Purpose

• Some fundamental training in teaching
• Introduction to some pedagogy
• Introduction to experiments that may be part of a lab section you’re going to teach
• Meet a few of the faculty
• Hear about policies at UT for GTA’s
• Learn about teaching resources in department and University
Now you’re the TA

• Position of responsibility
• Can be tricky when students are similar age, or maybe older
• Think about appropriate behavior, language, clothing, etc.
• Judgment calls: should I give out my cell number? Should I “friend” my students?
Teaching Basics

• What should your expectations be for an undergraduate premed student? For an undergraduate engineering student? etc.
• Are notes legible?
• Are quiz questions ambiguous? Try on another TA.
• Perform the experiment yourself to make sure you know how to make it work BEFORE the class.
• Older TA’s are a resource, as is the professor.
Active Learning

Keeping students involved
What is active learning?

• Range of techniques
  – Peer Instruction
  – Just in Time Teaching
  – Interactive Engagement

• Students do not just sit quietly in class

• Usually linked to conceptual understanding
Why use active learning techniques?

• Various studies show that active learning improves student understanding\(^1,^2\) over traditional teaching.

• Despite focus being moved from numerical to conceptual problems, students perform better in tests on both\(^2\).

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but what does this have to do with me?

• Labs and recitations should by nature be active learning environments
• Think how you can enhance your students’ conceptual understanding
• Ask conceptual questions
• Find misconceptions
ConcepTests

• Conceptual, non-mathematical questions
• Make students think for themselves
• Test understanding
• Reveal misconceptions
• Can use real-life examples to help with more abstract concepts
Example 1

• By shaking one end of a string, a single pulse is generated. The travelling pulse carries:
  1. mass
  2. energy
  3. momentum
  4. energy and momentum
  5. mass and momentum
  6. All three
A group of sprinters gather at a point $P$ on a parking lot bordering a beach. They must run across the parking lot to a point $Q$ on the beach as quickly as possible. Which path from $P$ to $Q$ takes the least time? You should consider the relative speeds of the sprinters on the hard surface of the parking lot and on the loose sand.
Refraction

$n_a$ (air)

$n_b$ (glass)
Example 3

The *Hubble Space Telescope (HST)* offers sharper images than ground telescopes primarily because

a) *HST* is closer to planets & stars.
b) *HST* uses a larger primary mirror.
c) it gathers X-ray light.
d) *HST* orbits above the atmosphere.
e) it stays on the night-time side of Earth.
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HST orbits less than 400 miles above Earth – not much closer to stars & planets!

But it can gather UV, visible, & IR light, unaffected by Earth’s atmosphere.
Peer Instruction

• Students read material in advance
• Short lecture/discussion of material
• Ask ConcepTests
• If ~50-80% get ConcepTest correct
  – allow students to discuss KEY!
  – repoll
Let’s give it a try

I’ve selected some ConcepTests from my Gen Ed 100-level astronomy class as most of you will not know the answers straight off, but maybe can work them out.
If the sun was replaced by a one-solar-mass black hole

a) Earth’s orbit would not change.
b) Earth would be pulled into the black hole.
c) X-rays would destroy Earth.
d) Earth would be torn apart from the tidal force.
e) life would be unchanged.
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The force of gravity depends only on mass and distance, not the type of matter, or its size.
What types of electromagnetic radiation from space reach the surface of Earth?

a) radio and microwaves
b) X rays and ultraviolet light
c) infrared and gamma rays
d) visible light and radio waves
e) visible light and X rays

Note: in the context of the astronomy class it should be clear that I’m asking what can be measured in a telescope.
Question

What types of electromagnetic radiation from space reach the surface of Earth?

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d) visible light and radio waves
e) visible and X rays

Think what can you measure from on the Earth? Think radio telescopes.
The frequency at which a star’s intensity is greatest depends directly on its

a) radius.
b) mass.
c) magnetic field.
d) temperature.
e) direction of motion.
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Wien’s law means that hotter stars produce much more high-frequency light.
The constellation ORION

**Rigel** appears as a bright bluish star, whereas **Betelgeuse** appears as a bright reddish star.

Rigel is ______ Betelgeuse.

- a) cooler than
- b) the same temperature as
- c) older than
- d) hotter than
- e) more massive than
Rigel appears as a bright bluish star, whereas Betelgeuse appears as a bright reddish star.

Rigel is ______ Betelgeuse.

The constellation ORION

Betelgeuse

Rigel
Analyzing a star’s spectral lines can tell us about all of these EXCEPT:

a) its composition.
b) its surface temperature.
c) its transverse (side-to-side) motion.
d) its rotation.
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Only motion toward away from us influences a star’s spectral lines.

Spectra can also tell us about a star’s magnetic field.
You can best model the size and distance relationship of our Sun & the next nearest star using

a) a tennis ball here, and one on the Moon.
b) two beach balls separated by 100 city blocks.
c) two grains of sand 100 light years apart.
d) two marbles 200 miles apart.
e) two marbles 100 yards apart.
You can best model the size and distance relationship of our Sun & the next nearest star using

d) two marbles 200 miles apart.
Question

Some regions of the Milky Way’s disk appear dark because

a) there are no stars there.
b) stars in that direction are obscured by interstellar gas.
c) stars in that direction are obscured by interstellar dust.
d) numerous black holes capture all the starlight behind them.
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A heavy ball is attached to a string and swung in a circular path in a horizontal plane as illustrated in the diagram to the right. At the point indicated in the diagram, the string suddenly breaks at the ball. If these events were observed from directly above, indicate the path of the ball after the string breaks.
A heavy ball is attached to a string and swung in a circular path in a horizontal plane as illustrated in the diagram to the right. At the point indicated in the diagram, the string suddenly breaks at the ball. If these events were observed from directly above, indicate the path of the ball after the string breaks.

(b) In the absence of the force provided by the string the ball continues to move in the direction it had been moving.
Similar question posed in a different way

The accompanying diagram depicts a semicircular channel that has been securely attached, in a horizontal plane, to a table top. A ball enters the channel at "1" and exits at "2". Which of the path representations would most nearly correspond to the path of the ball as it exits the channel at "2" and rolls across the table top.
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Again answer is b

**Misconception** “circular impetus”. Objects moving in a circle will continue to move in a circle.
23. A bowling ball accidently falls out of the cargo bay of an airliner as it flies along in a horizontal direction. As seen from the ground, which path would the bowling ball most closely follow after leaving the airplane?
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(d) constant velocity in direction of plane, accelerating down due to gravity.

Does this question confuse? It looks like the ball is moving ahead of the airplane.