FINAL EXAM Practice Problems

1. Which one of the following phenomena most clearly demonstrates the particle nature of light? (Choose the best response)
(A) diffraction
(B) polarization
(C) the photoelectric effect
(D) refraction
(E) interference

2. Which of the following phenomena most clearly demonstrates the wave nature of electrons? (Choose the best response)
(A) the photoelectric effect
(B) blackbody radiation
(C) the Compton effect
(D) diffraction of electrons by crystals
(E) none of these answers

3. A meterstick moving at 0.860c relative to the Earth's surface approaches an observer at rest with respect to the Earth's surface. What is the meterstick's length as measured by the observer?
(A) 1.96 m
(B) 0.75 m
(C) 3.11 m
(D) 0.51 m
(E) none of these

4. The work function for platinum is 6.35 eV. Ultraviolet light of wavelength 155 nm is incident on the clean surface of a platinum sample. We wish to predict the stopping voltage we will need for electrons ejected from the surface. What is the photon energy of the ultraviolet light?

(A) 14.1 eV
(B) 13.6 eV
(C) 8 eV
(D) -67 eV
(E) none of these

5. In problem 4, how do you know that the electrons will be ejected from the platinum?
(A) $hf > 6.35$ eV
(B) $hf < 6.35$ eV
(C) $hf = 6.35$ eV
(D) $hf > m_0\gamma$
(E) none of these

6. In problem 4, what is the maximum energy of the ejected electrons?
(A) 6.35 eV
(B) 1.65 eV
(C) 91.7 eV
(D) 7.20 eV

7. X-rays having energy of 250 keV undergo Compton scattering from a target. The scattered rays are detected at 41.0° relative to the incident rays. (a) Find the Compton wavelength shift at this angle.

(A) 5.79×10^{-2} nm
(B) 5.952×10^{-4} nm
(C) 7.117 nm
(D) 4.38×10^{-11} nm
(E) none of these

8. An electron and a proton both moving at nonrelativistic speeds have the same de Broglie wavelength. Which of the following are also the same for the two particles? (Choose the best response)

(A) speed
(B) kinetic energy
(C) frequency
(D) momentum

9. Both an electron and a proton are accelerated to the same speed, and the experimental uncertainty in the speed is the same for the two particles. The positions of the two particles are also measured. Describe the minimum possible uncertainty in the electron's position. (Choose the best response)

(A) less than the minimum possible uncertainty in the proton's position
(B) the same as that for the proton
(C) more than that for the proton
(D) impossible to tell from the given information

10. A particle is compose of 3 quarks. It is a

(A) lepton
(B) meson
(C) baryon
(D) neutrino

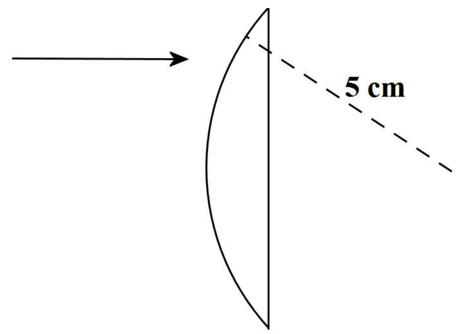
11. Which of the following is not a Generation 1 particle?

(A) charm quark
(B) down quark
(C) electron
(D) electron neutrino
(E) neutron

12. A small object is placed at a distance of 30 cm from a convex mirror of focal length 30 cm. The image will form at

(A) Infinity
(B) the surface
(C) the focus
(D) 15 cm behind the mirror

13. Consider a plano-convex lens, whose surface facing the incoming light has a radius of curvature of 5 cm. If the lens is constructed from glass with an index of refraction of 1.5, what is the focal length of the lens?



(A) 5 cm
(B) 10 cm
(C) 15 cm
(D) -10 cm
(E) none of these

14. Which of the following cannot form a real image?
(A) convex mirror
(B) convex lens
(C) concave mirror
(D) none of these
(E) all of these

15. How much current must pass through a circular wire loop, whose radius is 2 cm, in order for the magnetic field in the center of the loop to equal 1 Tesla?
[$\mu_0 = 4\pi \times 10^{-7}$ Tesla-meter/Ampere]
(A) 16.7 Amps
(B) 3.14×10^8 Amps
(C) 3.18×10^4 Amps
(D) 10,300 Amp
(E) none of these