GOAL Problem Solving Steps

Gather information

- Do a complete Pictorial Model including
  - What the question asking for
  - Writing down the relevant known and unknown quantities with units.
- Guesstimate a reasonable range for the answer based on your own common-sense experiences.
- Consider how the answer could vary for limiting cases. (e.g. What happens when an angle approaches 0° or 90° or when a mass goes to zero?)
- Look for key phrases like "at rest," or "falls freely" for clues about relevant physics principles.

Organize your approach

- Draw a motion diagram labeled with the variables assigned from the **G** step above to help visualize the situation.
- Draw any additional diagrams or graphs needed to visualize the physics of what's going on.
- Classify the problem according to the **general** physics principles that apply. (e.g. Newton's second law, conservation of energy)
- Describe how you will solve the problem.

Analyze the problem

- Write down relevant **general** equations (express general physics principles in equation form).
- Add equations of constraint that specify special conditions that restrict the problem. (e.g. two objects have the same mass: $m_1 = m_2$) Make sure that you have enough equations to solve the problem (the same number of independent equations as variables).
- Solve for the desired unknown variable (on the left of the equation) in terms of the known variables (on the right). This may require manipulating and combining several equations without substituting numbers.
- Substitute known values, calculate a numerical answer, and round the answer to the appropriate number of significant figures based on the precision of the input data.

Learn from your efforts

- Check your answer.
  - Does the answer agree with the prediction in the **G** step?
  - Are the units correct?
  - Does the result have the correct sign or direction?
  - Does the algebraic result make sense for limiting cases as predicted in the **G** step?
- If the problem were modified, how would the result change? (e.g. What if air resistance or friction were significant factors?)
- Why was this particular problem assigned?
  - What is the key point or critical issue in this problem?
  - How is this problem similar or different from other problems you have examined?