

Physics 10164 - Exam 3A

Partial credit will be given provided you show all work and are solving parts of the problem correctly. Points will be deducted if you don't show your work even if you get the right answer. Clearly indicate your answer with a circle or a box and remember to include correct units and significant figures.

1. (25 pts) The intensity of sunlight received by a satellite just outside of the Earth's atmosphere is 1380 W/m^2 .
 - a) What is the rms value of the Electric field of this radiation?
 - b) Assume the Earth's cross-sectional area is that of a circular disk with a radius equal to the radius of the Earth (on page 1 of formula sheet). How much solar energy is incident on the Earth in one day?
 - c) The amount of energy used by all of humanity on the Earth in one day is approximately 1.9×10^{18} Joules. How much time does it take for that much solar energy to shine on the entire Earth?

2. (25 pts) A lens forms an inverted image that is 2.5 times the size of the original object.

- a) If the image is 12 cm in front of the lens, where is the object?
- b) If the object distance is doubled, what is the new image distance for the same lens?
- c) What is the new magnification of the image?

3. (25 pts) Light of wavelength 632 nm is incident on a single slit of width 6.8×10^{-5} m. The resulting single-slit interference pattern illuminates a screen 7.5 meters away.

- a) If the center of the central maximum is in the geometric center of a circular screen of radius 55 cm, how many complete maxima can fit on the screen, considering both the central maximum and the maxima on either side of the center?
- b) If the slit width increases significantly, would your answer to part (a) increase, decrease or remain the same? Justify your answer mathematically or qualitatively.

4. (25 pts) A thin film ($n = 1.65$) is applied to a glass surface ($n = 1.50$). If the coating has a thickness of 520 nm, find the wavelengths of light in the visible spectrum (from 400 - 700 nm) that experience destructive interference when transmitted through the glass. Not reflected!