Effective Recitations: The Power of Being Prepared

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What is a recitation session?

Most of the required (core) classes that undergraduates take in their first two years have recitation sessions, two 1-hour lectures led by a graduate student where students work through problems and bridge the gap between the lecture material and the concepts they will need for their problem sets. What material you cover and how you present it is up to you. It is a serious responsibility but extremely rewarding – be worthy of it!

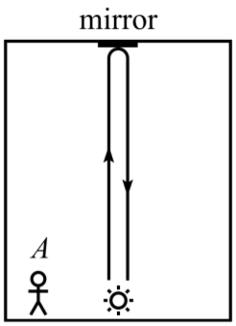
What this section will and will not cover

Teaching requires an amalgamation of many important skills (exhibit mastery of the material, speak confidently, maintain eye contact, etc.), but we will not cover any of those. Instead, we are going to focus on what separates the best recitation sessions from those that are "good enough."

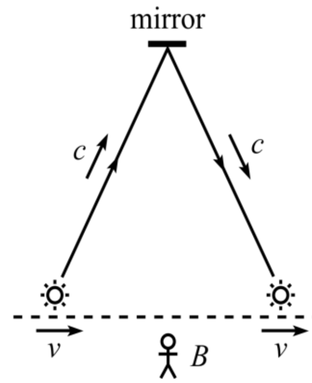
This does not imply that all of those other skills are less important. Needless to say, you should scope out the room you will teach in ahead of time to ensure that your computer plugs in, carry your own chalk/markers in case disaster strikes, learn students names *before the first class* (ask the professor for the class roster with pictures), arrive at least 5 minutes early, always start on time…we are simply going to talk about the skills that you would likely not learn for yourselves with experience!

This section will cover ways to add pizzazz to your teaching, suggest novel strategies for encouraging questions, encourage you to make summary sheets (like the one on the following page), and discuss how to come up the amazing material that you will teach your students. We hope you will leave session bursting with enthusiasm to try out some of these ideas.

Time Dilation

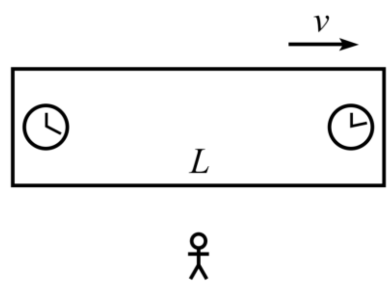


- Light moves at speed c in all frames
- Two events that occur simultaneously in one reference frame may not be simultaneous in another frame
- Two events that occur <u>at the same location</u> in frame A, separated by a time t_A, will take a greater time $t_B = \gamma\ t_A$ in frame B moving at velocity v with respect to frame A
- $\gamma = \frac{1}{\sqrt{1-\frac{v^2}{c^2}}}$ (with $\gamma \geq 1$)

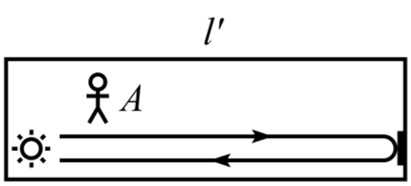


Head Start Effect

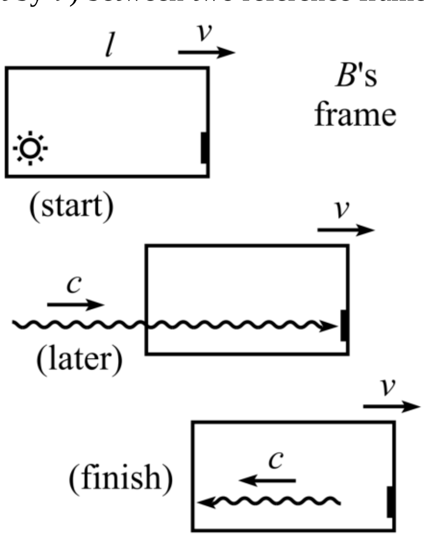
- Two clocks are positioned at the end of a train of length L (as measured in its own frame. The clocks are synchronized in the train's reference frame
- The train travels past an observer at speed v. The observer will see the *rear clock* showing a higher reading than the front clock by $\Delta t = \frac{Lv}{c^2}$
- The rear clock does not tick faster than the front clock, it simply remains a fixed time ahead of the front clock



Length Contraction



- An object in frame A moves with velocity v relative to frame B. The object has length l' along this direction of motion in A's frame. The object has a *shorter* length $l = \frac{l'}{\gamma}$ in B's frame
- Length contraction does not apply in the directions transverse to the direction of motion (set by v) between two reference frames



Example

A muon moves from a height h straight down towards the Earth with a large velocity v. It decays after time T in its own frame. Can the muon reach the ground?

- In the Earth's frame, time dilation applies. The muon has to travel a distance h in time $\gamma\ T$
- In the muon's frame, length contraction kicks in. The muon must travel a distance $\frac{h}{\gamma}$ in time T

Problem Solving: Rewards and Set Backs

What are some elements of an engaging problem?	**What are some things to avoid when posing a problem?**

Think Pair Share:

Think of a time you were given a particularly challenging problem with a rewarding solution. What made that problem memorable?