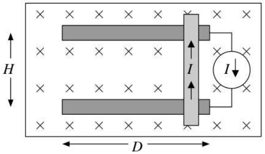
Announcements

- **Grab a set of handouts and flash cards from the front of the room.**
- What you need for PHYS 212:
  - Volume 2 of ESSENTIAL UNIVERSITY PHYSICS by Wolfson (4th edition)
  - PHYS 212 Supplementary Reading
  - Spiral bound graph paper notebook
  - Calculator
- Problems with the PHYS 212 webpages? Contact Katharina Vollmayr-Lee (course administrator)
- The structure of PHYS 212 is the same as PHYS 211: lectures, problem sessions, assigned problems, hand-in problems, reading quizzes, drills, ...

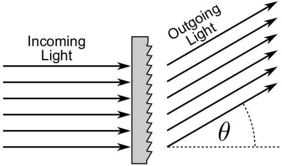
  If you are unfamiliar with any part of this, talk to me after class.

What will we learn in PHYS 212?

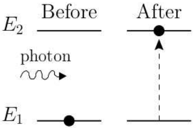
1. Electricity & Magnetism



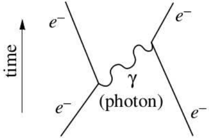
2. Waves and Interference



3. Quantum Mechanics

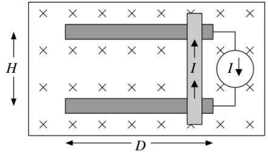


4. Fundamental Particles & Cosmology



What will we learn in PHYS 212?

1. Electricity & Magnetism

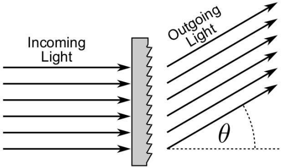


Forces

Oscillations

Vector addition

2. Waves and Interference

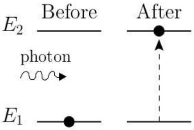


Energy

Thermodynamics

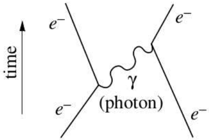
Relativity

3. Quantum Mechanics



Angular momentum

4. Fundamental Particles & Cosmology



Partial list of Applications and Everyday Phenomena

- Molecular interactions
- The entire field of chemistry, especially physical chemistry
- Static forces and static cling.
- Contact, friction and tension forces
- Television sets and computer monitors
- The entire field of electronics
- Particle accelerators
- Nervous system
- Brain and thought
- Geology: EM of molten core of planets.
- Geology: EM techniques for detecting underground formations
- Shielding of sensitive electrical equipment
- Batteries and voltage
- Current and simple circuits
- Electrophoresis
- Photocopy machines and laser printers
- Lightning and sparks
- Simple electrical circuits
- Blowing things up with a simple electrical outlet and a power cord.
- Fuses and circuit breakers
- Light bulbs
- Hair dryers and electrical heaters

Partial list of Applications and Everyday Phenomena (page 2)

- Electromagnets
- Refrigerator magnets
- Rail guns: mining of moon and asteroids
- Electrical power generation
- Tokomak fusion reactors
- Magnetic resonance imaging
- Magnetic data storage: credit cards, computers
- Electromagnetic braking
- Radio and TV waves
- Cell phones and tablets
- Microwave ovens
- Polarization and applications
- Refraction and reflection
- Fiber optics communications
- Non-invasive surgery with fiber optic bundles
- Focusing of light with lenses: laser surgery, DVDs
- Image formation: eyes, cameras, telescopes
- Lousy radio reception
- Radio transmitters
- Soap films
- Precision flatness measurements

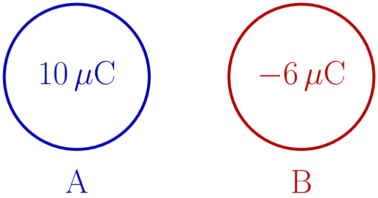
Partial list of Applications and Everyday Phenomena (page 3)

- Anti-reflective coatings
- Hearing someone from behind a tree
- Optical and electron microscopes
- Compact disks and DVD drives
- Holograms
- Remote sensing and surveillance
- Health hazards of electromagnetic radiation
- Photodetectors and video cameras
- Spectroscopy: identifying chemical compositions of materials
- Fluorescence and phosphorescence
- Diodes, transistors, LEDs, photodiodes
- Quantization of energies in atoms
- Genetically mutated, fluorescent biological organisms and GFP tags.
- Radioactive decay
- The Periodic Table of the Elements
- Lasers and their applications (CD players, grocery check-outs, laser surgery, surveying, etc.)
- Innumerable medical diagnostic and treatment equipment.
- Quantum computation and encryption techniques
- Superconductors and superfluids
- Magnetically levitated trains

Lecture 1 — Concept Test 1

Two identical conducting spheres A and B are initially prepared with charges $q_A = 10\,\mu\text{C}$ and $q_B = -6\,\mu\text{C}$.

The conductors are brought into contact and then separated again. What are the new charges on the two spheres?



1. $q_A = 0, \quad q_B = 0$
2. $q_A = 10\,\mu\text{C}, \quad q_B = -6\,\mu\text{C}$
3. $q_A = 5\,\mu\text{C}, \quad q_B = -3\,\mu\text{C}$
4. $q_A = 2\,\mu\text{C}, \quad q_B = 2\,\mu\text{C}$
5. $q_A = 4\,\mu\text{C}, \quad q_B = 0\,\mu\text{C}$
6. $q_A = 8\,\mu\text{C}, \quad q_B = 8\,\mu\text{C}$

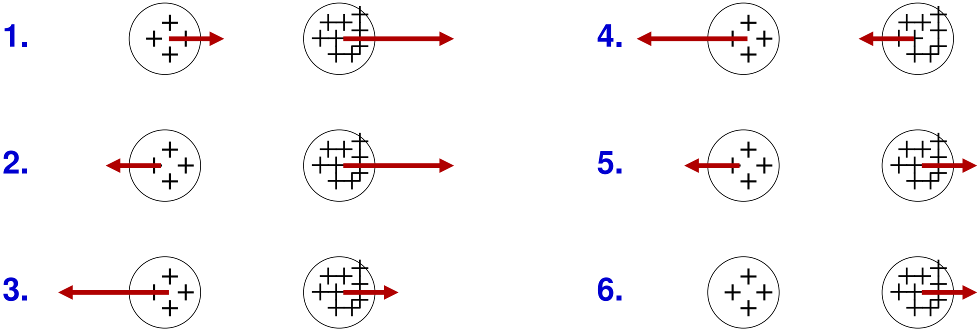
Lecture 1 — Concept Test 2

Assume the balloon has a negative charge and I am net charge neutral, how is it that a charged balloon can be attracted to me?

1. I must have a net positive charge
2. I must have a net negative charge
3. There can be electrical attraction even if I am net charge neutral.
4. There must be a thin layer of glue or some other sticky substance on my hand (and on the ceiling too).
5. It isn't an electrical force holding the balloon up. There is some other force involved.
6. I'm up here muttering *wingardium leviosa* to levitate the balloon.

Lecture 1 — Concept Test 3

Two positively charged spheres are shown below. Which of the diagrams best depicts the magnitude and direction of the electrostatic forces on each sphere?



Lecture 1 — Concept Test 4

Which arrow best shows the direction of the net force on particle 1?