Welcome to Physics 161
Elements of Physics
Fall 2018, Sept 4

Wim Kloet
Lecture 1  TOPICS

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One dimensional motion: learning objectives
Define terms displacement, velocity and acceleration, and apply them to problems involving motion in one dimension.

We will leave Chapter 1 of Serway & Vuille for self study as part of course introduction. I strongly recommend you read this chapter yourself.
Course Web Pages

http://physics.rutgers.edu/ugrad/161/

Check this page regularly.

We post useful information and important course announcements there.

WE WILL NOT USE SAKAI
Lecturer + Administrator

Prof Wim Kloet

Office: 211 Serin Physics (across street from ARC)
Email: kloet@physics.rutgers.edu
Phone: do not use phone

Please don’t hesitate to contact me to discuss any course-related matters.

Come to my office hour Thursday 12-1:30pm. If you cannot make that time, email me to make an appointment.
Textbook

College Physics
By Serway and Vuille, 11th edition.

See the course website for instructions on how to purchase this book.

Important: Please be sure to also purchase access to the online WebAssign homework.
iClicker

iClicker, a student response device, must be purchased and is needed in lectures.

iClicker+ or iClicker 2 will work.

The “iClicker Go” app will not work.

Go to the course home page to see how to register your device.

The iClicker will be used for answering questions during lectures. 4% of your final grade is based on lecture participation.

You are not allowed to use someone else's iClicker!
iClicker

iClicker, a student response device, must be purchased and is needed in lectures.

reasons we will use the iClicker:

1. You will do better in your exams.
1. You will remember the material better.
1. You will understand the material better.
1. I need your feedback.
ICLICKER REGISTRATION

http://www.iclicker.com/registration/

Questions:

Class software: Iclicker Classic

No Learning Management System (LMS)

Name and ICicker Code
ICLICKER QUESTION

DID YOU HAVE PHYSICS BEFORE?

a. NO
b. YES, AS PART OF GENERAL SCIENCE
c. YES, AS PART OF CHEMISTRY
d. YES, AS PHYSICS COURSE
Syllabus and Slides

The syllabus can be found on the course website.

For each lecture the syllabus lists the topic and the sections of the textbook that will be covered.

Read the material from the textbook before coming to lecture. You’ll get a lot more out of the lecture.

I will post the slides from lectures online.

Taking notes is encouraged.
SYLLABUS 161
Lectures

Reasons to attend lectures:

1. Demonstrations

1. Worked problems similar to those in homeworks and on the exams. These solutions will not appear online.

1. 4 % of your grade is associated with participation.

1. Demonstrations that don’t work.
Homework

Homework will be assigned online using the computer graded assignment system called WebAssign. See the course home page for details.

Homework will be due
Fridays at 5:00 pm sharp.
Late homework will not be accepted.

Homework will count for 15% of the course grade. The lowest homework grade will be dropped.

The first homework assignment will be due on Friday, September 14.
Labs

There will be a 3-hour lab meeting each week. Please check your registration to see your section number and time.

Each lab period will consist of:

· discussion of some problems due on Friday
· quiz on the recent material discussed in the course
· 2-hour lab: pre-lab questions, introduction and lab report writing

You will receive a lab grade based on your participation, quiz and lab report.

All labs meet in Room 232 Serin Physics.

Before coming to lab please print out the lab manual and lab report form for that week. These can be found on the course web page. Paper copies will not be available in the labs. Please be sure to read the lab manual before lab.
Exams

There will be three exams.

- Exam 1: Thursday October 18 from 10:00 to 11:20 PM
- Exam 2: Thursday November 15 from 10:00 to 11:20 PM
- Final exam: Wednesday December 19, 12:00pm

You must attend these exams unless you have a valid excuse. For an excuse due to illness, you must provide a doctor’s note. Only legitimate conflicts as defined by university regulations will be allowed. If you believe that you have an exam conflict, please contact me as soon as possible.
Grading (gradebook)

Course grades will be assigned as follows:

1st exam: 15%
2nd exam: 15%
Final exam: 30%
Homework: 15%
Lab: 21%
PRS: 4%
Office Hours

The lab instructors and myself will hold regularly scheduled office hours.

The times and locations of these office hours will be announced on the course web page.
Students with disabilities

The Physics Department maintains a webpage for students with disabilities

http://www.physics.rutgers.edu/ugrad/disabilities.html

Please get in touch with me if you require any accommodations.

More information and support is available at the Office of Disability Services

https://ods.rutgers.edu/
Special Tutoring Session

Prof. William DeBuvitz, a retired physics professor, will hold special tutoring sessions on Friday from 10:00 to noon in room Serin-232, (where the lab sessions meet).

Tutoring sessions start on September 14.

Bill is an excellent teacher and has been quite popular in the past. Please take advantage of help, particularly if you are having difficulty with any of the course material. It is never too early.
Actual Physics*

*The next few slides are background information and will not be on the exam.
Development of Physics

Classical Physics (pre 1905)
- Newtonian Mechanics
- Thermodynamics
- Electromagnetism

Modern Physics (post 1905)
- Quantum Mechanics - the physics of the very small
- Relativity - the physics of the very fast

Atomic physics
Condensed matter physics
Nuclear physics
Elementary particle physics
Cosmology

Not on the exam.
This course covers Classical Physics (pre 1905)
- Newtonian Mechanics
- Thermodynamics
- Electricity

This course has not enough time for Modern Physics (Atoms, electrons, protons, neutrons)
Newtonian Mechanics

Developed by Isaac Newton in 1687

Describes motion of macroscopic objects

Works quite well for
- low speeds \( (v<<c) \),
- large objects \( (x>>\text{atomic size}) \),

Basically, things that we observe in our everyday lives.
Space and Time

Our universe has three spatial dimensions.
- must specify three numbers to say “where”

Our universe has one time dimension.
- must specify one number to say “when”

In Classical Physics space and time are separate.

Einstein showed in his theory of relativity that space and time are mixed together and are actually different aspects of the same thing, spacetime.

Not on the exam.
One-dimensional Motion

One dimensional motion: CONCEPTS

DISPLACEMENT \( (x) \).

VELOCITY \( (v) \).

ACCELERATION \( (a) \).

You will be able to define the terms displacement, velocity and acceleration, and apply them to problems involving motion in one dimension.
One dimensional motion

Diagrams are standard ways to visualize problems.

e.g. train on straight track, elevator, falling stone, etc.
Displacement $\Delta x$

Displacement: The distance and direction between a particle’s final position and its initial position.

$$\Delta x = x_f - x_i$$

Displacement can be either positive or negative depending on whether $x_f$ is to the right or left of $x_i$.

Displacement ($\Delta x$) is not the same as distance ($d$). Distance has only a magnitude (size).
Problem: total displacement

What is the total displacement of a particle that moves left from the origin \((x = 0 \text{ m})\) for 10 m and then right 2.5 m?
Average velocity

Velocity specifies the speed at which the particle is moving and the direction, which is either positive (to the right) or negative (to the left).

Average velocity (between two times):
Displacement divided by the difference of the times

\[ \overline{v} = \frac{\Delta x}{\Delta t} = \frac{x_f - x_i}{t_f - t_i} \]

Velocity is not the same as speed. Speed has only a magnitude (size).
Average velocity:

\[ \bar{v} = \frac{\Delta x}{\Delta t} = \frac{x_f - x_i}{t_f - t_i} \]

Slope of the line connecting the initial and final points.
Instantaneous velocity (at a particular time): The limit of the average velocity as the time interval vanishes, or $\Delta t \to 0$.

\[
v = \lim_{\Delta t \to 0} \frac{\Delta x}{\Delta t}
\]

This is called taking the derivative.

\[
v = \lim_{\Delta t \to 0} \frac{\Delta x}{\Delta t} = \frac{dx}{dt}
\]

The slope is the tangent to the curve.
Average and instantaneous velocity

\[ v = \text{slope between two points} \]

\[ v = \text{tangent at a point} \]

\[ \bar{v} = \text{slope between two points} \]
Average acceleration

Acceleration specifies:
the rate at which the velocity changes and
the direction of that change, which is either positive
(to the right) or negative (to the left).

**Average acceleration (between two times):**
change in Velocity divided by the change in time.

\[
\bar{a} = \Delta v / \Delta t = \frac{v_f - v_i}{t_f - t_i}
\]

Acceleration does not have to have the same
direction (sign) as the velocity!
Instantaneous acceleration (at a particular time): The limit of the average acceleration as the time interval vanishes, or $\Delta t \to 0$. 

\[ a = \lim_{t \to 0} \frac{\Delta v}{\Delta t} \]

The slope is the tangent to the curve.
Average and instantaneous acceleration

\[ v \text{ (m/s)} \]

\[ t \text{ (s)} \]

\[ \alpha = \text{tangent at a point} \]

\[ v_i \]

\[ v_f \]

\[ \Delta t \]

\[ \Delta v \]

\[ \bar{\alpha} = \text{slope between two points} \]
Problem: velocity

In what kind of motion does the average velocity equal the instantaneous velocity?
Problem: velocity

\[ v = \text{tangent at a point} \]

\[ \bar{v} = \text{slope between two points} \]

$x (m)$

$x_f$

$v = \Delta x / \Delta t$

$x_i$

$t_i$

$t_f$

$t (s)$