Midterm 3, Physics 142H

Take-home exam, due 2:00pm, Thursday, December 4

1) The Second Law of Thermodynamics

a) Explain why a room can be warmed by leaving open the door of an oven, but cannot be cooled by leaving open the door of a refrigerator.

b) A 1kg mass falls off a table of height 1m onto the floor in a room at temperature $T = 300\text{K}$. What is the change, if any, in the entropy of the universe?

c) One mole of diatomic ideal gas is heated isovolumetrically until its pressure has doubled. Determine the change in entropy of the gas.

2) Geometrical optics

a) Explain the phenomenon of *total internal reflection*.

b) Draw a *ray diagram* illustrating the formation of an image by a thin lens of focal length f due to an object a distance $f/2$ from the lens. Is the image real or virtual? What is the magnification?

c) Why does chromatic aberration occur in simple lenses but not in mirrors?