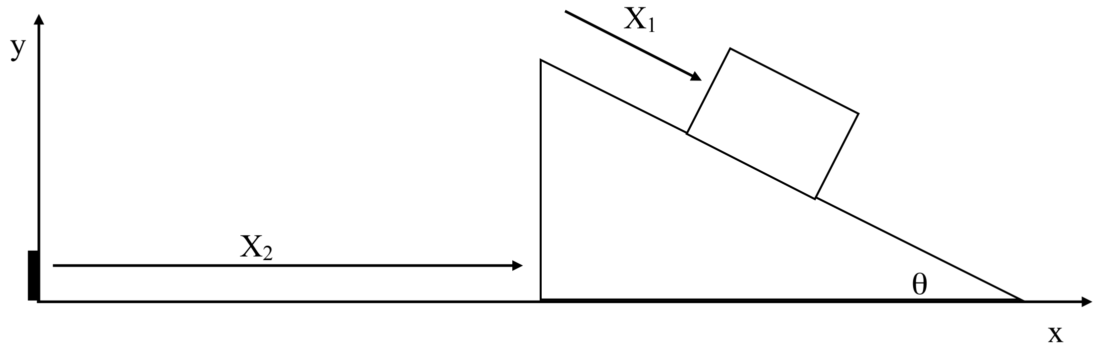
Please use a separate sheet of paper to show your work.

Usually, after generalized coordinates are chosen for a system, you write the kinetic and potential energies of the system in terms of the coordinates. Sometimes this is simple; other times it can be tricky. We have drawn the generalized coordinates traditionally chosen for this problem.

The variable X_2 points from an arbitrary point to the left edge of the incline, while X_1 points down the incline from the edge. The incline is at an angle θ above horizontal.



A. Consider the ramp. Using the generalized coordinates X_1 and X_2,

1. What is its kinetic energy? Explain your answer.
2. What is its potential energy? Explain your answer.

B. Consider the block on the ramp. Both generalized coordinates affect the motion of the block. Sometimes, it is possible to write the kinetic energy of the block "by inspection" (*i.e.*, Fowles and Cassiday make this claim in chapter 10). For this problem, though, do the often simpler (though longer) following procedure:

1. First, express the *x* and *y* positions of the block in terms of the generalized coordinates
2. Now, differentiate to find the *x* and *y* components of velocity in terms of the generalized coordinates.
3. Next, find the kinetic and potential energy of the block in terms of the external coordinate system. Recall that $v^2 = \dot{x}^2 + \dot{y}^2 + \dot{z}^2$.
4. Finally, using the equations you wrote in (1) and (2), rewrite the energies in terms of the generalized coordinates.

C. Consider the total system. Write expressions for the total kinetic and total potential energies of the system in generalized coordinates. Compare your answers to those given in the text in chapter 10.