

## PHYSICS 1 (ETR6): Course Syllabus

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 Office Hours: Thursday 1:30 - 3:00, or by appointment

Lecture: Tuesday, Thursday 6:30-7:45; Room 2143N  
 Recitation: (A&B) Tuesday 5:30-6:20; 2143N  
 (C&D) Thursday 5:30-6:20; 2143N  
 Lab (2408N): (A) Thu. 3:40-6:25; (B) Thu. 8:00p-10:45p;  
 (C) Tue. 3:40-6:25; (D) Tue. 8:00p-10:45p.

Physics 1 Website: <http://academic.brooklyn.cuny.edu/physics/liu/phys1>

## Goals of This Course

To introduce students to basic concepts of physics.  
 To let students acquire the ability to apply theories and equations to problem solving.  
 To let students develop reasoning skills.

I'd like you to take something away from this course.

I need your help in achieving these goals. You need to put in some effort.

If we can achieve these goals together, you'll get good grades.

## How To Do Well In This Class

**Be responsible.** Attend all classes. Pay attention in class. Study the textbook before each chapter/section begins. Understand the material and ask questions when you don't. Read and re-read the textbook after each chapter is finished. Pay attention during lab experiments and turn in reports on time.

**Practice problem solving.** Do the assigned homework and make a habit of writing down your solutions step by step. Explain every step you make. (Important! This helps you spot your own mistakes.) Study unassigned textbook problems and study the solutions posted on the course website. If necessary, go back to certain sections of the textbook and read them over carefully. Attend the recitation class, and don't be afraid to ask questions. If you need help, come see me or, if the need is extensive, inquire at the Learning Center.

**Do well in exams.** Pay attention to what will be covered in each exam. Study hard for your exams. Read the exam problems carefully. Be neat and clear on the exam paper.

## Syllabus (Cont.)

### Textbooks:

Serway & Faughn, *College Physics*, 8th Edition (Brooks/Cole)  
 Laboratory Manual, Physics 1, 1.2, and 1.5, Brooklyn College

**General Comments:** Basic concepts of mechanics and thermodynamics are covered. Students will be asked not only to understand basic concepts but also to be able to apply them to solve standard problems. Memorization of equations is not emphasized. Practicing problem solving is essential to succeed in this course.

**Attendance:** Will be taken randomly during lectures and recitation classes. No points will be deducted from scores of students with poor attendance. However, students with good attendance records will be put on a more favorable distribution "curve" for their final exam scores.

## Syllabus (Cont.)

**Exams:** There will be 3 scheduled lecture exams and a final exam. Please bring your calculator to these exams. Relevant equations will be provided during all the exams. No makeup exams will be given. Absences from exams must be excused by the lecturer or a grade of zero will be assigned. Generally, a doctor's note is required for an absence due to illness. Any cheating on exam will result in a zero for that exam. Graded lecture exams will be returned to the students, usually at the following lecture. Returned exams uncollected in one week will be discarded. The final exam will be kept at the physics department for record.

**Grades:** will be based on lecture exams (10%, 20%, 20%), final exam (35%), and laboratory work (15%). However, to pass this course you must receive a passing grade for laboratory. The letter grades will be based on class distribution, but will not be lower than the conventional grade system. For example, a student scoring 90 will get at least an A-, even if the class average is over 90.

\*Transparent scoring system \*Students have full control

## Syllabus: (Cont.)

Tuesday 6:30-7:45 PM	Thursday 6:30-7:45 PM
1/27 Chap 1	1/29 Chap 2
2/3 Chap 2/3	2/5 Chap 3
2/10 Exam 1 (Chaps 1-3)	2/12 --
2/17 Chap 4	2/19 Chap 4
2/24 Chap 5	2/26 Chap 5
3/3 Chap 6	3/5 Chap 6
3/10 Chap 7	3/12 Chap 7
3/17 Chap 8	3/19 Chap 8
3/24 Chap 9	3/26 Exam 2 (Chaps 1-8)
3/31 Chap 9	4/2 Chap 9
4/7 Chap 13	4/9 --
4/14 --	4/16 --
4/21 Chap 13	4/23 Chap 14
4/28 Chap 14	4/30 Chap 10
5/5 Exam 3 (Chaps 1-9,13,14)	5/7 Chap 11
5/12 Chap 12	5/14 Review
5/19 Final Exam (Ch. 1-14) 6:00P-8:00P	

### General Laboratory Guidelines

1. Students should read the manual about each week's experiment before coming to lab.
2. Students should come to lab on time.
3. Students should remain in lab sessions for full duration.
4. Follow safety procedures and safeguard laboratory equipment.
5. Students may be grouped for experiments. However, all students in one group are required to actively participate in the experiments.
6. Lab reports should be prepared by students individually and according to the instructor's specification. They should be submitted on time.
7. Three or more missed labs (or lab reports) will result in failed lab.
8. Students should make every attempt to attend the lab session they are assigned to. In the event that a student cannot attend a particular lab at the assigned time, it is the responsibility of the student to make up missed labs, with permissions from the lab instructors. Reports for missed lab should be submitted to the student's regular lab instructor.

### Location of Homework Solution

This URL address is not linked from any of the web pages on our website. It does not appear on our lecture viewgraph set either.

So you need to write this down by hand.

### The Nature of Physics

Physics is a study of nature. Physical laws are based on experimental observations.

Physical laws describe wide-ranging phenomena. (Beware of limits)

- The goal of physics is to understand and predict how things work by developing theories based on experiments
- A theory is a "guess", expressed mathematically, about how a system works
- The theory makes predictions about how a system should work
- Experiments check the theories' predictions
- Every theory is a work in progress

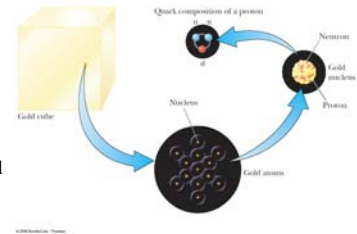
### Matters and Their Interactions

#### Building Blocks of Matter

Atoms are the smallest "units" of different materials.

Each atom is made up of a nucleus and a number of electron(s).

Electrons, protons, and neutrons are made up of quarks.



### Units and Dimensions

- To communicate the result of a measurement for a quantity, a *unit* must be defined
- Basic dimensions in this class: Length, Time, Mass

TABLE 1.5 Dimensions and Some Units of Area, Volume, Velocity, and Acceleration

System	Area (L <sup>2</sup> )	Volume (L <sup>3</sup> )	Velocity (L/T)	Acceleration (L/T <sup>2</sup> )
SI	m <sup>2</sup>	m <sup>3</sup>	m/s	m/s <sup>2</sup>
cgs	cm <sup>2</sup>	cm <sup>3</sup>	cm/s	cm/s <sup>2</sup>
U.S. customary	ft <sup>2</sup>	ft <sup>3</sup>	ft/s	ft/s <sup>2</sup>

Textbook uses SI units: meter (m), kilogram (kg), second (s)



### Dimensional Analysis

Dimensional analysis can be used to check for errors in equations and calculations. (If the dimensions don't agree, the equation must be wrong).

- Dimensions (length, mass, time, combinations) can be treated as algebraic quantities
  - add, subtract, multiply, divide
- Both sides of equation must have the same dimensions
- Each term in addition or subtraction must have the same dimensions
- Cannot give numerical factors: this is its limitation

Examples:  $E = 1/2 mv^2 + 3 gh$   
 $m a = F t$

### Conversion of Units

Carry units like algebraic quantities.

$$\frac{3.5 \text{ cm/s} \cdot 2.0 \text{ cm}}{10 \text{ g}} = 0.70 \text{ cm}^2 \text{ s}^{-1} \text{ g}^{-1}$$

Two sides of a conversion equation can be divided into each other to make unity. Unity can then be multiplied as needed.

$$1 \text{ mile} = 1609 \text{ m} = 1.609 \text{ km}$$

$$\frac{1 \text{ mile}}{1609 \text{ m}} = 1 = \frac{1609 \text{ m}}{1 \text{ mile}}$$

Can express Greek prefixes with their mathematical equivalents.

Power	Prefix	Abbreviation
10 <sup>-18</sup>	atto-	a
10 <sup>-15</sup>	femto-	f
10 <sup>-12</sup>	pico-	p
10 <sup>-9</sup>	nano-	n
10 <sup>-6</sup>	micro-	μ
10 <sup>-3</sup>	milli-	m
10 <sup>-2</sup>	centi-	c
10 <sup>-1</sup>	deci-	d
10 <sup>1</sup>	deka-	da
10 <sup>3</sup>	kilo-	k
10 <sup>6</sup>	mega-	M
10 <sup>9</sup>	giga-	G
10 <sup>12</sup>	tera-	T
10 <sup>15</sup>	peta-	P
10 <sup>18</sup>	exa-	E

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55. How many seconds are there in one year?

### Uncertainty in Measurement & Significant Figures

A significant figure is a reliably known digit (other than zeros used to locate a decimal point).

• All non-zero digits are significant

• Zeros are significant when

- between other non-zero digits: 12.204
- after the decimal point and another significant figure: 0.1500
- can be clarified by using scientific notation: 16000?

When multiplying or dividing two or more quantities, the number of significant figures in the final result is the same as the number of significant figures in the least accurate of the factors being combined.  $4.23 \text{ m} \times 15.732 \text{ m} = 66.54636 \text{ m}^2$

When adding or subtracting, round the result to the smallest number of decimal places of any term in the sum.  $14.42 \text{ kg} + 432 \text{ kg} = 446.42 \text{ kg}$

### Order of Magnitude Calculations

Useful in the old days when there were no electronic calculators.

Useful today for very rough estimates and for error checking.

Use the first digit of a number: convert 1-3 down to 1 and convert 4-9 up to 10.

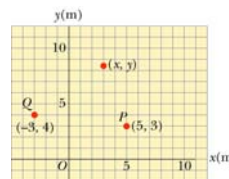
760 becomes 1000 (10<sup>3</sup>), 20 becomes 10 (10<sup>1</sup>), 0.05 becomes 0.1 (10<sup>-1</sup>).

(760 x 20 x 0.05 is estimated to be 10<sup>3</sup>)

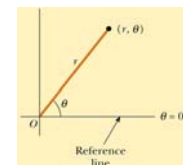
### Coordinate Systems

A coordinate system allows the locations (of objects) to be identified relative to the origin and a set of specified axes or directions. In two dimensions,

Cartesian coordinate system (x, y)



Polar coordinates (r, θ)



Conversion:  $r = \sqrt{x^2 + y^2}$      $x = r \cos \theta$   
 $\theta = \arctan(y/x)$      $y = r \sin \theta$

### TRIGONOMETRY

$\sin \theta = \text{opposite side} / \text{hypotenuse}$

$\cos \theta = \text{adjacent side} / \text{hypotenuse}$

$\tan \theta = \text{opposite side} / \text{adjacent side}$

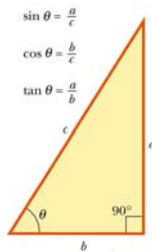
Since " $\sin^2 \theta + \cos^2 \theta = 1$ " is a mathematical identity, it follows that

$$(a/c)^2 + (b/c)^2 = 1$$

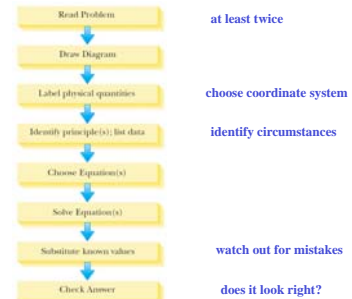
Therefore,

$$a^2 + b^2 = c^2$$

Pythagorean Theorem



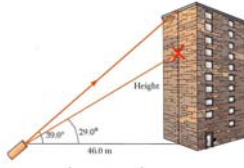
### Problem Solving Strategy



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### Examples

A person attempts to measure the distance between the top of a building and a mark "X" on its side. He walks out a distance of 46.0 m from the base of the building and shines a flashlight beam toward the building. He finds that when the beam is elevated at an angle of  $39.0^\circ$  with respect to the horizontal, the beam just strikes the top of the building. When the beam is  $29.0^\circ$  above the horizontal, it hits the spot "X". What is the distance between the top of the building and spot "X"?



In the above question, does it matter how high above the ground the flashlight is? For example, will the answer be different if the flashlight is held in the person's hand (1m above ground) or placed at the ground level?

### Review of Chapter 1

Physical laws are based on experimental observations.

Units of measurement; Conversion; Dimensional analysis.

Significant Figures.

Order of Magnitude Calculations.

Coordinate Systems.

Trigonometric functions and Pythagorean theorem.