Polytechnic Tutoring Center
Final Review – PH 2033 Spring 2021

Disclaimer: This mock exam is only for practice. It was made by tutors in the Polytechnic Tutoring Center and is not representative of the actual exam given by the Academic Department.

1. An unpolarized 20 W/m^2 beam of light is passing through a pair of polarizing lenses that are perpendicular to another. How much does the intensity of the output beam increases if another polarizing lens is place in the middle, 45° from each of the two lenses?

2. Two rooms, each a cube 4.5 m per side, share a 13-cm-thick brick wall. Because of a number of 100-W lightbulbs in one room, the air is at 35℃, while in the other room it is at 12 ℃. How many of the 100-W bulbs are needed to maintain the temperature difference across the wall? (Assume conduction constant for brick is 0.84)

3. If the speed of light in an optical fiber is 2.16 x 10^8 m/s, what is the maximum angle the light ray can make with the internal wall of the optical fiber, place in air, to still achieve total internal reflection?

4. What is the equilibrium temperature of the mixture of 9 kg of water at 3℃ is mixed with 5 kg of water at 38℃ in a well-insulated container?

5. If the critical angle for a coronavirus cell when surrounded by air ($n_{air} = 1.00$) is 38°, what is the critical angle for the gem when it is surrounded by water ($n_{water} = 1.33$)?

6. A plano-convex lens has flat surface on one side and spherical surface whose radius of curvature is 45 cm on the other. If the focal length of the lens is 75 cm, what is the index of refraction of the glass?

7. If you move a 60W light bulb originally 3m from you to a location that is 4m from you. What is the decrease of intensity that you will experience?

8. A monochromatic beam of light with wavelength 650 nm is incident to a 0.1 mm single slit, and on a screen 1.5 m away, what is the distance between the central diffraction peak and the third dark spot?

9. A 2m tall tree is reflected in a convex mirror 10m in front of it. If the radius of curvature of the mirror is 30 cm, how tall is the image of the tree?

10. Two lenses, each with focal length of 20 cm, are placed 10 cm apart. If an object is placed 30 cm in front of the first lens, how far behind the second lens does the final image appear?

11. A coin is placed 70 cm in front of a concave mirror. If the radius of curvature of the mirror is 50 cm, what is the ratio of the area of the image to the area of the coin?

12. You have an aluminum measuring tape whose markings are calibrated at 20°C. When you use the tape at 40°C the length that you are reading from the tape is 35.280 m. What is the difference from the actual length? The aluminum linear expansion coefficient is 2.4×10^{-5} K^{-1}.

13. An ideal monatomic gas, consisting of 3.5 moles expands adiabatically to a volume of 1.2 m^3. The initial and final temperatures are 35°C and -22°C. What is the initial volume?

14. A heat engine working in a cycle takes 1.8 kJ of heat from a high–temperature reservoir at temperature 1300°C, and exhausts 0.94 kJ of heat into a low–temperature reservoir at 38°C. Find the ratio of the engine efficiency to the efficiency of the Carnot engine operating between the same reservoirs.

15. What is the amplitude of acceleration of a simple harmonic motion if the amplitude is 10cm and period is 3s?