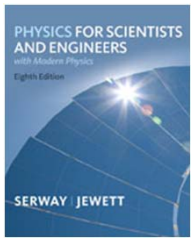
PHY 114 A General Physics II
11 AM-12:15 PM TR Olin 101

Plan for Lecture 1:

1. Welcome & overview
2. Class structure & announcements
3. Electrical charges and forces

PHY 114 A General Physics II
11 AM-12:15 PM TR Olin 101

Instructor: Natalie Holzwarth (Olin 300)
Course Webpage: http://www.wfu.edu/~natalie/s12phy114



Webpage for Webassign system:
http://www.webassign.net/

You will also need an
i-clicker device for each class

Where to find information about the course on the web:

PHY 114 General Physics II -- Section A

TR 11 AM-12:15 PM | OPL 101 | http://www.wfu.edu/~natalie/s12phy114/

Instructor: Natalie Holzwarth | Phone:758-5510 | Office:300 OPL | e-mail:natalie@wfu.edu

- General information
- Syllabus and homework assignments
- Class notes

HOME | HELP | SEARCH | CONTENTS | CALENDAR | DIRECTORY

Last modfied: Tuesday, 20-Dec-11 13:56:58

Course organization:

Grading:

It is likely that your grade for the course will be determined by the following factors:

3 exams*	45%
Final exam	25%
Problems sets**	15%
Laboratory work***	10%
Quiz****	5%

*In order to relieve exam stress, the lowest exam score will be weighted 5% while the other two exams will be weighted 20%. **Homework sets are processed through Webassign. In general there will one homework set for each lecture. Note that in many cases, there may be extra webassign problems available for practice. These will not count in your grade but may provide additional help with learning the material. Discussion of homework problems among classmates is allowed and encouraged, but all work submitted for grading should represent the student's *own best efforts*. Students are encouraged to keep a notebook or section of a notebook for the algebraic and graphical work associated with each assignment. This notebook will be especially helpful during tutorial sessions, consultations with your instructor, and preparing for exams. The numerical work for your homework must be submitted through WebAssign. After each assignment's "due" time has passed, the correct answers will be available through your Webassign account.

***It is the policy of the Physics Department that satisfactory completion of laboratory work is necessary for earning credit for the course. Laboratories begin meeting on Monday, January 23. Laboratory manuals may be purchased at the Book Store. The Lab scheduling is coordinated by Eric Chapman (Olin 110, email contact).

****Reading assignments for each lecture should be completed before the class meeting. In place of a quiz, within 1 hour before each class, each student should email the instructor one or more thoughtful questions on the course topic. These questions, various iclicker exercises, and other in class quizes will comprise this component of your grade.

Schedule and assignments

Note: This schedule may need to be modified -- please check for changes and additions frequently.

Starting with reading assignment **2**, you are requested to email at least one topical question to your instructor within one hour of the start of class. [If your browser is correctly set up, this is most easily done using the links given in "Text Sections" in the schedule below.] If possible, your question will be addressed during the class lecture. In any case, your mailed question will be recorded for part of your "quiz" grade in the course.

Note that in many of the Webassign problem sets there are some zero point "extra practice" problems set in the assignment for your consideration.

No.	Lecture Date	Topic	Text Sections	Problem Assignments	Assignment Due Date
1	01/19/2012	Coulomb's law	23.1-23.4	23.6,23.8a,23.13	01/24/2012
2	01/24/2012	Electric field	23.4-23.7	23.22,23.20,23.61a	01/26/2012
3	01/26/2012	Gauss's Law	24.1-24.3	24.22a,24.23,24.40	01/31/2012
4	01/31/2012	Electric potential	25.1-25.4	25.12,25.23,25.34,25.01	02/02/2012
5	02/02/2012	Electric potential	25.5-25.8	(Review for exam)	
	02/07/2012	Exam			
6	02/09/2012	Capacitance and dielectrics	26.1-26.7		
7	02/14/2012	Current and resistance	27.1-27.6		
8	02/16/2012	Direct current circuits	28.1-28.2		

Tentative schedule – subject to change (after vote)

Spring 2012 Schedule
for N. A. W. Holzwarth

	Monday	Tuesday	Wednesday	Thursday	Friday
8:00-10:00	Lecture Preparation/ Office Hours	Lecture Preparation/ Office Hours	Lecture Preparation/ Office Hours	Lecture Preparation/ Office Hours	Lecture Preparation/ Office Hours
10:00-11:00	Thermo PHY341/641		Thermo PHY341/641		Thermo PHY341/641
11:00-12:30	Office Hours	General Physics II PHY114	Office Hours	General Physics II PHY114	Office Hourse
12:30-2:00	Condensed Mater Theory Journal Club	Office Hours	Physics Research	Office Hours	Physics Research
2:00-3:30					
3:30-5:00	Physics Research	Physics Research	Physics Colloquium	Physics Research	CEES - Renewable Energy Research

Travel dates:

- **Feb. 27 - Mar. 2, 2012** (March APS meeting -- Boston, MA.)

i-clicker exercise:

When would you prefer to have scheduled office hours? (Note additional meetings with your instructor can always be arranged.)

A. Before class (9-10:30 AM TR)
B. After class (12:15-1:30 PM TR)
C. Evenings 6-7 PM TR
D. Evenings 6-7 PM MWF
E. Other

➔ PHY 114 Labs will start Monday Jan. 23rd and run through the week of April 16th.

➔ PHY 114 Tutorial sessions will also start next week.

General advice on how to learn physics:

- Physics is built on basic principles ("laws") from which all results can be derived (deduced)
- Focus your attention on **understanding** the basic principles
- Practice **using** the basic principles to solve problems
- Take care to **formulate** your questions and make sure they are **answered**

Note: In general, the best way to develop your problem solving skills is to **practice** solving problems. There is less (no ??) need to memorize.

As you are working problems, you may wish to construct a sheet of paper containing the basic equations you need to consult in order to solve the problems. You can take this same basic equation sheet to use during the in-class exams.

Overview --

Important concepts from General Physics I

F = m **a** (force ↔ acceleration)

$K_f + U_f = K_i + U_i + W_{(other)}$ (energy relationships)

Important concepts in General Physics II

General Physics I **is still true**

Electricity & Magnetism

Light

"Modern" Physics

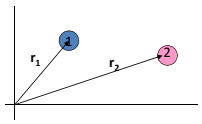
Charging ahead.... (Chap. 23 of S & J)

- Most matter is made up of charged particles
  - labeled + (proton: $q_p = 1.60217733 \times 10^{-19}$ C)
  - labeled - (electron: $q_e = -1.60217733 \times 10^{-19}$ C)
- Coulomb's law describes the electrical force between two charged particles:

$$\mathbf{F} = k_e \frac{q_1 q_2}{|\mathbf{r}_1 - \mathbf{r}_2|^2} \hat{\mathbf{r}}_{12}$$

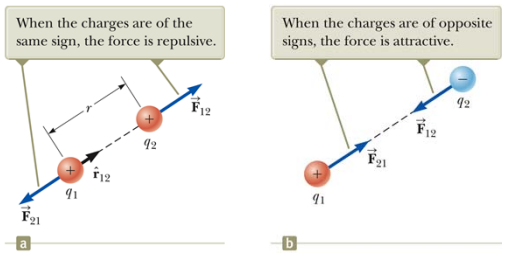
or equivalently:

$$\mathbf{F} = k_e \frac{q_1 q_2 (\mathbf{r}_1 - \mathbf{r}_2)}{|\mathbf{r}_1 - \mathbf{r}_2|^3}$$



Coulomb's law (continued)

$$\mathbf{F} = k_e \frac{q_1 q_2}{|\mathbf{r}_1 - \mathbf{r}_2|^2} \hat{\mathbf{r}}_{12}$$



Coulomb's law (continued)

$$\mathbf{F} = k_e \frac{q_1 q_2}{|\mathbf{r}_1 - \mathbf{r}_2|^2} \hat{\mathbf{r}}_{12}$$

$$k_e \equiv \frac{1}{4\pi\varepsilon_0} \equiv \frac{\mu_0 c^2}{4\pi}$$

$k_e = 8.99 \times 10^9 \ \mathrm{N \cdot m^2 / C^2}$

$\varepsilon_0 = 8.85 \times 10^{-12} \ \mathrm{C^2 / N \cdot m^2}$ (permittivity of free space)

$\mu_0 = 4\pi \times 10^{-7} \ \mathrm{T \cdot m/A}$ (permeability of free space)

$c = 3.00 \times 10^8$ m/s (speed of light in vacuum)

i-clicker exercise:

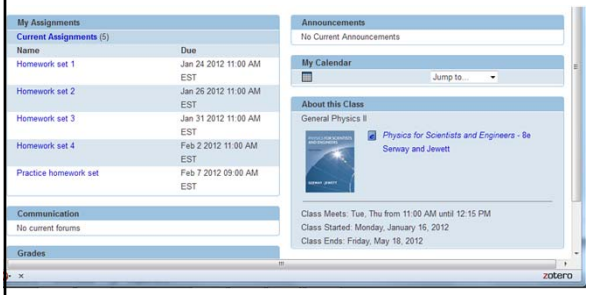
Consider a proton (m_p=1.67x10^{-27} kg; q_p=+1.60x10^{-19} C) and an electron (m_e=9.11x10^{-31} kg; q_e=-1.60x10^{-19} C) separated by 5.29x10^{-11} m. The particles are attracted to each other by both the force of gravity and by Coulomb's law force. Which of these has the larger magnitude?

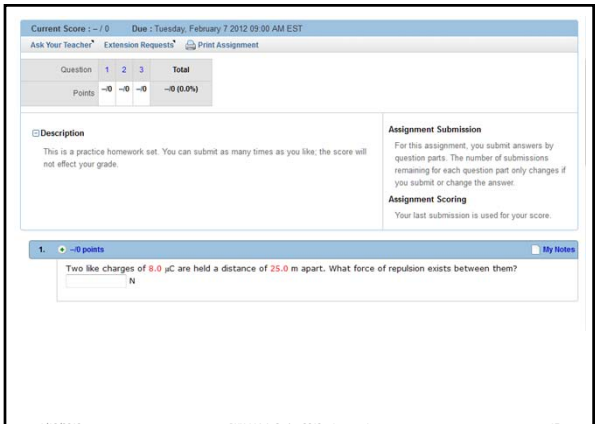
A. Gravitational force
B. Coulomb's law force

Problem solving steps

1. Visualize problem – labeling variables
2. Determine which basic physical principle(s) apply
3. Write down the appropriate equations using the variables defined in step 1.
4. Check whether you have the correct amount of information to solve the problem (same number of knowns and unknowns).
5. Solve the equations.
6. Check whether your answer makes sense (units, order of magnitude, etc.).

Problem example from Webassign:





Two like charges of 8.0 μC are held a distance of 25.0 m apart. What force of repulsion exists between them?

9.21e-4 N

Problem solving steps

1. Visualize problem – labeling variables
2. Determine which basic physical principle(s) apply
3. Write down the appropriate equations using the variables defined in step 1.
4. Check whether you have the correct amount of information to solve the problem (same number of knowns and unknowns).
5. Solve the equations.
6. Check whether your answer makes sense (units, order of magnitude, etc.).

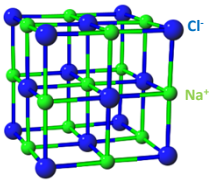
Where do the charges q_i come from?

All matter is composed of nuclei ($q_N = Ze$) and electrons ($q_e = -e$) and generally there are an equal number of positive and negative charges.

cst-www.nrl.navy.mil/lattice/struk.jmol/b1.html

Insulating material

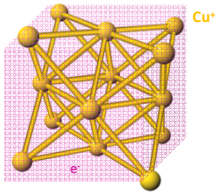
The NaCl (B1) Structure



cst-www.nrl.navy.mil/lattice/struk.jmol/a1.html

Metallic material

The Face-Centered Cubic (A1) Lattice



Note: Coulomb's law applies both at the atomic level and at the macroscopic scale

Example on the macroscopic scale:

In Figure 21-43, two tiny conducting balls of identical mass m and identical charge q hang from nonconducting threads of length L. Assume that θ is small so that the small angle approximation is valid, $\tan\theta \approx \sin\theta$.

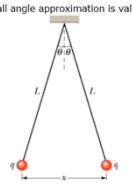
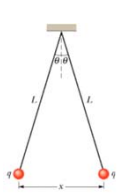
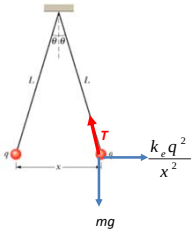


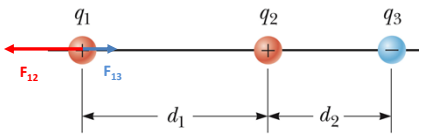
Fig. 21-43

(a) Find an expression for the equilibrium separation x of the balls in terms of the symbols k, q, m, L, g and numeric constants.(HINT: start with a free body diagram.)





Coulomb's law for multiple charges



$$\mathbf{F}_1 = \mathbf{F}_{12} + \mathbf{F}_{13}$$

$$\mathbf{F}_1 = -\frac{k_e \,|\, q_1 q_2 \,|}{d_1^2} + \frac{k_e \,|\, q_1 q_3 \,|}{(d_1 + d_2)^2}$$

i-clicker exercise

Consider the configuration of 4 charges at the 4 corners of a square shown in the diagram. Which vector a,b,c,d, or e (pointing into the screen) indicates the direction of net force on the charge?