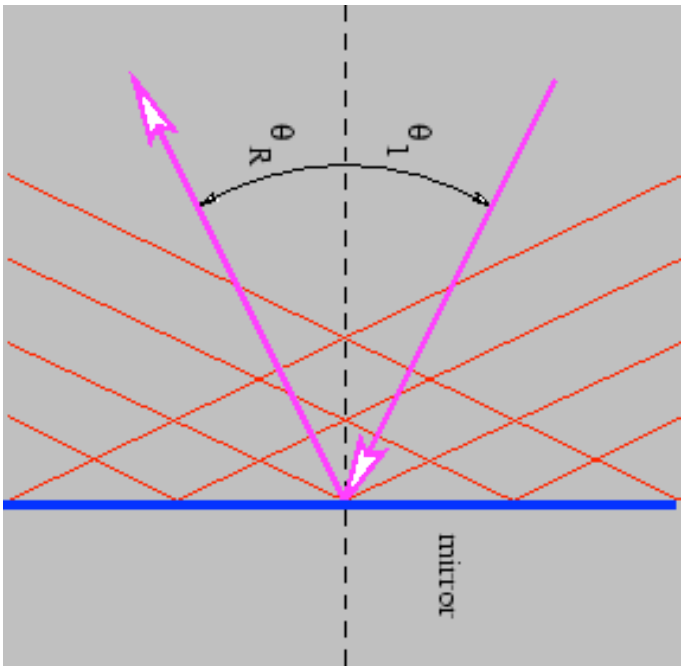

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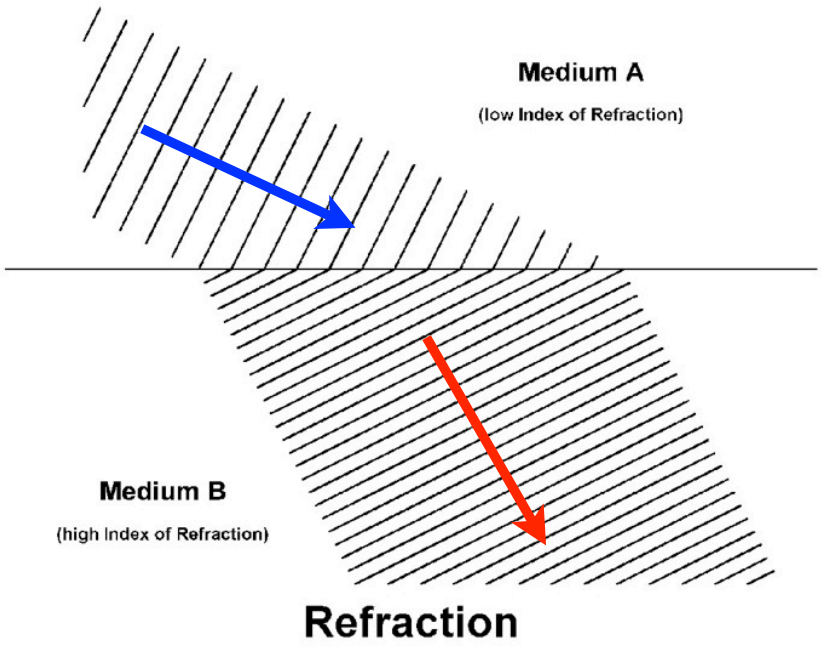
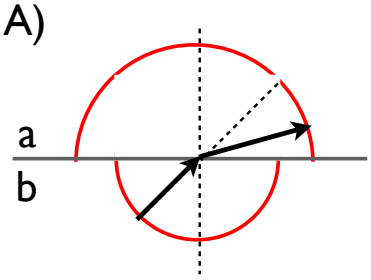


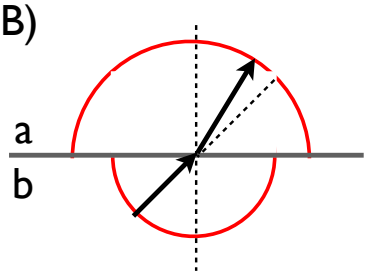
Clicker Question

Which ray diagram is drawn correctly if $n_a > n_b$?

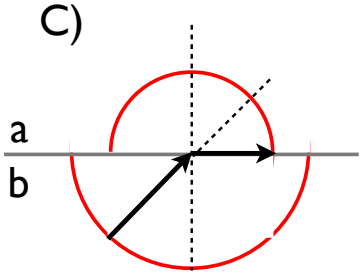
A)



B)



C)



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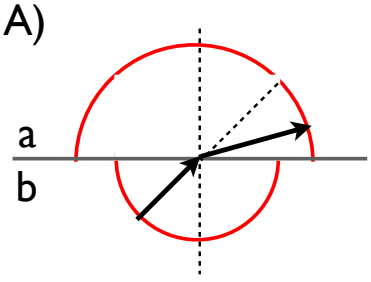
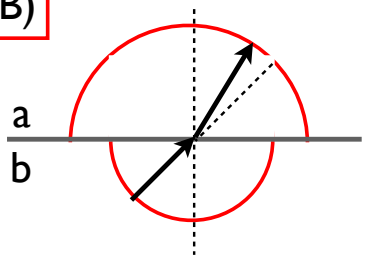
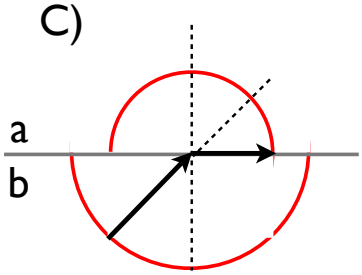


B)



C)



Clicker Question

Light passes from vacuum (index of refraction $n = 1$) into water ($n = 1.333$).

If the incident angle θ_a is in the range $0° < \theta_a < 90°$,

A. the refracted angle is greater than the incident angle.

B. the refracted angle is equal to the incident angle.

C. the refracted angle is less than the incident angle.

D. the answer depends on the specific value of θ_a .

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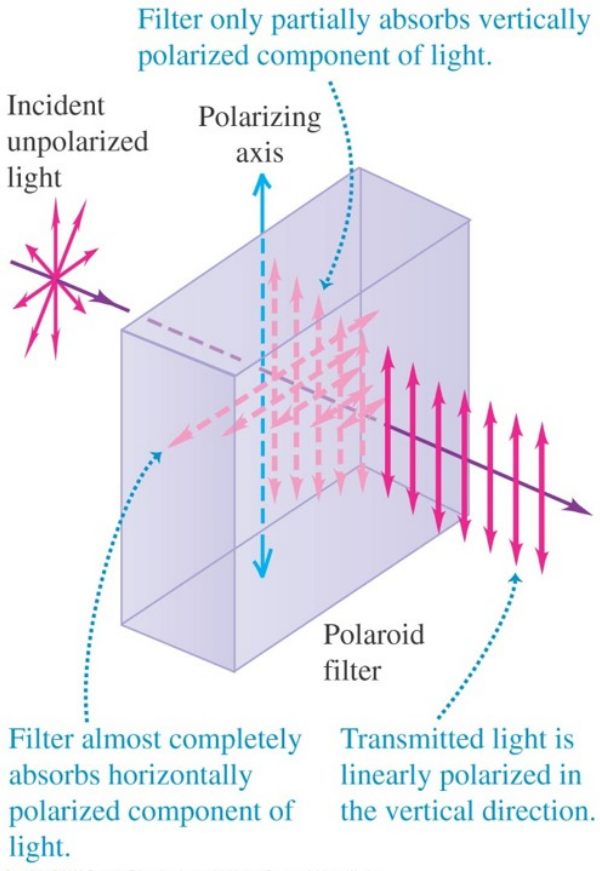
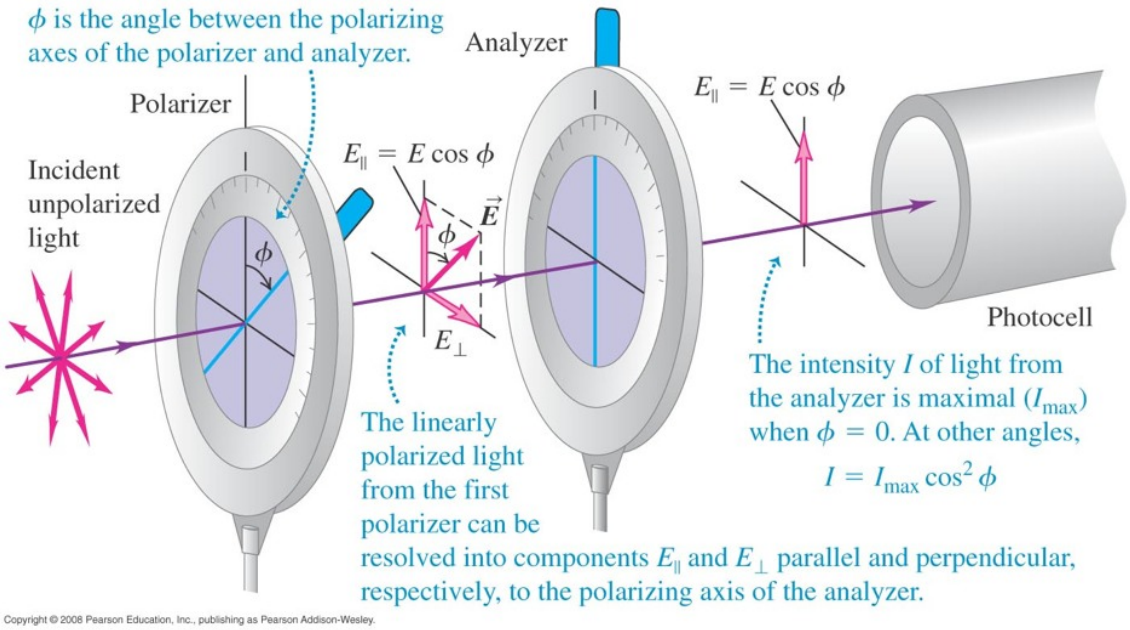
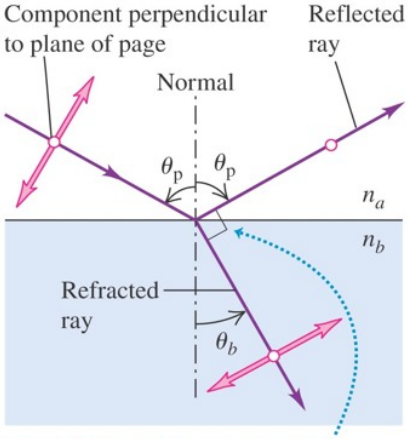




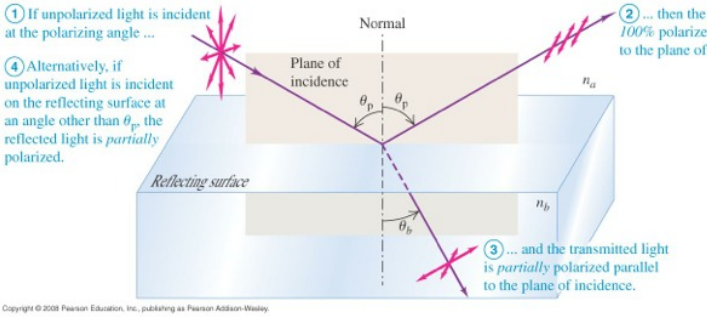
I_o $I_o/2$ $I_o/2\cos^2\phi$

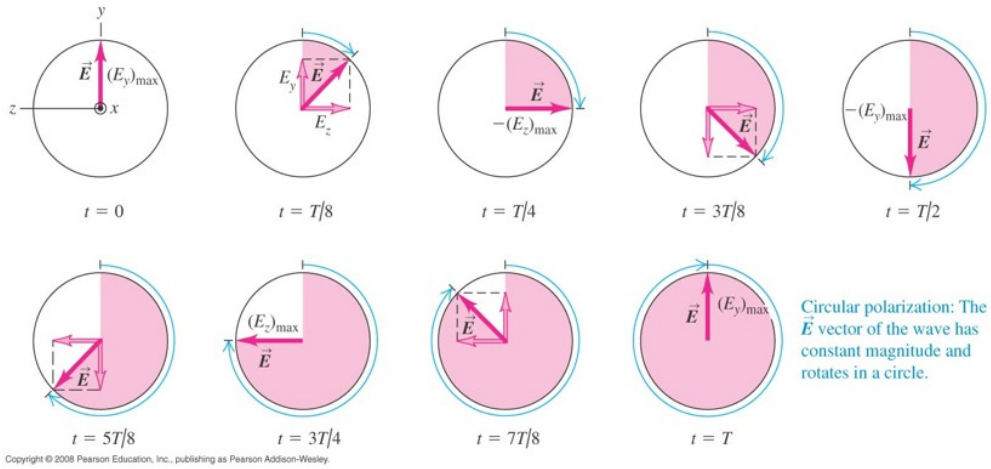
Note: This is a side view of the situation shown in Fig. 33.27.



When light strikes a surface at the polarizing angle, the reflected and refracted rays are perpendicular to each other and

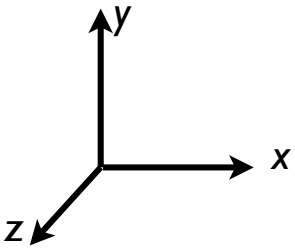
$$\tan\theta_p = \frac{n_b}{n_a}$$





Clicker Question

In what direction is the light polarized after the polarizing filter?

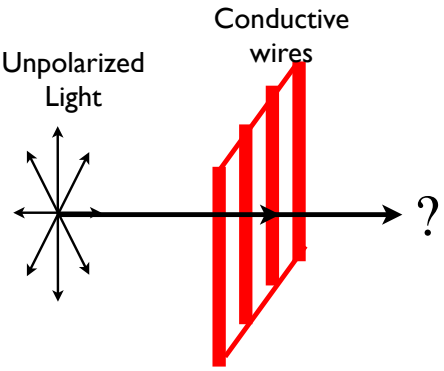


A) x

B) y

C) z

D) still unpolarized



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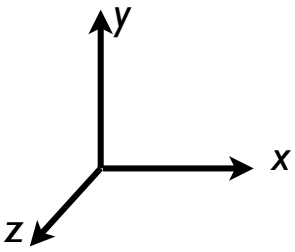

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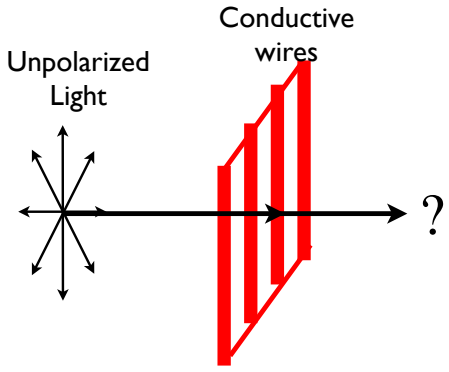

Clicker Question

Three polarizing filters are stacked with the polarizing axes of the second and third filters oriented at 45° and 90°, respectively, relative to the polarizing axis of the first filter. Unpolarized light of intensity I_0 is incident on the first filter. The intensity of light emerging from the third filter is

A) 0

B) $I_o / \sqrt{2}$

C) $I_o / 2$

D) $I_o / 4$

E) $I_o / 8$

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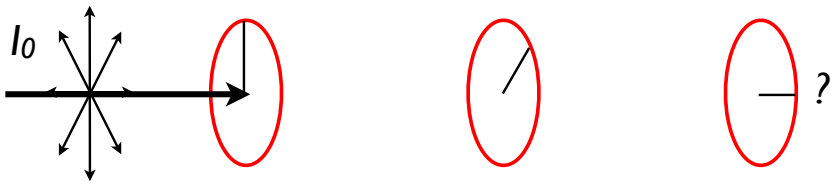

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Clicker Question

The middle polarizing filter is then removed. What is now the intensity of the resulting light?

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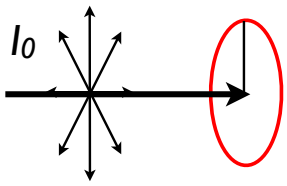

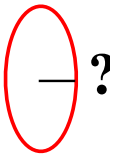

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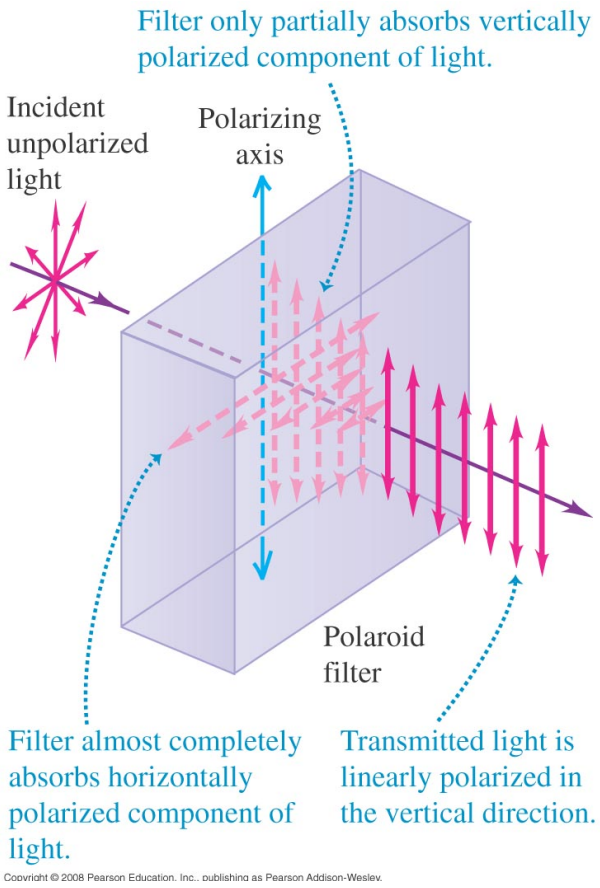
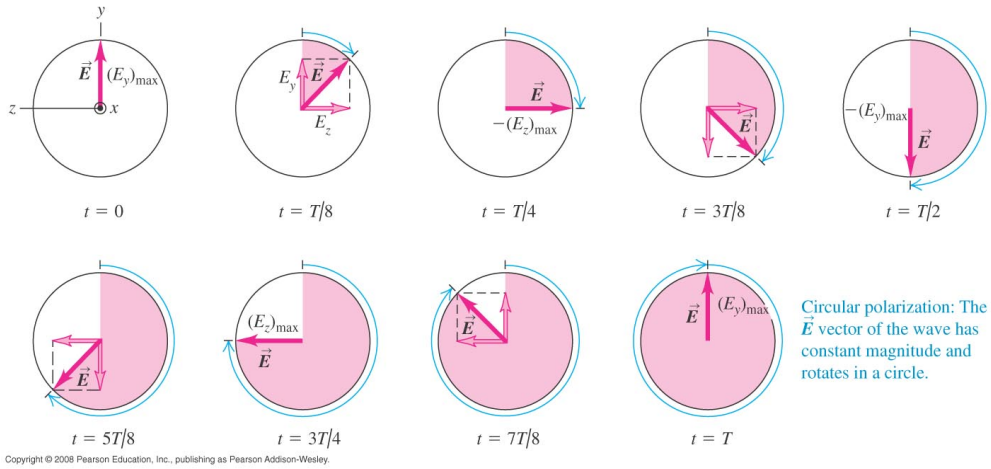
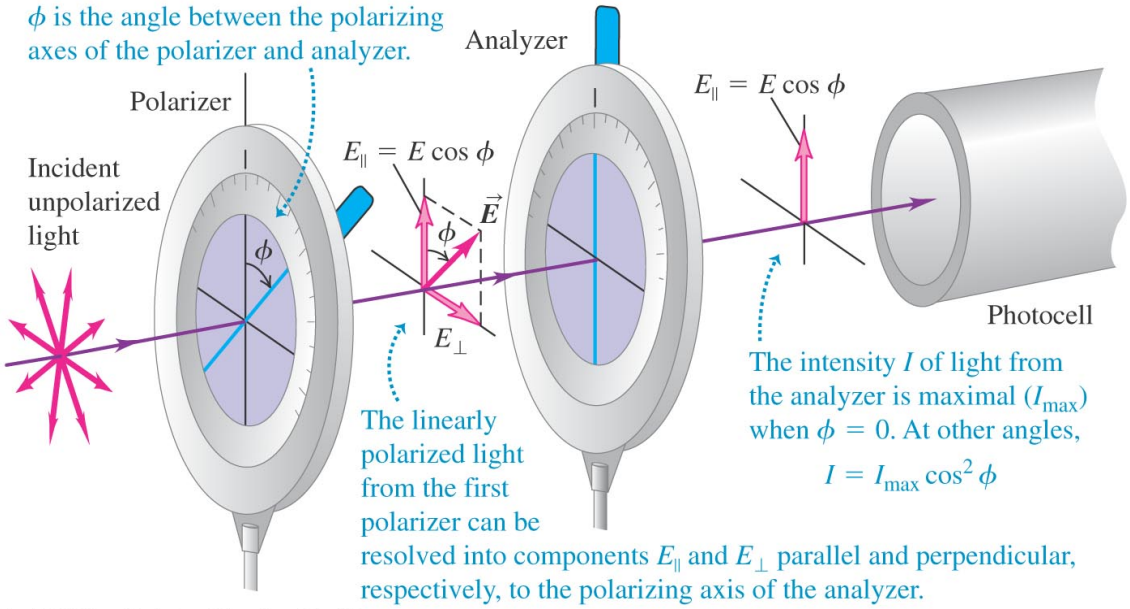


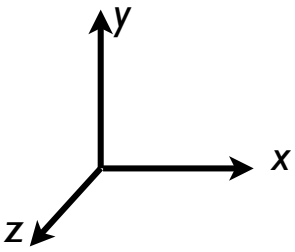




I_0 $I_0/2$ $I_0/2 \cos^2\phi$

Clicker Question

In what direction is the light polarized after the polarizing filter?



A) x

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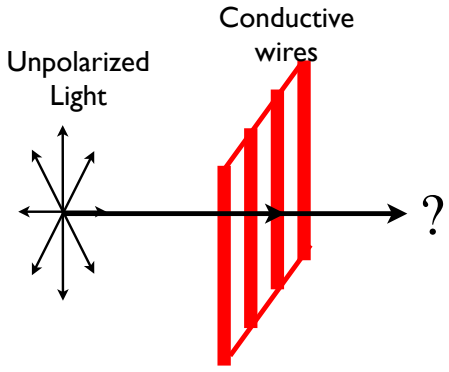

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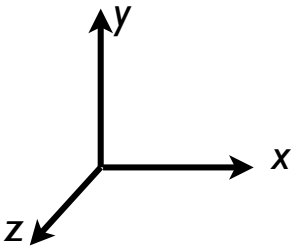

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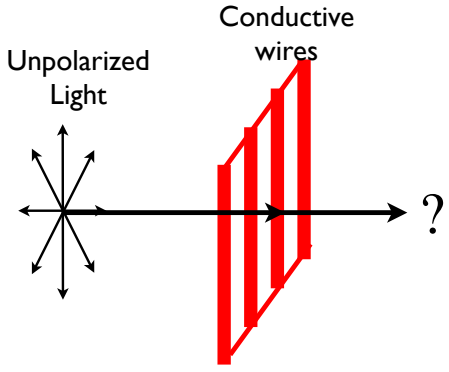

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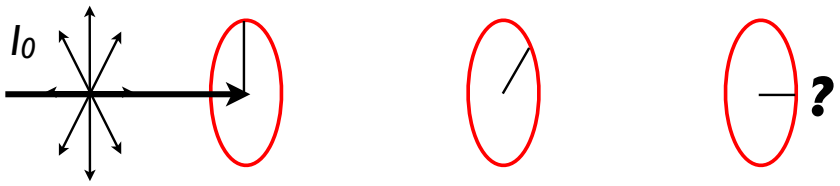

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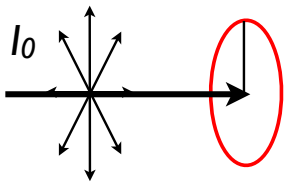

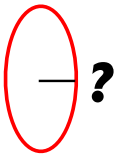

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Clicker Question

Un-polarized light is incident on a system consisting of a Polarizer and Analyzer. They are aligned so that no light is passed though the system. What is the angle between the polarizing directions of the Polarizer and Analyzer?

A) 0
B) π/2
C) π
D) 3π/2
E) B or D

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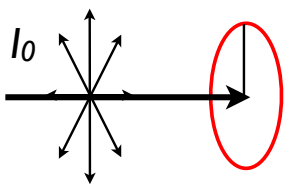

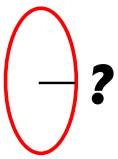

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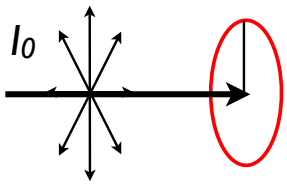
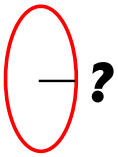
Clicker Question

The middle polarizing filter is then removed. What is now the intensity of the resulting light?





A) 0

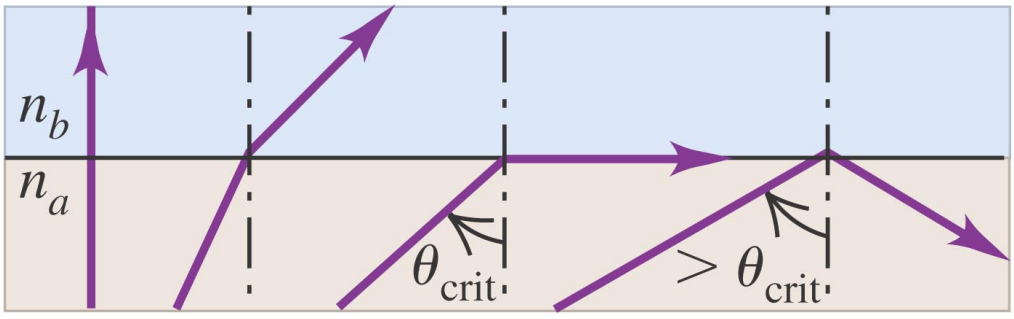
B) $I_o / \sqrt{2}$

C) $I_o / 2$

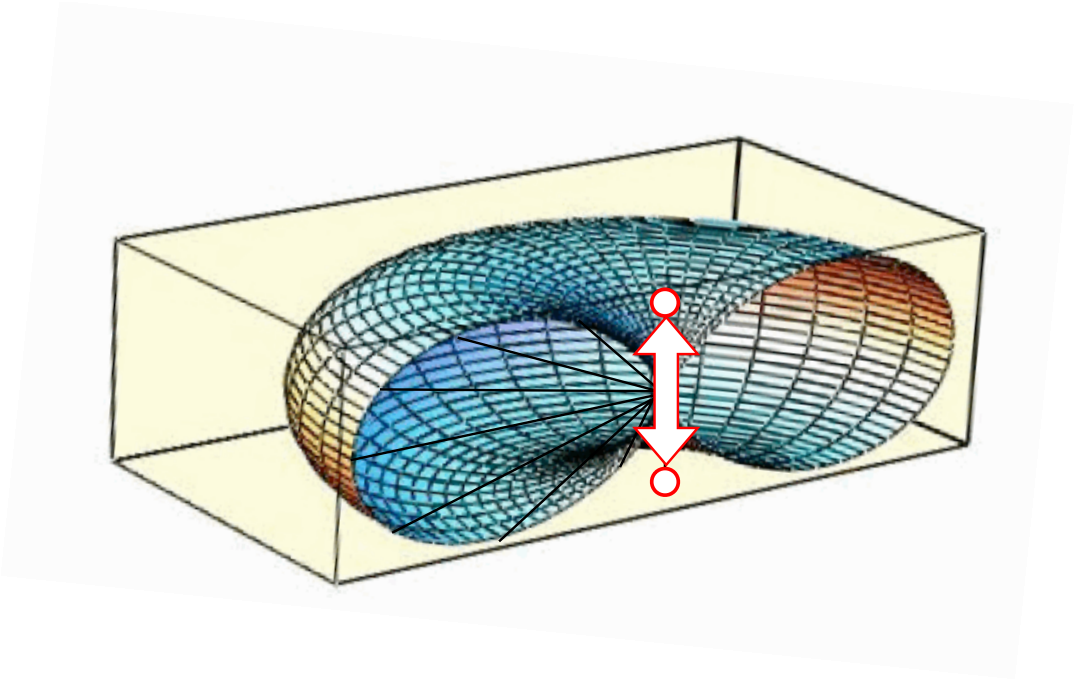
D) $I_o / 4$

E) $I_o / 8$

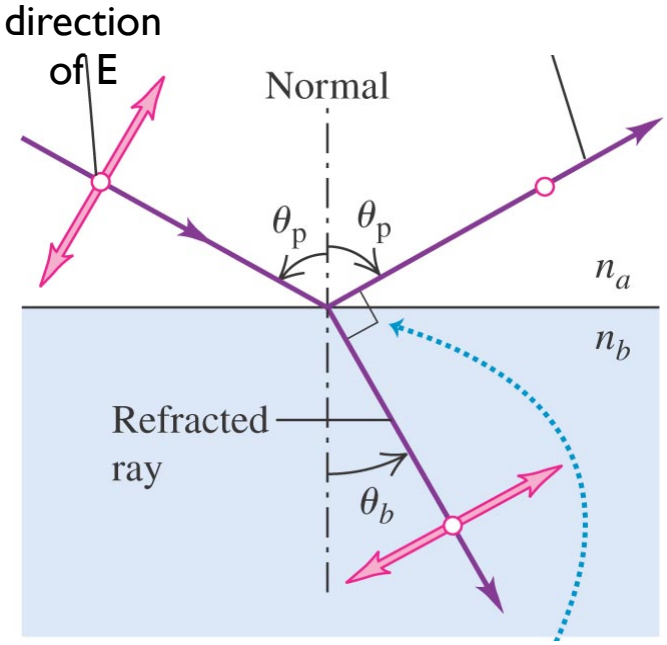
Critical Angle - Total Internal Reflection

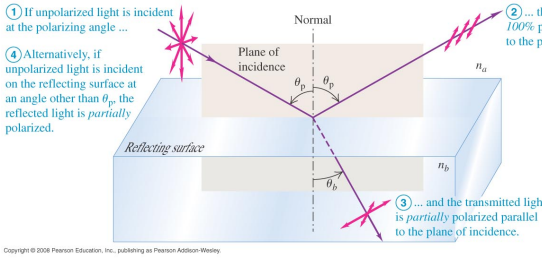


Dipole and dipole radiation pattern

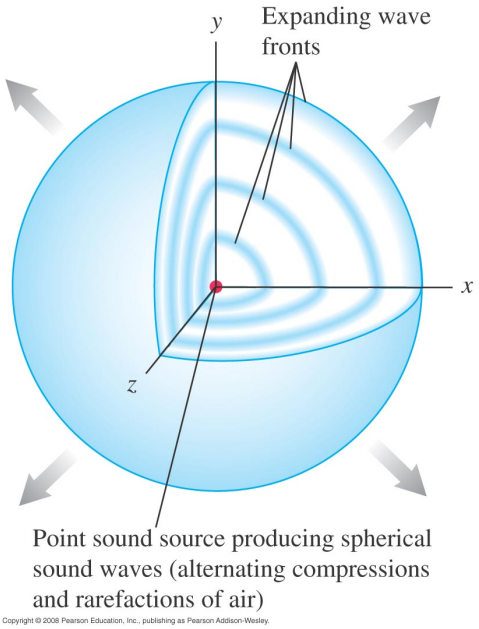


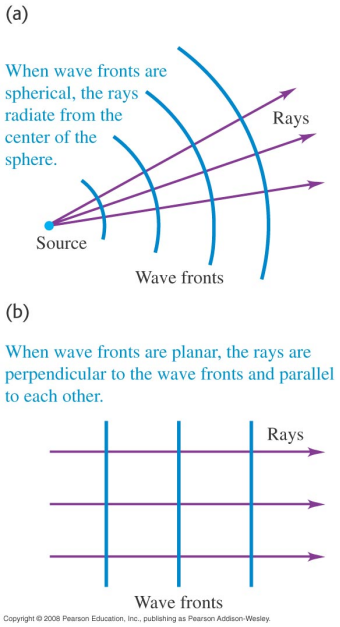
Brewster Angle-Polarizing angle, Perfect transmission

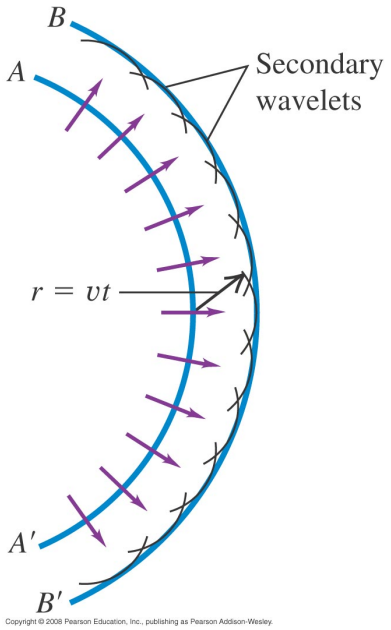




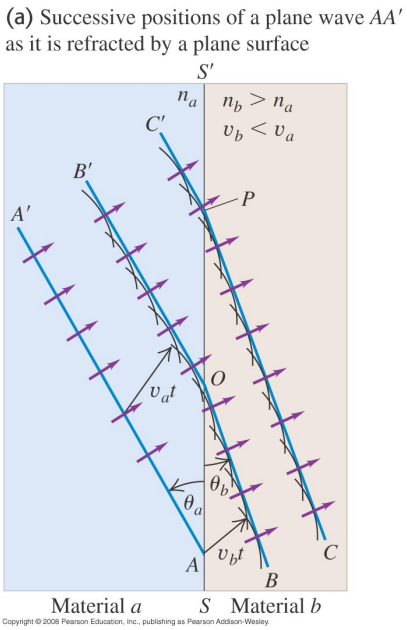
Wave Front/Phase Front: Plane of constant φ in cos(φ)=cos(kx-ωt)







Huygen's Principle



Huygen's Principle for refraction

Huygen's Principle:

Every point of a _____ may be considered the source of secondary wavelets that spread out in all directions with a speed equal to the speed of propagation of the wave.

A) Wave

B) Wave Front

C) Ray

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Every point of a _____ may be considered the source of secondary wavelets that spread out in all directions with a speed equal to the speed of propagation of the wave.

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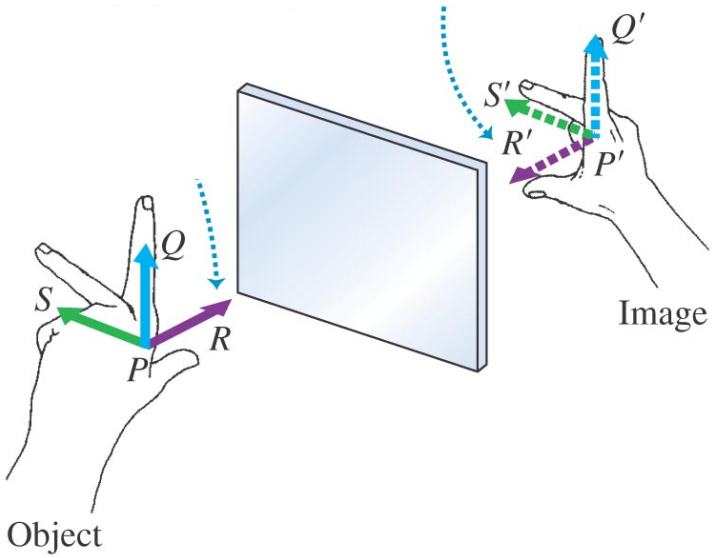
Clicker Question

The image formed by a planar mirror is _____ reversed.

A) Left-Right

B) Top-Bottom

C) Back-Front



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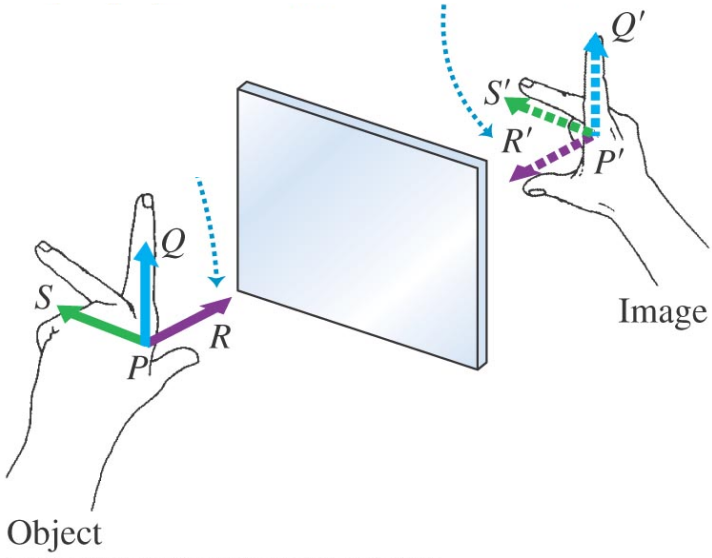


Clicker Question

A circular metal loop antenna is can be oriented in the XY, XZ or YZ planes. Which orientation will receive the highest signal?

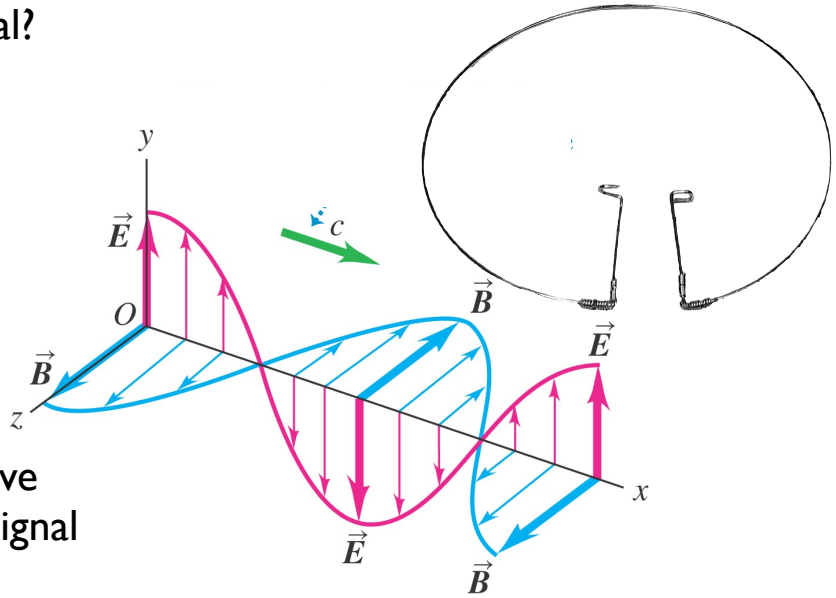
Super Problem!

A) XY Plane

B) XZ Plane

C) YZ Plane

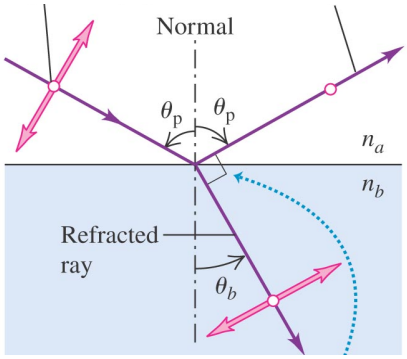
D) All will receive the same signal



$\vec{E}$: y-component only
$\vec{B}$: z-component only

1. **Sign rule for the object distance:** When the object is on the same side of the reflecting or refracting surface as the incoming light, the object distance s is positive; otherwise, it is negative.
2. **Sign rule for the image distance:** When the image is on the same side of the reflecting or refracting surface as the outgoing light, the image distance s' is positive; otherwise, it is negative.
3. **Sign rule for the radius of curvature of a spherical surface:** When the center of curvature C is on the same side as the outgoing light, the radius of curvature is positive; otherwise, it is negative.

Clicker Question



Natural light is incident on the surface of a liquid.

The reflected light will be completely polarized if the incident angle θ_a is:

A) greater than the Brewster (polarizing) angle.

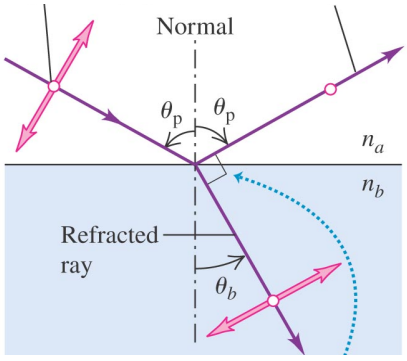
B) greater than or equal to the Brewster (polarizing) angle.

C) equal to the Brewster (polarizing) angle.

D) less than or equal to the Brewster (polarizing) angle.

E) less than the Brewster (polarizing) angle.

Clicker Question



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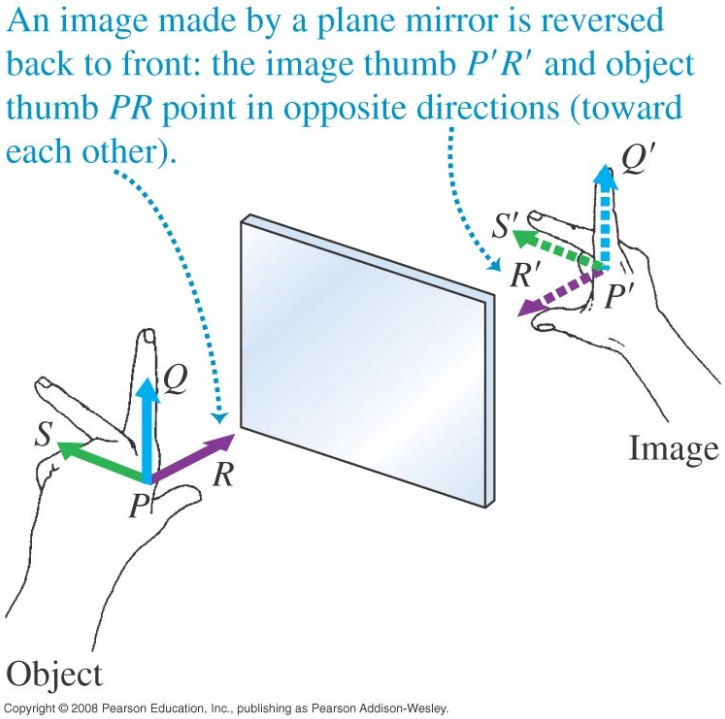
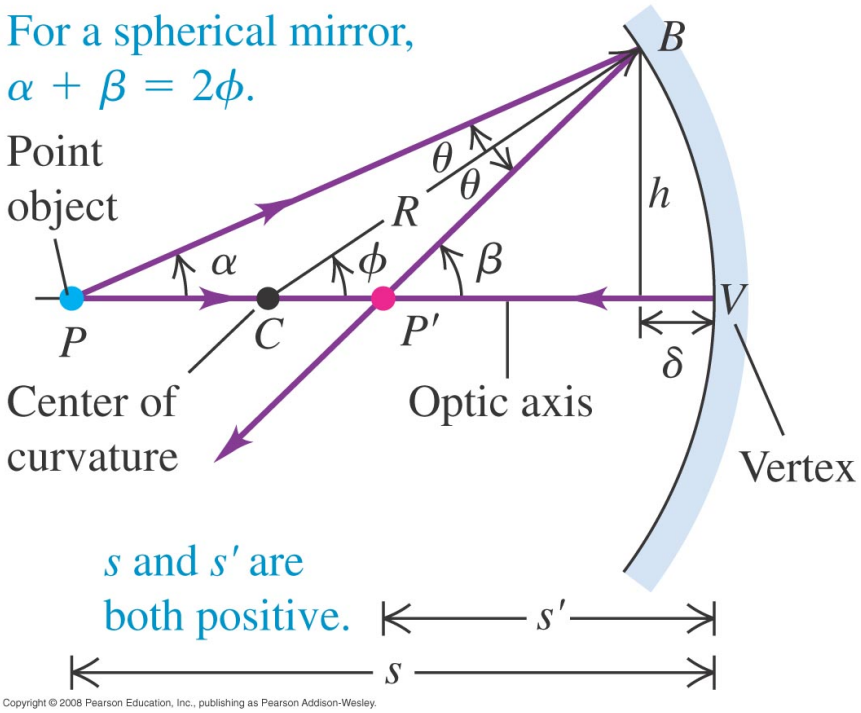
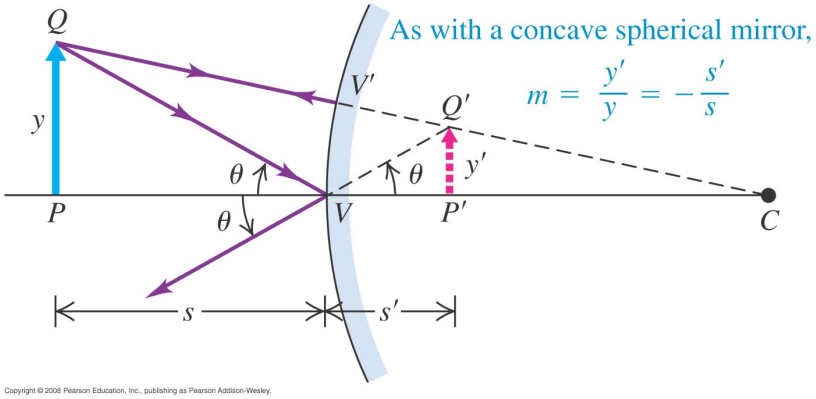


(a) Construction for finding the position P' of an image formed by a concave spherical mirror



(b) Construction for finding the magnification of an image formed by a convex mirror



Clicker Question

The Sandia Solar Thermal Facility includes several concentrators consisting of mirrors that focus sunlight on a "heat engine" that converts thermal energy into mechanical motion. Where should the heat engine be located with respect to the mirror? The radius of curvature of the mirror is R.

A) At R
B) at 2R
C) at -2R
D) at R/2
E) any position as long as it is centered.

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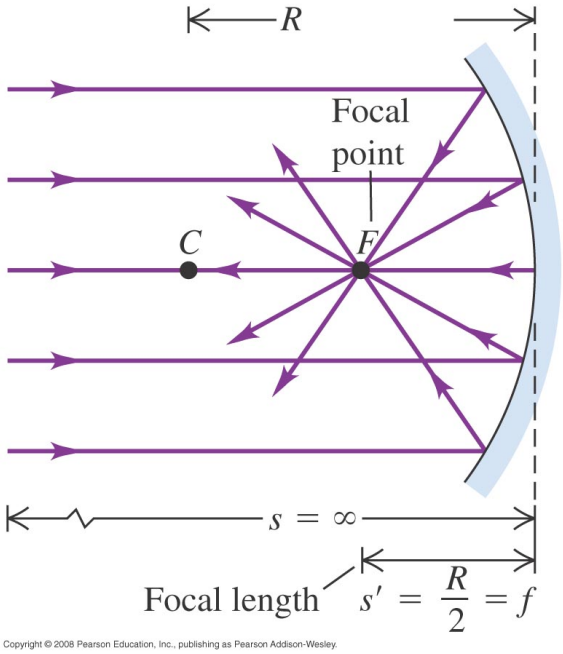
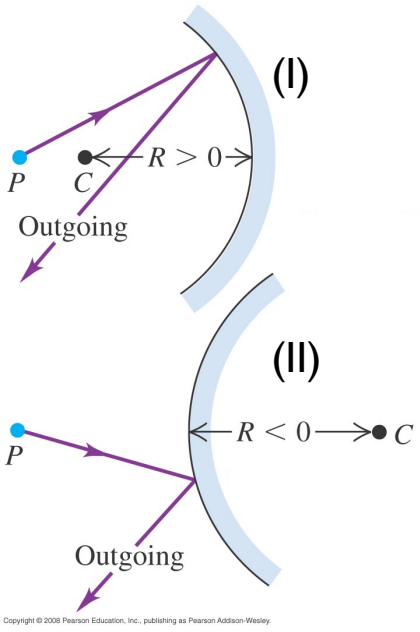
(a) All parallel rays incident on a spherical mirror reflect through the focal point.



Clicker Question

In which of these diagrams is the center of curvature R negative according the sign convention used in optics?



A) I

B) II

C) Both I and II

D) Neither I nor II

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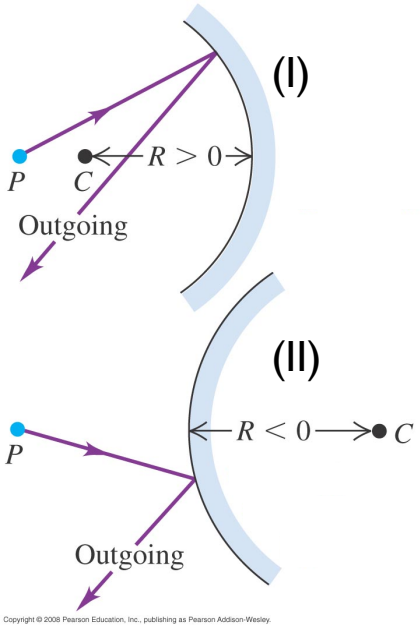


A) I

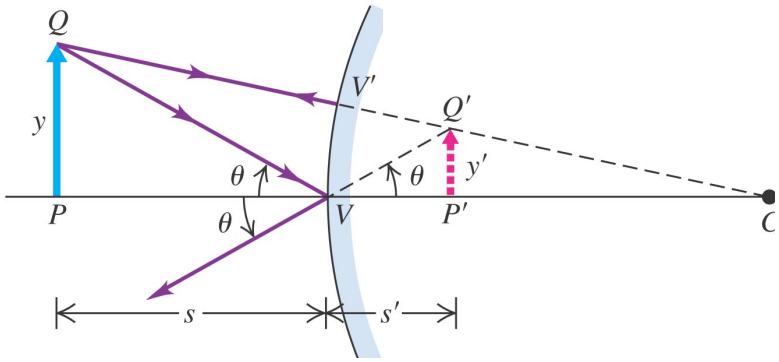
B) II

C) Both I and II

D) Neither I nor II

Clicker Question

The sign of s' is:



A) Positive

B) Negative

Clicker Question

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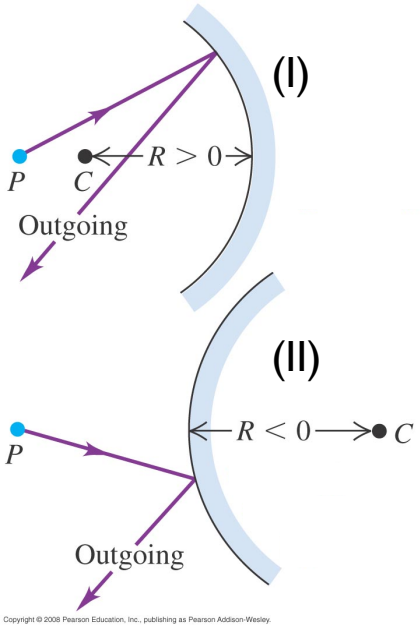


A) I

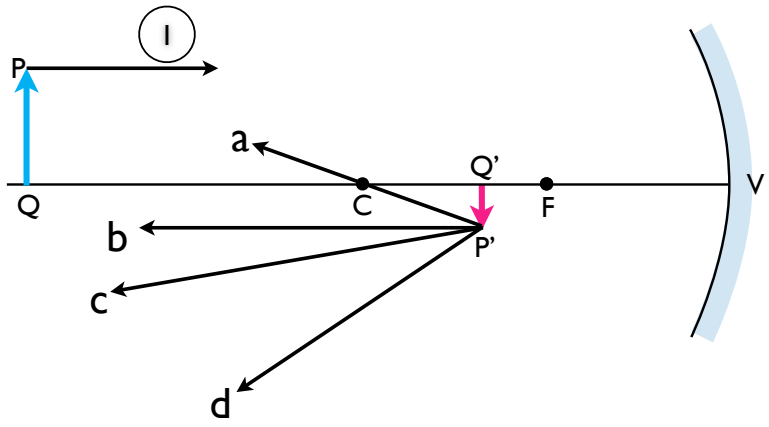
B) II

C) Both I and II

D) Neither I nor II

Clicker Question

Ray 1 leaves the object parallel to the optical axis. Which ray from the image is the result of its reflection from the concave mirror?



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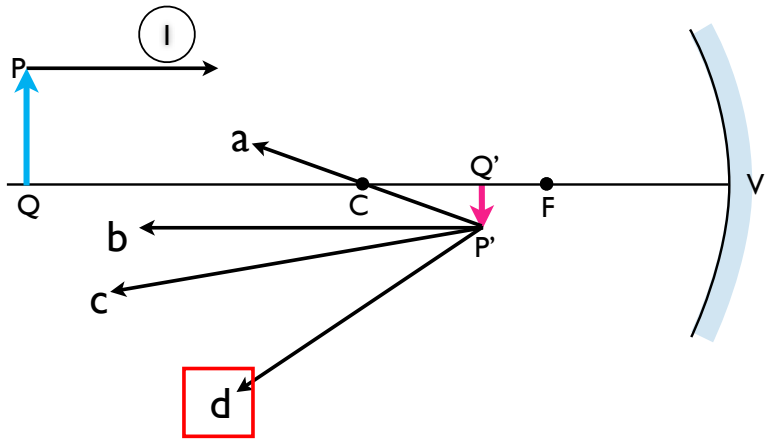
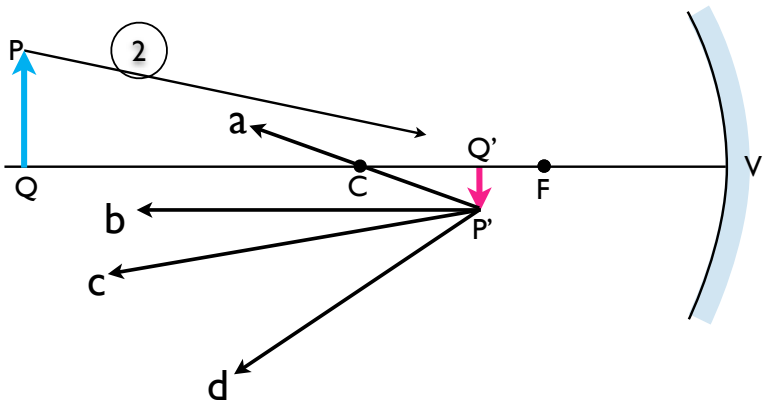


Clicker Question

Ray 2 leaves the object and passes through the focal point F. Which ray from the image is the result of its reflection from the concave mirror?



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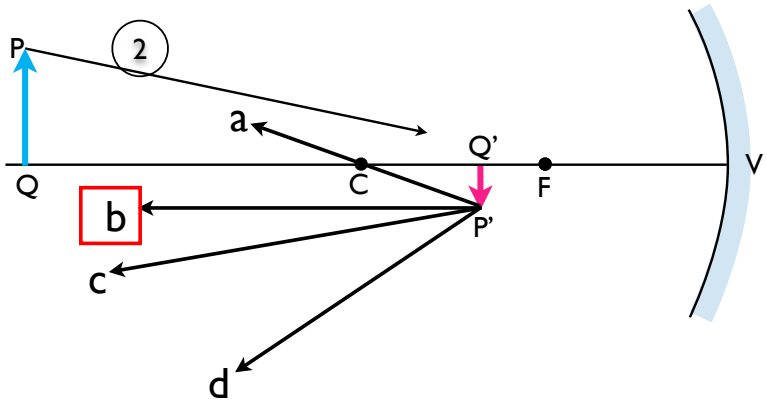
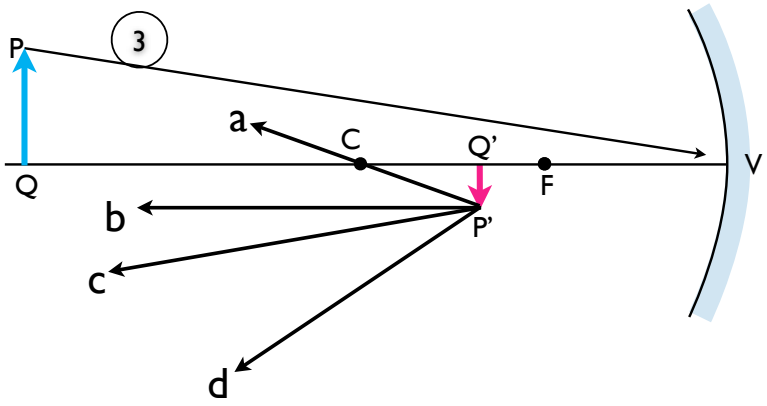


Clicker Question

Ray 3 leaves the object and hits the mirror at the vertex V. Which ray from the image is the result of its reflection from the concave mirror?



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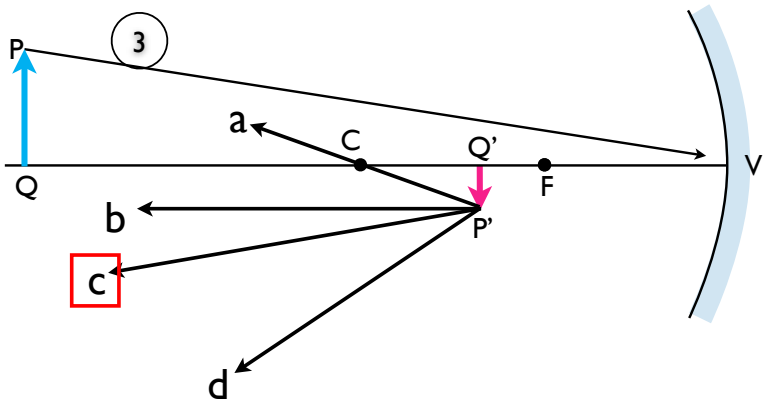
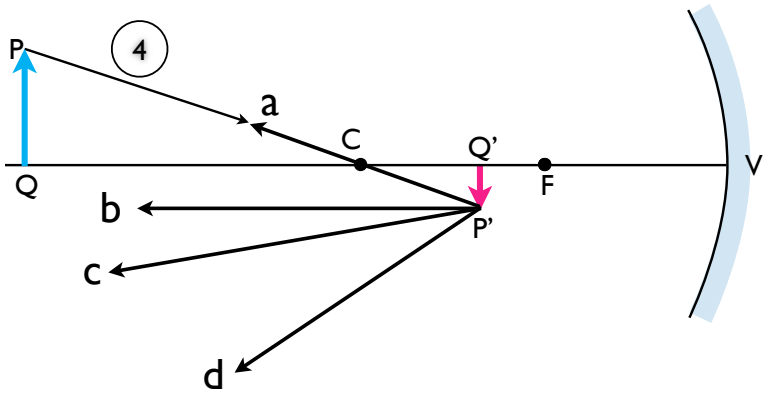


Clicker Question

Ray 4 leaves the object and passes through the center of curvature C. Which ray from the image is the result of its reflection from the concave mirror?



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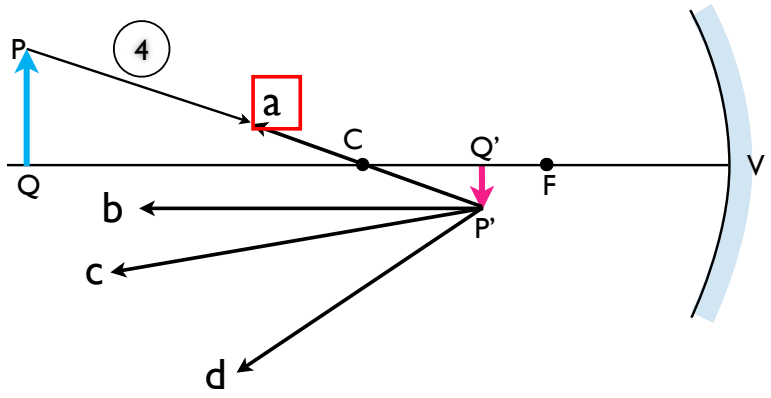
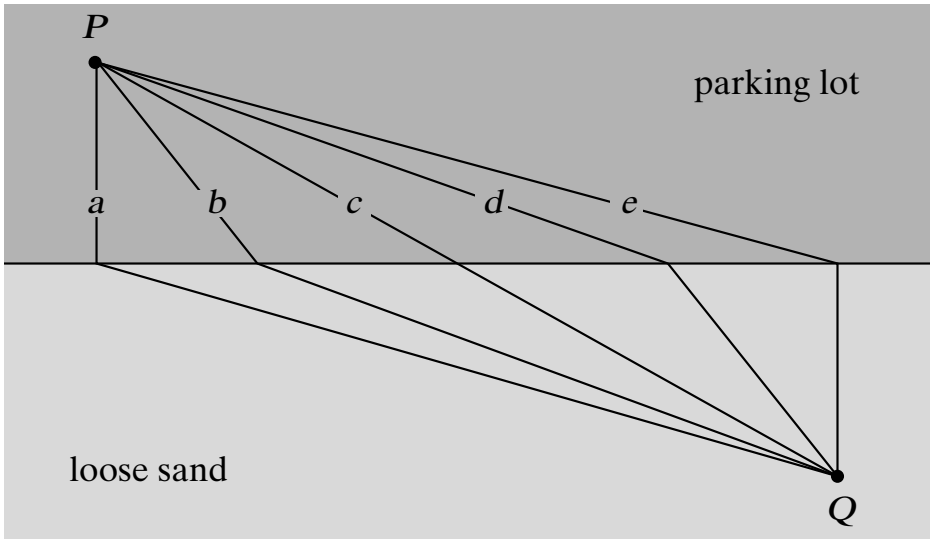


Clicker Question

A group of sprinters gather at point *P* on a parking lot bordering a beach. They must run across the parking lot to a point *Q* on the beach as quickly as possible. Taking into account the difference in sprint speed in the parking lot and on loose sand, which path from *P* to *Q* takes the least time?



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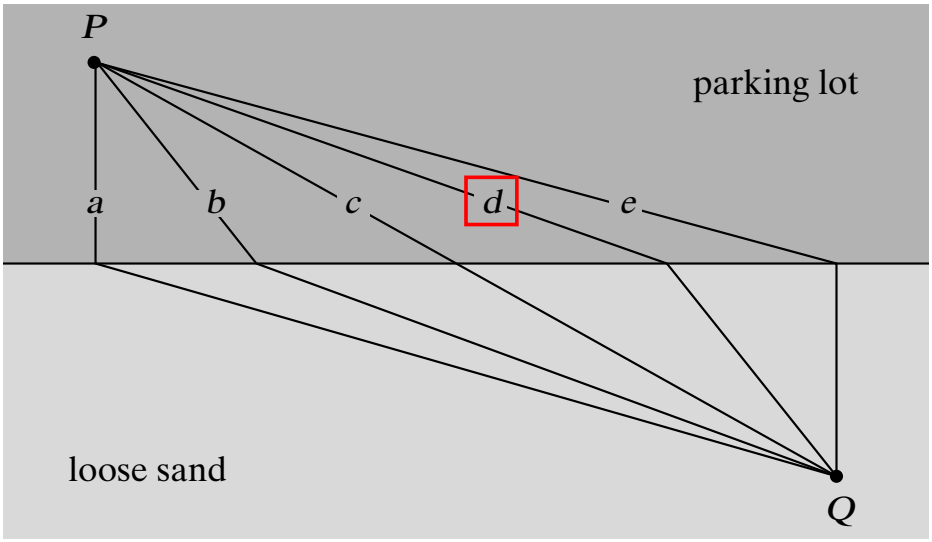

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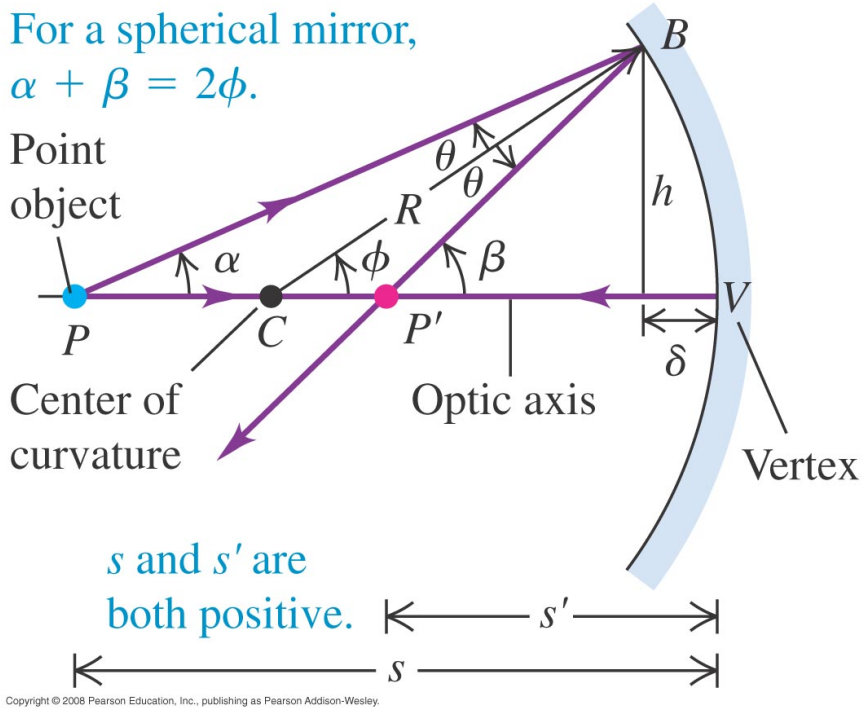
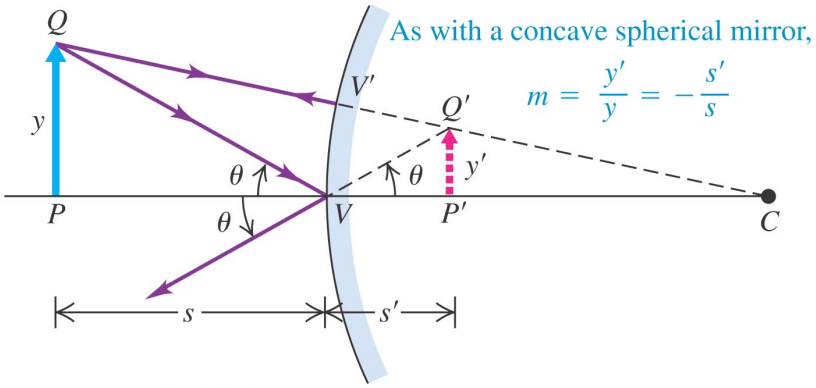
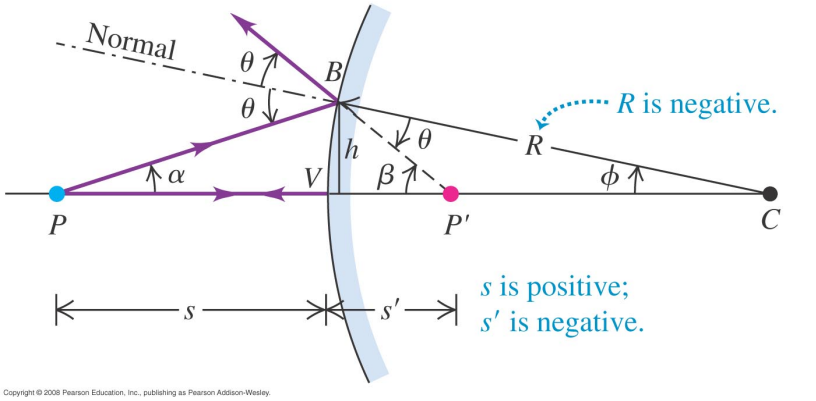


(b) Construction for finding the magnification of an image formed by a convex mirror

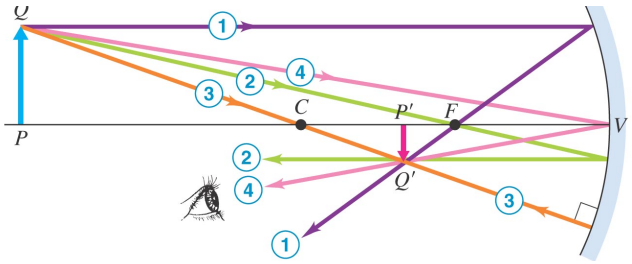


(a) Construction for finding the position of an image formed by a convex mirror



Clicker Question

An object is placed 2.0 m away from a concave mirror of focal length +1.0 m. The image formed by the mirror is



A. real and larger than the object.

B. real and smaller than the object.

C. real and the same size as the object.

D. virtual and larger than the object.

E. virtual and smaller than the object.

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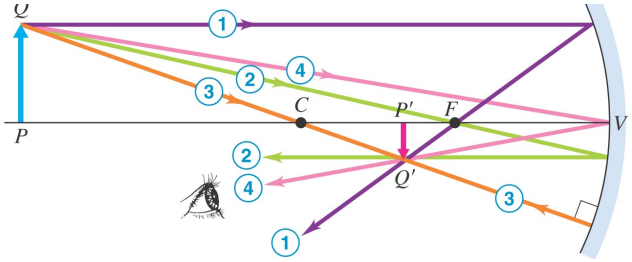

A. real and larger than the object.

B. real and smaller than the object.

C. real and the same size as the object.

D. virtual and larger than the object.

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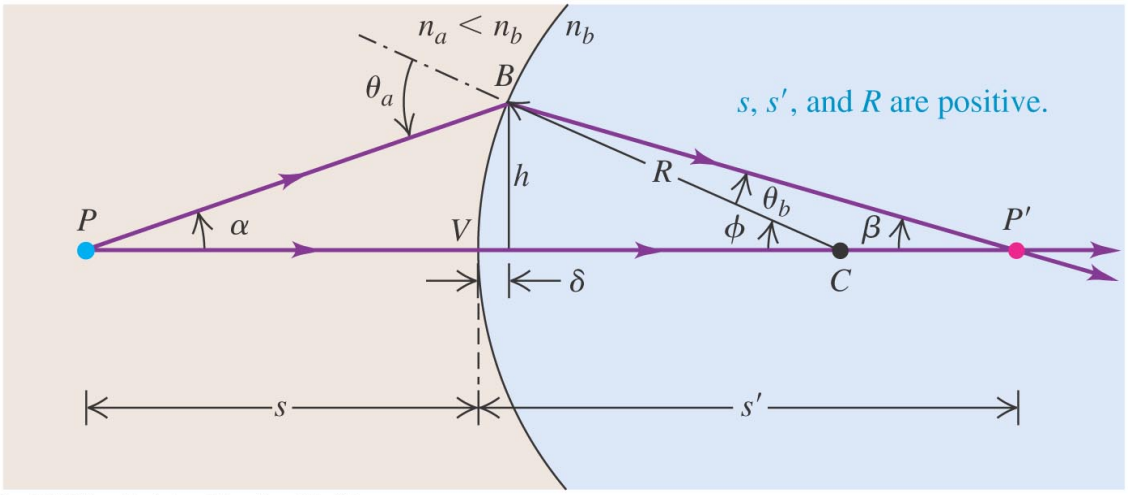
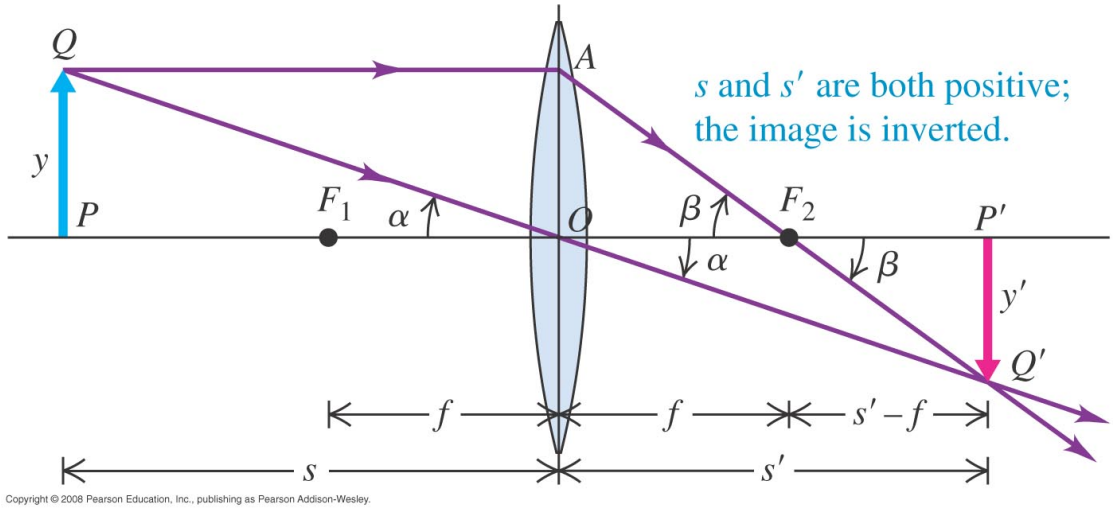
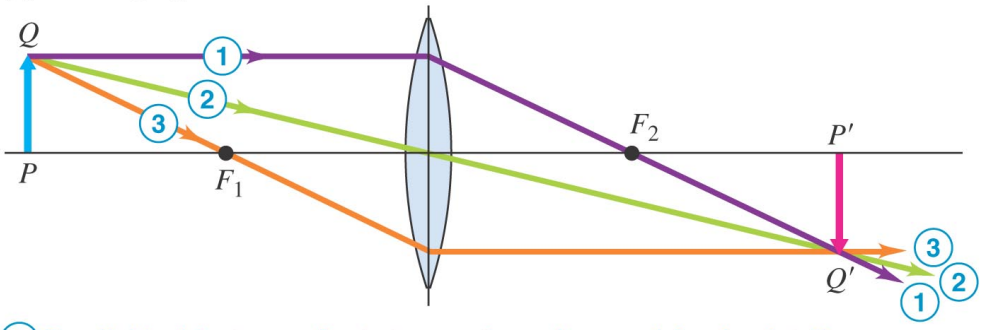
Refraction at a spherical surface



Thin lenses=spherical mirrors



(a) Converging lens

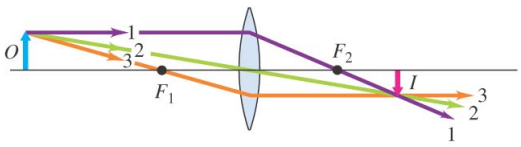


(1) Parallel incident ray refracts to pass through second focal point F_2.

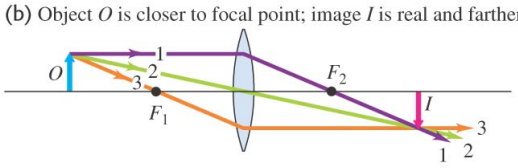
(2) Ray through center of lens does not deviate appreciably.

(3) Ray through the first focal point F_1 emerges parallel to the axis.

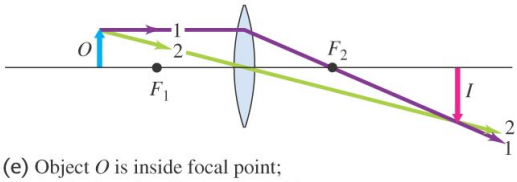
(a) Object O is outside focal point; image I is real.



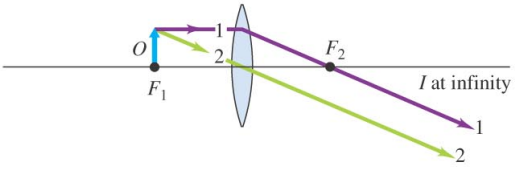
(b) Object O is closer to focal point; image I is real and farther away.



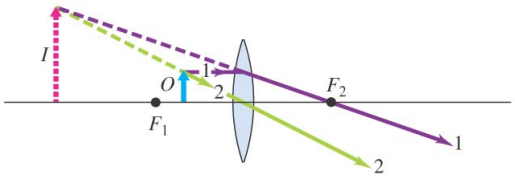
(c) Object O is even closer to focal point; image I is real and even farther away.



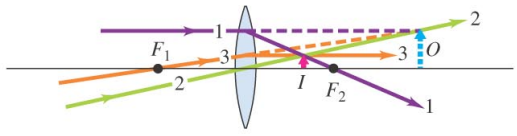
(d) Object O is at focal point; image I is at infinity.



(e) Object O is inside focal point; image I is virtual and larger than object.

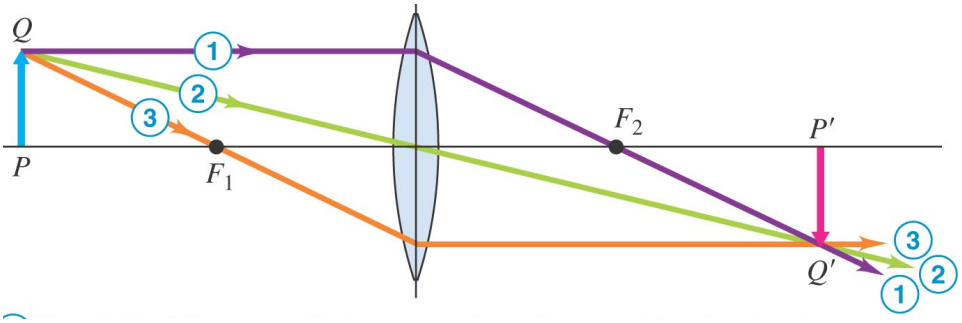


(f) A virtual object O (light rays are *converging* on lens)



Clicker Question

If the object is moved to the right of F_1, the image is:



A) Real and inverted

B) Real and erect

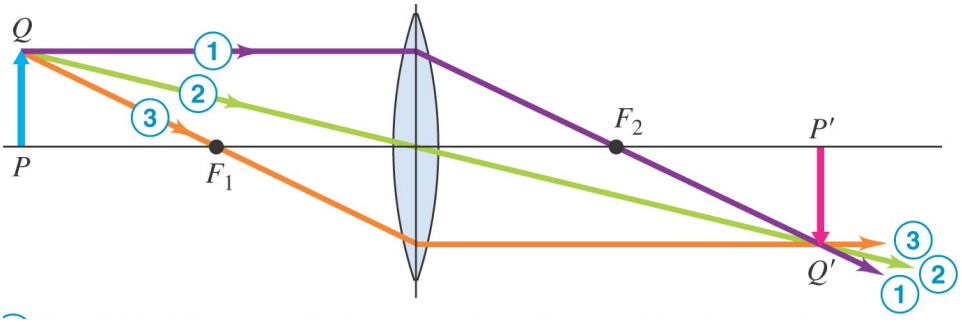
C) Virtual and inverted

D) Virtual and erect

E) At infinity

Clicker Question

If the object is moved to the right of F_1, the image is:



A) Real and inverted

B) Real and erect

C) Virtual and inverted

D) Virtual and erect

E) At infinity

Clicker Question

A lens is used to image an object onto a screen. If the right half of the lens is covered,

A) the left half of the image disappears.

B) the right half of the image disappears.

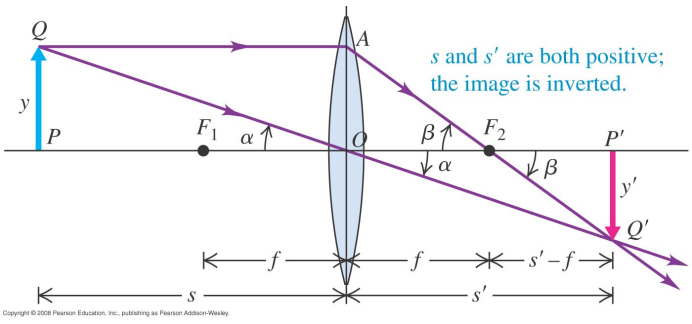
C) the entire image disappears.

D) the image becomes blurred.

E) the image becomes fainter.

Clicker Question

An object *PQ* is placed in front of a converging lens, forming a real image *P´Q´*. If you use black paint to cover the lower half of the lens,



A. only the object's upper half will be visible in the image.

B. only the object's lower half will be visible in the image.

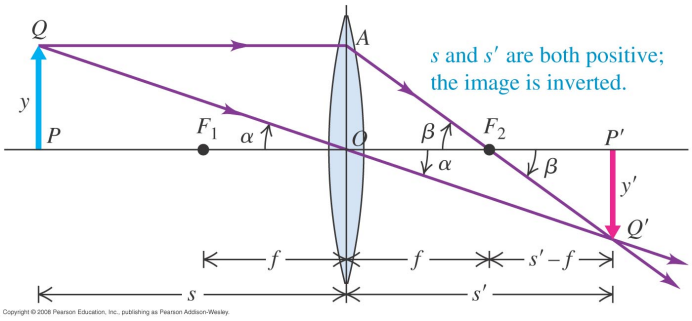
C. only the object's left-hand half will be visible in the image.

D. only the object's right-hand half will be visible in the image.

E. the entire object will be visible in the image.

Clicker Question

An object *PQ* is placed in front of a converging lens, forming a real image *P′Q′*. If you use black paint to cover the lower half of the lens,



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Clicker Question

Which of the following changes its focal length when it is immersed in water?

A) a concave mirror

B) a convex mirror

C) a diverging lens

D) all of the above

E) none of the above

Clicker Question

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A) a concave mirror

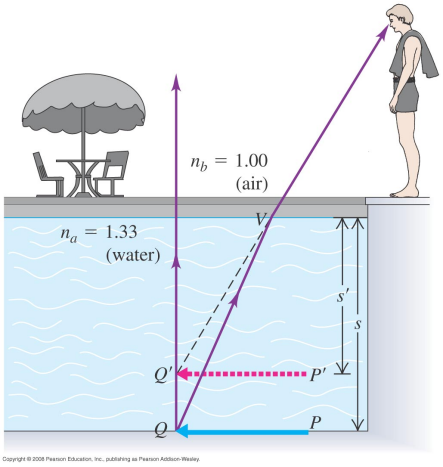
B) a convex mirror

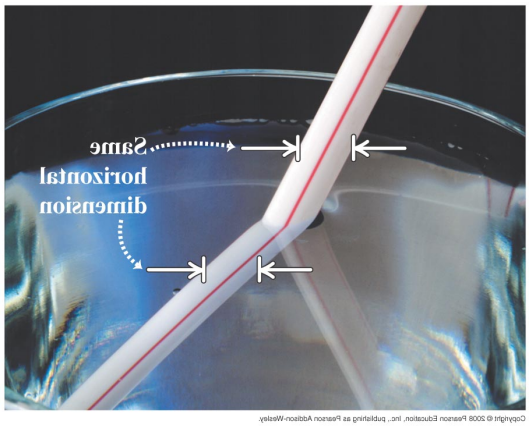
C) a diverging lens

D) all of the above

E) none of the above

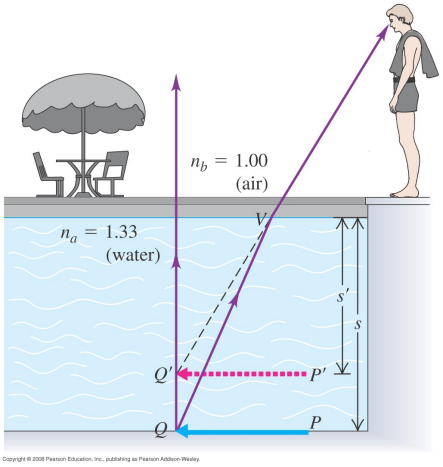
Is there a contradiction?

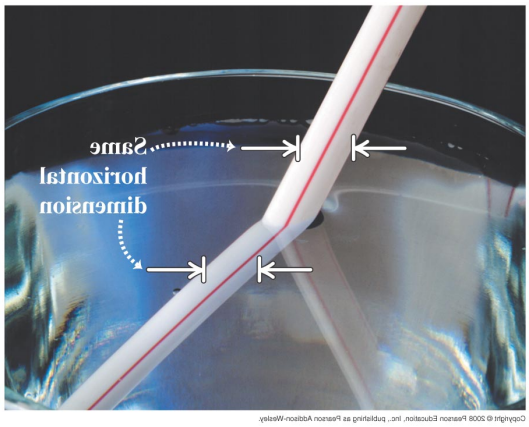




http://buphy.bu.edu/~duffy/java/Opticsa1.html

Is there a contradiction?





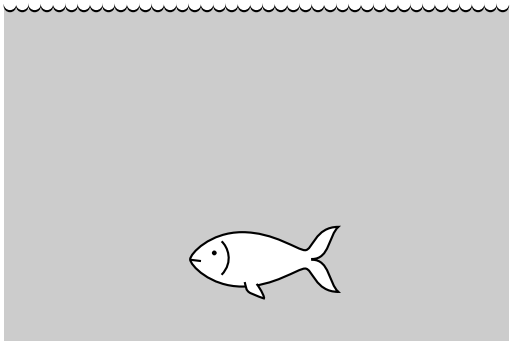
Clicker Question

A fish swims below the surface of the water. Suppose an observer is looking at the fish from point O′— straight above the fish. The observer sees the fish at

A) a greater depth than it really is.

B) the same depth.

C) a smaller depth than it really is.



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Which of the following changes its focal length when it is immersed in water?

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D) all of the above

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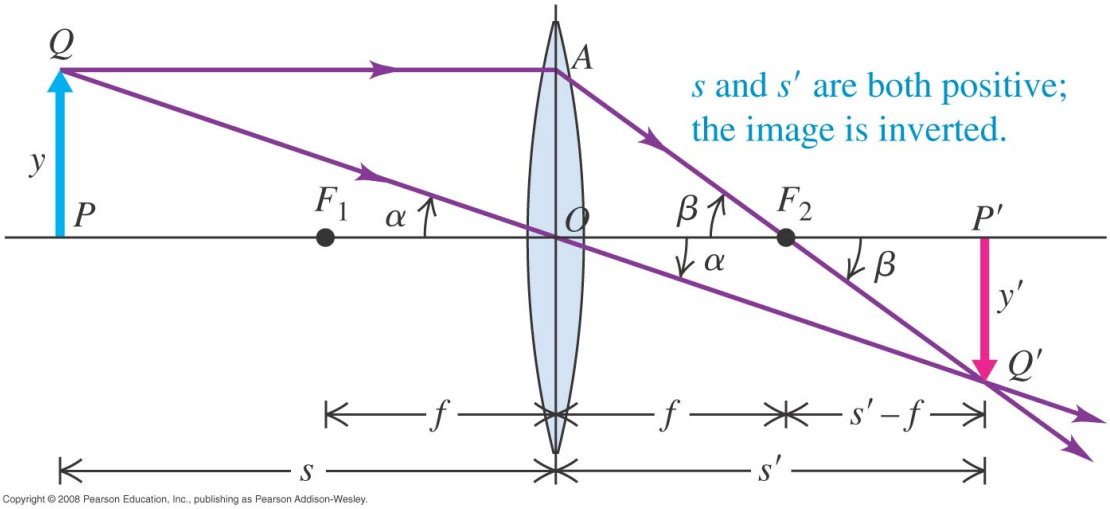
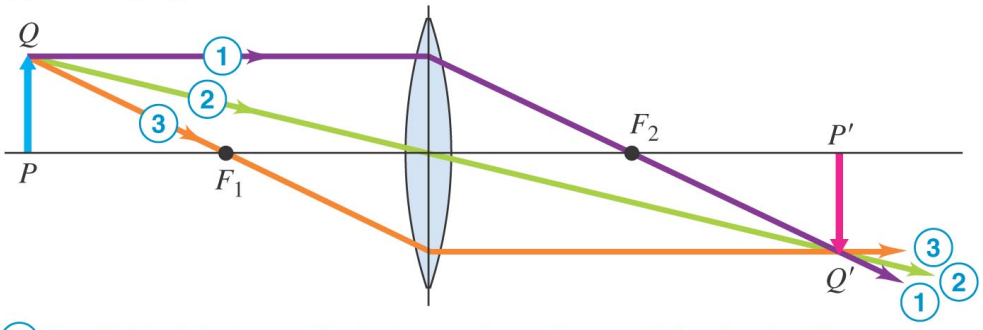
Thin lenses : spherical mirrors



(a) Converging lens

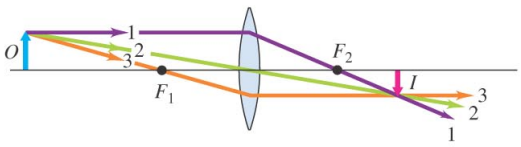


(1) Parallel incident ray refracts to pass through second focal point F_2.

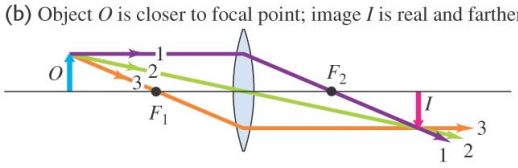
(2) Ray through center of lens does not deviate appreciably.

(3) Ray through the first focal point F_1 emerges parallel to the axis.

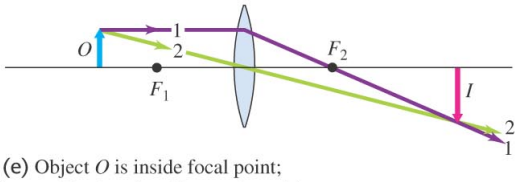
(a) Object O is outside focal point; image I is real.



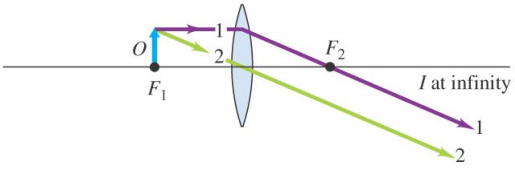
(b) Object O is closer to focal point; image I is real and farther away.



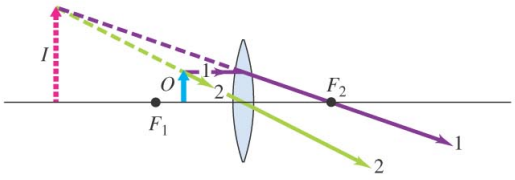
(c) Object O is even closer to focal point; image I is real and even farther away.



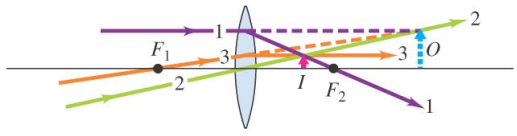
(d) Object O is at focal point; image I is at infinity.



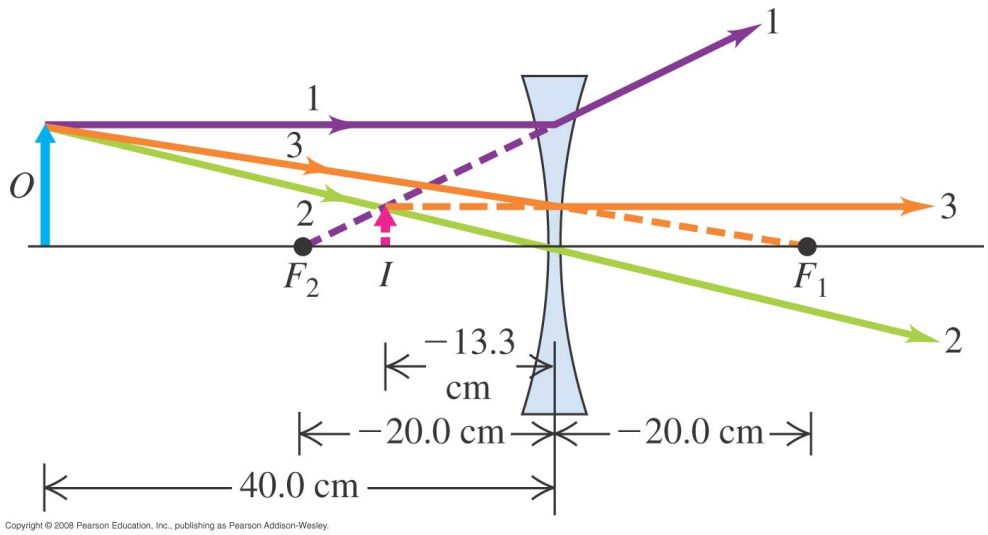
(e) Object O is inside focal point; image I is virtual and larger than object.



(f) A virtual object O (light rays are *converging* on lens)



Diverging Lens - Principal Rays



Clicker Question

A thin lens has focal length $f = -12$ cm.

If an object 9 cm tall is placed 24 cm from the lens, what is the height of the image?

A. 27 cm tall

B. 18 cm tall

C. 9 cm tall

D. 4.5 cm tall

E. 3 cm tall

Clicker Question

A thin lens has focal length $f = -12$ cm.

If an object 9 cm tall is placed 24 cm from the lens, what is the height of the image?

A. 27 cm tall

B. 18 cm tall

C. 9 cm tall

D. 4.5 cm tall

E. 3 cm tall

Several optical instruments are placed along the x axis, with their axes aligned along the x axis. A plane mirror is located at x=-1.0 m. A converging lens with focal length 5.0 m is located at x=0.0 m. An object is placed at 30 m. Find the location of the final image.

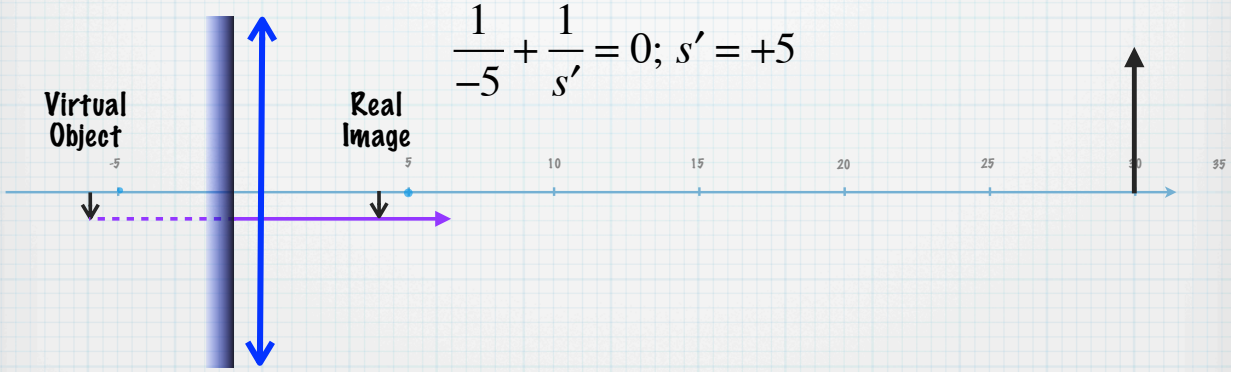
Step 1: Lens $\frac{1}{s} + \frac{1}{s'} = \frac{1}{f}$

$$\frac{1}{+30} + \frac{1}{s'} = \frac{1}{5};\ s' = -6$$

Step 2: Mirror

$$\frac{1}{s}+\frac{1}{s'}=\frac{1}{f}=0$$

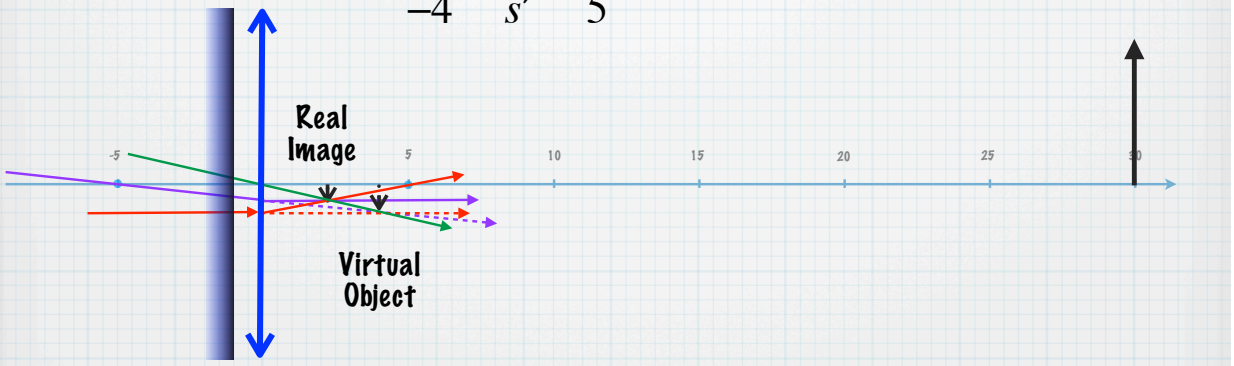
$$\frac{1}{-5}+\frac{1}{s'}=0;\ s'=+5$$



Step 3: Lens

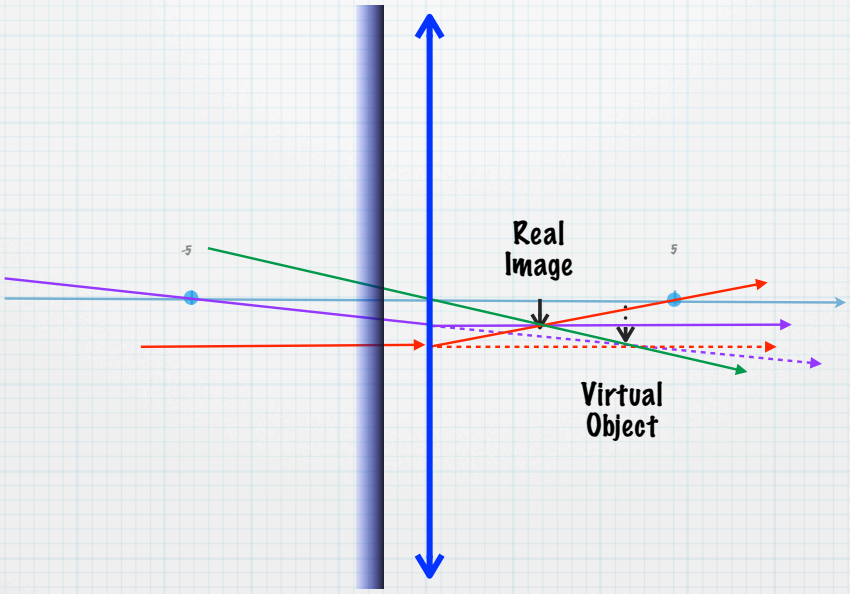
$$\frac{1}{s}+\frac{1}{s'}=\frac{1}{f}$$

$$\frac{1}{-4}+\frac{1}{s'}=\frac{1}{5};\ s'=+2.22$$



Step 3 (expanded): Lens

$$\frac{1}{-4}+\frac{1}{s'}=\frac{1}{5};\ s'=+2.22$$



Overall

Clicker Question

A lens is used to image an object onto a screen. If the right half of the lens is covered,

A) the left half of the image disappears.

B) the right half of the image disappears.

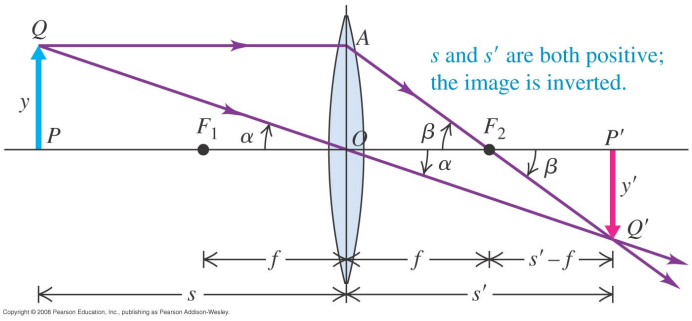
C) the entire image disappears.

D) the image becomes blurred.

E) the image becomes fainter.

Clicker Question

An object *PQ* is placed in front of a converging lens, forming a real image *P′Q′*. If you use black paint to cover the lower half of the lens,



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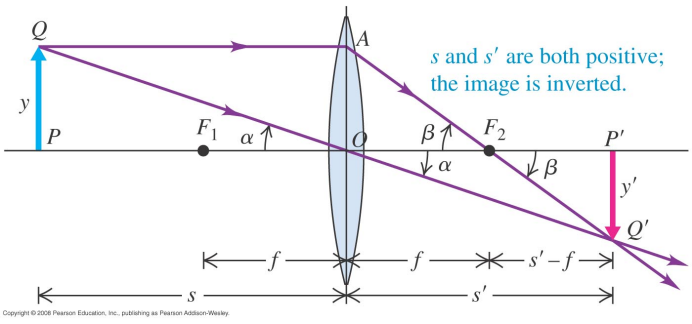

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E) the image becomes fainter.

http://www.mtholyoke.edu/~mpeterso/classes/phys301/geomopti/twolenses.html

Clicker Question

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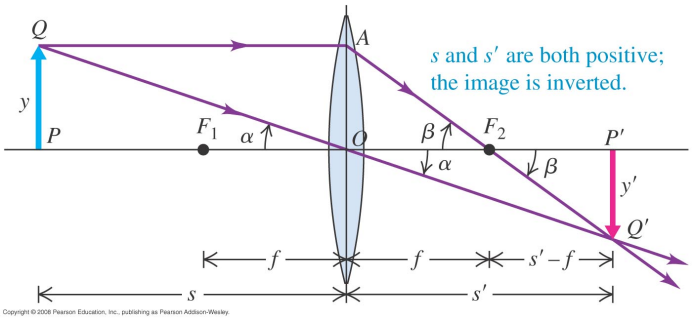

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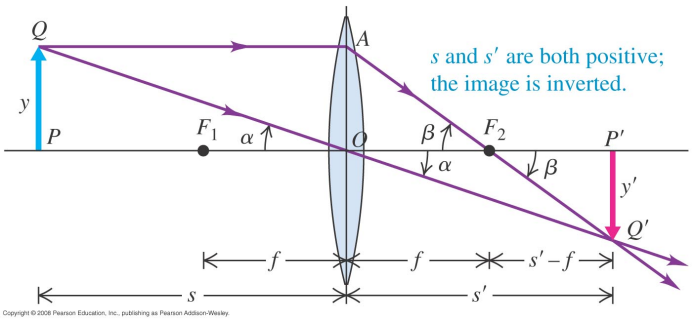

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Figure 34.45

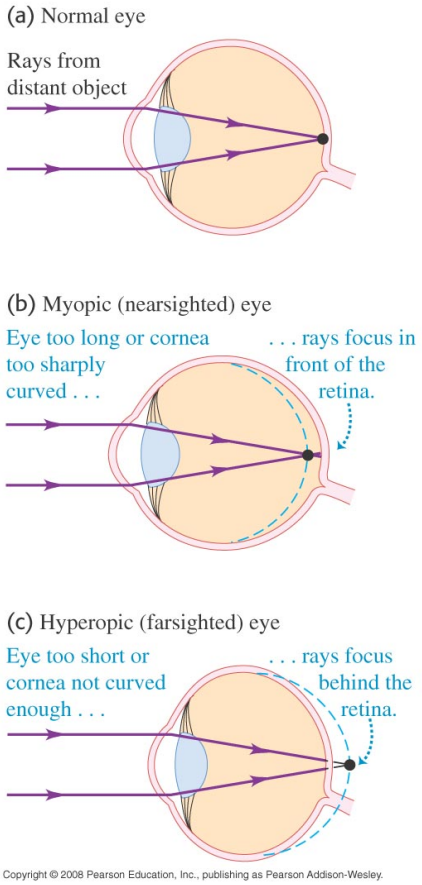


Figure 34.49

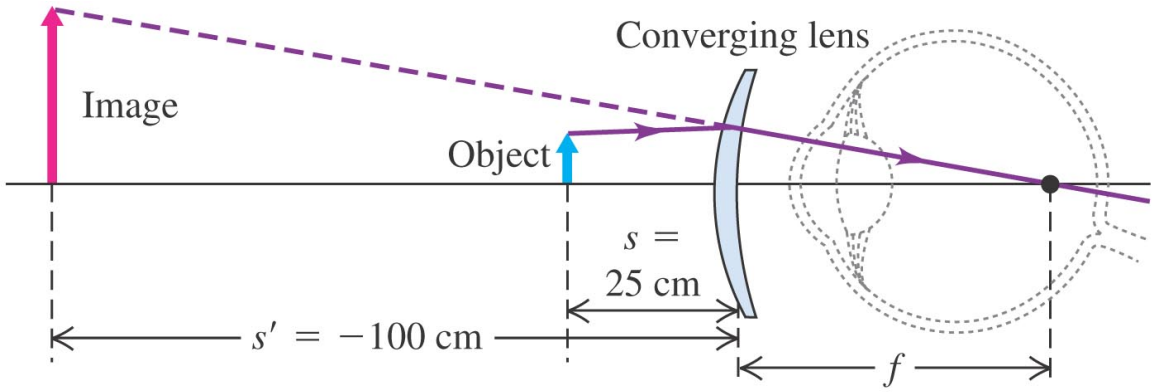
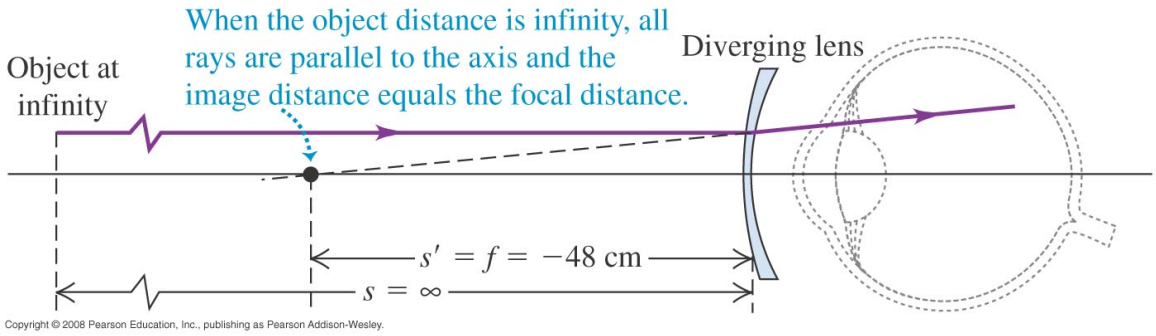


Figure 34.50



Clicker Question

Which statement is true about a farsighted (hyperopic) eye?

A. The image point is in front of the retina;
a converging eyeglass lens is used to correct this condition.

B. The image point is in front of the retina;
a diverging eyeglass lens is used to correct this condition.

C. The image point is behind the retina;
a converging eyeglass lens is used to correct this condition.

D. The image point is behind the retina;
a diverging eyeglass lens is used to correct this condition.

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D. The image point is behind the retina;
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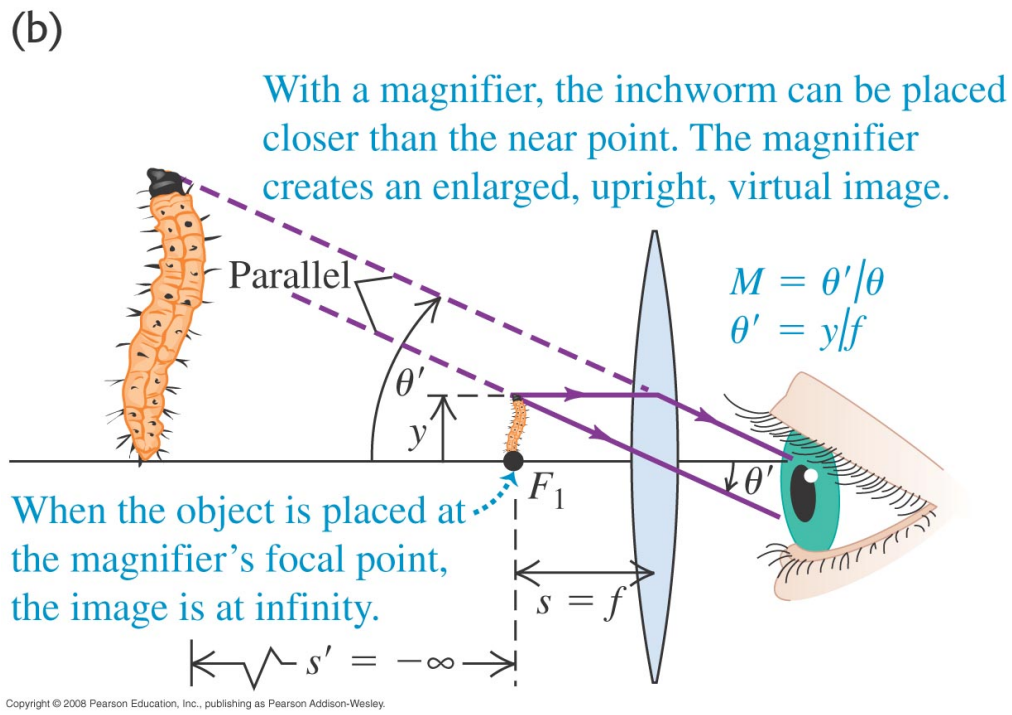
Figure 34.51b



Clicker question

When using a magnifier, if a smaller focal length lens is used it will (compared to using the original magnifier):

a) Make the image larger on the retina.

b) Make the image the same on the retina.

c) Make the image smaller on the retina.

Clicker question

When using a magnifier, if a smaller focal length lens is used it will (compared to using the original magnifier):

a) Make the image larger on the retina.

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c) Make the image smaller on the retina.

Figure 34.52b

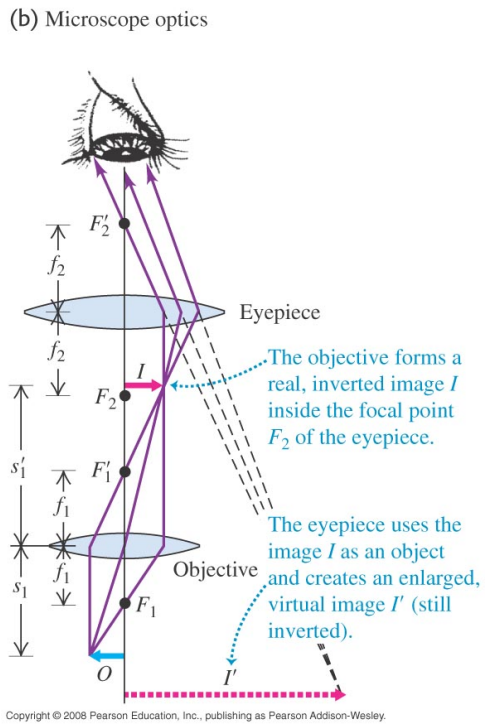


Figure 34.53

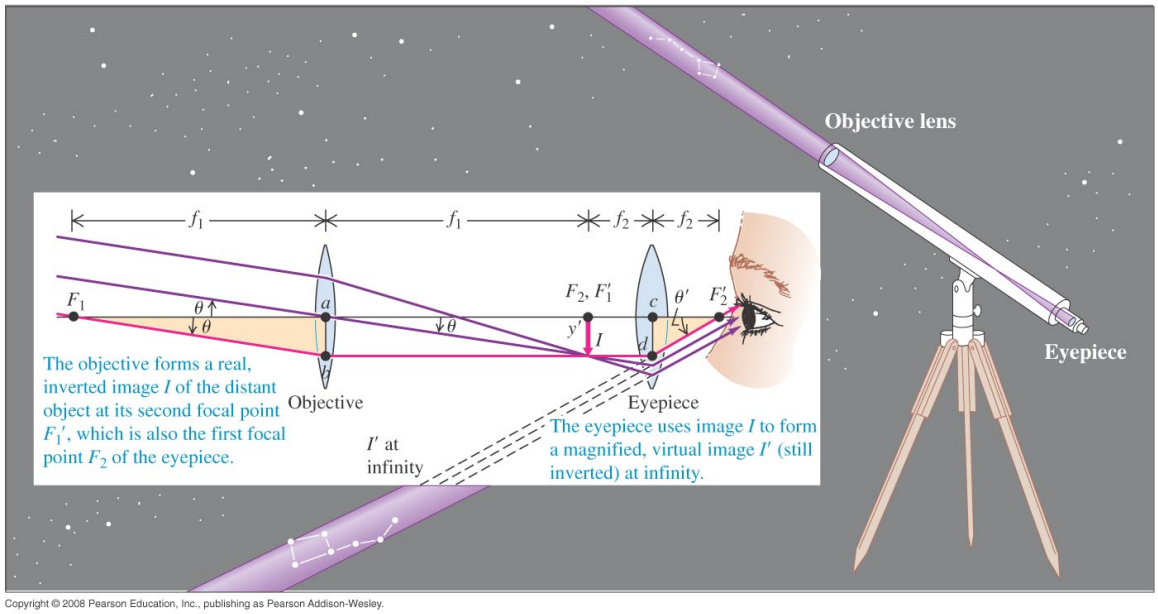
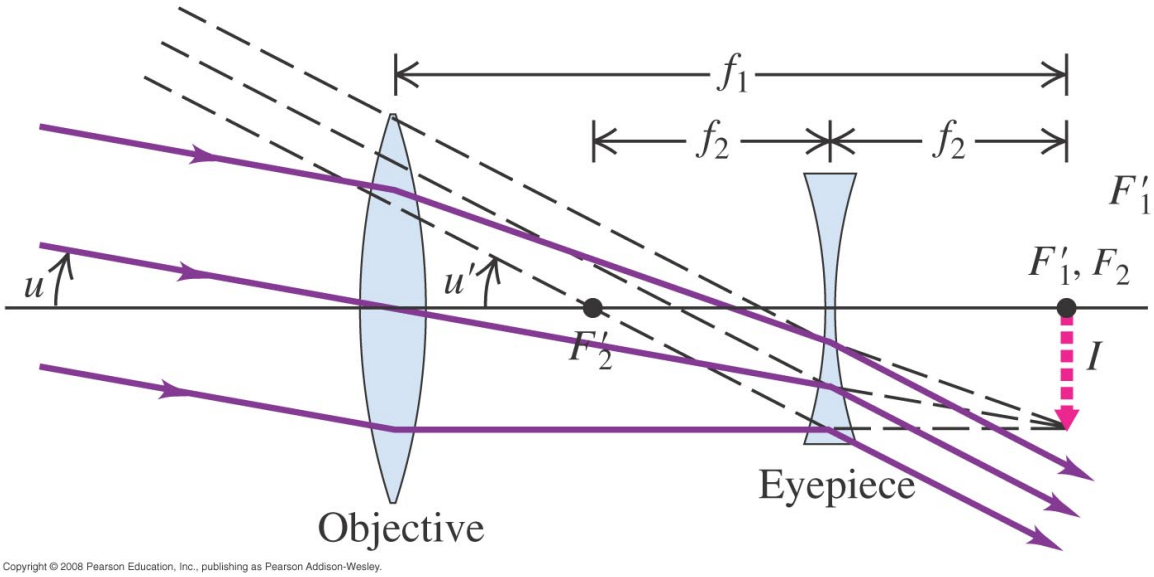


Figure 34.64



Clicker question

You are choosing lenses for a telescope that you will use to look at the Moon and planets. You should select

A. an objective lens with a long focal length and an eyepiece lens with an even longer focal length.

B. an objective lens with a long focal length and an eyepiece lens with a shorter focal length.

C. an objective lens with a short focal length and an eyepiece lens with a longer focal length.

D. an objective lens with a short focal length and an eyepiece lens with an even shorter focal length.

Clicker Question

Which end of the telescope should you look into?

A) Left

B) Right

C) Either would work as a telescope

Clicker Question

Which end of the telescope should you look into?

A) Left

B) Right

C) Either would work as a telescope

Clicker Question

The image is

A) erect

B) inverted

C) Depends if you hold the telescope upside down or not

Clicker Question

The image is

A) erect

B) inverted

C) Depends if you hold the telescope upside down or not

Clicker Question

Clicker question

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B. an objective lens with a long focal length and an eyepiece lens with a shorter focal length.

C. an objective lens with a short focal length and an eyepiece lens with a longer focal length.

D. an objective lens with a short focal length and an eyepiece lens with an even shorter focal length.