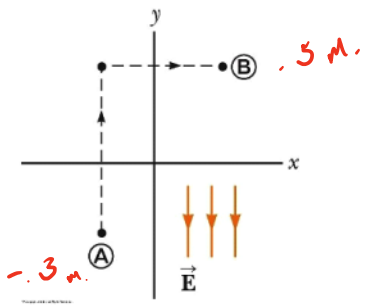
Recitation 6

Tuesday, October 20, 2020 2:38 PM

PEP 112: Electricity and Magnetism Name:

Week 4 Section:

Problem 1: A uniform electric field of magnitude **325 V/m** is directed in the negative **y** direction as shown in the figure. The coordinates of point A are **(-0.200, -0.300) m**, and those of point B are **(0.400, 0.500) m**. Calculate the electric potential difference V_B-V_A using the dashed line path.



Answer:

$E = 325 \text{ V/m}$

$\Delta V = -E \Delta x$

$\Delta V = -(325)(.5 - (-.3))$

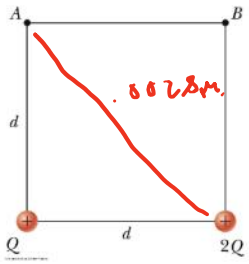
$\Delta V = 260 \text{ V}$

Problem 2: The two charges in the figure are separated by a distance **d=0.200 cm**, and **Q=5.00 nC**. Find

a) The electric potential at A

b) The electric potential at B

c) The electric potential between A and B



A.) $V = \frac{kq}{r}$

$V = k\left(\frac{Q}{d} + \frac{2Q}{\sqrt{d^2+d^2}}\right)$

$V = (8.99\times10^{9})\left(\frac{5\times10^{-9}}{.2\times10^{-2}} + \frac{2(5\times10^{-9})}{.0028}\right)$

$V = 54582.14\ V$

B.)

$V = (8.99\times10^{9})\left(\frac{5\times10^{-9}}{.0028} + \frac{2(5\times10^{-9})}{.2\times10^{-2}}\right)$

$V = 61003.57\ V$

C.) $61003.57 - 54582.14$

$= 6421.43$

Problem 3: A uniform electric field of magnitude **250 V/m** is directed in the positive **x** direction. A **+12.0 μC** charge moves from the origin to the point **(x,y)=(20.0 cm, 50.0 cm).**

a) What is the change in potential energy of the system?

b) Through what potential difference does the charge move?

Answer:

A.) $\Delta U = q \Delta V$

$\Delta U = (12 \times 10^{-6})(-50)$

$\Delta U = -6 \times 10^{-4}$ J

B.) $\Delta V = -E \Delta x$

$\Delta V = -(250)(.2)$

$\Delta V = -50$ V.

Problem 4: The electric potential outside a charged conducting sphere is **210 V**, and **10.0 cm** farther from the enter the magnitude of the electric field is **400 V/m**. Determine

a) The radius(es) of the sphere

b) The charge(s) on the sphere

c) Are the answers in part a and b unique

Answer:

A.) $V = \frac{nq}{r}$

$$\frac{kQ}{(r+.1)^2} = 400$$

$$\frac{kQ}{r^2 + .2r + .01} = 400$$

$$kQ = 400(r^2 + .2r + .01)$$

$$\frac{kQ}{r} = 210$$

$$kQ = 210r$$

$$400r^2 + 80r + 4 = 210r$$

$$400r^2 - 130r + 4 = 0$$

$$r = .29 \text{ m.}$$

$$r = .03 \text{ m.}$$

B.) $\frac{kQ}{r} = 210$

$Q = \frac{2\pi r}{n}$

$Q = 6.8\,nC \quad Q = 7.008 \times 10^{-10}\ C$

c.) No, there is more than one solution.