Physics 211
Elementary Physics
Fall 2012

Instructor: Dr. Geoffrey Lovelace
Sections 1 & 70

Lecture 1 — 8/28/12

I. Introduction

- A. A little bit about me
- B. Syllabus
- C. What is physics?

II. Orders of magnitude

- A. Powers of 10
- B. Order of magnitude estimate
- C. Length scales
- D. Powers of 10 video

III. Assignments

- A. No homework today
- B. Class participation: 1 thing you look forward to, 1 question/concern/dislike

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Lecture 2 — 8/30/12

I. Survey results

A. Looking forward to…

B. Questions & concerns

II. Measurement

A. Units & unit conversion

B. Uncertainty & significant figures

III. Assignments

A. Homework #1 posted on Mastering Physics website (due Sept. 6, 11:59PM)

B. Next week: chapter 2 of Wilson, Buffa, & Lou

C. Class participation: math survey

Physics 211
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Lecture 3 — 9/4/12

I. Introduction to Kinematics = How Things Move

A. Scalars: Distance, average speed, instantaneous speed

B. Vectors: Displacement, average velocity, instantaneous velocity

C. Problem solving strategy & worked example: was I speeding?

D. Vector: average, instantaneous acceleration

II. Plotting position, velocity and acceleration

A. Position vs. time

B. Velocity = slope of position vs. time

C. Acceleration = slope of velocity vs. time

D. Demo: motion sensor: student walking, running, basketball

III. Assignments

A. Reminder: Homework #1 due Thursday, September 6 at 11:59PM

B. Next class: remainder of chapter 2: free fall, more motion

C. Class participation: position graph clicker question

Physics 211
Elementary Physics
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Lecture 4 — 9/6/12

I. Constant acceleration motion & freefall

A. Freefall demo: feather & penny drop (http://physics.fullerton.edu/department/lecture-demos/96)

B. Kinematic equations for constant acceleration

C. Worked example: Mario Kart

II. Math review: trig

A. sin, cos, tan, and "SOH-CAH-TOA"

B. Pythagorean theorem

III. Assignments

A. Reminder: Homework #1 due Thursday, September 6 at 11:59PM

B. Homework #2: assigned today, due in 1 week, September 13 at 11:59PM

C. Next week: more kinematics, start 2D motion (chapter 3)

D. Class participation: a trig identity

Physics 211
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Lecture 5 — 9/11/12

I. Trigonometry review

A. SOH-CAH-TOA

B. Pythagorean theorem & a trig identity

II. More constant acceleration in 1D

A. Example: Ball toss

B. Group problem: stopping distance

III. Intro to 2D motion

A. Geometric vector addition ("tip to tail")

B. 2D motion reduces to 2 independent 1D problems

C. Projectile demo: ball toss on a train (http://physics.fullerton.edu/department/lecture-demos/96)

IV. Assignments

A. Reminder: homework #2 due Thursday at 11:59PM

B. Exam #1: in 2 weeks, covers chapters 1-3. (We are now going through Ch. 3.)

C. Class participation: ranking vector sums

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Lecture 6 — 9/13/12

I. "Speed" bus jump

II. Vector components & addition by components

A. Components <===> magnitude, direction: the trig you will need

B. Addition by components

C. Worked example: vector addition

III. Projectiles

A. When velocity, acceleration not parallel, motion is along a curve

B. Projectile: horizontal: uniform motion, vertical: freefall

C. Demo: monkey shoot

IV. Assignments

A. Reminder: homework #2 due today at 11:59PM

B. Homework #3 assigned today: due in 1 week

C. Exam #1: 2 more classes remain before first exam

D. Class participation: opinion survey #2

E. Reading: to end of chapter 3

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Lecture 7 — 9/18/12

I. Survey results

II. More projectiles

A. Demo: simultaneous fall

B. More examples: shot-put, archer fish

C. Features of projectile motion

1. Visualize position, velocity, acceleration

2. Hang time

3. Worked example: range vs. angle

III. Assignments

A. Reminder: homework #3 due Thursday at 11:59PM

B. Exam #1: 1 more class remains before first exam

C. Class participation: Concept you are feeling most confident about, least confident about; do you like whiteboard or slides better for examples?

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Lecture 8 — 9/20/12

I. Relative velocity

A. Example: "Star Wars" bike chase showing different frames of reference

B. Calculating relative velocities: application of vector addition

II. Introduction to the laws of motion

A. Force = vector = something capable of giving an object acceleration

B. Net force = vector sum of all forces acting on an object

C. Mass = resistance to acceleration

C. Newton's first law: if net force is zero, velocity constant & acceleration zero

D. Newton's second law: a=Fnet/m

E. Example: projectile motion

III. Assignments

A. Exam #1: Tuesday (next class period)

B. Homework #3: due 11:59PM tonight

C. Homework #4: assigned today

D. Class participation: make a wish for what you would like on the formula sheet

E. Reading: continue chapter 4

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Lecture 9 — 9/27/12

I. Newton's first and second laws of motion: conceptual

A. Newton's first law (demo: air puck)

B. Normal force

C. Newton's second law (demo: inclined air track)

II. Newton's third law of motion: conceptual

A. Forces come in pairs of equal magnitude and opposite direction

B. These forces act on *different* objects

C. Newton's third law (demo: push off the wall, WALL-E fire extinguisher video)

III. Assignments

A. For next week: continue reading chapter 4, about free-body diagrams

B. Homework #4: due 11:59PM tonight

C. Homework #5: assigned today

D. Class participation: just your name (ran out of time to pose the planned question)

E. Midterm Exam #1 results

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Elementary Physics
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Lecture 10 — 10/02/12

I. Summary & review: Newton's laws of motion

II. Forces: weight & normal force, string tension

A. Weight & normal force: flat vs. inclined surface

B. String tension, pulleys

III. Quantitative examples

A. Example 4.3: pulling blocks connected by a string

B. Example: Atwood's machine

C. Demo: Atwood's machine on a slope: funicular train up a mountain

IV. Assignments

A. Homework #5 due: 11:59PM Thursday

B. Class participation: climbing the rope clicker question

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Elementary Physics
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Lecture 11 — 10/04/12

I. More quantitative second-law problems

A. Free-body diagrams

B. Worked example: Atwood machine & ramp

II. Friction

A. How friction works

B. Static & kinetic ("sliding") friction

III. Assignments

A. Homework #5: due today at 11:59PM

B. Homework #6: assigned today

C. Class participation: free-body diagram question

D. Reading: finish chapter 4, start chapter 5

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Elementary Physics
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Lecture 12 — 10/09/12

I. Class participation Followup: free-body diagram

II. Group problem: free-body diagram problem with friction (Ex. 4.11 from text)

III. Homework followup

A. Kinematic equations apply for constant acceleration only

B. Newton's third law recap

IV. Assignments

A. Homework #6: due Thursday at 11:59PM

B. Class participation: free-body diagram worksheet

C. Reading: chapter 5

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Elementary Physics
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Lecture 13 — 10/11/12

I. Work & energy

- A. Work with constant force
- B. Variable force example: mass on a spring
- C. Work-energy theorem

II. Kinetic energy

III. Introduction to conservation of energy

- A. Demo: lightning bolt video
- B. Example: food, lightbulbs

IV. Assignments

- A. Homework #6: due today at 11:59PM
- B. Class participation
- C. Reading: chapter 5

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Lecture 14 — 10/11/12

I. Positive and negative work

II. Potential energy

III. Conservation of energy

A. Demo and examples: Wheaties, migrating birds, ball bounce

B. Quantitative example: ball toss

IV. Assignments

A. Homework #7: due Thursday at 11:59PM

B. Class participation: most & least confident going into the exam

C. Reading: finish chapter 5

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Lecture 15 — 10/11/12

I. Conservation of energy

A. Demo & example: pendulum

B. Examples: colliding black holes & roller coaster

C. Conceptual questions

II. Power

A. Examples: light bulbs, humans, horses, computers

B. Conceptual questions

III. Assignments

A. Homework #7: due today at 11:59PM

B. Class participation: Atwood free body diagram

C. Reading: start chapter 6 for Thursday

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Elementary Physics
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Lecture 16 — 10/25/12

I. Linear momentum

- A. Definition
- B. Force & impulse
- C. Conservation of linear momentum
- D. Collisions

II. Demos

- A. Gun recoil
- B. Colliding black holes
- B. Rocket

III. Assignments

- A. Homework #8: due Nov. 1 at 11:59PM
- B. Reading: continue chapter 6
- C. Class participation: favorite, least favorite demos

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Elementary Physics
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Lecture 17 — 10/30/12

I. Demos

A. Big rocket demo

B. Newton's cradle

II. More linear momentum

A. Recap: linear momentum, impulse, Newton's second law

B. Conservation of linear momentum

III. Collisions

A. Momentum is conserved

B. Elastic & inelastic

C. Example problems

IV. Assignments

A. Homework #8: due Nov. 1 at 11:59PM

B. Class participation: none

C. Reading: finish chapter 6 for Thursday

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Elementary Physics
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Lecture 18 — 11/01/12

I. Linear momentum wrapup

A. Center of mass

B. Completely inelastic collisions (see also piazza note posted 11/01/12)

C. Elastic collisions revisited: double-ball-bounce quantitative example

II. Assignments

A. Homework #8: due today at 11:59PM

B. Class participation: Atwood free body diagram

C. Reading: start chapter 7 for Thursday

Physics 211
Elementary Physics
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Lecture 19 — 11/06/12

I. Exam #2 followup

II. Angular motion

A. Arc length, radians & degrees, small angles

B. Angular displacement

C. Angular velocity & tangential velocity

II. Circular motion

A. Period & frequency

B. Centripetal acceleration

C. Examples and demos (bicycle wheel & tennis ball on string)

III. Assignments

A. Homework #9: due Tuesday, 11/13 at 11:59PM

B. Class participation: angular velocity, tangential velocity of earth

C. Reading: start continue chapter 7 for Thursday

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Elementary Physics
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Lecture 20 — 11/08/12

I. Angular motion wrap-up

A. Period and frequency

B. Angular acceleration, angular kinematics

II. Gravitation

A. Newton's law of gravitation

B. Gravitational potential energy

C. Escape velocity

III. Assignments

A. Homework #9: due 11/13 at 11:59PM

B. Reading: finish chapter 7 for Thursday

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Elementary Physics
Fall 2012

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Sections 1 & 70

Lecture 21 — 11/13/12

I. Kepler's laws of planetary motion

A. Gravitation recap

B. First & second laws

C. Third law & quantitative example

II. Thermodynamics special

A.Temperature

B. Heat

C. Entropy

III. Assignments

A. Homework #9: due today at 11:59PM

B. Class participation: most, least looking forward to going into exam

C. Reading: after break, will start chapter 8

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Elementary Physics
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Lecture 22 — 11/27/12

I. Exam followup

II. Introduction to rigid body motion

A.Rigid bodies

B. Rolling without slipping

C. Torque

D. Equilibrium

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Elementary Physics
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Lecture 23 — 11/29/12

I. Class participation followup: direction of velocity, acceleration, angular velocity, angular acceleration

II. Rigid body motion

A. Stable equilibrium

B. Rotational dynamics

1. Moment of inertia

2. Example: opening a door

C. Rotational work and kinetic energy

D. Example: automotive torque and power

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Lecture 24 — 12/04/12

I. Exam followup

II. Angular momentum

- A. Definition
- B. Conservation
- C. Examples and demos

III. Bonus examples

- A. Rotational energy / power /work
- B. Torque
- C. Rotational dynamics

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Lecture 25 — 12/06/12

I. Exam followup

II. Simple harmonic motion (SHM)

A.SHM, amplitude, period, frequency, energy

B. Connection to uniform circular motion

C. Demo & examples: mass on a spring & others

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Lecture 26 — 12/11/12

I. Simple harmonic motion wrapup

- A. Equations of motion
- B. Damped harmonic motion

II. Wave motion

- A. Definitions
- B. Examples

III. Student Opinion Questionnaires (SOQs)

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Lecture 27 — 12/13/12

I. Exam followup

II. Wave motion wrapup

A. Transverse vs. longitudinal

B. Interference

III. Gravitational waves & black holes

IV. Class participation followup: survey results, grandfather clock clicker question