**Semester 2 Assignment Plan**

**AP Physics**

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|  |  |  | http://cwx.prenhall.com/bookbind/pubbooks/wilson/ | | | | | | |
| Date | Topic | Book Chap: Read/Notes and EoC Problems  Click on Ch for more info | Practice Questions | Physlet Problems | Ranking Task Exercises | Practice Problems | Other | Labs/Sims | Test |
| [Jan 7-11](#Week_1) 5 | Electric Charge, Forces and Fields | [Ch 15](#_Chapter_15:_Electric_) | [1-25](http://cwx.prenhall.com/bookbind/pubbooks/wilson/chapter15/deluxe.html) | [1-11](http://cwx.prenhall.com/bookbind/pubbooks/wilson/chapter15/deluxe.html) | [1, 2, 4, 5](http://cwx.prenhall.com/bookbind/pubbooks/wilson/chapter15/deluxe.html) | [1-10](http://cwx.prenhall.com/bookbind/pubbooks/wilson/chapter15/deluxe.html) |  | Electroscope Map an Electric Field |  |
| [Jan 14-17](#Week_2) 4 | Electric Potential, Energy and Capacitance | [Ch 16](#_Chapter_16:_Electrical) |  |  |  |  |  |  |  |
| [Jan 22-25](#Week_3) 4 | Electric Current and Resistance | [Ch 17](#_Chapter_17:_Electric) |  |  |  |  |  |  |  |
| [Jan 28-Feb 1](#Week_4) 5 |  |  |  |  |  |  |  |  |  |
| [Feb 4-8](#Week_5) 5 | Circuits |  |  |  |  |  |  |  |  |
| [Feb 11-13](#Week_6) 3  Mid Q PT Conf |  |  |  |  |  |  |  |  |  |
| [Feb 19-22](#Week_7) 4 | Optics |  |  |  |  |  |  |  |  |
| [Feb 25- Mar 1](#Week_8) 5 |  |  |  |  |  |  |  |  |  |
| Mar 4-8 5 | Relativity |  |  |  |  |  |  |  |  |
| Mar 11-15 5 |  |  |  |  |  |  |  |  |  |
| Mar 18-22  End 3rd Q 5 | Quantum |  |  |  |  |  |  |  |  |
| Spring Break |  |  |  |  |  |  |  |  |  |
| Apr 2- 5 | The nucleus |  |  |  |  |  |  |  |  |
| Apr 8-12 |  |  |  |  |  |  |  |  |  |
| Apr 15-19 | Nuclear Reactions |  |  |  |  |  |  |  |  |
| Apr 22-26 |  |  |  |  |  |  |  |  |  |
| Apr 29-May 3  MQ | review |  |  |  |  |  |  |  |  |
| May 6-10 | review |  |  |  |  |  |  |  |  |
| May 13-17 | AP EXAM |  |  |  |  |  |  |  | AP EXAM |
| May 20-24 |  |  |  |  |  |  |  |  |  |
| May 28-31  Final Exams  End of Year |  |  |  |  |  |  |  |  |  |
| Jun 3-7  Xtra Days if Required |  |  |  |  |  |  |  |  |  |

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### **Chapter 15: Electric Charge, Forces, and Fields**

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College Board Performance Objectives:

* Discuss the nature of electrical charge.
* Understand charge quantization.
* Recognize that all charges are multiple of the fundamental unit of charge.
* Demonstrate that charge is conserved.
* Explain how to charge a body by induction.
* Distinguish between an insulator and a conductor.
* State Coulomb's Law and express it in terms of an equation.
* Apply Coulomb's Law to physical situations involving systems of point charges.
* Define the electrical field in terms of an isolated point charge.
* Show how the electric field is similar to a gravitational field.
* Calculate the magnitude and the direction of the force that would act on a test charge placed at a given point in an electric field.
* Write a mathematical expression to determine the electrical field at a given point in space.
* Calculate the electric field of a system of charge distributions.
* Discuss the motion of a charged particle in a uniform electric field.

Key Words:

* electrical charge, p. 483
* fundamental unit of charge, p. 483
* coulomb, p. 484
* microcoulomb, p. 484
* picocoulomb, p. 484
* net charge, p. 484
* conservation of charge, p. 484
* quantized charge, p. 485
* conductors, p. 485
* insulators, p. 485
* semiconductor, p. 485
* electrostatic charging, p. 487
* charging by induction, p. 488
* polarization, p. 488
* Coulomb's Law, p. 489
* electric field, p. 495
* electric lines of force, p. 498
* electric dipole, p. 498

Critical Thinking Questions: Should be able to answer.

1. Two particles separated by a distance of 10.0 cm have charges of +120 µC and –70 µC respectively. (a) Calculate the force acting between them. The bodies are allowed to touch and then are returned to their original separation. (b) What is the charge on each particle? (c) What is the new force acting between them?
2. The electron and proton in the hydrogen atom are separated by 0.53 Å. Compare the magnitude of the electrical force to the gravitational force between them.
3. point charges, q(1) = 3 µC and q(2) = 7 µC, are separated by 20.0 cm. (a) Where, between q(1) and q(2), should a third charge be placed so that it has zero resultant force acting on it? (b) What is the magnitude of the electric field at this point?
4. Four point charges, q(1) = +40 nC, q(2) = +70 nC, q(3) = +50 nC, and q(4) = + 70 nC are placed at the vertices of a square that measures 10.0 cm on a side. Calculate the magnitude of the resultant electric field at the center of the square.

Troubleshooting Tips/Error Traps:

* Make sure to convert µC, nC, and pC to proper powers of ten when making calculations.
* Students may have difficulty understanding action-at-a-distance electrical force. Don’t forget the properties of the electric field.
* Students may have difficulty in properly expressing the direction of electrostatic forces. Remember the sign of the charge tells you the charge of the article not the quantity of charge.

End of Chapter Activity: Try on your own

1. Tear a sheet of paper into small pieces and drop them on a tabletop. Stretch a rubber band and bring it near them. What happens? Why?
2. How can you prove that a body is charged?
3. Why does plastic wrap stick to itself and to other bodies?
4. Rub a balloon against your shirt. Place it against a wall. What happens? Why does this happen? Make a vector diagram and show all forces acting on the balloon.
5. How does electric charge accumulate in cumulonimbus clouds?
6. Explain why electrons usually transfer charge.

Suggested Problem Assignments:

pp. 506–510: Problems: 1, 2, 3, 5, 6, 7, 8, 9, 10, 12, 14, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 76, 77, 78,79, 80, 81, 82, 89, 90

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# Chapter 16: Electrical Potential, Energy, and Capacitance

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**College Board Performance Objectives:**

* Distinguish by definition and example between potential energy, electric potential, and electric potential difference.
* Distinguish between positive and negative work.
* Compute the potential energy of a known charge at a given distance from another known charge and state whether the potential energy is positive or negative.
* Determine the electric potential at any point due to a charge of known magnitude.
* Compute the electric potential at a point in the neighborhood of a number of isolated charges.
* Find the force that would be exerted on a given charge placed between two oppositely charged parallel plates of known separation and potential difference.
* Describe and illustrate Millikan's Oil-Drop Experiment and its significance in the history of the development of physics.
* Define the electron volt, eV, and be able to express energy in terms of this unit.
* Define the dielectric strength of a material and describe the part it plays in limiting the charge that can be placed on a conductor.
* Discuss the effects of the size and the shape of a conductor on its ability to store a charge.
* Derive a relationship between applied voltage, capacitance, and total charge.
* Find the capacitance of a parallel-plate capacitor when the area of the plates is given and they are separated by a medium of a known dielectric constant.
* Define permittivity and give examples illustrating its effect on a capacitor.
* Calculate the equivalent capacitance of a number of capacitors arranged in (1) series, (2) parallel, and (3) series and parallel combination.
* Define and calculate the energy of a charged capacitor.
* electrical potential energy, p. 512
* electrical potential difference, p. 512
* volt, p. 513
* voltage, p. 513
* electrical potential, p. 513
* equipotential surface, p. 519
* electron volt, p. 523
* capacitor, p. 524
* capacitance, p. 525
* farad, p. 525
* dielectric constant, p. 528
* dielectric permittivity, p. 530
* equivalent series capacitance, p. 534
* equivalent parallel capacitance, p. 534

**Critical Thinking Questions:** Should be able to answer.

1. An electrical charge q creates a field of 5400 N/C at a point R away from the charge. The potential at that point is +2700 V. Determine values of q and R.
2. Calculate the radius of a spherical capacitor that will have a capacitance of 1.0 F in air.
3. The potential difference between two parallel plates 4.0 cm apart is 2000 V. A silk thread holding a 10 mg body attached to the upper edge of the positive plate makes an angle of 5° with the plate. What is the magnitude of the charge on the body?
4. A 24.0 µF capacitor and a 12.0 µF capacitor are connected in series to a 60 V source. Calculate the charge and voltage on each. The capacitors are disconnected from the power source and reconnected in parallel. What is the new charge and voltage on each?
5. An electron is released from rest from the negative plate in a parallel plate capacitor maintained in vacuum. The plates are 2.00 mm apart and are connected to a 12.0 V battery.
   1. What force does the electron experience?
   2. What is the acceleration?
   3. With what velocity does the electron impact the positive plate?
   4. How long does it take the electron to travel to the positive plate?
   5. What is the kinetic energy of the electron on impact?
   6. How much work does the electrical field do?

**Troubleshooting Tips/Error Traps:**

* Students may treat the electric potential as a vector. Stress the definition of electrical potential. Emphasize that electrical fields have two properties. The electric field is a vector with magnitude and direction, and electrical potential is a scalar with magnitude only. Electric field is used to calculate the force on a charged particle at a given point in space whereas electrical potential is used to calculate the work done in transporting a charge through the field.
* Stress that potential is a property of space while potential energy is a property assigned to a charge.
* Students may have difficulty understanding that the surface of a conductor is an equipotential surface. Stress the definition of the equipotential surface.
* Students have difficulty understanding that potential is zero at great distance from a charge. Emphasize the concept with appropriate examples.
* Students may have difficulty recognizing that potential difference and difference in potential energy is not the same quantity.

**End of Chapter Activity:** Try on your own

1. A proton and an electron are 1.0 cm apart in air. Show the direction of the electrical field in the region around the charges and indicate the equipotential surfaces.
2. Research the Millikan Oil-Drop Experiment.
3. Research the Van de Graaff generator.
4. If the net charge of a capacitor is always zero, what is stored in the capacitor?

**Suggested Problem Assignments:**

pp. 537–541: Problems:2, 4, 6, 7, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32,42, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 64, 65, 66, 67, 68, 69, 70, 71, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 96, 97, 99

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# **Chapter 17: Electric Current and Resistance**

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College Board Performance Objectives:

* Define the ampere as the unit of electrical current.
* Distinguish between conventional flow and electron flow.
* State Ohm's Law for electrical components.
* Define the unit of resistance, the ohm.
* Determine the potential drop across a resistance carrying a given current.
* Define the factors that determine the resistance of a given wire.
* Calculate the resistance of a wire given its resistivity, length, and radius.
* Explain, on the atomic level, the effect of increased temperature in a given resistance.
* Calculate the change in resistance of a conductor with change in temperature.
* Relate the potential difference across a resistor carrying a current to its energy loss.
* Define the watt as the unit of electrical power.
* Determine the power loss across a given current-carrying resistance.

Key Words:

* battery, p. 543
* cathode, p. 543
* anode, p. 544
* emf, p. 544
* terminal voltage, p. 544
* direct current, p. 545
* DC, p. 545
* conventional current, p. 546
* electric current, p. 546
* ampere, p. 546
* drift current, p. 547
* resistance, p. 548
* Ohm's law, p. 548
* ohm, p. 548
* resistivity, p. 549
* conductivity, p. 549
* temperature coefficient of resistivity, p. 551
* superconductivity, p. 552
* electric power, p. 552
* joule heat loss, p. 554
* kilowatt-hour, p. 558

Critical Thinking Questions: Should be able to answer.

1. A potential difference of 6.0 V is applied to a 24 gauge (diameter = 0.5106 mm) copper wire 50.0 m long, for 3.0 minutes. Determine the total charge and the number of electrons that have moved during this time.
2. A student performs an Ohm's Law experiment using a 20 m spool of 30 gauge copper wire, diameter 0.2546 mm. The student obtains the following data:

|  |  |
| --- | --- |
| V in volts (V) | I in amps (A) |
| 1.0 V | 0.148 A |
| 2.0 V | 0.333 A |
| 4.0 V | 0.671 A |
| 6.0 V | 0.866 A |
| 8.0 V | 1.176 A |
| 10.0 V | 1.506 A |
| 12.0 V | 1.842 A |

1. Graph V vs. I and determine the experimental value of the resistance of the spool and compare this value to the calculated value. What is the % difference?
2. A 1.2 kg aluminum pot contains a mixture of 2.0 kg of water and 0.5 kg of ice. The system is placed on an electric heater connected to a 120 V line. If the resistance of the heater is 20 and it is 70% efficient, how much time is required to bring the system to the boiling point?



1. A motor that is 60% efficient is used to lift a 20 kg body 2.4 m in 15 seconds. If the resistance of the motor is 40 , what current is required to operate the motor?



Troubleshooting Tips/Error Traps:

* Students may confuse resistance with resistivity. Stress the difference between them using examples.
* Students may forget how to calculate cross-sectional area and the correct conversion for cm2 to m2. Emphasize both with example problems.
* Students may have difficulty calculating the power dissipated in a resistor. Stress this with examples.

End of Chapter Activity: Try on your own

1. Learn the color codes for identification of resistors in circuits. Be able to identify an unknown resistor in a circuit and to write the color code for a known resistor.
2. Connect a power supply, switch, an ammeter, and a known resistor (at least 0.5 W) in series. Using a stopwatch, take a series of readings of current and time. Design a method of analyzing the current variation. Include a graph.
3. Why are electrodes used in connecting various components such as receivers and amplifiers gold-plated?
4. Calculate the electrical energy consumed in your house for a week.

Suggested Problem Assignments:

pp. 561–565: Problems: 2, 3, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19, 23, 24, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 51 54, 55, 56, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 81 83, 84

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**AP Physics Weekly Lesson Plan**

Week 1: Jan 7-11

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| **Day** | **Section to Read** | **Concepts** | **Lecture Topic** | **Demos** | **Labs** | **Videos** | **Homework** | **Test/ Quiz** |
| **Monday** | 15.1, 15.2 | Electric Charge and Charging | Charge  Charge-force law  Conservation of charge  Electrostatics | Van de Graaff |  |  | EoC: 1, 2, 3, 5, 6, 7, 8, 9, 10, 12, 14 |  |
| **Tuesday** | 15.3 | Electric Force | Coulomb’s Law |  | Electroscope |  | EoC: 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34 |  |
| **Wednesday** | 15.4,15.5 | Electric Field | Electric Field Diagrams |  |  |  | EoC: 35, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 76, 77, 78,79, 80, 81, 82, 89, 90  [Online: PQ;1-25](http://cwx.prenhall.com/bookbind/pubbooks/wilson/chapter15/deluxe.html) |  |
| **Thursday** |  |  |  |  | Map an Electric Field |  | [Online: Phys; 1-11](http://cwx.prenhall.com/bookbind/pubbooks/wilson/chapter15/deluxe.html)  [RTE: 1,2,4,5](http://cwx.prenhall.com/bookbind/pubbooks/wilson/chapter15/deluxe.html) |  |
| **Friday** |  |  | Summation | Franklin’s Bell |  |  | [Online: PP; 1-10](http://cwx.prenhall.com/bookbind/pubbooks/wilson/chapter15/deluxe.html) |  |
| **Next Week** | Ch 16 |  |  |  |  |  |  |  |

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**AP Physics Weekly Lesson Plan**

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| **Day** | **Section** | **Concepts** | **Lecture Topic** | **Demos** | **Labs** | **Videos** | **Homework** | **Test/ Quiz** |
| **Monday** |  |  |  |  |  |  |  |  |
| **Tuesday** |  |  |  |  |  |  |  |  |
| **Wednesday** |  |  |  |  |  |  |  |  |
| **Thursday** |  |  |  |  |  |  |  |  |
| **Friday** | Institute Day |  |  |  |  |  |  |  |
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Week 3: Jan 22-25

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| **Day** | **Section** | **Concepts** | **Lecture Topic** | **Demos** | **Labs** | **Videos** | **Homework** | **Test/ Quiz** |
| **Monday** | Holiday |  |  |  |  |  |  |  |
| **Tuesday** |  |  |  |  |  |  |  |  |
| **Wednesday** |  |  |  |  |  |  |  |  |
| **Thursday** |  |  |  |  |  |  |  |  |
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| **Monday** |  |  |  |  |  |  |  |  |
| **Tuesday** |  |  |  |  |  |  |  |  |
| **Wednesday** |  |  |  |  |  |  |  |  |
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| **Monday** |  |  |  |  |  |  |  |  |
| **Tuesday** |  |  |  |  |  |  |  |  |
| **Wednesday** |  |  |  |  |  |  |  |  |
| **Thursday** |  |  |  |  |  |  |  |  |
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**AP Physics Weekly Lesson Plan**

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| **Day** | **Section** | **Concepts** | **Lecture Topic** | **Demos** | **Labs** | **Videos** | **Homework** | **Test/ Quiz** |
| **Monday** |  |  |  |  |  |  |  |  |
| **Tuesday** |  |  |  |  |  |  |  |  |
| **Wednesday** |  |  |  |  |  |  |  |  |
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Week 7: Jan 7-11

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| **Day** | **Section** | **Concepts** | **Lecture Topic** | **Demos** | **Labs** | **Videos** | **Homework** | **Test/ Quiz** |
| **Monday** |  |  |  |  |  |  |  |  |
| **Tuesday** |  |  |  |  |  |  |  |  |
| **Wednesday** |  |  |  |  |  |  |  |  |
| **Thursday** |  |  |  |  |  |  |  |  |
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Week 8: Jan 7-11

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| **Day** | **Section** | **Concepts** | **Lecture Topic** | **Demos** | **Labs** | **Videos** | **Homework** | **Test/ Quiz** |
| **Monday** |  |  |  |  |  |  |  |  |
| **Tuesday** |  |  |  |  |  |  |  |  |
| **Wednesday** |  |  |  |  |  |  |  |  |
| **Thursday** |  |  |  |  |  |  |  |  |
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