Required Solution Format:

1. **Understand the problem and devise a plan**
    a. **Read and translate the problem statement.** Read the problem carefully. What are the key words? What information is given and what will be determined? Translate the problem statement from English into math. Write equations of the form "symbol equals number units". Write "symbol equals ?" to indicate which quantity is to be determined.
    b. **Determine applicable concepts and/or laws and assumptions and/or simplifications.** Determine which physics concepts and/or laws are involved and what assumptions and/or simplifications can be made about the physical situation in order to apply them. What simplifications are reasonable? Can the sizes of the objects be ignored? Can they be treated as particles? Can friction be ignored? *The assumptions which simplify the problem must be explicitly stated and consistent with the applicable concepts. For example, if momentum conservation is being applied to a system of two cars in a collision, then friction from the road will be ignored since it is an external force and the system has been simplified to have no external forces in order to apply the conservation law.*

2. **Represent the problem physically and mathematically**
    a. **Represent physically.** Draw an appropriate type of physical representation such as a graph, motion diagram, free-body diagram, energy bar chart, or ray diagram. Include all of the relevant quantities in the diagram. Choose and draw the coordinate axes. Indicate which directions are positive and negative. Force diagrams must have labeled axes and force arrows of representative magnitude and direction with defined labels. For example, if a force vector is labeled F_{eb}, then it must stated that e is the earth and b is the box, or if it is labeled F_{g}, then it must stated that F_{g} is the force of gravity acting on the box.
    b. **Represent the concepts and/or laws mathematically.** Use the physical representation to construct a mathematical representation. Make sure that this representation is consistent with the physical representation. For example, if the origin is defined to be above the ground, then an object on the ground will not have zero gravitational potential energy. *Always include symbolic mathematical statements from the formula sheet which clearly show what concepts and/or laws are being used to solve the problem. For example,* $K = (1/2)mv^2$.

3. **Solve for the unknown quantity (or quantities)**
    a. **Solve for the unknown quantity (or quantities) using algebra, geometry, trigonometry and/or calculus.** Make sure to include enough steps so that another student in the course could understand the solution. Use consistent units. If the problem has been set up properly, then this step will be purely mathematical. However, you may get stuck and not be able to solve the problem. In that case, go back and check all of the above steps to make sure you haven't overlooked some piece of physics implied by the situation or some relationship such as the force of kinetic friction is proportional to the normal force. Keep symbols in the solution for as long as possible, and, when appropriate, only insert the numerical values at the end. Always include units with any numerical answer.

4. **Reflect. Is the answer reasonable? Does it make physical sense?**
    a. **Evaluate the result.** Is the answer reasonable? Are the units correct? Does the answer make sense in limiting cases? Does the answer make physical sense? *Include a written explanation for why the answer makes sense and what it implies about the physical system.*

Assessment Rubric:

The following table gives the detailed grading rubric that will be used to score homework solutions. 0, 1, 2 or 3 points will be awarded for each of the categories listed on the left. In the cases where 2 and 3 are blank that part of the solution is worth up to only 1 point. The categories correspond to those on the previous page. Use this rubric when writing solutions to assess them and make sure they're complete.

Staple the pages together and submit them on 8.5" x 11" paper with no loose edges. Print your full name, studio day and time (Tuesday 02:00, Wednesday 11:00 or Wednesday 02:00) and homework assignment number at the top of the first page.

Points:	0	1	2	3
1 a. Read and translate the problem statement	The problem is not translated.	A clear translation of the problem is given.		
1 b. State applicable laws and what assumptions/ simplifications allow them to be used in this situation	No information is given about applicable laws and what assumptions/ simplifications allow them to be used.	Only the concepts/laws are listed with no assumptions or simplifications, or incorrect information is given.	Correct assumptions are given with no information about how they relate to the concepts/laws that will be used, or an important assumption is missing.	Correct assumptions/ simplifications are given and related to how they allow the concepts/laws to be used to solve this particular situation.
2 a. Represent physically	No physical representation is given.	An incorrect physical representation is given, or one that is correct, but does not include any labels or defined quantities.	A reasonable physical representation is given, but is not clearly labeled, does not define all quantities, or a clear representation is given but it contains a mistake.	A clearly labeled, correct physical representation is given, with all relevant quantities clearly defined.
2 b. Represent the concepts/laws mathematically	No mathematical representation is given.	A mathematical representation is given in symbols with no numbers.		
3 a. Work through the mathematics	No solution is given.	Only a partial solution or an incorrect solution is given.	There is some small mistake in the solution, or units are neglected, or the mathematical steps are unclear.	A complete solution with clear mathematical steps is given, and the answer has correct units.
4 a. Evaluate the result	No evaluation is given.	Very little information is given to evaluate the result.	A partial explanation is given for why the result makes sense (or does not make sense if the incorrect answer was reached), and what it tells us about the physics of the situation.	A clear and complete explanation is given for why the result makes sense (or does not make sense if the incorrect answer was reached), and what it tells us about the physics of the situation.