

The Student-Centered Activities for Large Enrollment Undergraduate Programs (SCALE-UP):

Teaching with technology in an interactive classroom

John S. Risley

Professor of Physics, North Carolina State University

President, WebAssign, Raleigh, NC

Student Centered Learning

- How to keep 100 students actively learning?
- Can they communicate and work as a team?
- Can you boost performance, especially of underrepresented groups?

Results*

- Female failure rate is 1/5 of previous levels, even though more is demanded of students.
- Minority failure rate is 1/4 that seen in traditionally taught courses.
- At-risk students are more successful in later engineering courses.
- Conceptual learning and problem solving are improved, with same content coverage

* R. Beichner, L. Bernold, E. Burniston, P. Dail, R. Felder, J. Gastineau, M. Gjertsen, and J. Risley, Phys. Educ. Res., Am. J. Phys. Suppl. 67-71, July 1999.

Active Learning

- Classroom environment
- Activities
 - Tangibles – experiments
 - Ponderables – questions
- Continual assessment
 - WebAssign: Online homework service

Classroom Environment



With students!



Activities

- Hands on experiments
 - Magic tape
- Conceptual questions
 - Conductors and charges
- Analytical problems
 - Electric field of a disk
- Labs
 - Work sheets with follow up

Electric Field of a Disk

Parallel Computing

Each group determines the electric field for a disk carrying a charge 4 nC with radius 4 cm. The distance from the center of the disk is determined by multiplying your group number by the appropriate distance, i.e., group 7b would use a distance of 7 cm.

Use $\epsilon_0 = 8.85\text{E-}12 \text{ C}^2/\text{N}\cdot\text{m}^2$ Report answers to 3 sig figs.

Group	Group a (group no. x 0.01 mm)	Group b (group no. x 0.1 cm)	Group c (group no. x 1 m)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			

Magic Tape



Figure 1.2 Fold under one end of a strip of tape to make a non-sticky handle.

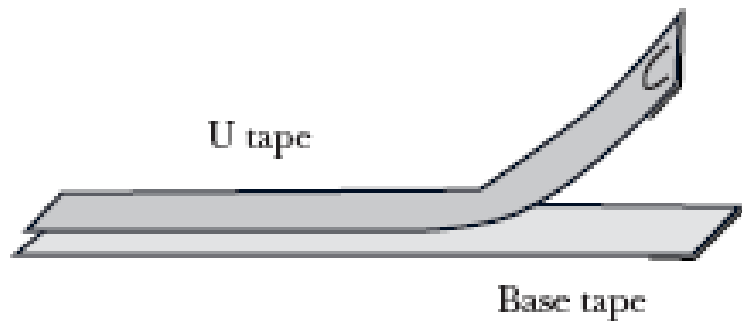


Figure 1.3 The U tape lies on top of the base tape.

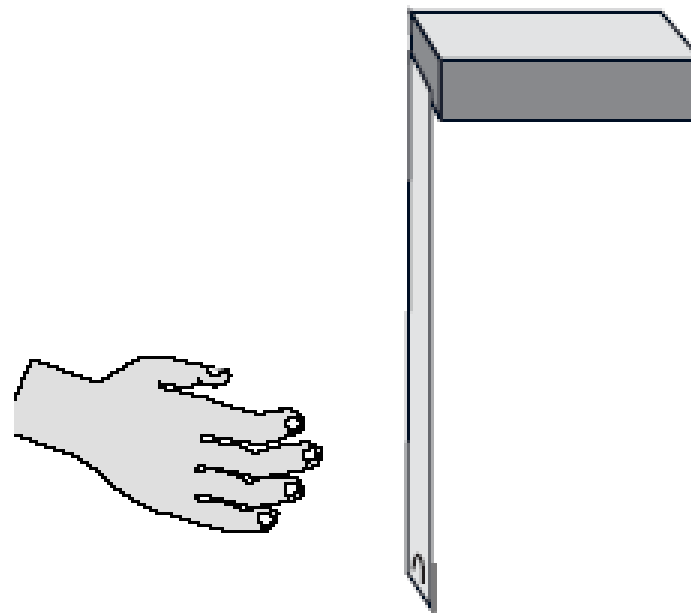
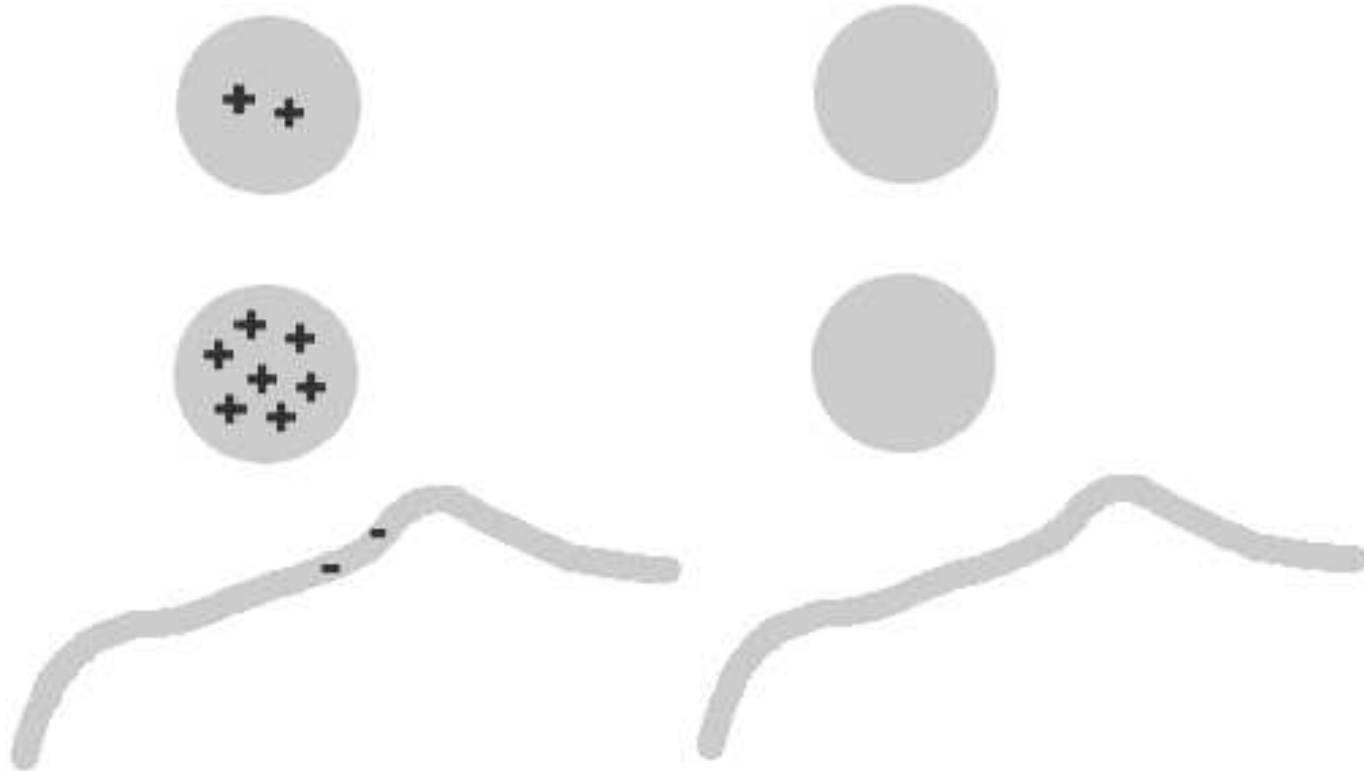


Figure 1.4 Bring your hand near a hanging U tape, and observe what happens.

Conductors and Charges



Continual Assessment

- Homework
 - Preview
 - Exercises
 - Touchstone Problems
- In-class
 - Follow up to an activity
 - Clicker questions

Continual Assessment

- Labs
 - Group
 - Individual follow up
- Group quizzes
- Tests

- All in all 140 assignments in 15 weeks!
 - No grading
 - Instant feedback
 - Up to date grade book