Topic 05/06. Vibrations and Waves / Light and Optics

1. An object-spring system oscillates with an amplitude of 3.5 cm. If the spring constant is 250 N/m and the object has a mass of 0.50 kg, determine (a) the mechanical energy of the system, (b) the maximum speed of the object, and (c) the maximum acceleration of the object.

2. The motion of an object is described by the equation $x(t) = (0.30\,m)\cos\left(\frac{\pi t}{3}\right)$. Find (a) the position of the object at t = 0 and t = 0.60 s, (b) the amplitude of the motion, (c) the frequency of the motion, and (d) the period of the motion.

3. A converging lens has a focal length of 20.0 cm. Locate the images for object distances of (a) 40.0 cm, (b) 20.0 cm, and (c) 10.0 cm. For each case, state whether the image is real or virtual and upright or inverted, and find the magnification. (d) solve the problem for the case of a diverging lens with the same focal length.

4. The use of a lens in a certain situation is described by the equation $\frac{1}{p} + \frac{1}{-3.50p} = \frac{1}{7.50\,\text{cm}}$. Determine (a) the object distance and (b) the image distance. (c) Use a ray diagram to obtain a description of the image. (d) Identify a practical device described by the given equation, and write the statement of a problem having a solution that contains the equation.