I. Mechanical Waves.
Last semester you learned about mechanical traveling waves. These could be on a string, in water, or through the air. The standard expression for a transverse traveling wave is:

\[ y(x, t) = A \sin(kx - \omega t) \]

Draw this wave for \( t=0 \) and label the wavelength \( \lambda \) and the amplitude \( A \).

Draw this wave for \( x=0 \) and label the period \( T \) and the amplitude \( A \).

II. Representation of an Electromagnetic Wave.
A. Shown below is a pictorial representation of an electromagnetic plane wave propagating through empty space. The electric field is parallel to the \( z \)-axis; the magnetic field is parallel to the \( y \)-axis.

1. Is the wave transverse or longitudinal? Explain in terms of the quantity or quantities that are oscillating.

2. Determine the direction in which the wave is propagating. Explain your reasoning in words.

3. Write tentative equations for the electric and magnetic field vectors that can be represented in the above picture.
B. In the diagram at right, the four points labeled “×” are all located in a plane parallel to the y–z plane. One of the labeled points is located on the x-axis.

1. On the diagram, sketch a vector to show the direction and relative magnitude of the electric field at these “×” points.

2. Justify the use of the term plane wave for the electromagnetic wave shown in the picture. [Hint: How do the wave fronts look? Use the equations from question 3 of the last part.]

C. The points 1 - 4 in the diagram below lie in the x-z plane.

1. For the instant shown, rank the magnitude of the electric field at points 1 – 4 from largest to smallest. If the electric field is zero at any point, state that explicitly.

2. For the instant shown, rank the magnitude of the magnetic field at points 1 – 4 from largest to smallest. If the magnetic field is zero at any point, state that explicitly.
D. Three light waves are represented below. The diagrams are drawn to the same scale.

1. How is the wave in case 1 different from case 2? Explain how you can tell from the diagrams in words.

2. If the wave in case 2 were green light, could the wave in case 3 be red light or blue light? Explain how you can tell in words. [Hint: Look at Slide #1 of Lecture 20.]