

Lecture 1

Handouts: * Syllabus

- * Survey - return by Friday
- * Attendance Sheet

Introductory Question

* How does your cellphone communicate with other devices/phones?

- Introduce yourself to neighbors
- Discuss question - what is your answer?
 - what evidence supports your answer?
 - assess neighbors answer

The way in which the phone transmits and receives signals involves

- electromagnetic waves
- moving electric charges / currents.

The branch of physics that addresses how electric charges and currents behave is called electromagnetic theory. This course is mostly about electromagnetic theory and a related branch of physics called optics (study of light).

Course scope

Electromagnetic theory provides a framework that completely explains all interactions between charged particles. This theory:

- 1) is a fundamental branch of physics
- 2) explains a wide range of phenomena
 - a) fundamental particles (e.g. electron)
 - b) atoms / molecules $\leadsto$ chemistry
 - c) materials $\leadsto$ solid state physics
 - d) stellar physics

3) is crucial for understanding + developing technology + scientific instruments

a) electrical devices

↳ Ask class for a list

b) scientific instruments (e.g. MRI, mass spectrometers, photodetectors).

Optics is the study of light and is closely related to electromagnetic theory. This is important for:

- 1) fundamental understanding of nature
- 2) understand interactions between light and matter
- 3) designing and understanding optical instruments (e.g. microscopes).

Phys 132 is a first introduction to these.

Course details

- 1) syllabus + contact
- 2) website / course materials page
- 3) D2L site - contains some material
- 4) Exam dates - deadline for notification about conflicts

This week

Wednesday - Warm Up - reading quiz on D2L (show problems)
- ~~credit~~ graded for completeness 2pts

Friday - HW due by 5pm
- Show where to find problems

Ex 1, 2, 3, 4, 5, 6, 7, 8 10pts

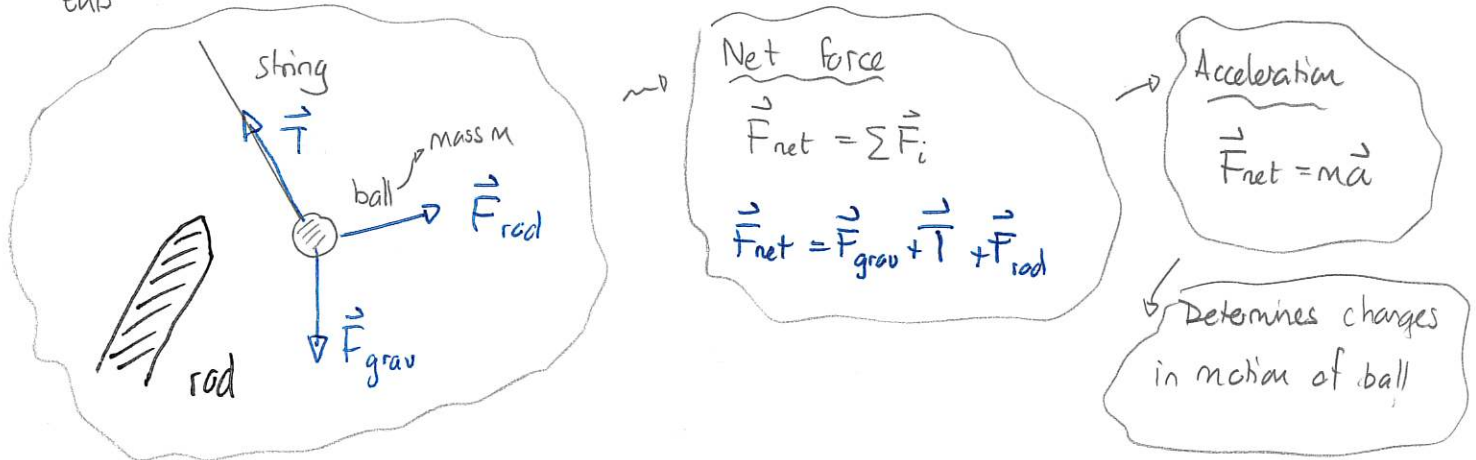
Electric charges and forces

Consider the following demonstration involving specially prepared objects

DEMO: Rod and suspended ball in three situations

- 1) (neutral) rod and ball — observe
- 2) rubbed rod held near to ball — observe
- 3) rubbed rod touches ball — observe.

In the cases 2 and 3 the rod exerts a force on the ball and this causes the ball to accelerate and to begin to move. We could use Newton's mechanics to explain this



But how can we describe these forces? We know that $F_{\text{grav}} = mg$ and points down. What about the force exerted by the rod?

Quiz 1

This is clearly not a gravitational force since it can be repulsive. It is not one of the other types of forces encountered in Phys 131. We need a new force law to describe this

In nature there are objects that exert and experience such forces. These are called electrically charged or are said to possess electric charge. The forces that they exert are called electric forces.

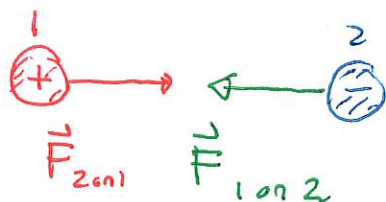
If all possible interactions between such objects are observed, we can classify electrically charged objects as:

- 1) positively charged $\oplus$
- 2) negatively charged $\ominus$

Qualitatively they interact according to :

Particles with like charges repel
Particles " opposite charges attract.

These rules describe the directions of the forces that electrical charges exert.
For example



Quiz 2

In electromagnetic theory we will provide the exact rules for the forces such charges exert and then use the rules to describe many distinct such situations

DEMO: Balloon rubbed + sticks to wall

DEMO: (if time) Physics girl, exploding soda cans