Phys 104

Practice Exam

Chapters 23, 29, 26, 27
If a man wishes to use a plane mirror on a wall to view both his head and his feet as he stands in front of the mirror, the required length of the mirror:

a. is equal to the height of the man.
b. is equal to one half the height of the man.
c. depends on the distance the man stands from the mirror.
d. depends on both the height of the man and the distance from the man to the mirror.

A convex mirror with focal length of \(-20\) cm forms an image 12 cm behind the surface. Where is the object located as measured from the surface?

a. 7.5 cm
b. 15 cm
c. 22 cm
d. 30 cm

An object 2 cm high is placed 10 cm in front of a mirror. What type of mirror and what radius of curvature is needed for an image that is upright and 4 cm tall?

a. Concave, \( R = 20 \) cm
b. Concave, \( R = 40 \) cm
c. Convex, \( R = -10 \) cm
d. Convex, \( R = -20 \) cm
4. A goldfish is swimming in water \((n = 1.33)\) inside a spherical plastic bowl of index of refraction 1.33. If the goldfish is 10 cm from the front wall of the 15-cm radius bowl, where does the goldfish appear to an observer in front of the bowl?

a. 6.0 cm behind the plastic  
b. 7.0 cm behind the plastic  
c. 8.0 cm behind the plastic  
d. 9.0 cm behind the plastic

5. Two thin lenses with 10.0-cm focal lengths are mounted at opposite ends of a 30.0-cm long tube. An object is located 45.0 cm from one end of the tube. How far from the opposite end is the final image?

a. 12.8 cm  
b. 24.0 cm  
c. 25.6 cm  
d. 33.6 cm

6. A Young’s double-slit apparatus is set up. A screen is positioned 1.60 m from the double slits, and the spacing between the two slits is 0.040 0 mm. The distance between alternating bright fringes is 1.42 cm. What is the light source wavelength? \((1 \text{ nm} = 10^{-9} \text{ m})\)

a. 710 nm  
b. 490 nm  
c. 280 nm  
d. 355 nm
In a Young's experiment, the paths from the slits to a point on the screen differ in length causing constructive interference at the point. Which of the following path difference would cause this constructive interference?

a. $\frac{5\lambda}{2}$
b. $\frac{3\lambda}{4}$
c. $4\lambda$
d. None of the above.

A silicon monoxide thin film ($n = 1.45$) of thickness 90.0 nm is applied to a camera lens made of glass ($n = 1.55$). This will result in a destructive interference for reflected light of what wavelength?

a. 720 nm
b. 558 nm
c. 522 nm
d. 450 nm

What is the highest order maximum for wavelength 450 nm that can be obtained with a grating with 600 lines per mm?

a. 3
b. 4
c. 6
d. 7

Unpolarized light is passed through polarizer 1. The light then goes through polarizer 2 with its plane of polarization at 45.0° to that of polarizer 1. Polarizer 3 is placed after polarizer 2. Polarizer 3 has its plane of polarization at 45° to the plane of polarization of polarizer 2 and at 90° to that of polarizer 1. What fraction of the intensity of the original light gets through the last polarizer?

a. 0.707
b. 0.500
c. 0.250
d. 0.125
Doubling the momentum of:

a. a particle doubles its relativistic total energy.
b. a particle quadruples its relativistic total energy.
c. a photon doubles its relativistic total energy.
d. a photon quadruples its relativistic total energy.

A tuning fork has a frequency of 400 Hz and hence a period of $2.50 \times 10^{-3}$ s. If the tuning fork is in an inertial frame of reference moving by the observer at speed of 0.750 c, what is the frequency of the fork as measured by the observer? (Assume that measurements are strictly by optical means and that the speed of sound waves in air is not pertinent here).

a. 265 Hz
b. 302 Hz
c. 454 Hz
d. 605 Hz

The astronaut whose heart rate on Earth is 60 beats/min increases his velocity to $v = 0.80$ c. Now what is his heart rate as measured by an Earth observer?

a. 36 beats/min
b. 48 beats/min
c. 75 beats/min
d. 100 beats/min

From a stationary position, I observe a moving boxcar, which has a mirror along the front wall, but it is open at the back of the boxcar. I send a flash of light from my flashlight and time the flash of light as it goes to the front of the boxcar and returns to the back of the boxcar. A passenger in the boxcar also times the round trip of the flash of light. Previously I had measured the time required for the round trip of a flash of light when the boxcar was stationary, and I call this the stationary time. Which two times are the same?

a. the time recorded on my watch and the previous stationary time
b. the time recorded on the passenger's watch and the previous stationary time
c. the time recorded on my watch and the time recorded on the passenger's watch
d. None of the times are the same.
An unknown particle in an accelerator moving at a speed of $2.00 \times 10^8$ m/s has a measured total energy of $1.80 \times 10^{-9}$ J. What is its mass? ($c = 3.00 \times 10^8$ m/s)

- a. $0.650 \times 10^{-26}$ kg
- b. $0.810 \times 10^{-26}$ kg
- c. $1.04 \times 10^{-26}$ kg
- d. $1.49 \times 10^{-26}$ kg

What is the surface temperature of a distant star (which emits light as if it were a blackbody) where the peak wavelength is 480 nm? (Hint: The surface of the human body at 35 °C has a peak wavelength of 941 μm). ($1 \text{ nm} = 10^{-9} \text{ m} = 10^{3} \mu\text{m}$)

- a. 4 510 K
- b. 5 100 K
- c. 6 040 K
- d. 6 350 K

A monochromatic light beam is incident on a barium target, which has a work function of 2.50 eV. If a stopping potential of 1.0 V is required, what is the light beam photon energy?

- a. 1.0 eV
- b. 1.5 eV
- c. 2.5 eV
- d. 3.5 eV

According to Einstein, increasing the brightness of a beam of light without changing its color will increase:

- a. the number of photons.
- b. the energy of each photon.
- c. the speed of the photons.
- d. the frequency of the photons.
Changing the accelerating voltage of an x-ray machine without changing the target material must change:

a. the work function of the material.

b. the wavelength of all the x-rays produced.

c. the wavelength of the minimum wavelength x-ray that will be produced.

d. Both b and c are correct.

In an x-ray diffraction experiment, using x-rays of wavelength $\lambda = 0.500 \times 10^{-10}$ m, a first-order maximum occurred at 5.00° off the crystal plane. Find the distance $d$ between crystal planes.

a. $2.87 \times 10^{-10}$ m

b. $1.36 \times 10^{-10}$ m

c. $6.24 \times 10^{-9}$ m

d. $1.93 \times 10^{-9}$ m