PHYS 1303

SOLVING PHYSICS PROBLEMS

Many students, even if they are good at other sciences, math, or engineering, often find physics problems very difficult because they do not adopt the right approach for physics. Physics consists of a very small number of conceptually-deep basic laws that are combined with mathematical methods to solve problems in the real world; no other subject works like this. Physics problems are like mystery stories - you often don't know who dunnit until the very end.

- **Don't search for "the right equation".** You will not be able to solve a real physics problem by finding an appropriate equation and then plugging numbers into it. No self-respecting college-level teacher would assign such a problem.
- **Don't memorize.** In physics you should not need to memorize anything (equations for basic laws should be available in your book or on a formula sheet) and it will not help you solve problems. It is important you understand the meaning of equations that express basic laws, and memorization usually indicates a simple lack of this conceptual understanding.

Below is a more detailed format it is suggested you use when solving *all* physics problems, even if you are sure you know how to get the answer. This skill will help you to solve physics problems and also to explain your solution to a reader (who may be the grader, yourself 2 months later, or the Nobel Prize committee).

DIANA

DESCRIPTION/ **D**IAGRAM – define unique symbols for unknowns sought and data given, label a diagram with your symbols, include a directed coordinate system, a few words to clarify perhaps.

IDEA – state the fundamental idea(s) or principle(s) of physics you will use. This can be expressed via an equation chosen from the formula sheet. You should then write it out explicitly for the current problem using your symbols (don't just write numbers immediately).

ANALYSIS – symbolically derive the unknown you want using algebra and calculus

NUMBERS – substitute data for the knowns and perform calculation of the unknown

ANSWER – check number makes sense, round to appropriate precision, put units

For more detailed advice about how to approach physics problems, see Dan Styler's page http://www.oberlin.edu/physics/dstyer/SolvingProblems.html

Partial Credit Grading Explanation

Each check mark is worth one point. The grader may sometimes mark an X or circle something wrong or they may offer advice in brackets; all this is for information only.

Check marks are embellished in 3 ways:

1. Diagram and/or Description (D) – see above

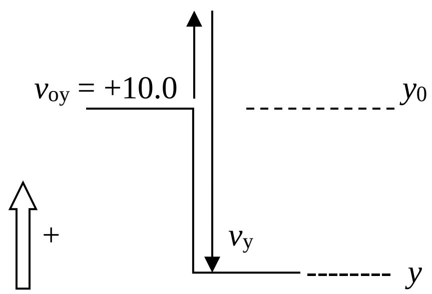
2. Method (M) - This is for *any valid* Method that forms part of the Idea or Analysis steps.

3. Answer (A) - This is for the correct final Answer, including units and appropriate precision.You will lose ½ point on an Answer (A) if either of the following occurred:
   a) wrong units b) inappropriate precision (you cannot lose more than one ½ point due to precision on the test.)

Carry Through Error (CTE) - an incorrect Answer (A) or diagram (D) *may* be awarded the points if it resulted from the use of a previous erroneous answer. The directly preceding method (M) points must have been awarded and the previous erroneous answer should not have simplified the problem. CTE points are awarded at the discretion of the grader.

Example Problem. A stone is thrown from the top of a building with an initial velocity of 10.0 m/s upwards. The top of the building is 100 m (3sf) above the ground. What is the speed of impact? [*Neglect air resistance and assume* $g = 9.80\ m/s^2$]

Diagram/Description (2 points)



a_y = - 9.80 m/s^2
$y - y_0$ = -100 m (change in y)
v_y velocity just before impact

Idea (1 point)	$v_y^2 = v_{0y}^2 + 2\,a_y\,(y - y_0)$	since constant acceleration	
Analysis (no points)	$v_y = \sqrt{(v_{0y}^2 + 2\,a_y\,(y - y_0))}$		
Numbers (no points)	$= \sqrt{[10^2 + 2(-9.8)(-100)]}$	= - 45.37	
Answer (1 point)	speed = 45.4 m/s (3sf)		