Physics 102 (S15) **Q3C**

Name: _____ **Section:** _____ **Score:** _____/20

1. A -11 μC point charge **A** is fixed in the space.
(1) You bring a positive charge **B** of 8 μC from infinity to a point which is 7 cm away from charge **A**. What is the work you have to do? [5]

The initial potential energy is 0, because B is infinitely away fro A.
The final potential energy is kQAQB/r = (9 x 10^9) (-11 x 10^{-6}) (8 x 10^{-6})/0.07
= - 11314 x 10^{9 - 6 - 6} = - 11.3 J.
Thus you do -11.3 J of work.

(2) Now, charge **B** is gently released and moves to a point 4 cm away from the fixed charge **A**. What is its speed, if its mass is 1.5 g? [5]

The initial potential energy is Ui = - 11.3 J as computed in (1).
The final potential energy is Uf = (9 x 10^9) (-11 x 10^{-6}) (8 x 10^{-6})/0.04 = - 19.8 J (which is = -11.3 x (.07/0,4)).
Energy conservation:
-11.3 + 0kinetic energy = -19.8 + (1/2)m v^2,
so
v^2 = 2 x (19.8 - 11.3)/ 0.0015 = 11333.33, so v = 106.45 m/s

2. There are four charges on the plane. The equipotential curves are described in the following figure.

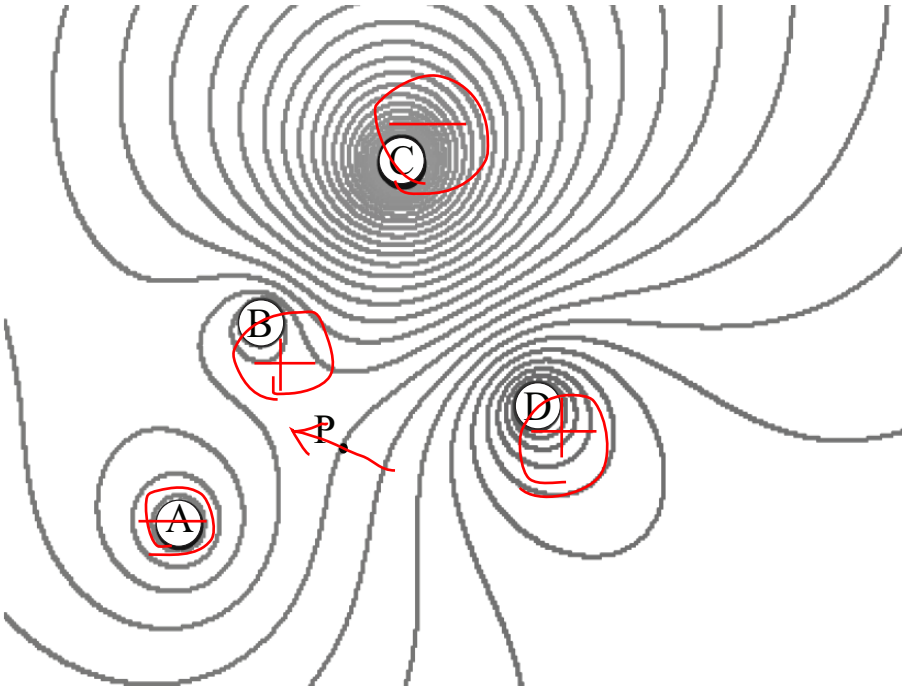

Figure 1:

(1) Suppose A is negatively charged. State the signs of all the remaining charges B - D.

(2) Which charge has the largest magnitude?

C

(3) Indicate the direction of the electric field at P.

Since D is positive and since A is negative, the left side must be with lower potential. E must be perp to the equipotential line.