# 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. If you're very clear, you can get all these points even if you never finish the math at all!

**Correct: 1 point** This is the "perfection point" for a solution that is exactly right. 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 should use clearly labeled diagrams, explicitly define variables and coordinates, and do the math symbolically (only plug in numbers in the last step). But it goes beyond that.

Every solution should include English sentences explaining what's going on. Aim to have nearly as much English as equations (it's rare for the math to be clear with much less than that). Don't narrate every niggling detail; point out the big ideas. If you use an equation from the book, mention why it applies. If you combine equations, explain how their physics fits 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. Consider these "reasonable" requirements:

- **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. (You won't lose points as long as you make note of the problem.)
- **Units**: Include units with any number that needs them (even in intermediate steps), and make sure they're sensible. Following units through the math is a great double check.
- **Significant figures** in final results: I'll forgive one extra sig. fig., *maybe* two. (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.)

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**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.
- **2 pts:** A complete solution with all the right physical reasoning.

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.

**Math errors and unreasonable results:** These will be marked where they occur, but they will deduct from your overall score rather than from individual problems. There is no deduction for 0–2 of these errors per assignment, but you'll get **-1 pt** if you have 3–5 of them and **-2 pts** for 6 or more. (Multiple *math* errors in a single problem will count as just one error.)

**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?

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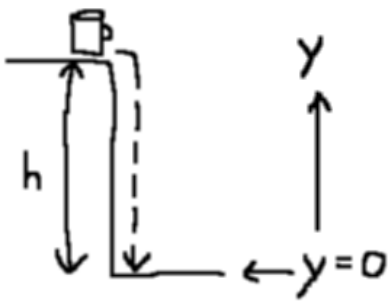
**Solution 1:** The falling mug has constant acceleration due to gravity. The constant acceleration equation for height $y$ at time $t$ is

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




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

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

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

Exam grade **7+1+2 = 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.*

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**Solution 2:**

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

Exam grade **7+1+0 = 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".*

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**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

$$h = 0 + 0\ t + \frac{1}{3}gt^2 \quad , \quad \text{so substituting,} \quad h = \frac{1}{3} \cdot 9.8\,\text{m/s}^2 \cdot (0.49\,\text{s})^2 = \boxed{75\,\text{m}} \quad .$$

But this can't be right: no table would be that high! I can't find my mistake.

Exam grade **7 + 0 + 2 = 9/10**: *Actually, there are two mistakes: this student copied down the equation wrong ($\frac{1}{3}$ instead of $\frac{1}{2}$) and also multiplied incorrectly (he typed "938" instead of "9.8"). 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.

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**On homework assignments,** these three solutions would be typical of assignments earning 3, 1 (at most), and 2 clarity points, respectively. #2 contains two *separate* "unreasonable" mistakes (sig. figs. and missing units). The two math mistakes in #3 count as just a single error.