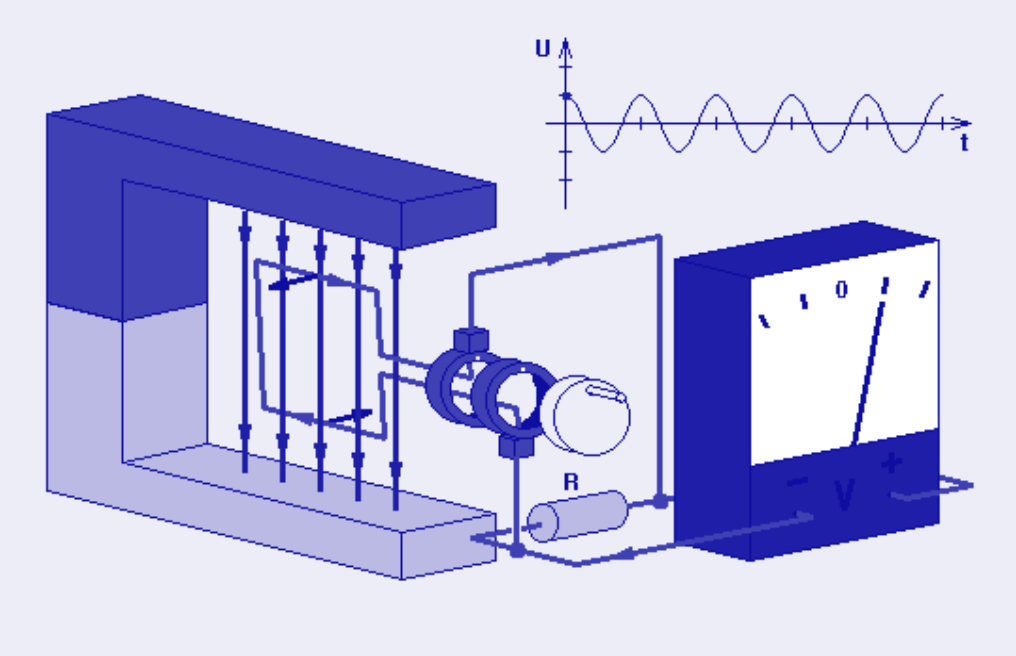
Welcome to Physics 212



http://online.physics.uiuc.edu/courses/phys212

This lecture is VERY full. Please sit next to someone nice.

Find out the best thing that happened to them during the Winter break!

Course Directors

Lectures

- Prof. Tim Stelzer: 2pm, 3pm (tstelzer@illinois.edu)
- Prof. Peter Adshead: 4 pm (adshead@illinois.edu)

Discussion

- Prof. Ben Hooberman (benhoob@illinois.edu)

Labs & Exams

- Prof. Verena Martinez Outschoorn (vimartin@illinois.edu)

We can only use your @illinois.edu email account for course communications.
Be sure yours is working!

Rumors about Physics 212

Has the person next to you heard the rumors about 212?

A) Yes
B) No
C) I forgot my iclicker

Congratulations, you made the team!

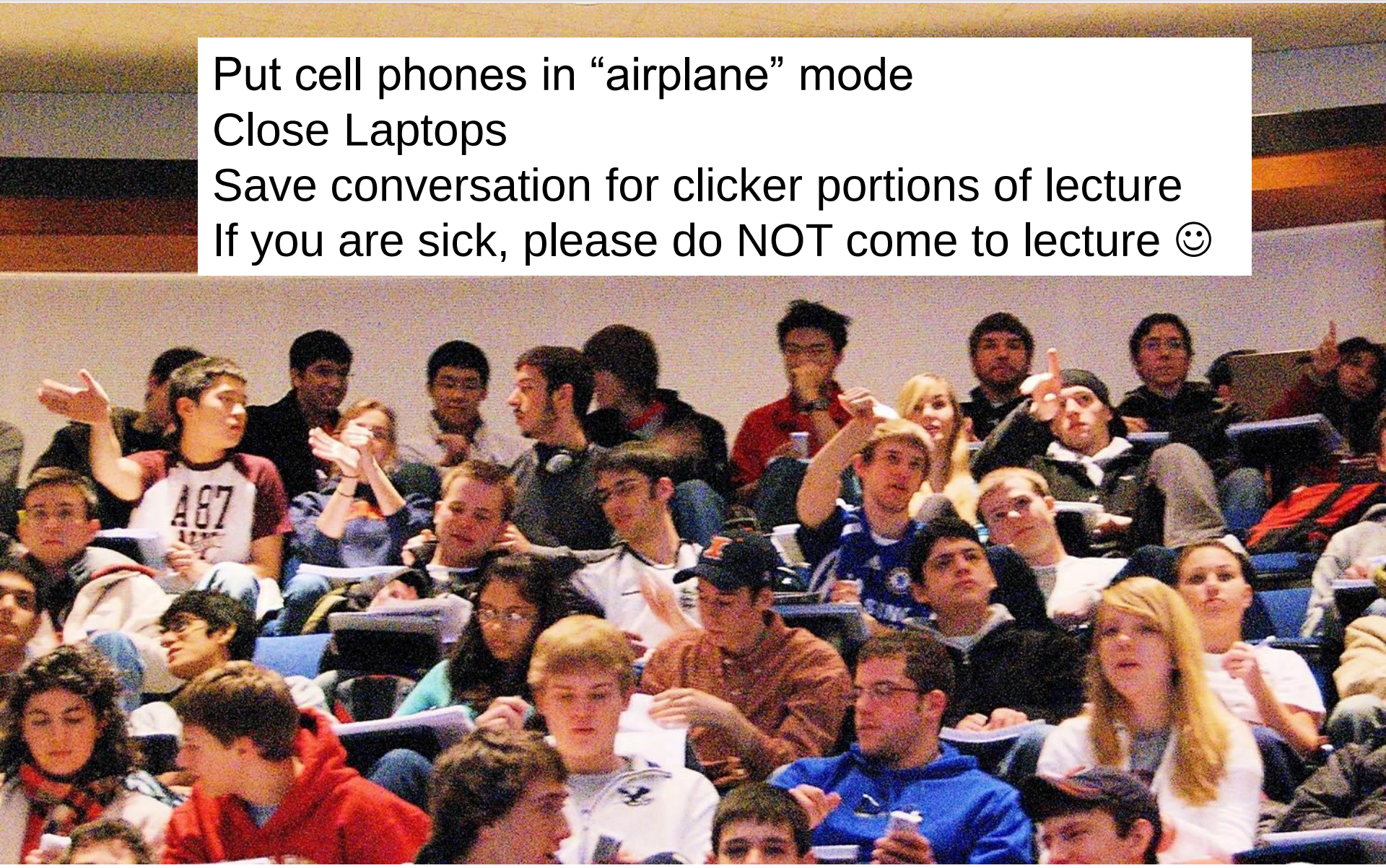
Our Goals

1)Help you learn Physics!

2)Accurately assess your understanding of physics!

3)Today's lecture should be worst of semester ☺

Be Respectful of your Classmates



Put cell phones in “airplane” mode
Close Laptops
Save conversation for clicker portions of lecture
If you are sick, please do NOT come to lecture ☺

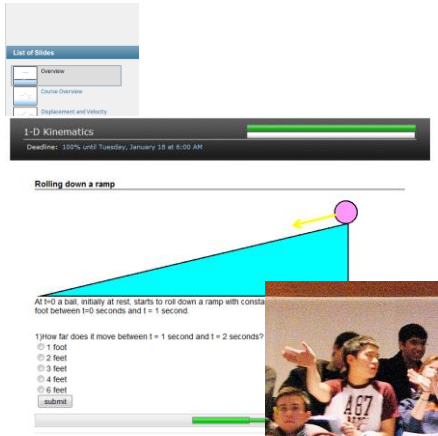
Course Structure

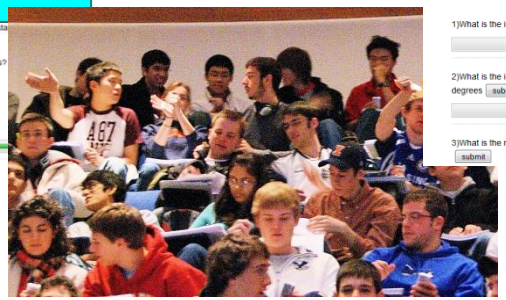
There are several parts, all are important:

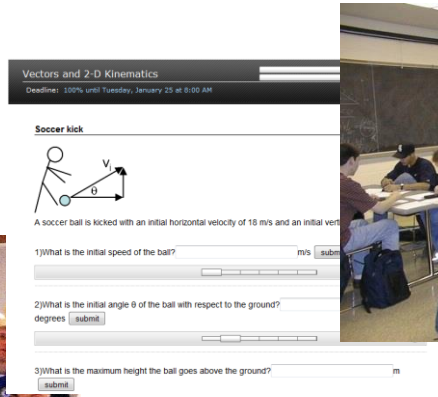
smartPhysics

- Online Prelectures (animated textbook, *before lecture*)
- Online CheckPoints (check knowledge, *before lecture*)
- Lectures – interactive, address issues found by checkpoints.
- Online Homework (first deadline next week)
- Discussion Sections (start this week)
- Lab Sections (start next week)

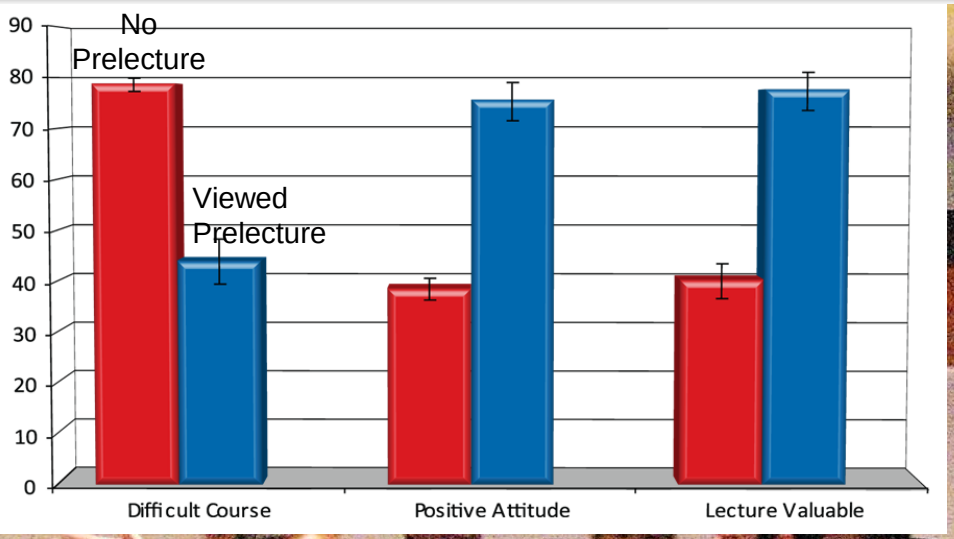
} Go to the right one !
Don't be late!

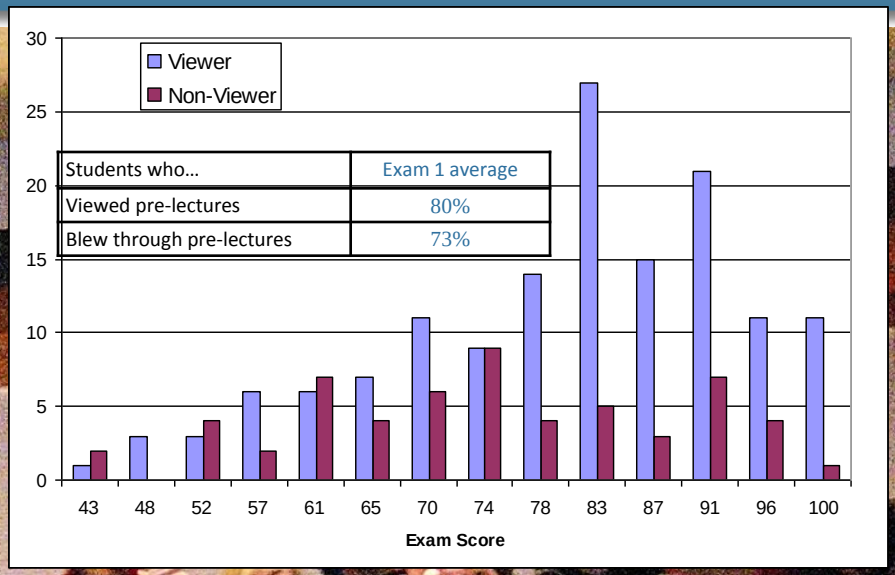


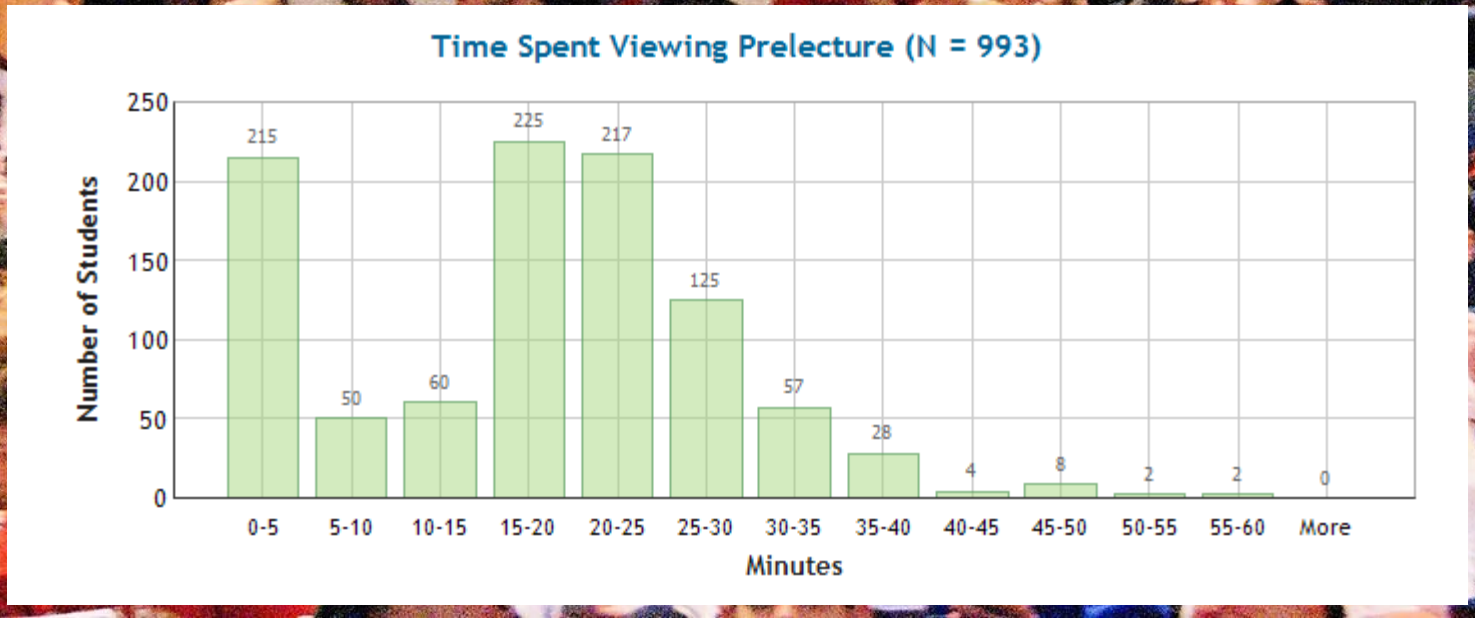




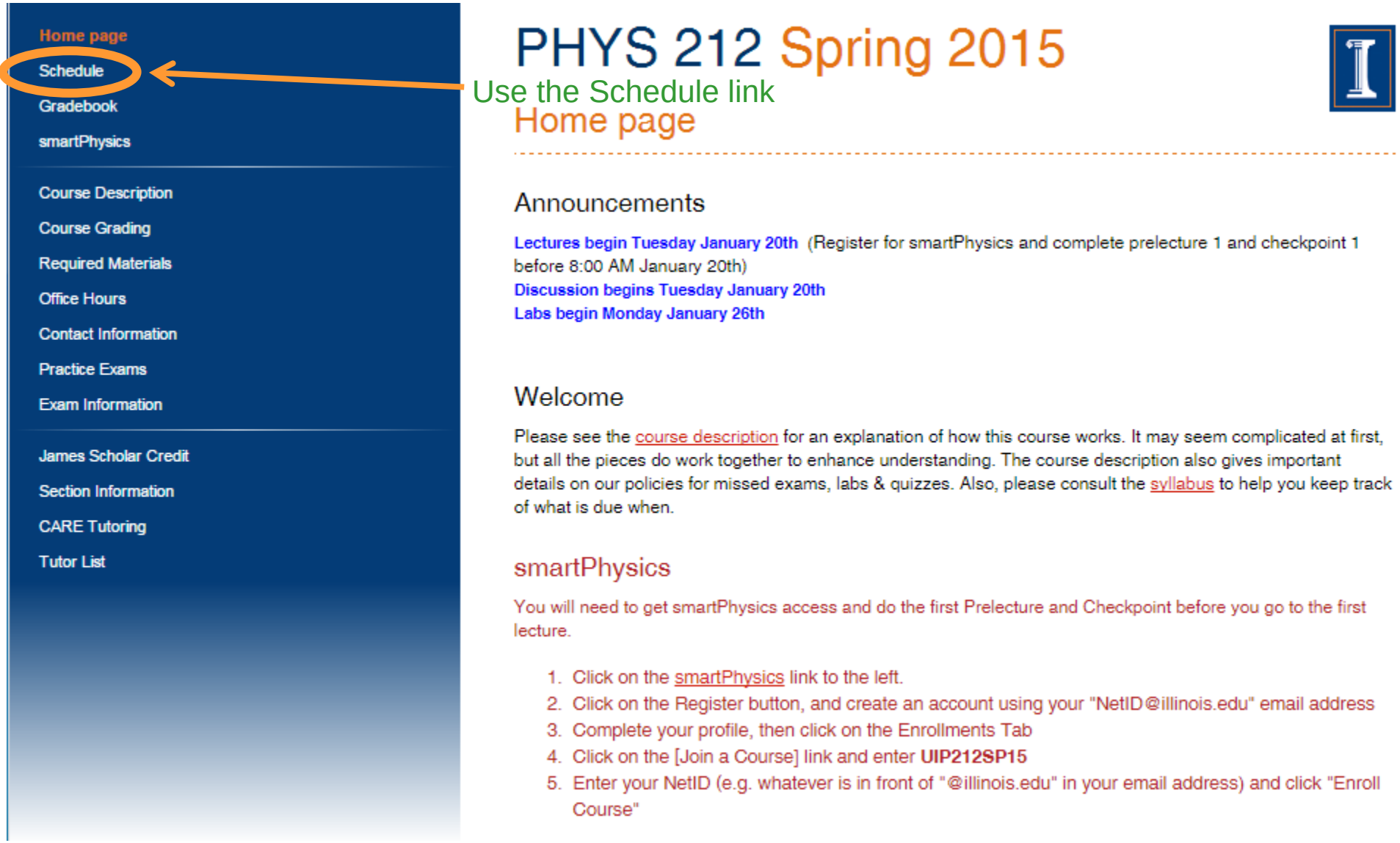
Lecture Prep+Participation: Just Do It







Get to know the course Home Page



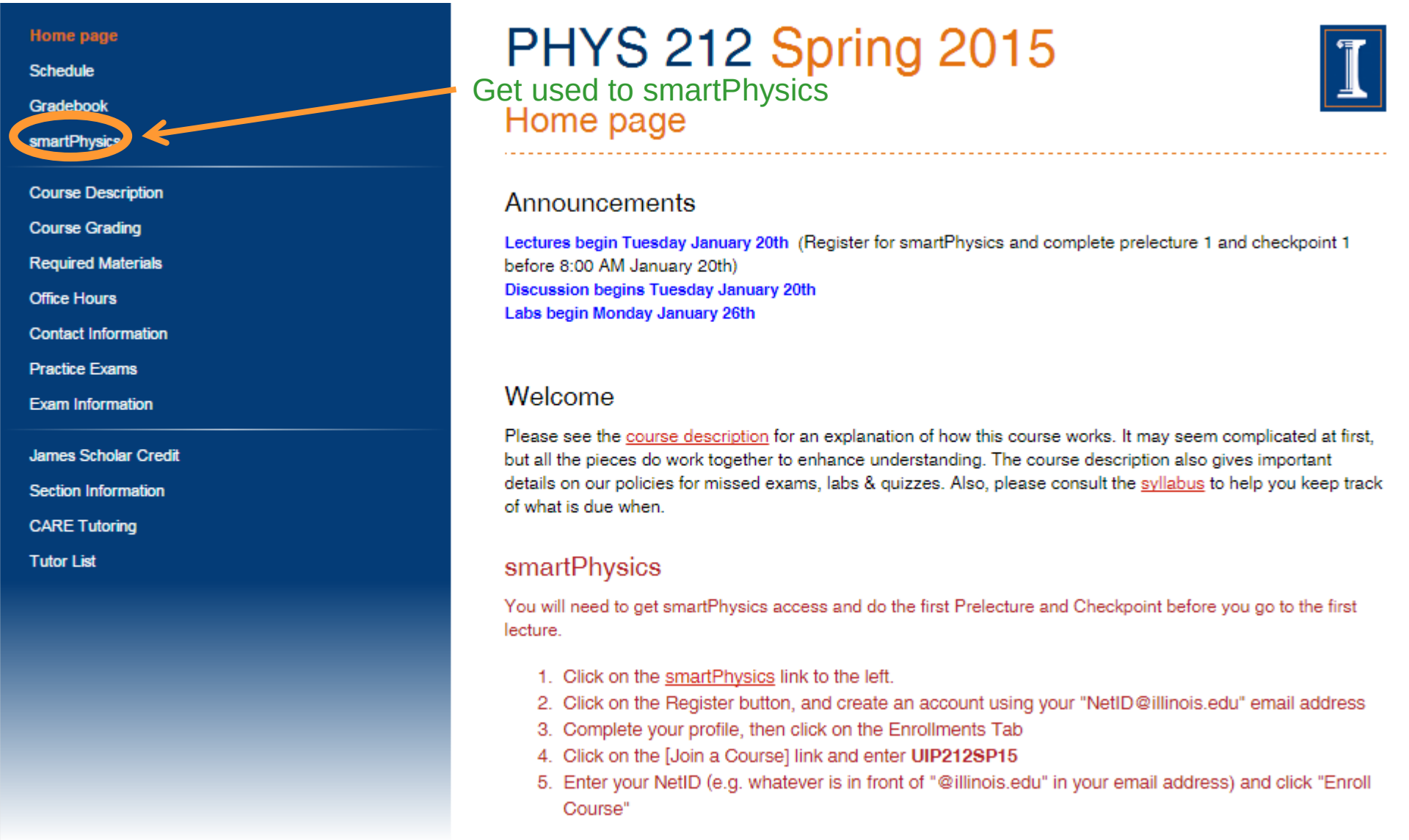
http://courses.physics.illinois.edu/phys212/

Syllabus…

Week	Date	Prelecture	Checkpoint	Lecture	Lab	Discussion	Homework	Exam
	Monday 1/19/2015	HOLIDAY NO CLASS!						
	Tuesday 1/20/2015	Prelecture 1	Checkpoint 1	Lecture 1: Introduction and Coulomb's Law pdf ppt				
1	Wednesday 1/21/2015				*No Lab*	Discussion 1		
	Thursday 1/22/2015	Prelecture 2	Checkpoint 2	Lecture 2: Electric Fields pdf ppt				
	Friday 1/23/2015							
	Monday 1/26/2015							
	Tuesday 1/27/2015	Prelecture 3	Checkpoint 3	Lecture 3: Electric Fields and Electric Flux pdf ppt	Lab 1: Coulomb's Law: Electrostatic Charges		Homework 1 due	
2	Wednesday 1/28/2015					Discussion 2 Quiz 1		
	Thursday 1/29/2015	Prelecture 4	Checkpoint 4	Lecture 4: Gauss's Law pdf ppt				
	Friday 1/30/2015							
	Monday 2/2/2015							

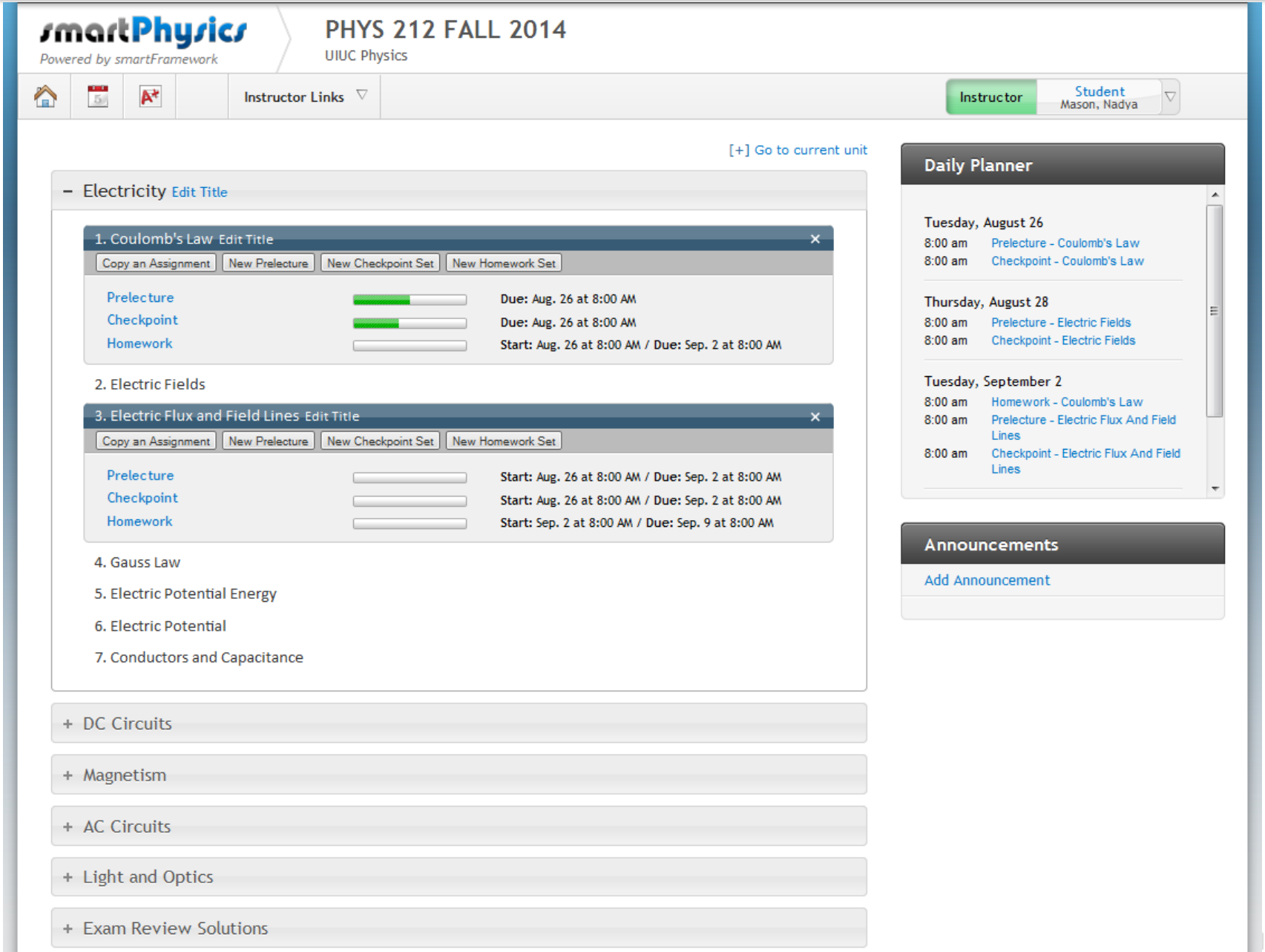
Lecture slides are available here after every lecture

Get to know the course Home Page



http://courses.physics.illinois.edu/phys211/

smartPhysics



Homework

smartPhysics
Powered by smartFramework

PHYS 212 Spring 2015
University of Illinois

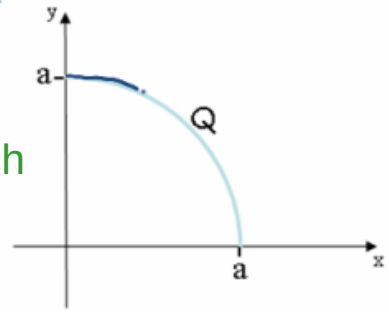
Administrator Links | Instructor | Student Stelzer, Timothy

Unit 1: Prelecture / Checkpoint / Homework /

Homework: Coulomb's Law (Est. 2.5 Hours)

Help:
1 | 2 | 3 | 4 | 5

A total charge Q = -4.2 μC is distributed uniformly over a quarter circle arc of radius a = 7.7 cm as shown.



We will try to produce a solution for 1 problem each week.

1) What is λ the linear charge density along the arc?

$$\lambda = \frac{Q}{L}$$

Problems

Print Assignment View

Worked Example
Coulomb's Law
-- Optional --

Standard Exercise
Point Charges in One Dimension

Standard Exercise
Point Charges in Two Dimensions

Interactive Example
Three Charges

Worked Example
Electric Fields
-- Optional --

Interactive Example
Zero

Standard Exercise
Electric Field from Point Charges

Standard Exercise
Electric Field from Arc of Charge

Standard Exercise
Tipler6 21.P.012.
-- Optional --

Standard Exercise
Tipler6 21.P.030.

Homework: Delayed Feedback

Purpose:
Promote
REFLECTION

4) How would you change q_1 (keeping q_2 and q_3 fixed) in order to make the net force on q_2 equal to zero?

- Increase its magnitude and change its sign
- Decrease its magnitude and change its sign
- (•) Increase its magnitude and keep its sign the same
- Decrease its magnitude and keep its sign the same
- There is no change you can make to q_1 that will result in the fet force on q_2 being equal to zero.

Submit

5) How would you change q_3 (keeping q_1 and q_2 fixed) in order to make the net force on q_2 equal to zero?

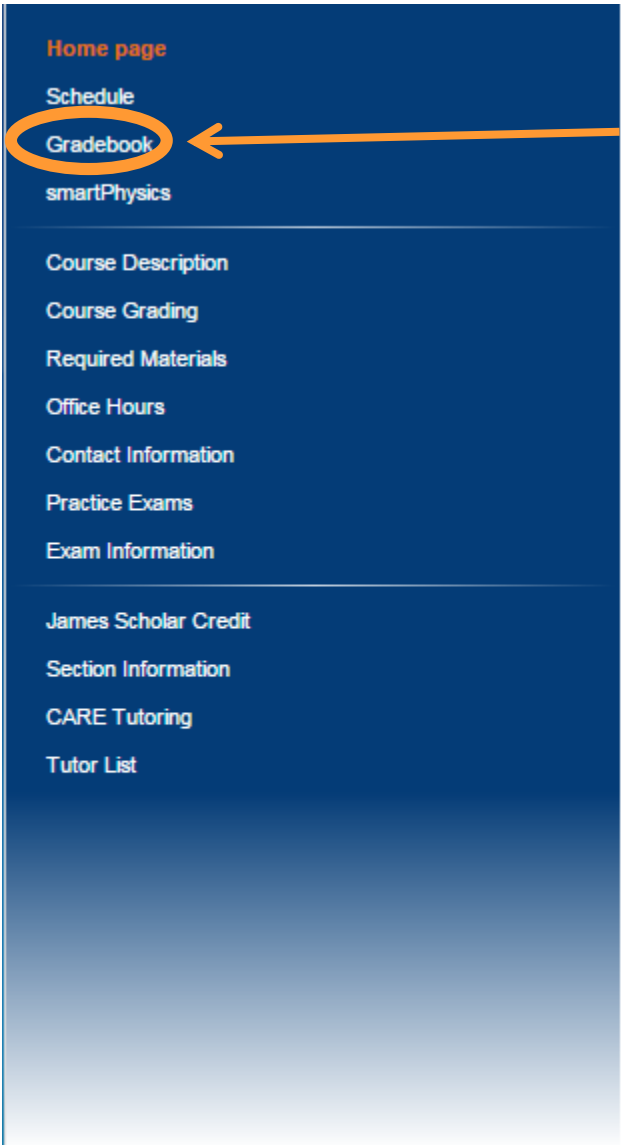
- Increase its magnitude and change its sign
- Decrease its magnitude and change its sign
- Increase its magnitude and keep its sign the same
- (•) Decrease its magnitude and keep its sign the same
- There is no change you can make to q_3 that will result in the fet force on q_2 being equal to zero.

Submit

These questions serve as a test of your understanding of the questions posed as immediate feedback.

After first deadline
Delayed feedback questions turn into immediate feedback questions. 80% credit can be obtained by answering these questions correctly before the second deadline.

Get to know the course Home Page



Use the gradebook

PHYS 212 Spring 2015

Home page

Announcements

Lectures begin Tuesday January 20th (Register for smartPhysics and complete prelecture 1 and checkpoint 1 before 8:00 AM January 20th)
Discussion begins Tuesday January 20th
Labs begin Monday January 26th

Welcome

Please see the course description for an explanation of how this course works. It may seem complicated at first, but all the pieces do work together to enhance understanding. The course description also gives important details on our policies for missed exams, labs & quizzes. Also, please consult the syllabus to help you keep track of what is due when.

smartPhysics

You will need to get smartPhysics access and do the first Prelecture and Checkpoint before you go to the first lecture.

1. Click on the smartPhysics link to the left.
2. Click on the Register button, and create an account using your "NetID@illinois.edu" email address
3. Complete your profile, then click on the Enrollments Tab
4. Click on the [Join a Course] link and enter **UIP212SP15**
5. Enter your NetID (e.g. whatever is in front of "@illinois.edu" in your email address) and click "Enroll Course"

http://courses.physics.illinois.edu/phys212/

Course Gradebook

i>clicker Information

No registered i>clickers found for Roberto.

Register a new i>clicker

i>clicker registrations and scores are updated in gradebook when your professor uploads them.
Last time i>clicker scores were uploaded: *Not yet uploaded for this term.*

"Do we need to reregister our Iclickers for this class?" **YES**

Go here to register your i>clicker.

Voting for someone else violates U of I academic integrity rules!

Upcoming Exam Information

You are currently signed up to take the following exams at the times below.

	Exam Name	Exam Date	Exam Start Time	Exam End Time	Date/Time you have to change your mind	Room
	Hour Exam 1	Wednesday 9/25/2013	7:00 PM	8:30 PM	Tuesday 9/24/2013 10:00 PM	View Room Info
	Hour Exam 2	Wednesday 10/30/2013	7:00 PM	8:30 PM	Tuesday 10/29/2013 10:00 PM	View Room Info
	Hour Exam 3	Wednesday 12/4/2013	7:00 PM	8:30 PM	Tuesday 12/3/2013 10:00 PM	View Room Info

If you have a conflict with the above time, sign-up for a conflict exam by selecting one below.

Choose a conflict exam time | Sign Up

Do you have a conflict with the exam times above?
You can request a special conflict exam time, but you must give a valid academic reason why you need one.

[Request a special conflict exam]

Scores will be imported from smartPhysics weekly

Grade Information

Use your mouse to hover over the assignment number to see more information about that assignment.

Assignment Name	Point Breakdown																	
Bonus [edit]	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.
Discussions [edit]	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.									
Exams [edit]	1.	2.	3.	4.															

How Your Grade will be Calculated

See homepage for Excused Absence Policy.

Prelectures + Preflights + Lectures	100
14 Homework + 10 Quizzes	250
Labs	150
Hour exams (3 x 100 each)	300
Final Exam	200

Prelectures: 50
Preflights: 25
Lecture participation: 25

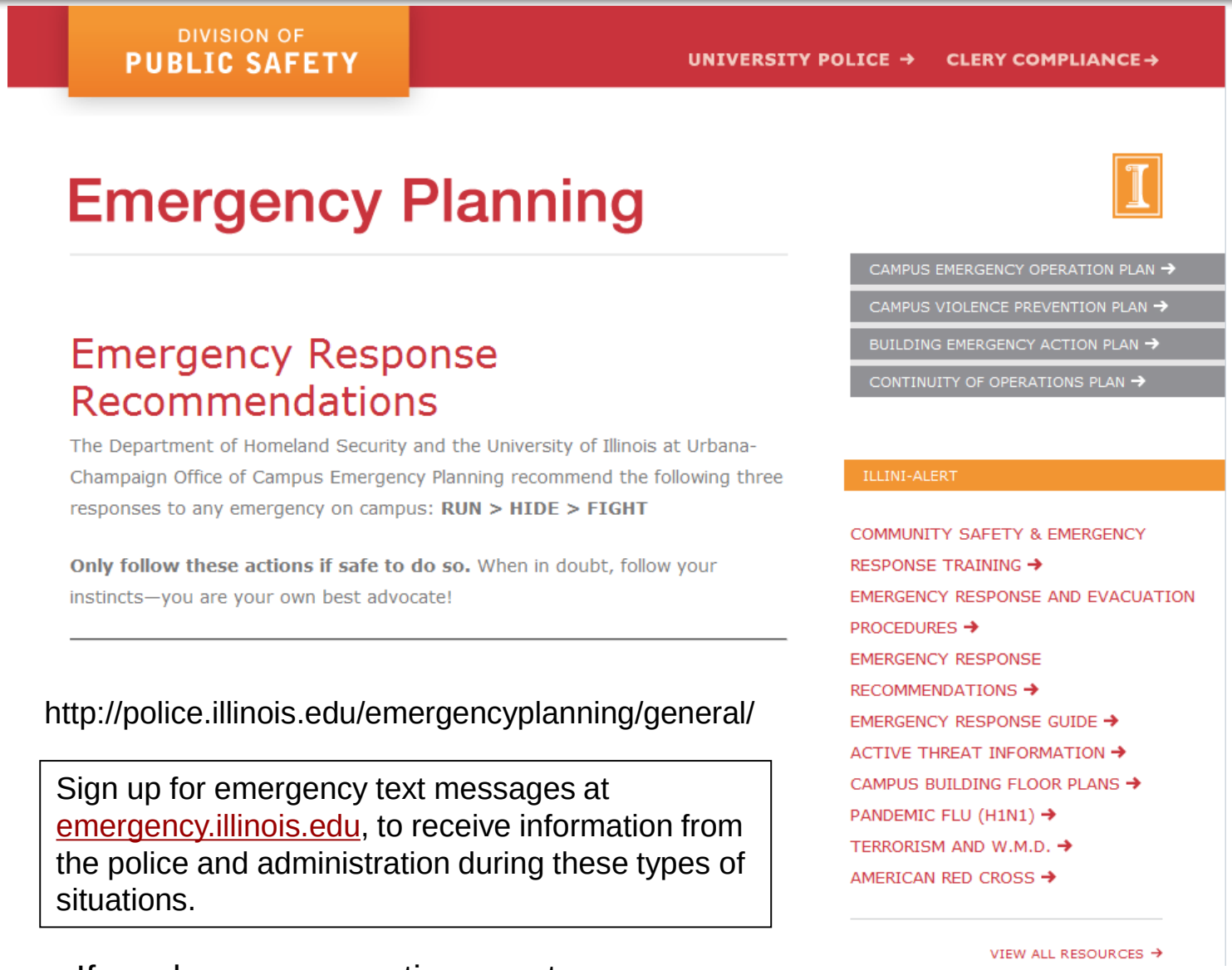
Your top 22 HW/Quiz scores determine your grade out of 250.

Bonus Points: You can earn up to 1 extra bonus point in every lecture (for a maximum of 25 bonus points for the semester) by getting the right answers to all of the clicker questions.

At the end of the semester your lecture bonus points are added to your HW/Quiz score (250 max).

We do not excuse missed Prelectures, Checkpoints, Lectures, Homework.
We do drop several of these so missing a few won't matter much.
You can also make up missed points with bonus points.
Don't forget the "week late" 80% HW deadline.

Emergency Response



http://police.illinois.edu/emergencyplanning/general/

Sign up for emergency text messages at emergency.illinois.edu, to receive information from the police and administration during these types of situations.

If you have any questions, go to police.illinois.edu, or call 217-333-1216

Electricity & Magnetism
Lecture 1

The checkpoints were the hardest. I feel like the questions weren't as intuitive as I would have liked. The prefecture is good, but it doesn't help with simple intuitive problems. So going over those would be AMAZING!

Excited, I hated Physics C in high school and did do so good in summer school while taking E and M. So I am hoping for the best :).

I just wondered if an object can have negative mass (repulsive?), just like something can have negative charge. I guess not.. intuitively

Electricity & Magnetism
Lecture 1

Today's Concepts:

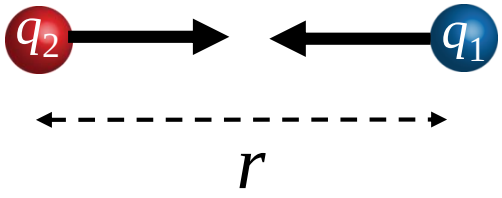
A) Coulomb's Law

B) Superposition

Coulomb's Law:

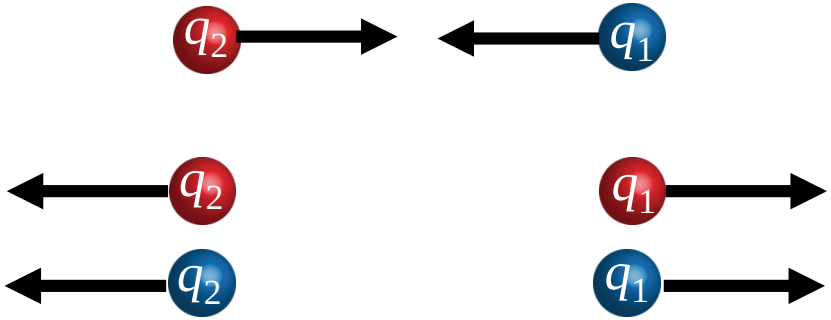
The force on a charge due to another charge is proportional to the product of the charges and inversely proportional to the separation squared.

"can you please go over the differences of forces from different signed particles"



$$F \propto \frac{q_1 q_2}{r^2}$$

The force is always parallel to a line connecting the charges, but the direction depends on the signs of the charges:

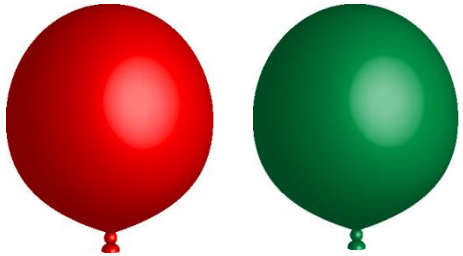


Opposite signs attract

Like signs repel

Balloons

Take two balloons and rub them both with a piece of cloth.
After you rub them they will:

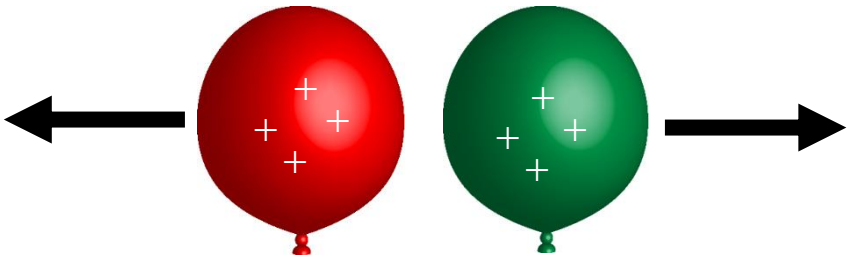


A) Attract each-other
B) Repel each-other
C) Either – it depends on the material of the cloth

Balloons

If the same thing is done to both balloons they will acquire the same sign charge.

They will repel!



Coulomb's Law

$$\vec{F}_{1,2} = \frac{kq_1q_2}{r_{1,2}^2}\hat{r}_{1,2}$$

Our notation:

$\vec{F}_{1,2}$ is the force by 1 *on* 2 (think "*by-on*")

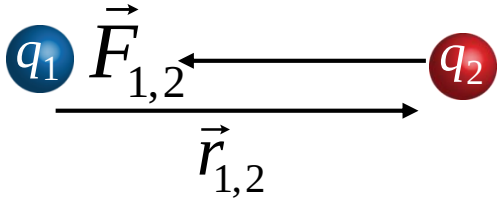
$\hat{r}_{12}$ is the unit vector that points *from* 1 *to* 2.

"Go over the formula(F=kq1q2*r^/r^2) and show us another example, because while the r^2 was accounted for in the example, the r^ was nowhere to be found and needs to be explained."

Examples:

If the charges have the same sign, the force **by** charge 1 on charge 2 would be in the direction of r_{12} (to the right).

If the charges have opposite sign, the force **by** charge 1 on charge 2 would be opposite the direction of r_{12} (left).



Example: Coulomb Force

Two paperclips are separated by 3 meters. Then you remove 1 electron from each atom on the first paperclip and place it on the second one.

$$\vec{F} = k\frac{q_1 q_2}{r_{12}^2}\hat{r}_{12}$$

$k = 9 \times 10^9$ N m^2 / C^2

electron charge $= 1.6 \times 10^{-19}$ Coulombs

$N_A = 6.02 \times 10^{23}$

What will the direction of the force be?

A) Attractive B) Repulsive

Example: Coulomb Force

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$$\vec{F} = k\frac{q_1 q_2}{r_{12}^2}\hat{r}_{12}$$

$k = 9 \times 10^9 \text{ N m}^2 / \text{C}^2$

electron charge $= 1.6 \times 10^{-19}$ Coulombs

$N_A = 6.02 \times 10^{23}$

Which weight is closest to the approximate force between those paperclips (recall that weight = mg, g = 9.8 m/s^2)?

Balloon demo

A) Paperclip (1 g x g)

B) Text book (1 kg x g)

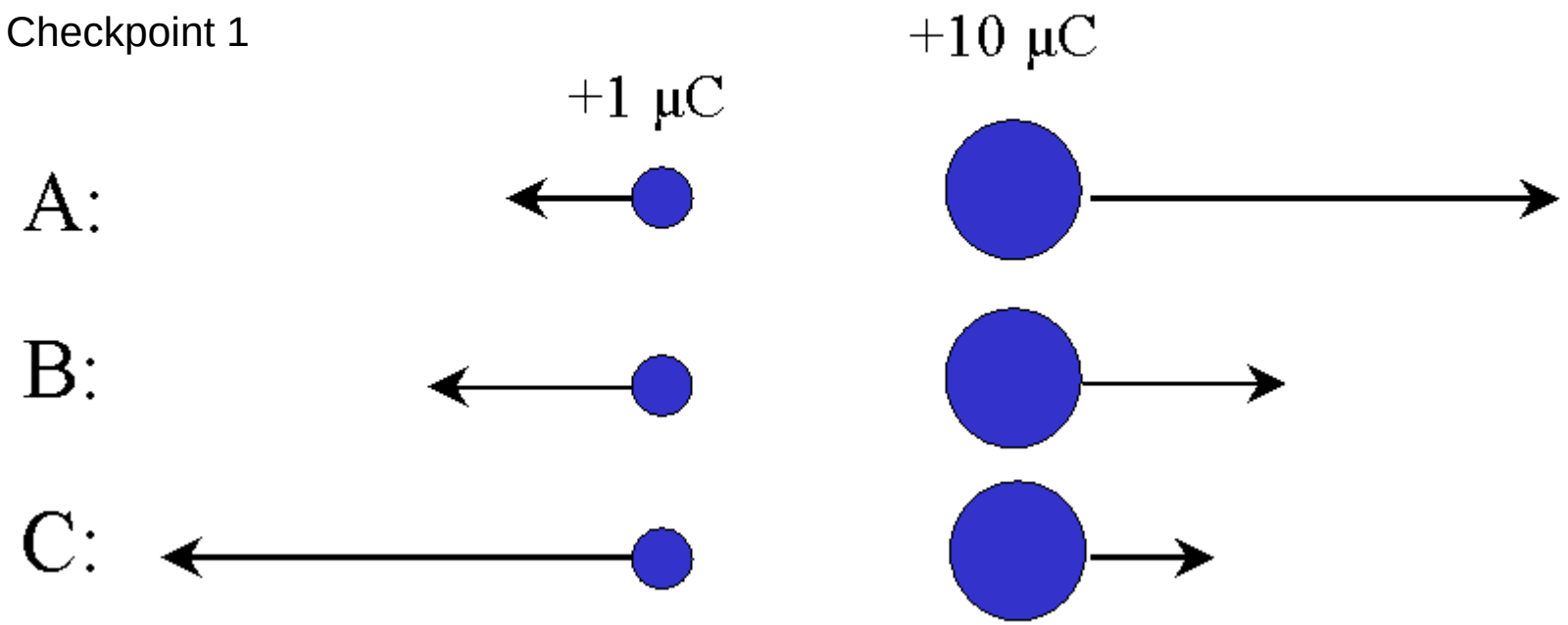
C) Truck (10^4 kg x g)

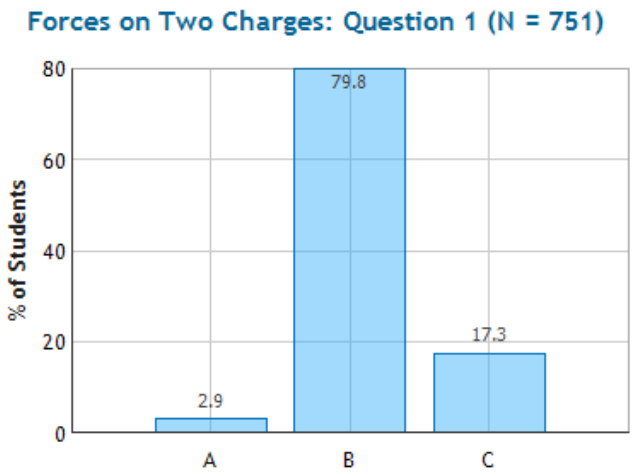
D) Aircraft carrier (10^8 kg x g)

E) Mt. Everest (10^{14} kg x g)

1) Two charges $q = +1\ \mu C$ and $Q = +10\ \mu C$ are placed near each other as shown in the figure. Which of the following diagrams depicts the forces acting on the charges:

Checkpoint 1





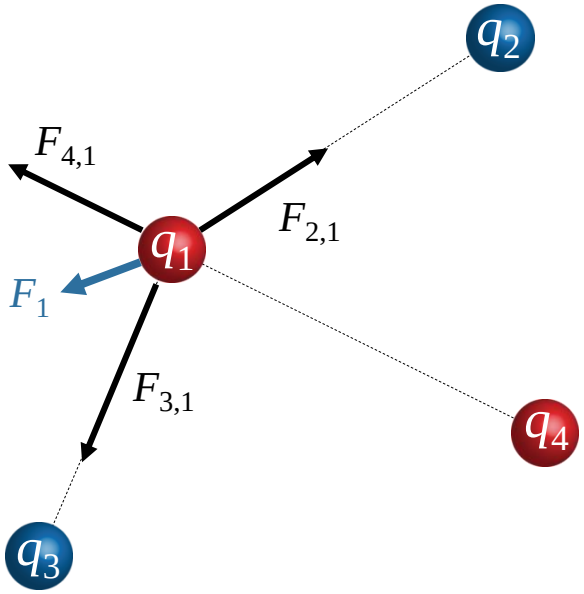
"A) The proportionally larger arrow corresponds to the greater (+10 μC) charge."

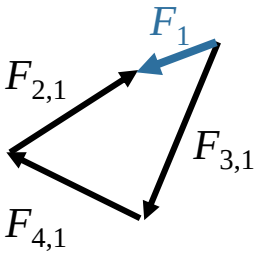
"B) The force that each charge exerts on the other is proportional to both charges. As a result, the force that each charge exerts on the other is the same and the forces form a newtons third law pair."

"C) Because they have similar signs, they will be repelling each other. However, because they have different charges one will be repelled at a greater rate which would be the 1 microColoumb charge."

Superposition:

If there are more than two charges present, the total force on any given charge is just the vector sum of the forces due to each of the other charges:





$$\vec{F}_1 = \vec{F}_{2,1} + \vec{F}_{3,1} + \vec{F}_{4,1} + \ldots$$

Superposition Clicker Question

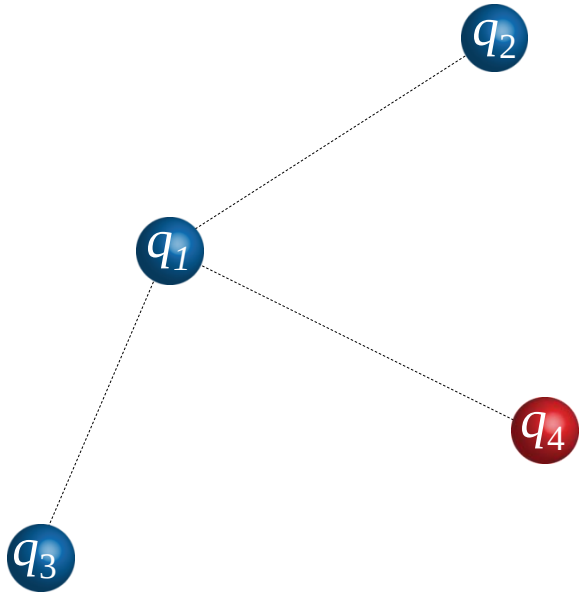
What happens to the magnitude of the Force on q_1 if its sign is changed from negative to positive?

A) $|F_1|$ increases

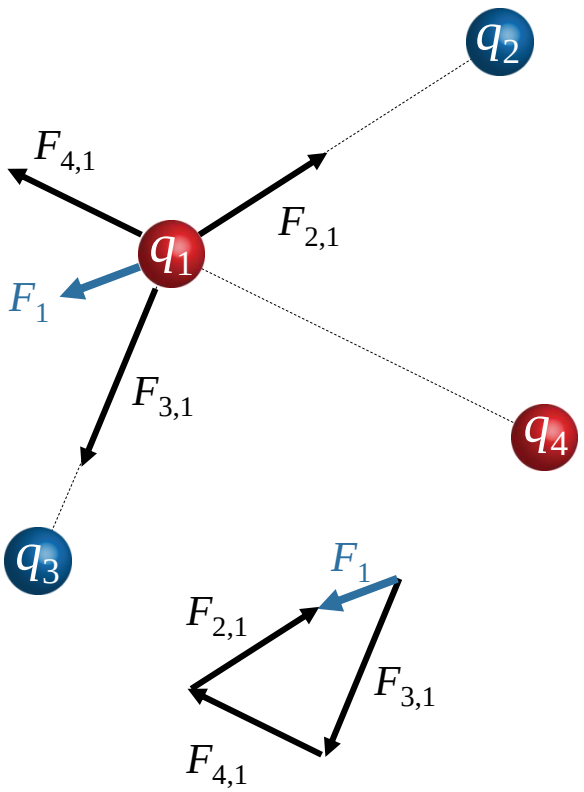
B) $|F_1|$ remains the same

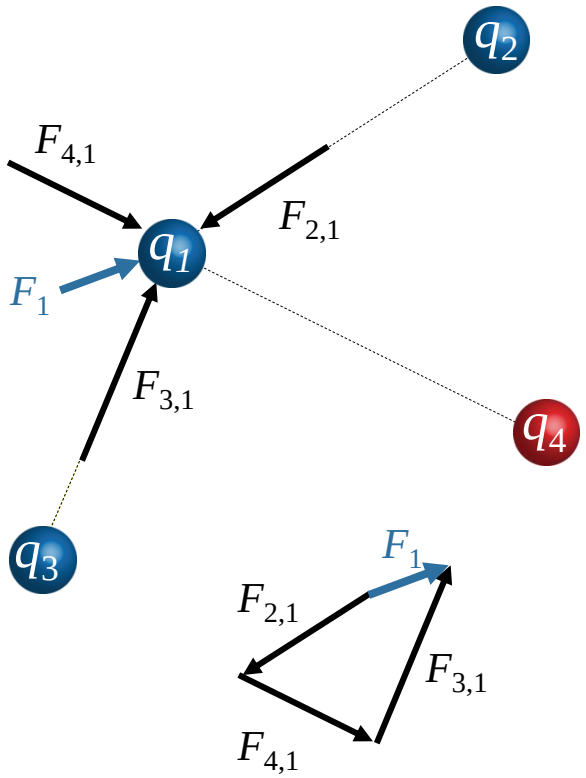
C) $|F_1|$ decreases

D) Need more information to determine



The direction of all forces changes by 180° – the magnitudes stay the same:





$$\vec{F}_1 = \vec{F}_{2,1} + \vec{F}_{3,1} + \vec{F}_{4,1} + \ldots$$

$$-\vec{F}_1 = -\vec{F}_{2,1} - \vec{F}_{3,1} - \vec{F}_{4,1} - \ldots$$

CheckPoint

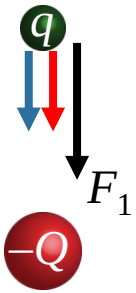
Compare the magnitude of the net force on q in the two cases.

A) $|F_1| > |F_2|$

B) $|F_1| = |F_2|$

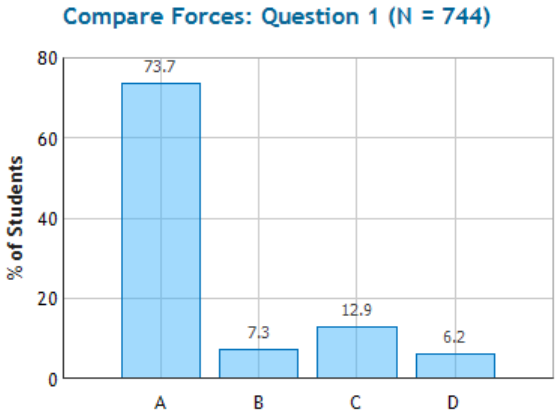
C) $|F_1| < |F_2|$

D) Depends on sign of q



$F_2 = 0$

A) "In Case 2, the charges cancel out, but in Case 1, there will be a net force in either direction (depending on which sign the central charge has."



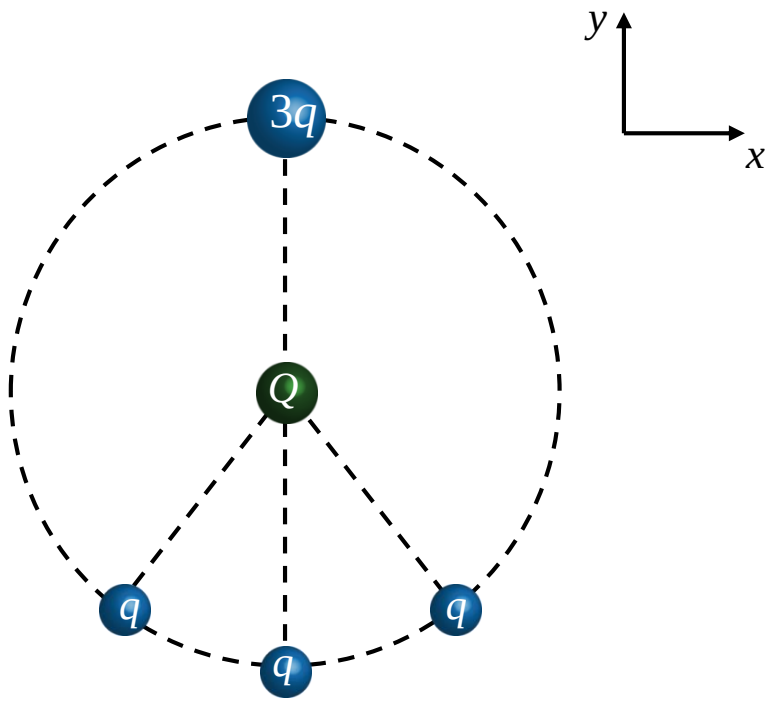
B) "Because they're equidistant and the charges are of the same magnitude, the magnitude of the net force is the same"

C) "The net force in Case 1 is always zero, regardless of q's charge. In Case 2, the force is either F=2k(Qq)/r^2, when q is positive or F=-2k(Qq)/r^2, when q is negative"

D) "You have to know the charge of q because the middle charge is what will determine the force of the whole system"

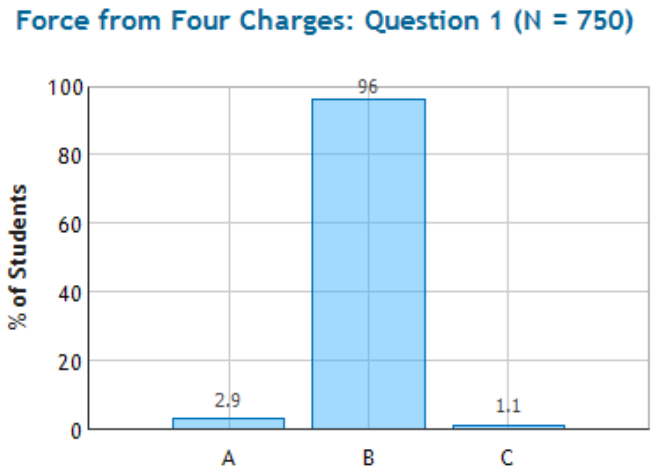
CheckPoint

Four charged particles are placed on a circular ring with radius 3 m as shown below. A particle with charge Q is placed in the center of the ring



What is the direction of horizontal force on Q?

A) $F_x > 0$ B) $F_x = 0$ C) $F_x < 0$

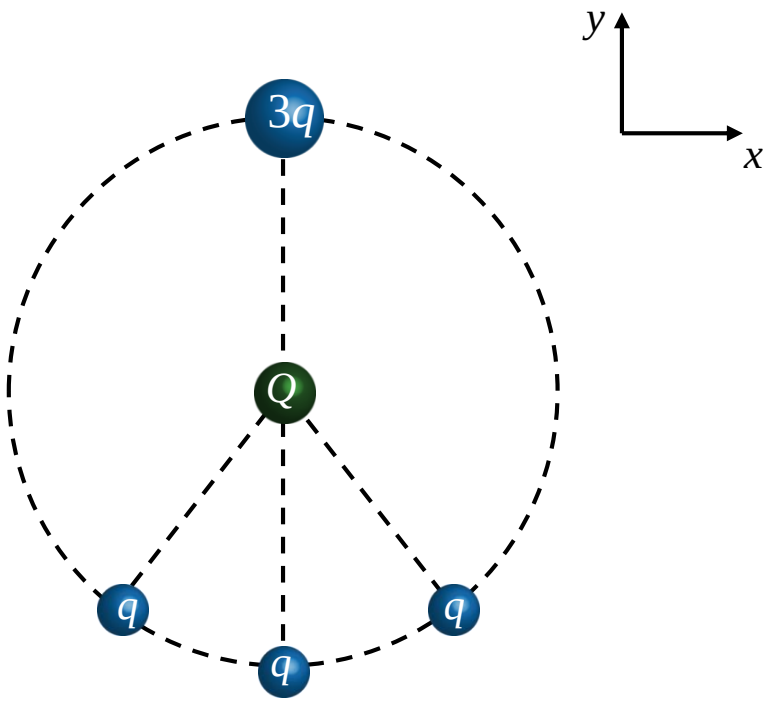


Excellent job!

"Only two of the q's provide a net x-direction force on Q, and these q's are equal and opposite in direction, causing Q to stay in the same x-position.".

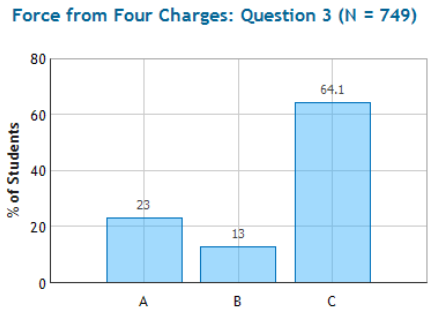
CheckPoint

Four charged particles are placed on a circular ring with radius 3 m as shown below. A particle with charge Q is placed in the center of the ring



What is vertical force on Q?

A) $F_y > 0$ B) $F_y = 0$ C) $F_y < 0$



A) "because the bottom charges are some arc out from the center, they lose some of their y-axis influence (because trig), so the top is stronger."

B) "the y forces balance because they have the same value at the same distance on both sides of the hemisphere, and they are symmetrical along the y-axis"

C) "Two of the q charges below Q exert some force in the x direction, thus the 3q above Q exerts more force in the -y direction than the 3 qs below Q in the +y direction"

See you Thursday!

Discussion Sections meet this week!

Be sure to complete prelecture 2 and preflight 2.

Labs begin next week.