PH 1120 Term D, 2015

STUDY GUIDE 1

1. What are study guides?

   They are handouts that provide you with information indicating what is expected of you to pass the course and serve as an aid in using the textbook.

2. What is in them?

   The guides contain statements of the objectives around which the course is designed. They point to particularly important sections of the text. They single out especially valuable examples worked out in the text. They list problems that you should attempt in order to see if you satisfy the objectives of the course.

3. What are the objectives?

   They are statements indicating what we think you should be able to do to demonstrate that you have learned the material.

4. Are the study guides useful?

   If you use them, yes. They will help you pass the course and learn some physics. If you don't use them, no!

Objective 1

State Coulomb's law. (This means write it out in symbolic form and make sure you can define each symbol used in the expression.)

Given a set of point charges (two or more) at rest at specified locations, calculate the resultant force (vector quantity) on one of the charges caused by the other charge(s).

ALL VECTOR QUANTITIES MUST BE EXPRESSED EITHER IN COMPONENT FORM (i,j,k NOTATION) OR IN TERMS OF A MAGNITUDE AND AN ORIENTATION RELATIVE TO WELL DESIGNATED COORDINATE AXES.

Suggested Study Procedures

Read Secs. 21-1 through 21-3. Study carefully Sec. 21-3. KNOW WHAT THE PRINCIPLE OF SUPERPOSITION MEANS AND HOW TO APPLY IT TO SOLVE PROBLEMS. Examples 21-1 through 21-4 are important to study. Make sure you can solve problems similar to Example 21-4.

Suggested Problems Related to Objective 1 (<u>NOT TO BE TURNED IN</u>):

Do this one first. Determine the unit vector directed
a) from (0,0) to (0,3); b) from (0,0) to (4,0); c) from (0,0) to (4,4);
d) from (1,2) to (2,3); e) from (3,1) to (-3,-1).

Chapter 21: problems 6, 15, 63, 66, 68

Objective 2

a) Define the electric field.

b) Calculate the electric field due to a set of point charges at rest at specified locations.

c) Determine the motion of a charge passing through an electric field.

d) Calculate the electric flux through a given surface

Suggested Study Procedures

Study Secs. 21-4 and 21-5 paying particular attention to examples 21-6 and 21-7. Read sec. 21-5, and examine Examples 21-9, 21-10 and 21-11. Although you won't be asked in the course to perform integrations such as these, we will refer to these results later in the course.

Suggested Problems Related to Objective 2 (NOT TO BE TURNED IN):

Chapter 21: Problems 33, 35, 45, 50, 75, 77

Objective 3

a) Sketch qualitatively the electric field lines associated with: (see the rules below)

- a single point charge of given polarity;
- two or more stationary point charges of given relative magnitude and polarities;
- a point charge or charges in the vicinity of a conducting surface

b) Use Gauss's Law to relate the electric flux through a closed surface to the charge contained within that surface, and to the electric field along the same surface.

Suggested Study Procedures Study Sec. 21-6. Study Secs. 22-1, 22-2, 22-3, 22-4, and 22-5, along with the example problems in these sections.

One difficulty faced by students of electricity is that the electric field seems so abstract or ethereal; there's nothing solid to help get an idea of what is going on. Electric field lines form a useful way to picture how the electric field behaves in space.

Rules for drawing electric field lines:

1. Field lines begin and end only on charges.
2. The number of lines beginning at a positive charge or ending at a negative charge is proportional to the charge.
3. At each point along a field line the direction of the field line is

parallel to the direction of the force experienced by a small positive test charge placed at that point.

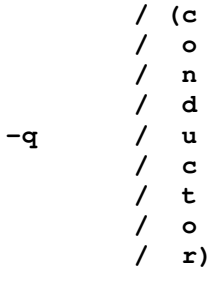
4. The density of field lines (the number of lines passing through an area of one square meter whose surface is perpendicular to the lines) is proportional to the magnitude of the electric field.
5. No two field lines can cross.
6. Under electrostatic conditions, field lines always meet the surface of a conductor perpendicularly; under electrostatic conditions no field lines penetrate a conductor.

Suggested Problems Related to Objective 3 (NOT TO BE TURNED IN)

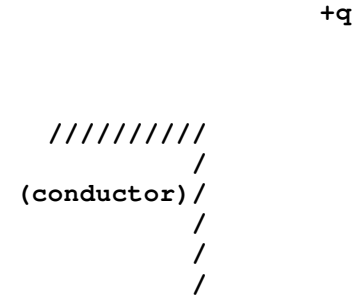
Sketch electric field line diagrams for each of the following configurations:

a) +q −2q

b)



c)



d) two infinite sheets, parallel to each other, with charge densities $+\sigma$ and $-\sigma$.

e) A thin disk of radius R, with surface charge density $+\sigma$.

f) An infinite line of charge with linear charge density $+\lambda$

g) A finite line of charge with linear charge density $-\lambda$

Also in Chapter 22: Problems 4, 6, 8, 9, 40, 41, 46, 47, 48

Homework assignments

The homework assignments are an important part of the course and overall will count as 10% of your grade. You are encouraged to discuss the homework problems with other students, but you are expected to prepare your own solutions for submission. Simply copying the work of another will not help you learn the material, and will not help you do well on the exams, which is the major portion of your grade. If you are having trouble doing the problems, don't copy, GET HELP.

Please note that because of the limited number of homework problems that you will be turning in for grading, it is important that you also try as many of the *suggested* problems as possible. Although the suggested problems are NOT to be turned in for grading, they are equally as important as the assigned homework in mastering the course Objectives.

PLEASE NOTE THAT WRITTEN HOMEWORK SOLUTIONS WILL ONLY BE ACCEPTED PRIOR TO LECTURE ON THE DUE DATE. NO LATE HOMEWORK WILL BE ACCEPTED. Online homework assignments are due at the time indicated.

HOMEWORK ASSIGNMENTS FOR STUDY GUIDE 1

Homework Assignment #1 - due in lecture Wednesday, March 18

1. A small charge of 4×10^{-6} C is located at the point $x = 2$ m, $y = 3$ m in the x-y plane. A second small charge of -3×10^{-6} C is at the point $x = 4$ m, $y = -2$ m.

   a) Draw a diagram showing the two point charges in the x-y plane.

   b) Calculate the force that the first charge exerts on the second. Remember: FORCE IS A VECTOR. Express your answer both in terms of magnitude and angle, and also in i,j notation.

   c) Calculate the force that the second charge exerts on the first charge. Again express your answer both in terms of magnitude and angle, and in i,j notation.

Homework Assignment #2 - due in lecture Friday, March 20

1. For the problem in Homework #1:

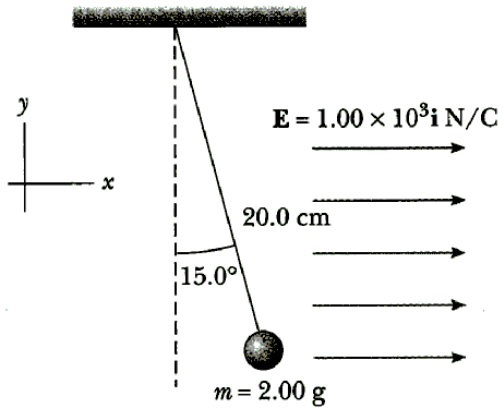
   a) Calculate the electric field at the origin produced by the two charges placed at their given locations. Express your answer in i,j notation.

   b) Calculate the force on a charge of -2×10^{-6} C placed at the origin. Express your answer in i,j notation.

Homework Assignment #3 – due in lecture Monday, March 23

1. **An electron is projected at an angle of 30° above the horizontal at a speed of 8.20 x 10^5 m/s in a region where the electric field is E = 390 j N/C. Neglecting the effects of gravity, find (a) the time it takes the electron to return to its initial height, (b) the maximum height it reaches, and (c) its horizontal displacement when it reaches its maximum height.**

2. **A small, 2.00-g plastic ball is suspended by a 20.0 cm long string in a uniform electric field, as shown below.**



If the ball is in equilibrium when the string makes a 15° angle with the vertical, what is the net charge on the ball?

Homework Assignment #4 – due by 5 pm Wednesday, March 25

Solutions for Assignment #4 will be submitted via the web. In your web browser, go to www.masteringphysics.com. Then (if this is your first time at that site) follow the instructions packaged with your textbook to register. You will need the six-word access code that comes with your textbook to register. For your information, the zip code at WPI is 01609. After you register, you will be able to login at any time using the username and password you have chosen. At your first login, you will be asked to enter the course ID for PH1120, which is:

THE COURSE ID is **PH1120D2015**

IF YOU ARE USING A USED OR BORROWED MASTERING PHYSICS ACCOUNT: go to the course web site and click on the link for "Mastering Physics information" to obtain instructions for enrolling in PH1120 using this account. The direct URL is
users.wpi.edu/~physics/ph1120d15/mp.html

After logging in, click on "Assignment List". Before you do Assignment #4, you may wish to complete Introduction to Mastering Physics – Assignment 0, a brief, noncredit tutorial on how to enter answers in Mastering Physics.

In the Mastering Physics problems, you will get 10 chances to submit a correct answer. If your first answer is incorrect, you should consider making use of the hints, and/or getting help. There is no penalty for opening a hint, and no penalty for giving a wrong answer to a hint. However, if you request an answer to a hint, you will lose some points. Also note that requesting the answer to a part of the problem results in no points for that part, so avoid doing this unless all other options have been exhausted.