PHY 114 B – General Physics II

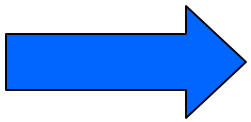
11-11:50 MWF Olin 101

1. **Welcome & overview**
2. **Class structure**
3. **Announcements**
4. **Electrical charges and forces**

Welcome –

Instructor: Natalie Holzwarth

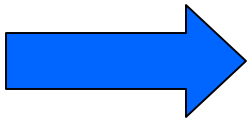
Office: Olin 300



Email: natalie@wfu.edu

Phone: x5510

Office hours – (make an appointment almost any time)



Formulate good questions and seek the answers.

Tentative schedule

Spring 2003 Schedule
for N. A. W. Holzwarth

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
8 -9 AM		Research		Research		Research
9-10	PHY 344 Quantum Physics II		PHY 344 Quantum Physics II		PHY 344 Quantum Physics II	
10-11						
11-12	PHY 114 General Physics II		PHY 114 General Physics II		PHY 114 General Physics II	
12-1 PM	Office hours	Office hours	Office hours	Office hours	Office hours	
1-2	Research	Research	Research		Research	
2-3						
3-4				Physics colloquium		
4-5						
5-6						

Overview --

Important concepts from General Physics I

$\mathbf{F} = m\,\mathbf{a}$ (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

Class structure --

Course webpage: http://www.wfu.edu/~natalie/s03phy114/

Text: Serway and Beichner, **Physics**, Chapters 23-46.

Tentative grading distribution

3 hour exams	45 %
Final exam	25 %
Problem sets (WebAssign)	15 %
Laboratory work	10 %
Quizzes, participation	5 %

Extra credit opportunities

Tentative schedule (subject to change!!)

Start online quiz →

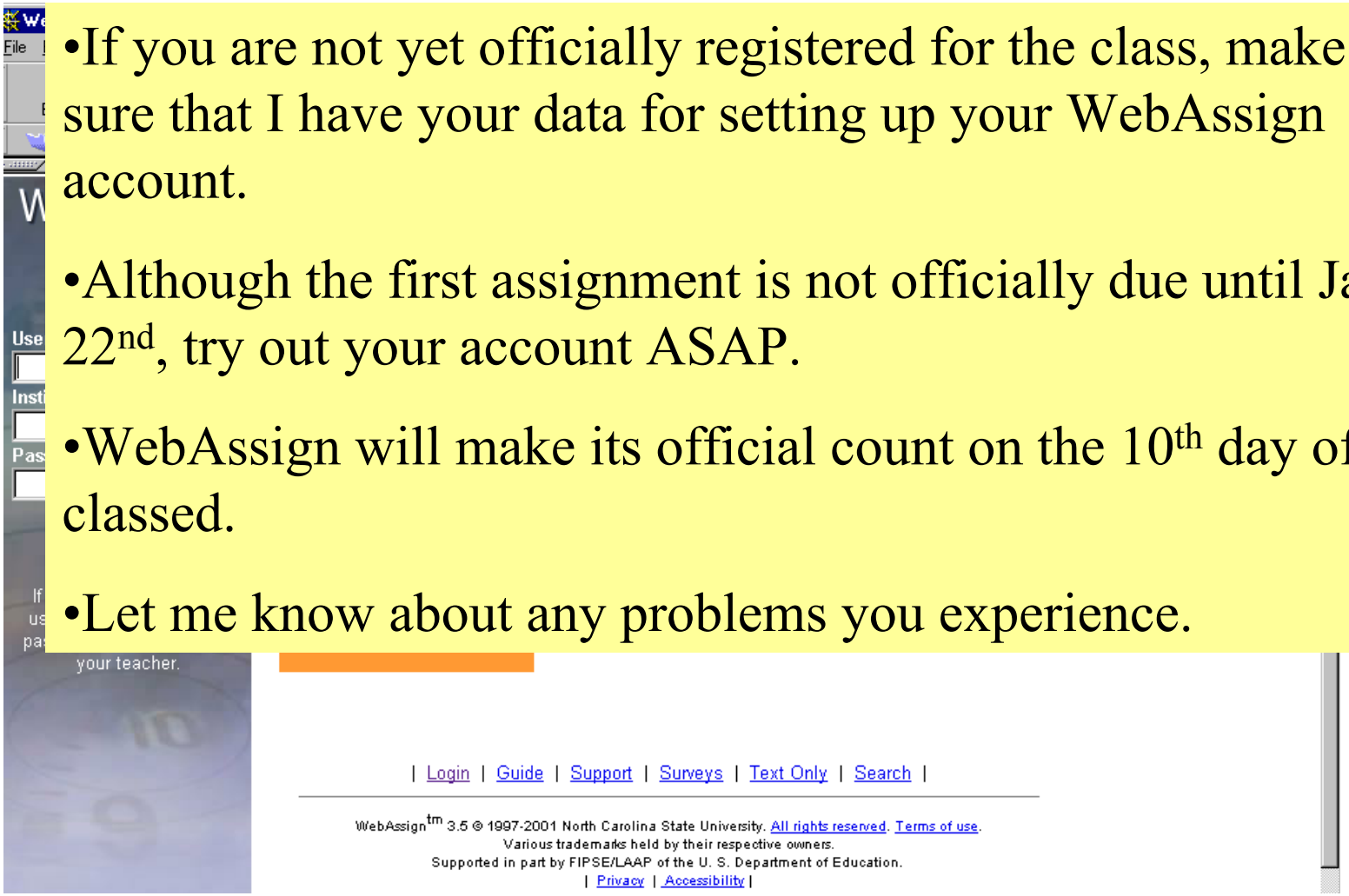
1st HW set @ 5 PM →

WebAssign count

No.	Lecture Date	Topic	Text Sections	Problem Assignments	Assignment Due Date
1	1/15/03	Electrical forces	23.1-23.6	23.2,5,7	1/22/03
2	1/17/03	Electrical field	23.7-24.2	23.15,48,55	1/22/03
	1/20/03	(Martin Luther King Day)			
3	1/22/03	Gauss's law	24.3-24.4	24.5,10,41,58	1/24/03
4	1/24/03	Electrical potential	25.1-25.8	25.2,6,16,33	1/27/03
5	1/27/03	Capacitance	26.1-26.7	26.1,3,40,54	1/29/03
6	1/29/03	Electrical current	27.1-27.3	27.1,7,12,13	1/31/03
7	1/31/03	Resistivity	27.4-27.6	27.14,37,54,63	2/3/03
8	2/3/03	Electrical circuits	28.1-28.2	28.2,6,11,15	2/5/03
9	2/5/03	Electrical circuits	28.3-28.6	28.18,24,28,32	2/7/03
	2/7/03	Review			
	2/10/03				
10	2/12/03	Magnetic fields	29.1-29.2		2/14/03
11	2/14/03	Magnetic fields	29.3-29.6		2/17/03

WebAssign homework submissions

http://www.webassign.net/student.html



- If you are not yet officially registered for the class, make sure that I have your data for setting up your WebAssign account.
- Although the first assignment is not officially due until Jan. 22nd, try out your account ASAP.
- WebAssign will make its official count on the 10th day of classed.
- Let me know about any problems you experience.

Sample WebAssign session:

Remember:

- Problems are due at 5 PM on the lecture day following their assignment.
- Extensions are available (within reason).
- Maximum number of submissions set to 20.
- **Keep a notebook with your solution steps. These will be very helpful in preparing for exams.**

Labs begin Tuesday 1/21/03

- If you need to register for lab or change sections, see Machele Cable, Rm. 110 (x 5532, cablem@wfu.edu)
- Purchase lab book from the bookstore.
- You must pass the lab in order to receive a passing grade in this course.

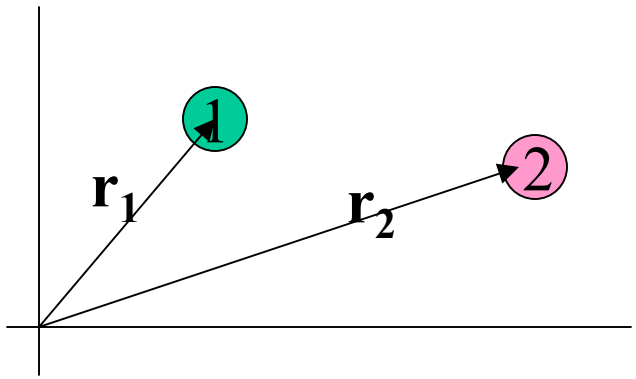
Tutorial sessions

- Weekly session by NAWH (suggestions of time)
- Daily tutorials by graduate students or undergraduate physics majors

Charging ahead....

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

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



Coulomb's law:

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

k_e: $8.987551787 \times 10^9\ \mathrm{N \cdot m^2/C^2}$

(recall $G = 6.67259 \times 10^{-11}\ \mathrm{N \cdot m^2/kg^2}$

Peer instruction question

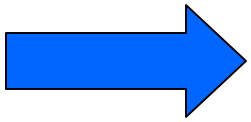
Suppose two identical charged particles are separated by 1m and the force experienced by one of the charges due to the Coulomb force of the other charge is measured to be 1 Newton. What is the approximate magnitude of the charge on each particle?

(A) 10 C (B) 1 C (C) 0.001 C (D) 0.00001 C

At the subatomic level, charges are discrete (and also discreet)

$|e| = 1.60217733 \times 10^{-19}$ C

$N_A |e| = 9.6485 \times 10^{4}$ C



However, since electrical forces are so very strong, most materials have an equal number of positive and negative charges.

Peer instruction question from Eric Carlson:

My body contains about 3×10^{28} electrons, all repelling each other. How come I don't explode?

A. Electrons actually attract each other.
B. The gravitational forces in my body compensate the electric forces.
C. My body also has positive charges which can compensate for the electrical forces between the electrons.
D. Exploding in class violates the Wake Forest ethics code.

Directional nature of Coulomb's law:

3. [SB5 23.P.07.] Three point charges are located at the corners of an equilateral triangle, as shown in Figure P23.7 ($q = 2.00\ \mu C$, $L = 0.650$ m). Calculate the net electric force on the 7.00 µC charge.

[0.1428571] _____ N

[0.1428571] _____ ° (counterclockwise from the +x axis)

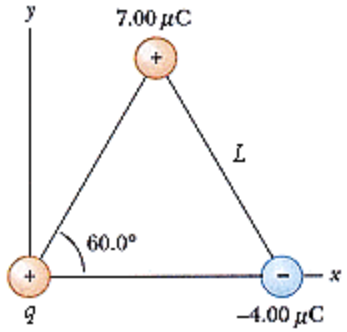


Figure P23.7.