Physics Grading Policies (Prof. Jensen)

Exams: Most exam problems in this class will be graded on a ten point scale, as follows:

Procedure: 7 points Show that you understand the relevant physical principles and combine them logically to reach the solution for full credit. Copious partial credit is available. Note that these points have nothing to do with mathematical details! You can get full procedure credit for a clear statement of what needs to be done even if you never finish the math at all.

Correct: 1 point This is the "perfection point". If your final answer(s) are exactly right (and your procedure's okay), you get the point. If not, you don't. This is the only place where silly math errors will hurt you (however many times you write $2 \times 3 = 5$). But if you make an actual physics mistake, you will lose this point *and* Procedure points.

Clear and Reasonable: 2 points Communicating your reasoning is a crucial part of science: you must explain what you are trying to do and why. Clearly labeled diagrams are important, as are explicit definitions of variables and coordinates, and you should usually solve each problem symbolically and only plug in numbers in the last step. But it goes beyond that.

In general, every solution should include English sentences explaining what's going on. On rare occasions very clear math can stand on its own without many words, but if possible aim to have as much English as equations (or close to it). Don't go overboard ("then divide both sides by two…"), but do comment on the important stuff. If you use an equation from the book, explain (briefly) why it applies to this case. If you combine equations, explain how they fit together. English is also great for filling in the Procedure when you're stuck on the math.

It's also crucial to *think* about your answers. Here are a few of the factors that you need to consider to make sure your answer is "reasonable":

- **Physically reasonable**: If you're calculating a runner's speed and you get 12,000 mph, something's wrong. Same thing if the temperature of hot steam comes out below freezing or gravity points up. (At least say you noticed the problem!)
- **Units**: Include units with any number that needs them, and make sure they're sensible. Following units through the math can be a great double check.
- **Significant figures** in final results: I'll forgive one extra sig. fig. most of the time, *maybe* two (but too few is always bad). Never copy all ten digits from your calculator! (But avoid rounding errors: keep an extra digit or two in *intermediate* steps.)

Homework: Each homework problem will be graded on a simple two-point scale:

- **0 pts:** No substantial work at all.
- **1 pt:** Good progress, but didn't get through all the necessary physical reasoning.
- **$1\frac{1}{2}$ pts:** Correct physics, but has minor math errors, missing units, wrong sig. figs., etc.
- **2 pts:** Both the physical reasoning and the final answer are just right.

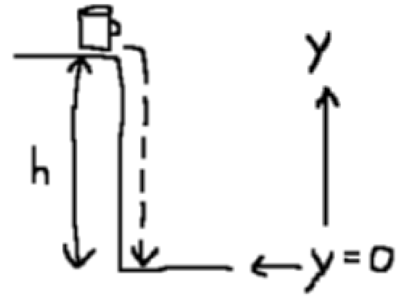
In addition, **every homework assignment will be given an overall clarity score** (out of two points, like an extra problem). There's even a chance for extra credit here.

- **0 pts:** Confusing and hard to follow even for someone who knows what's going on.
- **1 pt:** Math and diagrams are well organized, but with little or no English explanation.
- **2 pts:** English is sufficient to guide a knowledgeable reader through the reasoning.
- **3 pts:** Extra credit! Detailed explanations in English make this look like an answer key.

Example problem: Isabel, a curious cat, likes to push things off of tables to see what will happen. When she knocks a coffee mug straight off the edge, it takes 0.49 s to hit the floor. How high is the table?

Solution 1: The falling mug has constant acceleration due to gravity. The constant acceleration equation for height y at time t is

$$y = y_0 + v_0 t + \frac{1}{2} a t^2 \quad .$$



As drawn, the initial height is $y_0 = h$, and the final height is $y = 0$. Because Isabel pushes the mug straight off the edge, the initial vertical speed is $v_0 = 0$. And because the acceleration toward the earth is in the $-y$ direction as shown, $a = -g$. Then the equation reads

$$0 = h + 0\,t - \frac{1}{2} g t^2 \quad , \quad \text{so} \quad h = \frac{1}{2} g t^2 \quad .$$

When we substitute the numerical values of g and t, we find that the table's height is $h = \frac{1}{2} \cdot 9.8\,\mathrm{m/s^2} \cdot (0.49\,\mathrm{s})^2$, so $h = 1.17649\,\mathrm{m} \approx \boxed{1.2\,\mathrm{m.}}$

Exam grade $\mathbf{7+1+2} = \boxed{\mathbf{10/10}}$: *This is excellent: the reasoning is clearly explained, the drawing illustrates the problem* and *defines all the variables, and of course the physics is right.*

Solution 2:

$$0 = h - \frac{1}{2} g t^2 \quad \rightarrow \quad h = 1.17649$$

Exam grade $\mathbf{7+1+0} = \boxed{\mathbf{8/10}}$: *This solution is basically right, but only someone who already knew the answer would understand it: without any English it simply isn't clear. Also, the variables aren't defined: not only does the reader need to guess what h means, but the minus sign isn't explained. On top of that, the final answer has not been rounded to the right number of sig. figs. And its units are missing! Any* two *of those would mean zero points for "clear and reasonable".*

Solution 3: It falls from $y = 0$ down to the floor a distance h away. Starting speed is zero, so with constant acceleration g from gravity (which is positive, since it points down and h is down) the equation is

$$h = 0 + 0\,t + \frac{1}{3} g t^2 \quad , \quad \text{so substituting,} \quad h = \frac{1}{3} \cdot 9.8\,\mathrm{cm/s^2} \cdot (0.49\,\mathrm{s})^2 = \boxed{0.78\,\mathrm{cm}} \quad .$$

But this can't be right: no table would be less than 1 cm high! I can't find my mistake.

Exam grade $\mathbf{7+0+2} = \boxed{\mathbf{9/10}}$: *Actually, there are two mistakes: this student copied down the equation wrong ($\frac{1}{3}$ instead of $\frac{1}{2}$) and also used the wrong units for g. Even so, the physical reasoning is entirely correct. The English explanation is terse but acceptable; some of it could even be replaced by a diagram (though both would be better).*

Note that without the comment on the strange result there also would have been a deduction for not noticing a very unreasonable answer, giving a total score of just 8/10.

On homework assignments, these three solutions would be typical of assignments earning 3, 1 (barely), and 2 clarity points, respectively. (Also, #2 would lose $\frac{1}{2}$ pt. for units & sig. figs.)