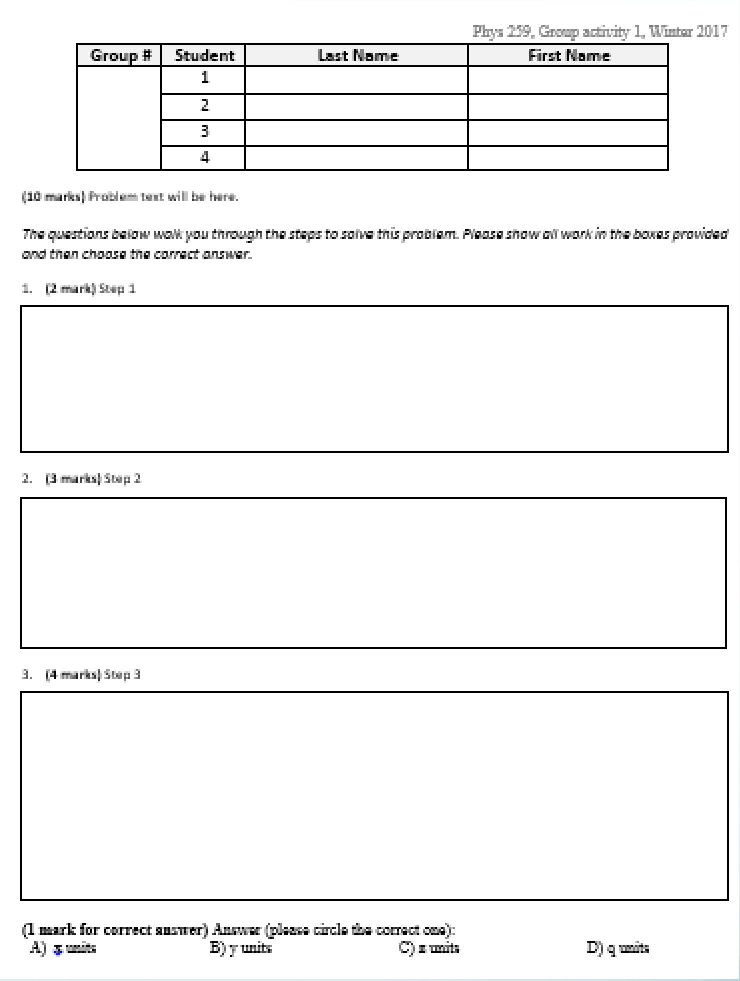
Electricity and Magnetism

- Physics 259 – L02
- Lecture 2

In-class activities

- Purpose: to help you develop problem solving skills for midterm and final exam
- Activity: problem with steps you need to take in order to solve it (showing your work); majority of the marks
- Final answer: MCQ (1 mark)
- Exams: no help with steps – MCQ only
- Ask questions: lecture TAs and instructor



Phys 259, Group activity 1, Winter 2017

Group #	Student	Last Name	First Name
	1		
	2		
	3		
	4		

(10 marks) Problem text will be here.

The questions below walk you through the steps to solve this problem. Please show all work in the boxes provided and then choose the correct answer.

1. (2 mark) Step 1

2. (3 marks) Step 2

3. (4 marks) Step 3

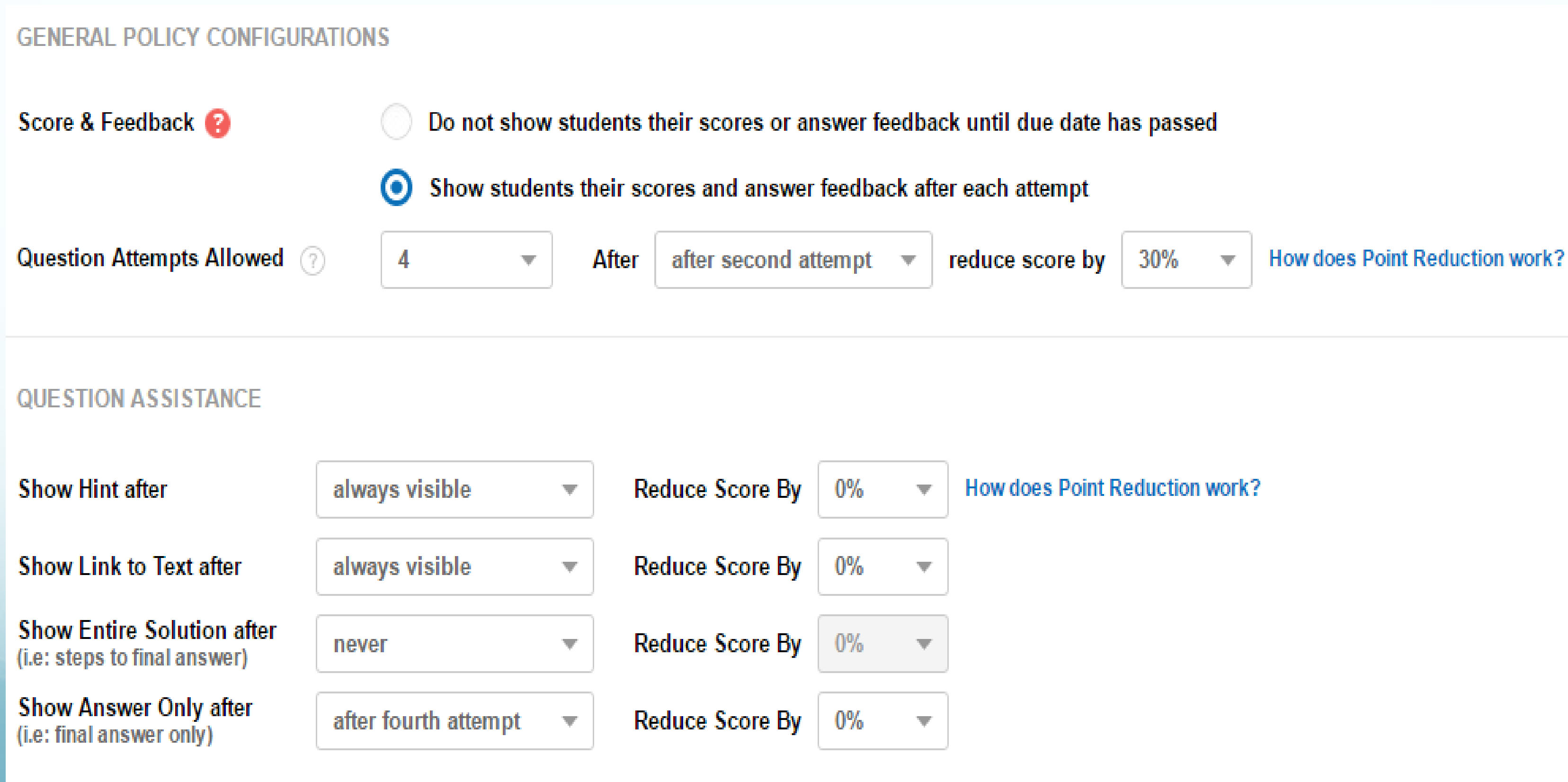
(1 mark for correct answer) Answer (please circle the correct one):
A) x units B) y units C) z units D) q units

In-class activities

- Groups of 4 (assignment on Friday Jan 13, please sit next to your preferred peers, if known)
- Each group will be given a number to self-enroll on D2L on Friday
- Groups stay the same for the entire term
- Activity (30 min); submission via group Dropbox
- File should include group number and names of peers present that day
- Submit PDF file (please install the app on your phone/ tablet: https://www.camscanner.com/)
- Submission by the end class (+ 10 min grace period), late submission = no grade

WileyPlus settings

- 4 attempts, 30% deduction after second attempt
- Settings are posted on D2L (folder: WileyPlus)


GENERAL POLICY CONFIGURATIONS

Score & Feedback

Do not show students their scores or answer feedback until due date has passed

Show students their scores and answer feedback after each attempt

Question Attempts Allowed 4 After after second attempt reduce score by 30% How does Point Reduction work?

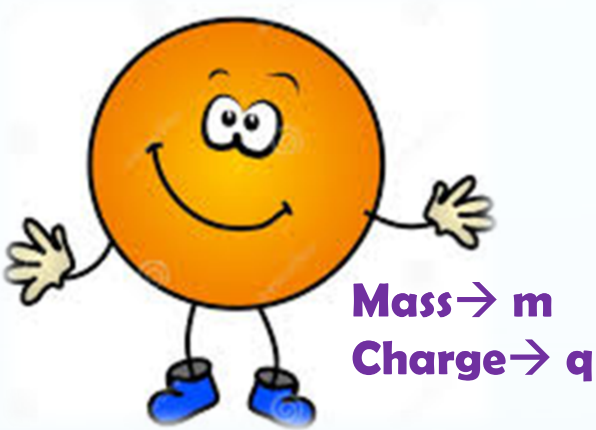
QUESTION ASSISTANCE

Show Hint after	always visible	Reduce Score By	0%	How does Point Reduction work?
Show Link to Text after	always visible	Reduce Score By	0%	
Show Entire Solution after (i.e: steps to final answer)	never	Reduce Score By	0%	
Show Answer Only after (i.e: final answer only)	after fourth attempt	Reduce Score By	0%	

Section 21.1

Fundamental characteristics of particles

All fundamental particles can be classified according to two observable parameters: mass and charge.



This simplified model of the universe is incredibly effective at explaining a wide range of physical phenomena.

Forces in nature

There are 4 fundamental forces in nature (that we know of):

1. Strong Nuclear Force: responsible for holding together protons and neutrons, as well as holding atomic nuclei together. Very short-range (~ 10^{-15} m)

2. Weak Nuclear Force: Responsible for radioactive decay and fusion reactions in the sun. Very short-range (~ 10^{-17} m)

3. Electromagnetic Force: Responsible for nearly everything we observe! Extremely important force to understand. Long range

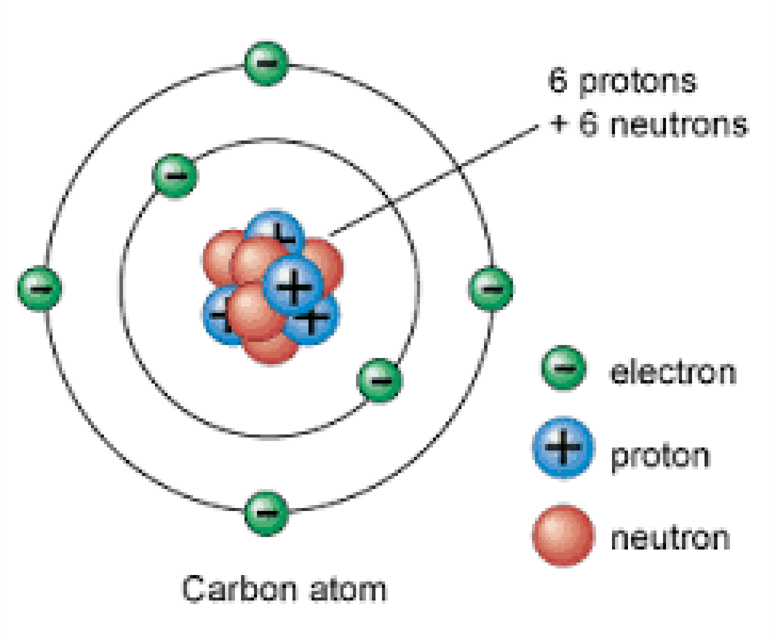
4. Gravitational Force: Responsible for planetary orbits, holding together galaxies, maintaining an atmosphere. Long range

What is an electric charge?

What is an electric charge?

- An intrinsic property of particles: electrons (–) and protons (+)
- A quantity that determines the strength of the electric force between two objects.
- Can’t be created or destroyed
- Can transfer from one object to another
- Like charges repel, opposites attract

Atom



https://goo.gl/BUVMm2

If you could fill a 4L milk jug with material as dense as an atomic nucleus, it would have the mass of Mount Everest.

Almost all of the mass is contained in the nucleus, while almost all of the space is occupied by the electron cloud.

The diameter of a nucleus is much smaller than the diameter of atom, by a factor of about 23,000 (uranium) to about 145,000 (hydrogen).

Electric charge is *quantized*

Charge always comes in some integral multiple of some fundamental charge e, which is the charge of electron.

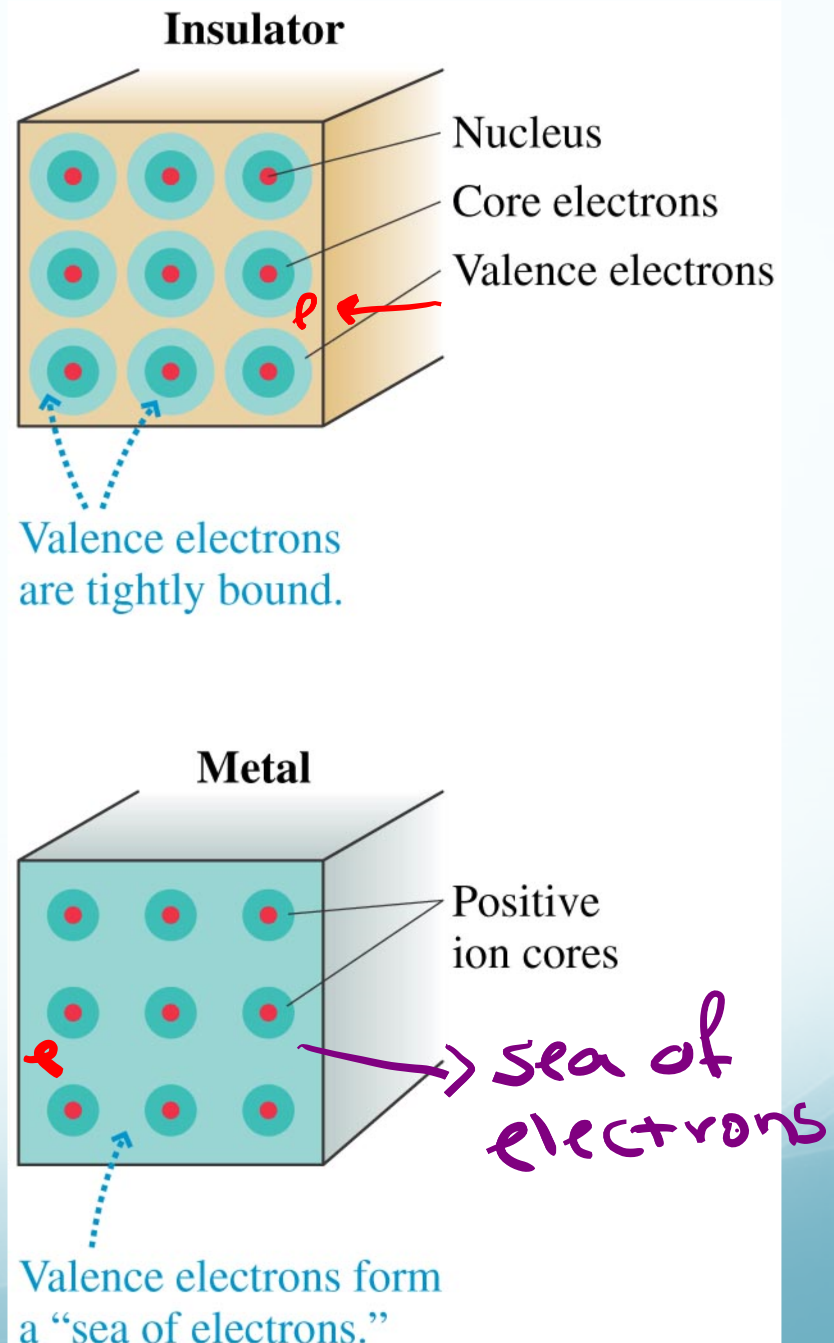
Electric charge comes in discrete packets.

Light comes in discrete packets too, photons.

$$E = h\nu$$

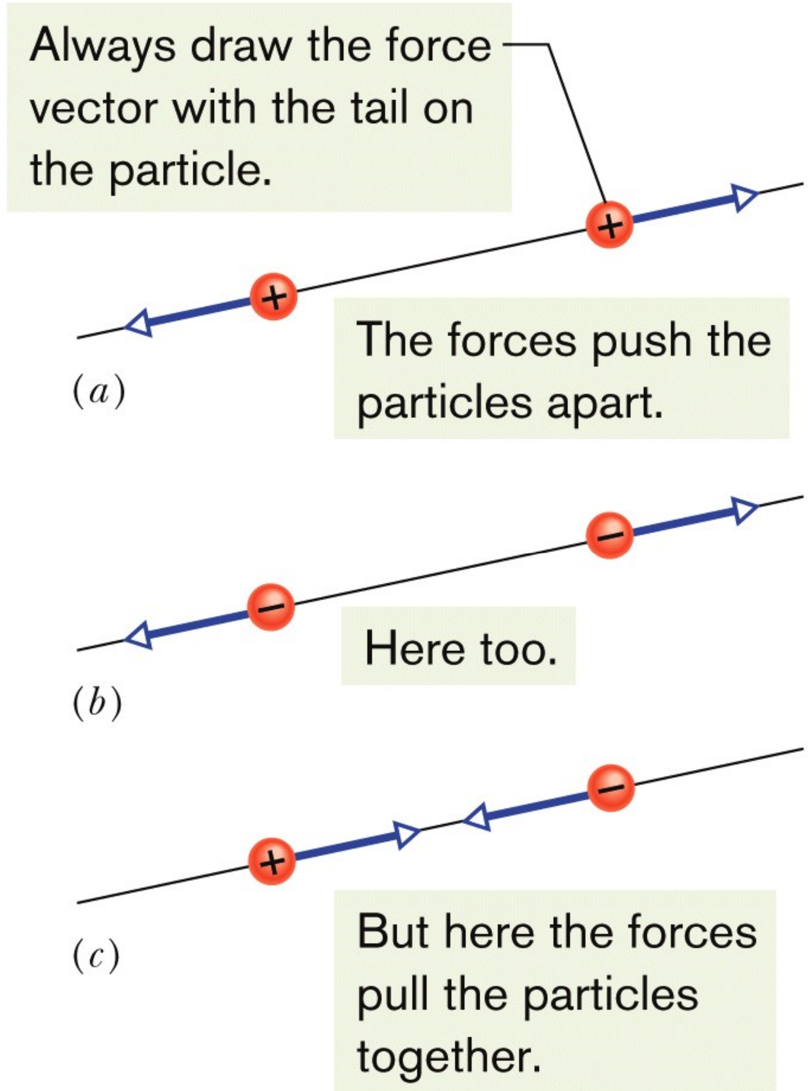
Insulators do not conduct electricity, because the electrons are **not** free to move.

Conductors do conduct electricity, because the electrons **are** free to move.



Two kinds of charges:

positive & negative
+ −



halliday_10e_fig_21_05

Balloon demo
(Yay! Everyone loves balloons!)

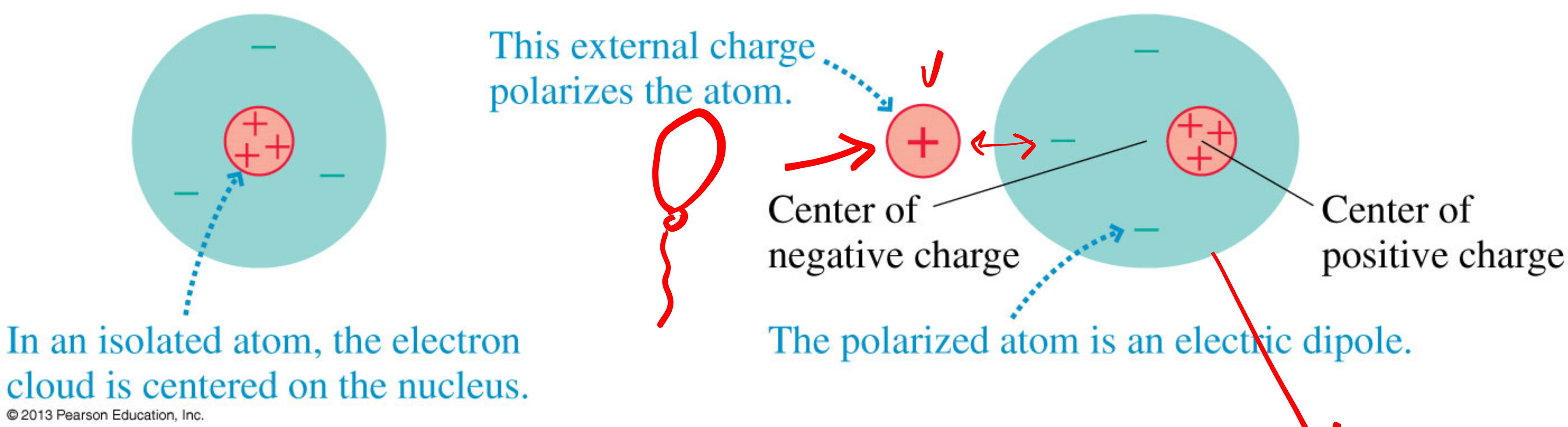
What is going on in the two cases?

Balloon on hair:
Balloon and hair rub together → oppositely charged → attraction

Balloon on wall:
is the wall charged?

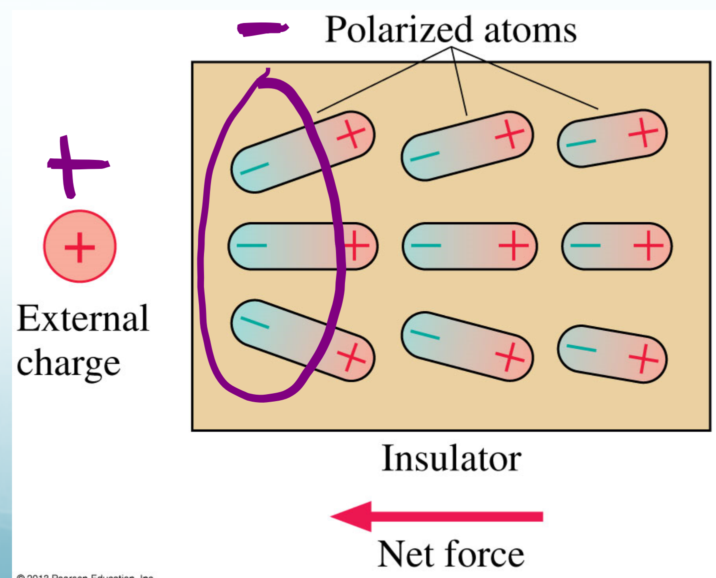
let's do the experiment

Charge Polarization



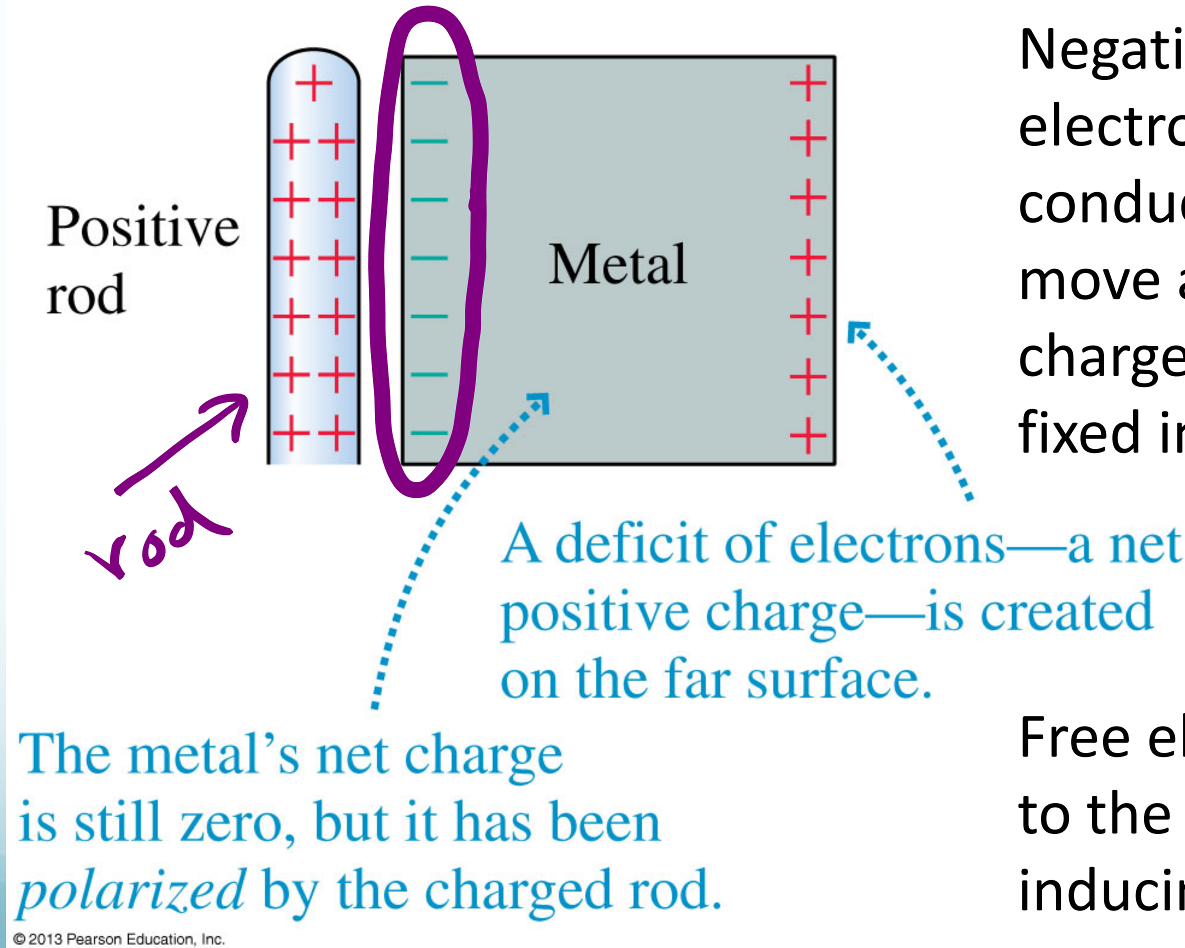
wall

Balloon



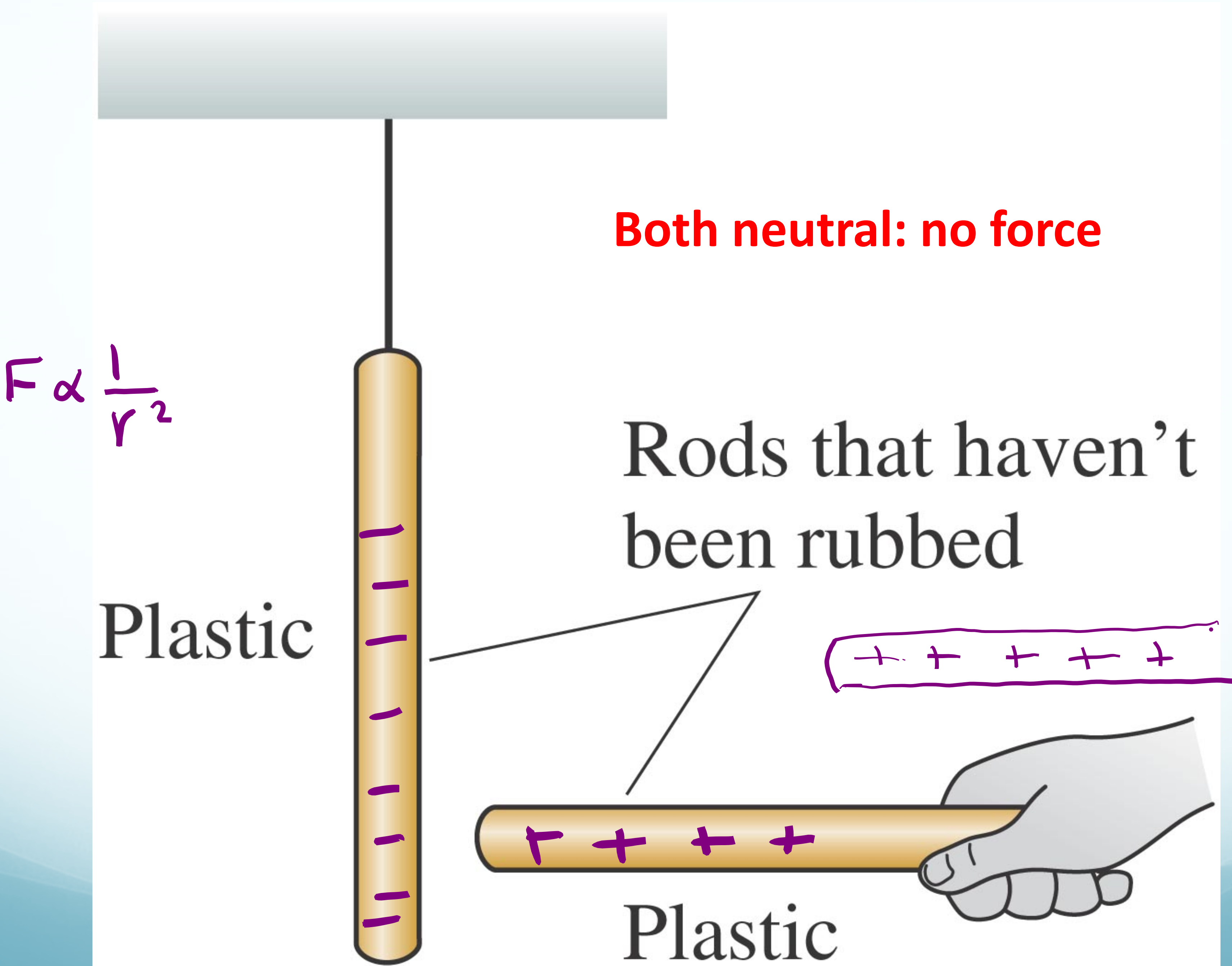
Wall

What happens with conductors?



Negatively charged valence electrons inside the conductor are able to freely move around. The positively charged atomic cores are fixed in place.

Free electrons are attracted to the positively charged rod, inducing a polarization.

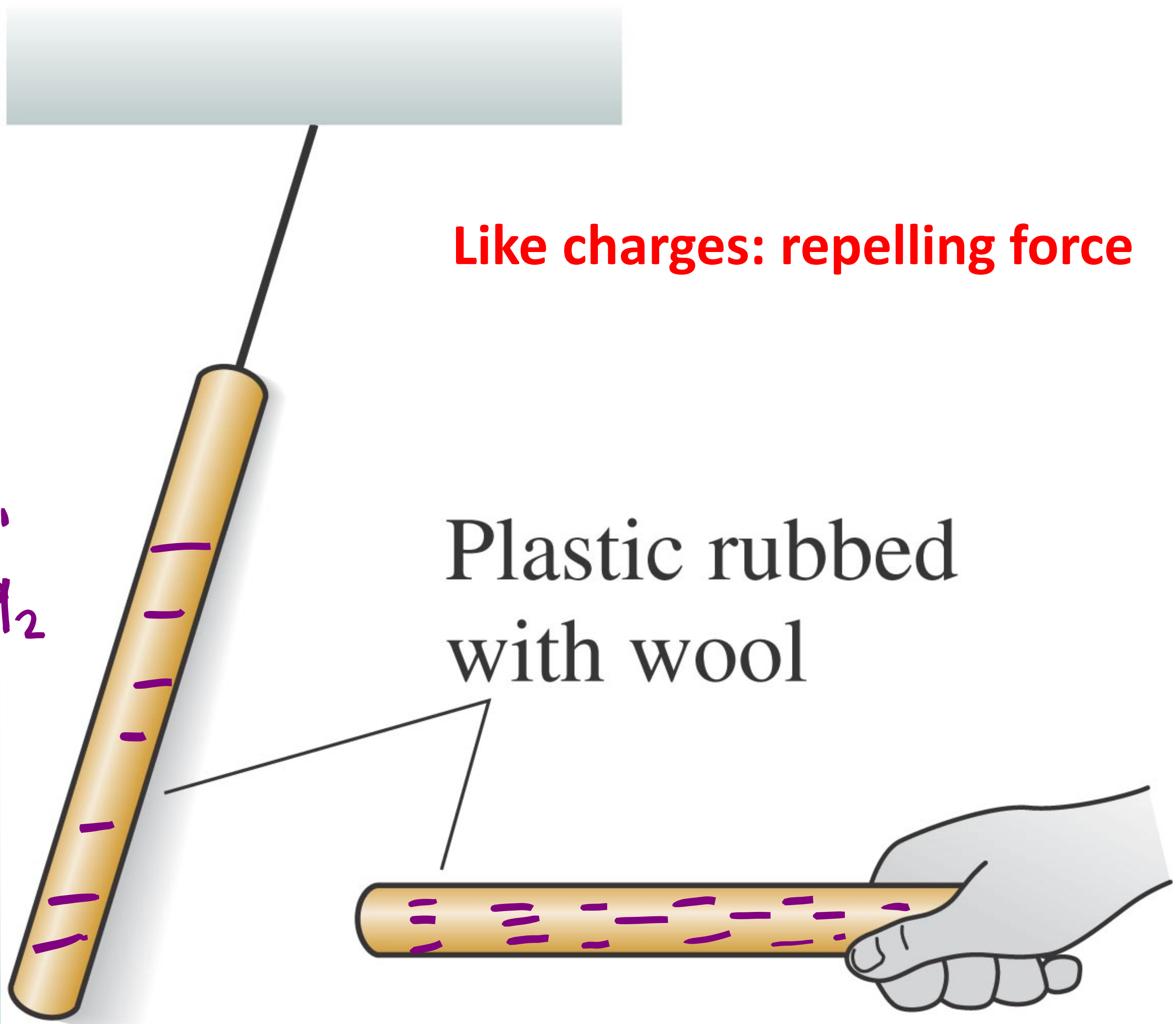


Both neutral: no force
$F \propto \frac{1}{r^2}$
Rods that haven't been rubbed
Plastic
Plastic

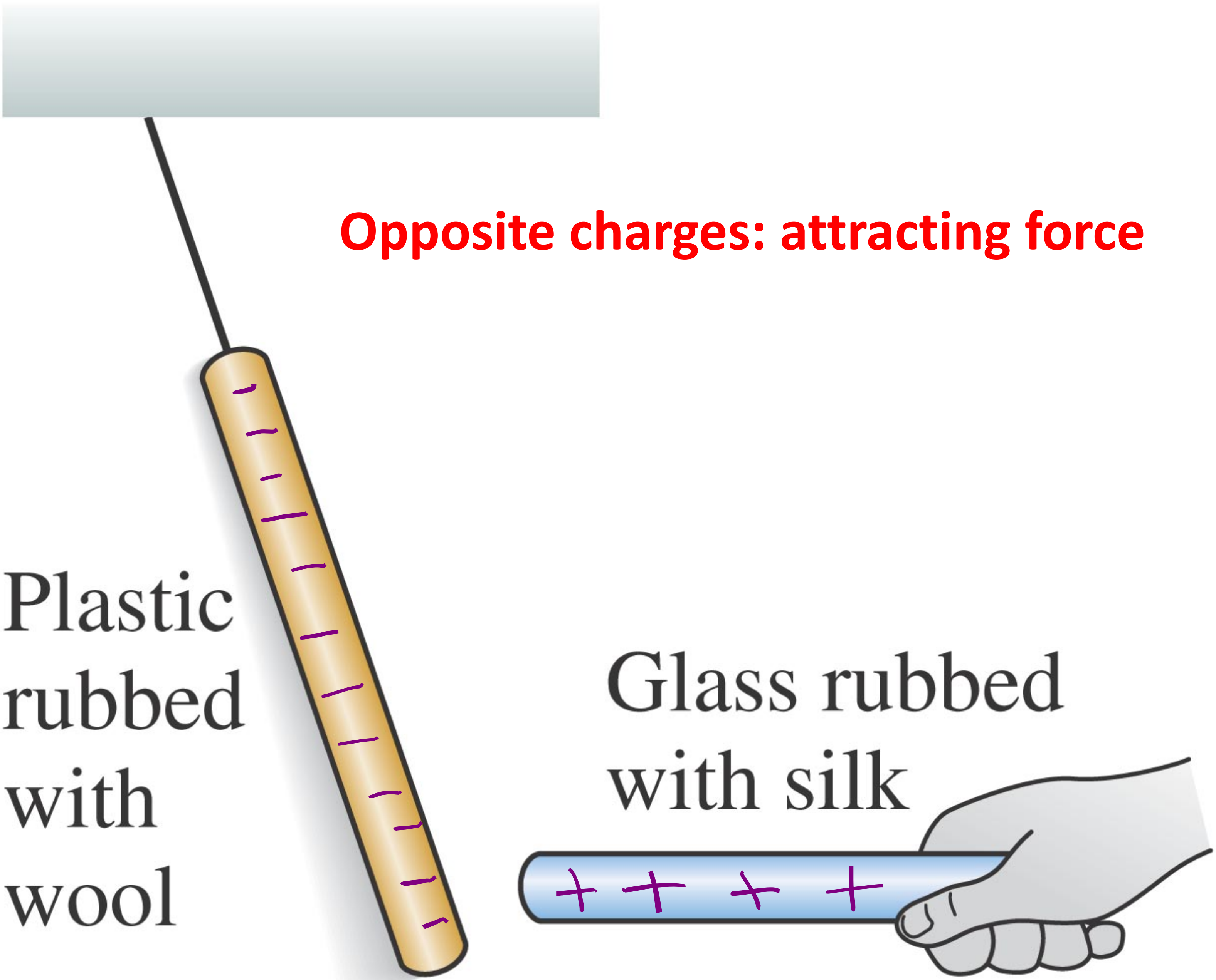
Like charges: repelling force

$F \propto q_1$

$F \propto q_2$



Opposite charges: attracting force



TopHat Question

Course name: PHYS259W2017L02

Registration Code: 655005

Which of the following terms is used to describe a material that does not allow electrons to easily move through it?

a) Conductor
b) Insulator
c) Inductor

98% Correct ⇒ Thank you

This section we talked about:

Chapter 21.1

See you on Thursday