Logistical+Administrative Info.

Lectures: Tu & Th 09:30-10:50 a.m., 2722 York Hall

TA: Grigor Aslanyan

You must also be concurrently enrolled in Physics 1B-LAB -- completely separate course/grading


Course website: http://physics.ucsd.edu/students/courses/fall2010/physics1b/
Our Office Hours:

My Office Hours: Mon 11:30-12:30 & Thur 11:30-12:30

My Office Location: 412 SERF Bldg.

Grigor’s Office Hours: Mon 2-3 & Thur 2-3
Grigor’s office: 4514 Mayer Hall Addn.
My Office Location

Science & Engineering Research Facility
Office #412
Grigor’s Office Location

Mayer Hall Addition,
Office #4514
Discussion / Problem Sessions: Every Monday evening, 6:00-7:50 p.m., in 2622 York

EXAMS:

4 QUIZZES in lecture:


FINAL EXAM:

Final Exam: Thursday, December 9, 08:00-11:00, location TBA
Grading:

Final Exam = 37%

Quizzes = 63% (top three quiz grades are 18% each; lowest quiz grade is 9%).

There will be no make-up exams. Please plan ahead for the exams accordingly!

*Bring your own scantron forms (X-101864-PAR only!) and #2 pencils!*

Scientific calculators: okay (but no iPhones, etc.!)
HOMEWORK -- Will not be collected/graded, but are the best way to practice for the quizzes/final.

Do all the text’s ‘Quick Quizzes’ and try as many conceptual questions as you can.

Physics Tutorial Center, 2702 Mayer Hall Addition. Days/Hours of operation (tentative as of 9/22): Sun through Thurs, 3-8 pm
More administrative info.

Deadlines:
Last day to add a class: Friday, 10/8
Last day to drop a class without a W and change grade option: Friday, 10/22
Last day to drop a class WITH a W but without an F: Monday, 11/29

See the Physics Dept. Student Affairs Office, 2521 Mayer Hall Addition, for additional info.
ACADEMIC DISHONESTY: Please read the "UC Policy on Integrity of Scholarship" in the UCSD General Catalog. Cheating, including knowingly allowing a peer to copy your quizzes or tests, will result in an F in this course and referral to the Dean for disciplinary action. See http://senate.ucsd.edu/manual/Appendices/app2.htm & http://www.ucsd.edu/catalog/front/AcadRegu.html
Some recommendations

Keep a running list of equations for quick reference (an ‘equation toolbox’)

Commit to studying and reviewing notes consistently -- Do not wait until the night before an exam (cramming never helps).

Online notes are meant to augment, not be a substitute for, attending lectures and problem sessions

All quizzes/exams are cumulative!
General overview of course:

19: Charges, electrostatic forces, electric fields
20: Electric potential, electrical energy, energy storage
21: Electrical Currents (moving charges), DC Circuits, Time-dependent Circuits
22: Magnets, magnetism, magnetic forces
23: Induced currents from magnetism; AC Currents; inductive circuits
24: Electromagnetic radiation
Why is E+M important?

In this course, applications covered include:

Electric Motors and Generators; Power Line Transmission & Distribution; Household Circuits; Batteries

Magnets & Magnetism: Electromagnets, Computer Drives & Data Storage, Planetary Magnetic Fields

Medical Diagnostic Imaging (X-rays)

Medical Devices (Defibrillators)

EM Radiation (visible light, radio, TV, cell phones)
High Energy Astrophysics Group

RXTE Begins Operation of 750th Week in Orbit
The Bruno Rossi X-ray Timing Explorer, launched on December 10, 1995, completed its 750th consecutive week of observing a variety of cosmic X-ray sources from low Earth orbit in mid-June...

June 5 at 6:52am - Comment · Like · Share
Macy Romenskie and Wayne Colburn like this.

High Energy Astrophysics Group

The Magnet Collaboration
The Magnet collaboration is a collection of astrophysicists from around the world interested in the effects of matter accreting onto the magnetic poles of highly magnetized neutron stars with toroidal magnetic fields...

June 3 at 6:52am - Comment · Like · Share
Wayne Colburn likes this.

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Like
Ch. 19: Electric Forces & Electric Fields

Properties of electric charges & how they interact with each other -- on both macroscopic and microscopic scales.
Electric Charges & Conservation of Charge

Nature of Matter

Insulators & Conductors

Charging by Induction
Electrical Charges

Two kinds of charges: positive & negative

Like charges repel

Unlike charges attract
Electrical Charges

Charge is a quantized quantity ("e")

Proton: $e = +1.6 \times 10^{-19} \text{ C}$

$m_p = 1.67 \times 10^{-27} \text{ kg}$

Electron: $e = -1.6 \times 10^{-19} \text{ C}$

$m_e = 9.11 \times 10^{-31} \text{ kg}$

Units = Coulomb

An object may have a total charge of 0, ±1e, ±2e, ±3e,…

CONSERVATION OF CHARGE: Total amount of charge is conserved in any interaction
Electric Charges & Conservation of Charge

Nature of Matter

Insulators & Conductors

Charging by Induction
Nature of Matter

Review: Atoms contain nuclei with protons and neutrons; e−’s orbit around nucleus

Most matter is neutral: equal numbers of +, − charges (sum of all charges is zero)

*Charge transfer is usually due to movement of electrons*
Charging by Rubbing

Examples: Glass + silk;
Rubbing a balloon against your hair

Negative charges are transferred from glass to silk

Application: static electricity
Electric Charges & Conservation of Charge

Nature of Matter

Insulators & Conductors

Charging by Induction
Insulators & Conductors

**Insulators:** do not conduct charges: glass, rubber, paper, plastic

**Conductors:** Charges can move freely. Most metals. Density of charge carriers in Cu: $10^{29}/m^3$

**Semi-conductors:** intermediate conduction properties -- silicon, germanium. Density of charge carriers in Si: $10^{16}/m^3$
In conductors, charges can move freely.
Electric Charges & Conservation of Charge
Nature of Matter
Insulators & Conductors
Charging by Induction
Charging by Induction

Conducting wire = Connection to ground: a “sink” or for negative electrical charge

Question - why do only negative charges ‘jump ship’?
Charging by Induction

In insulators: centers of +, – charges separate slightly: POLARIZATION

Ex.: rubber balloon sticking to neutral wall
19.4–19.6

Electrostatic Forces; Coulomb’s Law

Electrostatic Forces from multiple charges

Electric Fields: point charges

Electric Fields: multiple point charges, continuous charge distributions

Electric Field Lines
Electric Force

A collection of 4 charges, each with $+1e$…

…equivalent to “a charge” with $+4e$
Electric Force

A collection of 4 charges, each with +1e...  
...equivalent to “a charge” with +4e

Given two objects with charges $q_1$ & $q_2$:

Coulomb’s Law: $|F_e| = \frac{k_e |q_1| |q_2|}{r^2}$

Coulomb constant $k_e = 8.99 \times 10^9$ N m$^2$ / C$^2$ = $1/(4\pi\varepsilon_0)$

Permittivity of free space $\varepsilon_0 = 8.85 \times 10^{-12}$ C$^2$ / (Nm$^2$)
Electric vs. Gravitational Forces

Consider a hydrogen atom: One proton, one electron, \( r = 5.3 \times 10^{-11} \text{ m} \)

\[
F_e = \frac{k_e q_1 q_2}{r^2} = \frac{8.99 \times 10^9 \text{Nm}^2/\text{C}^2 (1.6 \times 10^{-19} \text{ C})^2}{(5.3 \times 10^{-11} \text{ m})^2}
\]

\[
= 8.2 \times 10^{-8} \text{ N}
\]

\[
F_g = \frac{G m_1 m_2}{r^2} = \frac{6.67 \times 10^{-11} \text{Nm}^2/\text{kg}^2 (1.67 \times 10^{-27} \text{ kg})(9.11 \times 10^{-31} \text{ kg})}{(5.3 \times 10^{-11} \text{ m})^2}
\]

\[
= 3.6 \times 10^{-47} \text{ N}
\]

Both forces are prop. to \( 1/r^2 \), but gravity is much weaker!