General Physics II
2009 Fall
Prof Richard Ignace

HOMEWORK #6

- *This homework is due by the beginning of class on November 24. It covers material in chapters 24, 25, and 26*
- *You will need a calculator and lots of scrap paper.*
- *Answers are to be recorded on a scantron that you will turn in. You may keep the questions (i.e., these sheets).*
- *You may (should) use your book. You may even work with other students. However, you should not copy the answers of other students. Since the exams are multiple choice, the homeworks are also exam prep, and so you need to be able to work these problems yourself. If you do not apply yourself to the homework and do your own work, you are not likely to perform well on the exams.*

1. If a wave from one slit of a Young's double-slit set-up arrives at a point on the screen one wavelength behind the wave from the other slit, what is observed at that point?

    a. dark fringe
    b. bright fringe
    c. multi-colored fringe
    d. gray fringe, neither dark nor bright

2. In a Young's double-slit interference apparatus, by what factor is the distance between adjacent light and dark fringes changed when the separation between slits is doubled?

    a. 1/4
    b. 1/2
    c. 1
    d. 2

3. A diffraction grating with 10 000 lines/cm will exhibit the first order maximum for light of wavelength 510 nm at what angle? (1 nm = 10^{-9} m)

    a. 0.51°
    b. 0.62°
    c. 15.3°
    d. 31°

4. Unpolarized light of intensity I_0 passes through two sheets of ideal polarizing material. If the transmitted intensity is 0.25 I_0, what is the angle between the polarizer and the analyzer?

    a. 60°
    b. 45°
    c. 30°
    d. 22.5°

5. Waves from a radio station with a wavelength of 600 m arrive at a home receiver a distance 50 km away from the transmitter by two paths. One is a direct-line path and the second by reflection from a mountain directly behind the receiver. What is the minimum distance between the mountain and receiver such that destructive interference occurs at the location of the listener? Assume no phase change on reflection.

a. 150 m
b. 300 m
c. 450 m
d. 600 m

6. A Young's double slit has a slit separation of 2.50×10^{-5} m on which a monochromatic light beam is directed. The resultant bright fringes on a screen 1.00 m from the double slit are separated by 2.30×10^{-2} m. What is the wavelength of this beam? (1 nm = 10^{-9} m)

a. 373 nm
b. 454 nm
c. 575 nm
d. 667 nm

7. Light of wavelength 540 nm is incident on a slit of width 0.150 mm and a diffraction pattern is produced on a screen that is 2.00 m from the slit. What is the width of the central bright fringe? (1 nm = 10^{-9} m)

a. 0.720 cm
b. 1.44 cm
c. 1.76 cm
d. 2.16 cm

8. A beam of unpolarized light in air strikes a flat piece of glass at an angle of incidence of 54.2º. If the reflected beam is completely polarized, what is the index of refraction of the glass?

a. 1.60
b. 1.39
c. 1.52
d. 2.48

9. Tripling the aperture diameter of a camera lens will change the *f*-number by what factor?

a. 1/9
b. 1/3
c. 3
d. 9

10. Plane polarized light is sent through two consecutive polarizers, the first having its plane of polarization in the same direction as the incident light and the second having its plane at 90º to the original plane of polarization. A third polarizer, with plane of polarization at 30º to the original plane of polarization is placed between the two other polarizers. What fraction of the original intensity now gets through?

    a. 0
    b. 0.56
    c. 0.25
    d. 0.19

11. The Yerkes refracting telescope has a 1-m diameter objective lens of focal length 20 m and an eyepiece of focal length 2.5 cm. What is the magnification of the planet Mars as seen through this telescope?

    a. 200
    b. 400
    c. 800
    d. 1 000

12. An individual's eye pupil changes from a diameter of 3.5 mm to 1.5 mm as the illumination is increased. By what factor does the minimum angle of resolution change?

    a. 0.43
    b. 0.65
    c. 2.0
    d. 2.3

13. According to the special theory of relativity, if a 30-year old astronaut is sent on a space mission is accelerated to speeds close to that of light, and then returns to earth after 20 years as measured on earth, what would be his biological age upon returning?

    a. less than 50 years
    b. 50 years
    c. more than 50 years
    d. exactly 100 years

14. How fast would a rocket have to move past a ground observer if the latter were to observe a 4.0% length shrinkage in the rocket length? ($c = 3.00 \times 10^8$ m/s)

    a. 0.12×10^8 m/s
    b. 0.28×10^8 m/s
    c. 0.84×10^8 m/s
    d. 1.2×10^8 m/s