- Answers -

AP E&M Unit 2 Worksheet 4

1. Sketch the electric field lines and equipotential lines for the following charges:

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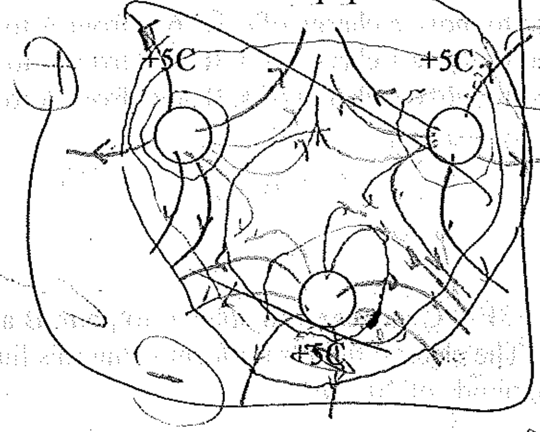
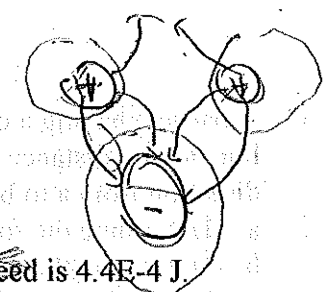


$\vec{E}$ field is ⊥ to equipotential surface

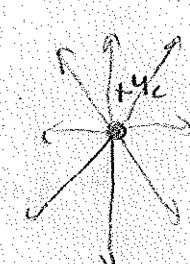


2. The work done to move a charge (q= 3.7E-5 C) at a ~~steady speed~~ is 4.4E-4 J.
   a. Find the difference in electric potential energy of the charge between the two points. 4.4E-4 J
   b. Determine the potential difference between the two points.

$W = \Delta U$

Volts $\quad \Delta V = \frac{W}{q} = \frac{4.4E-4}{3.7E-5} = 11.9\ V$

3. A point charge of +4C creates a field.
   a. What direction is the field from this charge? outward
   b. What is the potential difference (referencing infinity to be zero) 2 cm from the charge?
   c. 12 cm from the charge?
   d. ~~What is the electric field created between these two potentials?~~



b) $V = \frac{kq}{r} = \frac{(8.99E9)(4)}{.02} = 1.8E12\ V$

c) $V = \frac{kq}{r} = \frac{(8.99E9)(4)}{12E-2} = 3E11\ V$

$\Delta V = 1.5E12$

d) $E = \frac{\Delta V}{\Delta x}$ $\quad \frac{1.5E12}{10E-2}$ $\quad E = 1.5E13\ V/m$

4. The positive terminal of an x-ray tube has a potential of 125,000 V relative to the negative terminal.
   a. How much work is done to accelerate an electron through the x-ray tube?
   b. If the electron is initially at rest, how much kinetic energy does it have when it gets to the negative terminal of the tube?
   c. How fast is the electron moving?

positive

a) $\Delta V = \frac{W}{q}$

$W = q\Delta V = (1.6E-19)(125{,}000) = 2E-14\ J$

b) KE = 2E-14 J $\quad$ EPE → KE

c) $\frac{1}{2}mv^2 = 2E-14$

$\frac{1}{2}(9.11E-31)v^2 = 2E-14$ $\quad$ $v = 2.1E8\ m/s$

5. The potential of point A relative to point B (Va-Vb) is +60V. The potential of point C relative to point B (Vc-Vb) is +35 V.
   a. What is the potential difference between A and C?
   b. How much work is needed to move a charge of 4.3E-6 C from A to B?
   c. How much work is needed to move a charge of 4.3E-6 C from B to C?
   d. How much work is needed to move a charge of 4.3E-6 C from A to C?

6. A particle having a charge of +3E-9 C moves from point A to point B along a straight line, a total distance of 0.5m. The electric field is uniform along this line, in the direction from a to b with magnitude of 200 N/C.
   a. Determine the force on q.
   b. Determine the work done by the field.
   c. Determine the potential difference between A and B.

7. Point charges of +7E-6 C (point A) and –9E-6C (point B) are placed 6 cm apart (A on the left).
   a. Find the potential directly in the middle of these two points.
   b. Find the potential at a point 1cm to the left of A.
   C. Find the potential at a point 3 cm to the right of B.

8. A particle having a mass of 5g and charge of 2E-9 C starts from rest at point a and moves in a straight line to point b. what is the speed at point b? (All objects are 1cm apart)

+3E-9C a b -3E-9C