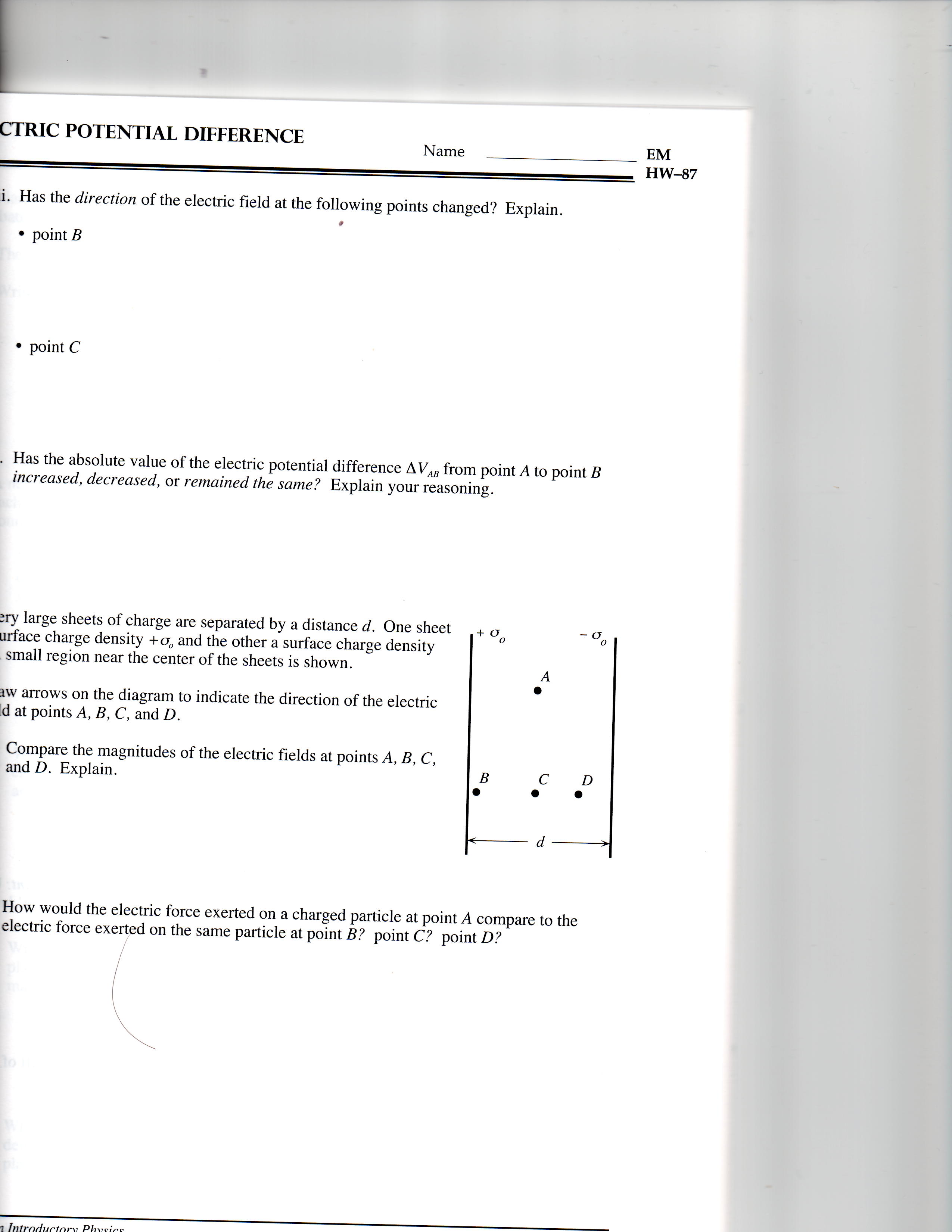
PY212

**Problem Set 3 Worksheet**

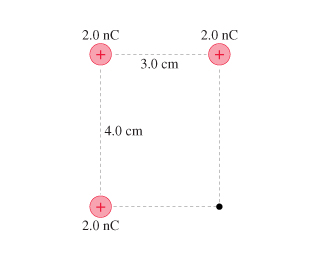
Please begin working immediately with your partners on this first page of tutorials.

1. **Electric Field and Potential between parallel plates**

Two very large sheets of charge are separated by a distance *d*. One sheet has a surface charge density  and the other a surface charge density . A small region near the center of the sheets is shown.



1. Draw arrows on the diagram to indicate the directions of the electric field at points *A, B, C,* and *D*.
2. Compare the magnitudes of the electric fields at the points *A, B, C,* and *D*. Explain.
3. How would the electric force exerted on a charge particle at point *A* compare to the electric force exerted on the same particle at point *B*? point *C*? point *D*?
4. A positively charged test particle moves from point *A* to point *C*.
5. Is the work done on the particle by the electric field *positive, negative,* or *zero*?
6. Find . Explain how you found your answer.
7. A positively charged test particle moves from point *A* to point *D*.
8. Is the work done on the particle by the electric field *positive, negative*, or *zero*?
9. Is  *positive, negative*, or *zero*? Explain how you can tell.
10. A particle of mass  and charge  is released from rest at a point just to the left of the right sheet.
11. Find the speed of the particle as it reaches the left sheet.
12. What are the two methods you can use to find the speed? Are there any benefits for using one versus another?

**II. Potential Energy and Electric Potential**

Consider three 2 nC charges place at 3 corners of a rectangle, shown in the diagram to the right.

a.) What is the potential energy of the system?

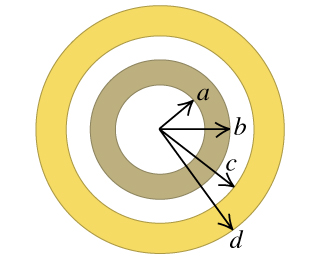
*A*

b.) Suppose we increased all the charges from 2 nC to 4 nC by how much would the energy change?

Express your answer in a ratio of . Explain.

c.) For the original 2 nC system, what is the electric potential at the point *A*?

d.) What amount of work would be required to bring a 3 nC charge from infinity to *A*?

**III. Conductors and Potential**

A small conducting spherical shell with inner radius a and outer radius b is concentric with a larger conducting spherical shell with inner radius c and outer radius d (see the figure). The inner and outer shells have total charges as +2q (on inner shell) and +4q (on outer shell).

a.) What methods are available to calculate the potential for this problem? Is one easier then the other? Explain.

b.) If we wanted to integrate the electric field to find the potential at r=0 what should our limits of integration be? Does it matter? Explain.

c.) For the potential in the region b<r<c write the integral equation for the potential. Does the electric field change in the region you are integrating? If so, how does this affect the integration?

d.) From last week we know that the electric field is zero in the region c<r<d.

1. What does this mean for the potential in this region?
2. What would be the work done moving a charge from r=d to r=c?

e.) Find the potential in the region d<r.

f.) How can we use this to find the potential at r=c? Explain