Class 2

Some tools of physics
Announcements

• Prof. Zegers will teach class on Friday
• Labor Day Monday-no class
• Reminder: Clickers (H-ITT transmitters)
• Helproom hours are posted on the website
• Reminder: LON-CAPA login
  – TA will be in 1248 12:30-6:30 on Friday to help
Today’s Objectives

• Concepts
  – What is Physics
  – Tools of Physics
    • Measuring
    • Estimating
    • Determining correctness (Dimensional analysis)

• Problem solving
  – Unit conversion
  – Dimensional analysis
  – Order or magnitude estimating
  – strategy
Concept 1:
What is Physics?

1. Observe the universe, ask the question: how does it work?
2. Construct a simple, testable, model
3. Make quantitative measurements
4. Test the model for correctness: it reproduces the observations adequately?
5. Iterate, adding complexity to the model as required
Physics theory checklist:

• Is the theory that crop circles are made by aliens a valid physics theory?
  – Refers to an observation about the universe around us
  – Is simple
  – Makes quantitative predictions
  – Can be tested by objective measurement
Concept 2: Tools of physics

- Measuring
- Estimating
- Checking for correctness
Measuring

• We use SI units: go read about it
Basic and derived physical quantities

• Basic quantities in mechanics:
  – Time \([T]\) (SI unit: seconds, \(s\))
  – Length \([L]\) (SI unit: meters, \(m\))
  – Mass \([M]\) (SI unit: \(kg\))

• Derived physical quantities:
  – Velocity \([(L)/(T)]\) (m/s)
  – Acceleration \([(L)/(T^2)]\) (m/s\(^2\))
  – Many more...
Time-Out!

Note on my lectures

• What are my lectures trying to achieve:
  – Stimulate thought/encourage you to think critically
  – Clarify the book
  – Explain confusing issues
  – Give you things to think about
  – Help the little light go on

• What they are not good for:
  – Introduce the material
  – Covering all the material [read the book/online materials!]
  – Brainless way of giving you good notes
Summary

- Bring your brain to class not your notebook
- Bring your questions to class
- Familiarize yourself with the material before class or you will not benefit from the experience: do the reading up-front
- Why bother?

Understanding = better grade
Dimensional analysis

- Used as a “gut-check”: is the equation I wrote down correct?
- Dimensions written as [L],[T] and [M]
  - Note, units are written m,s,kg for the same quantities
- LHS = RHS
  - Dimensions of LHS must be the same as dimensions of RHS
- LHS = A + B + C
  - Terms in a sum must all have the same dimensions => dimensions of LHS,A,B and C must be the same
- You can do algebra on dimensions
Understanding test: dimensional analysis

- The equation $v=v_0 + mv^2$ ($v=$velocity=$distance/time$, $m=$mass)
  1. must be correct
  2. May be correct
  3. Must be incorrect
  4. No way to tell without reading chapter 2
U-test 2: dimensional analysis

• The equation \( v = v_0 + \frac{1}{2}at \) 
  \((v=\text{velocity}=\text{distance}/\text{time}, \ a=\text{acceleration})\)

1. must be correct
2. May be correct
3. Must be incorrect
4. No way to tell without reading chapter 2
Unit conversion

• What is 70 mph in SI units? (1 mile = 1.609 km, 1h = 3600s)
Problem solving strategies (homework)

- READ THE PROBLEM CAREFULLY!!!
- DON’T PANIC, take deep breaths
- Try and visualize what is happening in the problem. Explain/discuss it with a friend, this helps
- It is testing some concepts from class, try and identify which ones may be relevant
- SLOW DOWN; think of some more possibilities before forging ahead
- Check whether your answer makes sense
- If you get the right answer, make sure you understand why; don’t leave it to chance in the exam!