

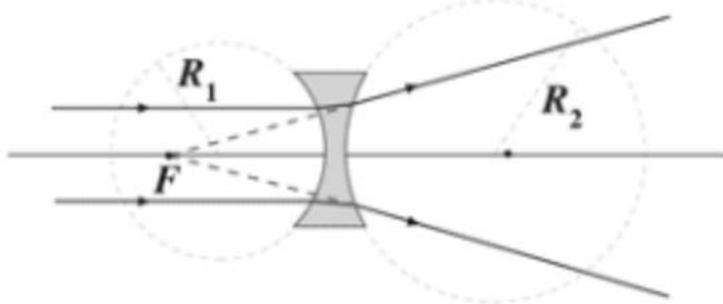


Polytechnic Tutoring Center

Final Review – PH 2033 Fall 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. A diverging lens ($R_1 = 3 \text{ cm}$ and $R_2 = 7 \text{ cm}$) is made with a glass ($n = 1.51$). When an object is placed 2 m away, how far away will the image appear?



- a) 3.5 cm b) 3.8 cm c) 4.2 cm d) 4.7 cm e) 5.0 cm

- 2. A thin film of refractive index of 1.4 is used as a nonreflective coating for light with $\lambda = 540 \text{ nm}$. If a glass covered with this coating has index of refraction of 2.3, what is the minimum thickness of this coating minimizing reflection?

 - a) 71.5 nm b) 90.0 nm c) 79.4 nm d) 84.4 nm e) 96.4 nm

- 3. Light of two colors is illuminated on two slits such that the minimum of one falls perfectly in the maximum of another about its center. If one of the colors has wavelength 450 nm, what could be the wavelength of the other?

 - a) 650 nm b) 675 nm c) 700 nm d) 725 nm e) 750 nm

- 4. A double-slit pattern contains exactly 9 visible fringes in the central diffraction peak. The first diffraction minimum occurs at an interference maximum. Find the ratio of the separation between the slits to the width of the slits.

 - a) 3 b) 5 c) 6 d) 7 e) 4

5. 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 $2.4 \times 10^{-5} \text{ K}^{-1}$.

a) 1.32 cm b) 1.69 cm c) 1.86 cm d) 1.27 cm e) 1.52 cm

6. 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°C, while in the other room it is at 12°C. How many of the 100-W bulbs are needed to maintain the temperature difference across the wall? (Assume conduction constant for brick is .84)

a) 30 b) 25 c) 20 d) 32 e) 16

7. Two stars both emitting 550-nm light are separated by 70 km. Assuming the resolution is limited only by diffraction, what is the furthest distance from the stars where one stands such that two stars could still be resolved?

a) $5 \times 10^8 \text{ m}$ b) $6 \times 10^6 \text{ m}$ c) $7 \times 10^9 \text{ m}$
d) $8 \times 10^{11} \text{ m}$ e) $9 \times 10^{15} \text{ m}$

8. An ideal monatomic gas, consisting of 3.5 moles expands adiabatically to a volume of 1.2 m³. The initial and final temperatures are 35°C and -22°C. What is the initial volume?

a) 0.811 m³ b) 0.883 m³ c) 0.984 m³ d) 0.901 m³ e) 0.957 m³

9. 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.

a) 0.381 b) 0.448 c) 0.596 d) 0.712 e) 0.835

10. What is the entropy change of the system when 9 kg of water at 3°C is mixed with 5 kg of water at 38°C in a well-insulated container? (C_p = 4183 J/kg/K for water.)

a) 96.9 J/K b) 215 J/K c) 603 J/K d) 1050 J/K e) 3240 J/K