1. A 5-mm tall object is placed 2 cm away from a lens, and an upright image is formed that is 5 cm tall. What is the focal length of the lens?
   a) -2.2 cm
   b) -5.0 mm
   c) +2.2 cm
   d) +3.3 cm

2. A light ray traveling in air enters a glass plate with index of refraction 1.62. The ray enters the glass at an angle of 49° to the normal. What angle does the ray make with the normal when it is in the glass?
   a) 28°
   b) 35°
   c) 49°
   d) the ray is completely reflected back into the air

3. A light ray in glass (index 1.62) is incident on an air/glass interface at an angle of 49° to the normal. What angle does the ray make with the normal when it leaves the glass and enters the air?
   a) 28°
   b) 49°
   c) 62°
   d) the ray is completely reflected back into the glass

4. Light of wavelength 600 nm falls on a single slit of width 0.015 mm. The resulting diffraction pattern is viewed on a screen 10 m away. Find the distance from the center of the pattern to the center of the second bright fringe.
   a) 10 cm
   b) 60 cm
   c) 80 cm
   d) 100 cm

5. An oil film floats on water. The refractive index of the oil is 1.4 and the index for water is 1.33. The film appears blue because it reflects light with wavelength 400 nm very well. Calculate the minimum thickness of the oil film.
   a) 71 nm
   b) 100 nm
   c) 143 nm
   d) 200 nm

6. Quincy Magoo is a man with poor eyesight. The farthest object he can see clearly is only 15 cm away. Find the lens power (in Diopters) that will correct his nearsightedness so that distant objects will appear clear to him.
   a) -15.0
   b) -6.67
   c) -1.50
   d) +1.50
7. At a point in space an electromagnetic wave is propagating in the negative x direction. At a certain instant, the magnetic field of the wave at this point is in the positive y direction. At this point and this instant, the electric field of the wave is

a) in the positive z direction
b) in the positive x direction
c) in the negative y direction
d) in the negative z direction

8. A certain part of the electromagnetic spectrum ranges from 200nm to 400nm. What is the highest frequency associated with this portion of the spectrum? (1nm = 10^{-9} m)

a) 1.50 x 10^{14} Hz
b) 7.50 x 10^{15} Hz
c) 1.50 x 10^{15} Hz
d) 7.50 x 10^{14} Hz

9. Polarizer 1 has a vertical transmission axis. Polarizer 2 has a transmission axis tilted 45° from the vertical, and polarizer 3 has a horizontal transmission axis. The light incident on polarizer 1 is polarized vertically. If polarizer 3 is removed, what will be the effect on the intensity of light at point P?

![Image of polarizers and light path]

a) the intensity will be zero (no light will emerge from polarizer 2)
b) the intensity will increase by a factor between 1 and 2
c) the intensity will decrease, but will be greater than zero
d) the intensity will increase by a factor of 2

10. You and a friend travel through space in identical spaceships. Your friend informs you that he has made some length measurements and that his ship is 150m long and yours is 120m long. What is the relative speed of the two ships?

a) 0.1c
b) 0.3c
c) 0.6c
d) 0.8c

11. If a convex lens that is normally used in air is placed in water instead, does the focal length increase, decrease, or stay the same?

a) Decrease
b) Stay the same
c) Increase
d) Cannot be determined from the information given
Physics 6C Midterm Practice Questions

12. A horizontal ray of light encounters an upside-down prism. After passing through the prism, the ray of light is
a) deflected upward  

![Diagram of prism](image)

b) still horizontal  

c) deflected downward  

d) cannot be determined from the information given

13. A 3-cm-tall object is placed 50 cm away from a diverging lens of focal length 25 cm. Describe the image.

a) The image is real, 1.5-cm tall, 25.0 cm on the same side as the object.  

b) The image is virtual, 1-cm tall, 16.7 cm on the same side as the object.  

c) The image is real, 3-cm tall, 50.0 cm on the other side of the lens.  

d) The image is virtual, 1-cm tall, 16.7 cm on the other side of the lens.

14. The sun produces energy by nuclear fusion reactions, in which matter is converted to energy. The rate of energy production is $3.8 \times 10^{26}$ Watts. How many kilograms of mass does the sun convert to energy each second?

a) $4.2 \times 10^9$ kg/s  

b) $6.1 \times 10^7$ kg/s  

c) $1.3 \times 10^{18}$ kg/s  

d) $9.0 \times 10^{16}$ kg/s

15. You are looking down on a puddle of water. When a thin oil film spreads out over the puddle, the thinnest part of the film looks dark. This tells you that the index of refraction of the oil

a) is greater than that of air and greater than that of water  

b) is less than that of air but greater than that of water  

c) is greater than that of air but less than that of water  

d) is less than that of air and less than that of water

16. As seen from Earth, the red dwarfs Krüger 60A and Krüger 60B from a binary star system with an angular separation of 2.5 arc seconds. What is the smallest diameter telescope that could theoretically resolve these stars using 550-nm light? ($1^\circ=3600$ arc sec)

a) 0.8 mm  

b) 1.0 mm  

c) 45 mm  

d) 55 mm

Answers:
1c; 2a; 3d; 4d; 5a; 6b; 7a; 8c; 9d; 10c; 11c; 12a; 13b; 14a; 15a; 16d