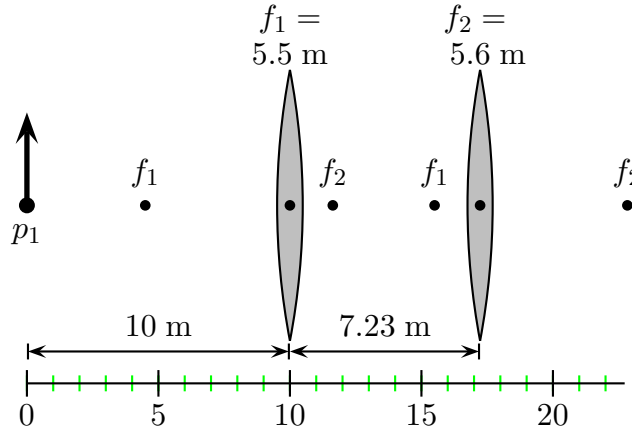
This print-out should have 19 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

001 (part 1 of 4) 10.0 points

An object is placed 10 m before a convex lens with focal length 5.5 m . Another convex lens is placed 7.23 m behind the first lens with a focal length 5.6 m (see the figure below).

Note: Make a ray diagram sketch in order to check your numerical answer.



At what distance is the first image from the first lens?

Answer in units of m.

002 (part 2 of 4) 10.0 points

What is the magnification of the first image?

003 (part 3 of 4) 10.0 points

At what distance is the second image from the second lens?

Answer in units of m.

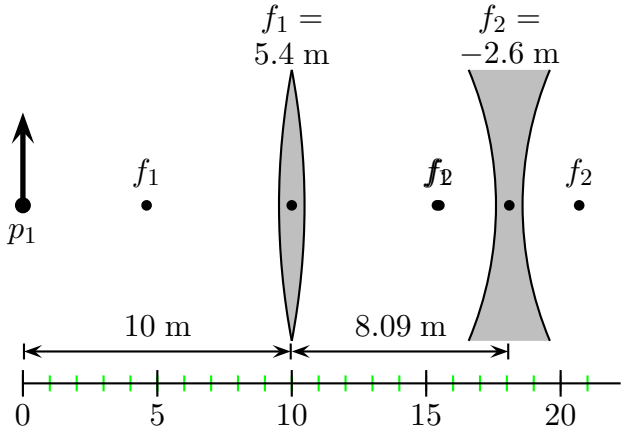
004 (part 4 of 4) 10.0 points

What is the magnification of the final image, when compared to the initial object?

005 (part 1 of 4) 10.0 points

An object is placed 10 m before a convex lens with focal length 5.4 m . Another concave lens is placed 8.09 m behind the first lens with a focal length −2.6 m (see the figure below).

Note: Make a ray diagram sketch in order to check your numerical answer.



At what distance is the first image from the first lens?

Answer in units of m.

006 (part 2 of 4) 10.0 points

What is the magnification of the first image?

007 (part 3 of 4) 10.0 points

At what distance is the second image from the second lens?

Answer in units of m.

008 (part 4 of 4) 10.0 points

What is the magnification of the final image, when compared to the initial object?

009 (part 1 of 2) 10.0 points

A double slit with a spacing of 0.0396 mm between the slits is 2.49 m from a screen.

If yellow light of wavelength 578 nm strikes the double slit, what is the separation between the zeroth- and first-order maxima on the screen?

Answer in units of m.

010 (part 2 of 2) 10.0 points

If blue light of wavelength 408 nm strikes the double slit, what is the separation between the second- and fourth-order maxima?

Answer in units of m.

011 (part 1 of 2) 10.0 points

A pair of narrow, parallel slits separated by 0.142 mm are illuminated by green light of wavelength 546 nm. An interference pattern is observed on a screen 1.17 m away from the plane of the slits.

Calculate the distance from the central maximum to the first bright region on either side of the central maximum. Answer in mm.

Answer in units of mm.

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012 (part 2 of 2) 10.0 points

Calculate the distance between the first and second dark bands. Answer in mm.

Answer in units of mm.

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013 10.0 points

A possible means for making an airplane invisible to radar is to coat the plane with an anti-reflective polymer. The radar waves have a wavelength of 2.04 cm and the index of refraction of the polymer is 1.63. What is the minimum thickness required to make the coating? Assume that the plane is made of metal, so electromagnetic waves will have a π phase change upon reflection from the plane's surface.

Answer in units of cm.

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014 10.0 points

A thin film of cryolite ($n_c = 1.3$) is applied to a camera lens ($n_g = 1.53$). The coating is designed to reflect wavelengths at the blue end of the spectrum and transmit wavelengths in the near infrared.

What minimum thickness gives high transmission at $\lambda = 1024$ nm?

Answer in units of nm.

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015 10.0 points

The light reflected from a soap bubble of index 1.42 appears red ($\lambda = 662$ nm) at its center.

What is the minimum thickness?

Answer in units of nm.

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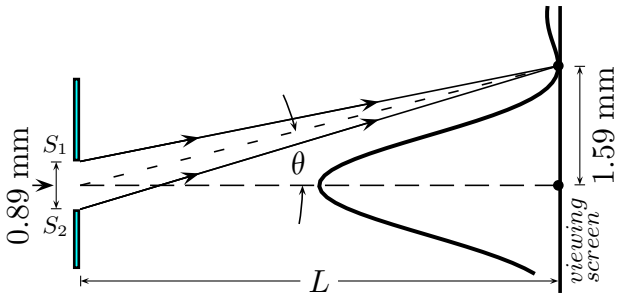
016 (part 1 of 2) 10.0 points

Light of wavelength 875.6 nm illuminates a single slit of width 0.89 mm.



At what distance L from the slit should a screen be placed if the first minimum in the diffraction pattern is to be 1.59 mm from the central maximum?

Answer in units of m.

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017 (part 2 of 2) 10.0 points

What is the width of the central maximum?

Answer in units of mm.

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018 10.0 points

Helium-neon laser light of wavelength 597.3 nm is sent through a 0.426 mm wide single slit.

What is the width of the central maximum on a screen 1.12 m from the slit?

Answer in units of mm.

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019 10.0 points

Potassium iodide has an interplanar spacing of 0.438 nm. A monochromatic x-ray beam shows a first-order diffraction maximum when the angle of incidence is 11.4°.

Calculate the x-ray wavelength.

Answer in units of nm.