Phys 132 2022

Lecture 1

Handouts: * Syllabus
* Survey - return by Thursday
* Attendance Sheet
* Lab Packet - for Friday
- note pre-lab

Introductory Physics Question.

* What keeps you from falling through Earth's surface?
- Introduce yourself to neighbors
- Discuss this question try to provide reasons for answer.

* We all use electrical devices. Ask students to list these
list of devices

How do these devices work?

* How many students have - connected a basic electric circuit
- opened an electric motor
- made an electromagnetic.

Content

This course will deal with the basic physics that helps to answer questions like these. The answers all lie in the properties of charged particles and how these interact with each other.

Youtube Video: Physics Girl Why outlets spark when unplugged.

The theory of electromagnetism offers a framework that in principle completely explains all interactions between charged particles. The theory:

1) is a fundamental branch of physics
2) explains a wide range of phenomena
    a) fundamental particles
    b) atoms / molecules ~> chemistry
    c) materials ~> solid state physics
    d) stellar physics
3) is crucial for understanding and developing technology + scientific devices.
    a) electrical devices
    b) scientific instruments (MRI, mass spectroscopy, photodetectors)

A related area of physics with a distinct flavor is the study of light (or optics). This is important for:

1) fundamental understanding of nature
2) understanding interactions between light + matter
3) optical instruments.

Phys 132 offers an introduction to these topics.

Course details

1) syllabus - my email / contact
   - use your CMU email.

2) course website - show main page
   - show calendar/materials page.

3) some material on D2L.

4) exam dates - these are known now
   Conflicts - consult me now
   conflicts generated later - may result in missing credit for exam.
   - absences → formal documentation

This week

~~Tuesday~~ - Lecture

Wednesday - Discussion / problem session

1) do problems before class — Phys 132 Exercises 1, 2, 3, 4, 5, 6, 7
   ↳ on website.
2) bring to class - work in groups
   - no turn in
3) at end of class 10 minute quiz (like one of the problems)

Forces between charges

We can observe interactions between specially prepared objects.

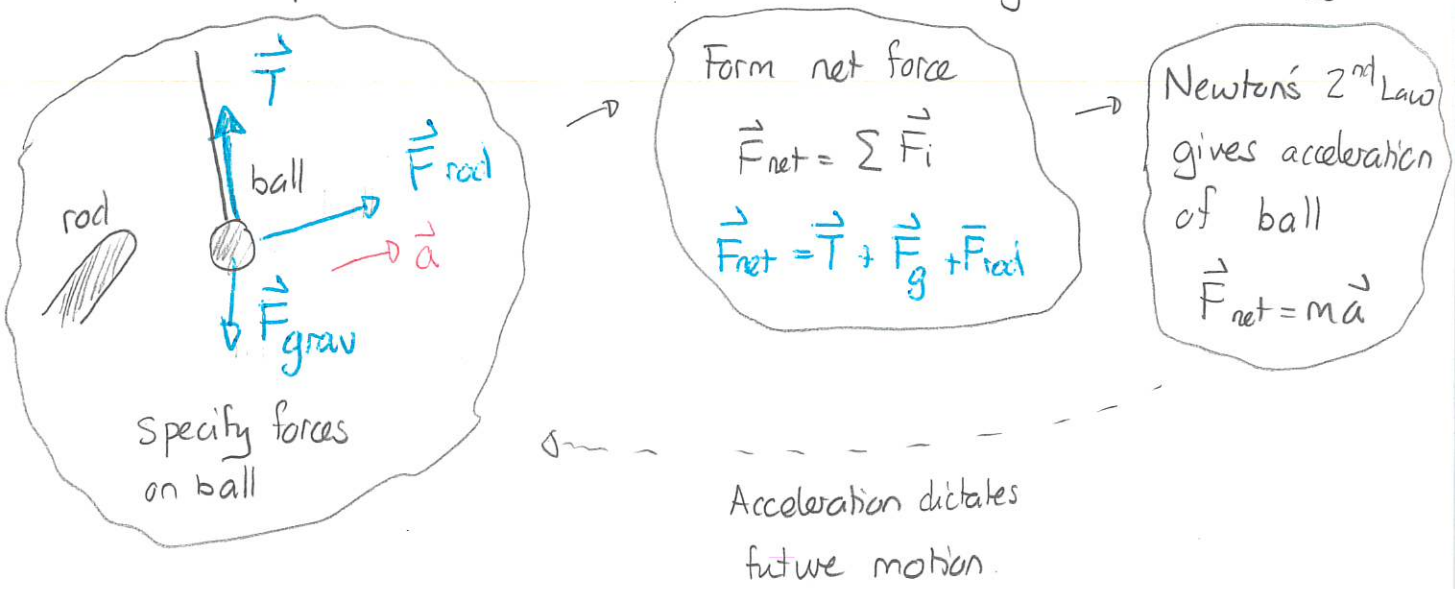
Demo: Suspended Ball + Rod

a) Neutral rod near ball - observe?

b) Rubbed rod " " - observe?

c) Touch + observe.

We can explain this in terms of Newton's system of mechanics



We know how to describe the gravitational force, starting with Newton's Law of gravitation. We also know of other types of forces: tension, spring force,.... We then ask whether the force exerted by the rod is one of these known types of forces.

Quiz!

This is clearly not a gravitational force, nor any of the others encountered in Phys 131. We need a framework for describing such forces.

The basic property that gives rise to such forces is called <u>electric charge</u>. This is a property inherent to certain objects and we will use it to describe how objects exert <u>electric forces</u> on each other.

Based on all possible interactions between objects we can conclude that there are two types of electrically charged object:

1) positive charge 

2) negative charge 

Then a basic rule for describing their interactions is:

Particles with like charge repel
Particles with opposite charges attract

For example:

repel 

 force

The study of electromagnetism begins with these interactions. To be more precise these are true when the particles are at rest relative to each other. In this case the forces are called <u>electrostatic forces</u>

<u>Demo</u>: PhET Balloons + Static Electricity.

- Rub balloons — no charges
- show all charges