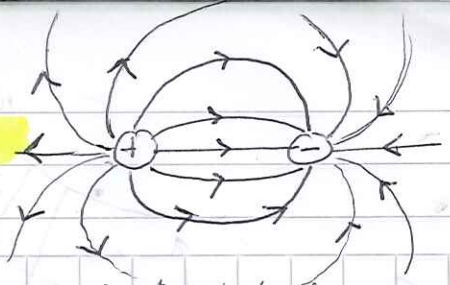
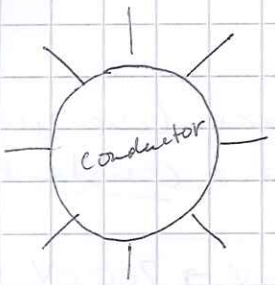
TSOKOS 5.1 #2, 4, 9, 11 SL² HW #3

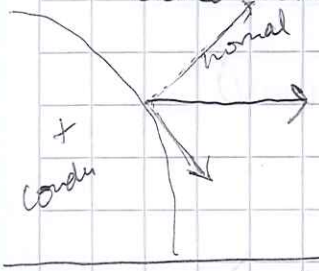


(3) E. field lines = imaginary lines mapping the electric field generated by 2 or more charges in space.



* If they are curved, the direction of the electric field at that exact point is directed tangent to the curve (see above) = same direction that a +Q would experience a force

** For a conducting surface (i.e. a sphere) the E. field lines must be normal (⊥) to the conducting surfaces. If one line was diagonal a component of that field line would be directed along the surface of conductor which would only happen if there were a potential difference on the surface (not true → all pts. on surface = same potential)



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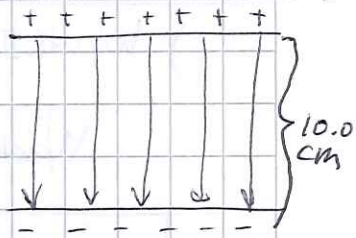
(8) 2 Parallel plates separated by 10.0 cm and a $\Delta V = 500.0\ V$

What is F on an e^- placed:

E is the same everywhere



a) 2.0 cm from the bottom plate
b) 4.0 cm " "
c) 6.0 cm " "

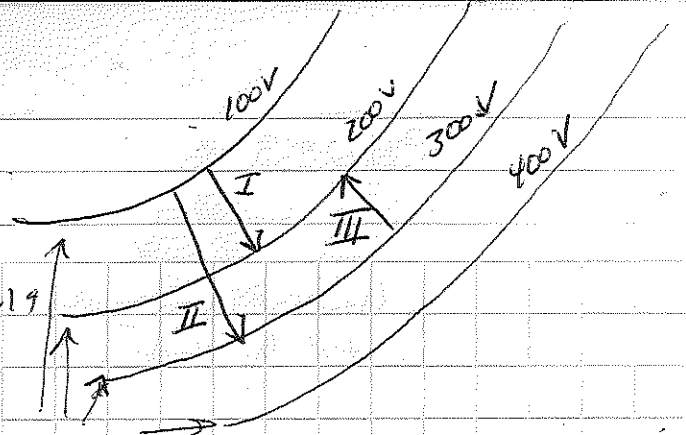
} distance is irrelevant.

$F = Eq$ $\quad E = \frac{\Delta V}{d} = \frac{500.0\ V}{0.10\ m} = 5000\ \frac{V}{m}$ (same as $\frac{N}{C}$)

$F = 5000\ \frac{V}{m} \times 1.60 \times 10^{-19}\ C = \boxed{8.0 \times 10^{-16}\ N \text{ for a) b) c)}}$

d) Work to move e^- from 2 cm from bottom "uphill" to 2 cm from top plate.

$W = \Delta U = qV = qEd = (1.60 \times 10^{-16}\ C)(500.0\ V) = \boxed{8.0 \times 10^{-17} J}$



(9) Figure 2.19

EQUIPOTENTIAL SURFACE = real or imaginary line where E-potential is at a constant value

a) Find W if Q = 5μC is moved from 100.0V → 200.0V (I)

$$W = Q(V_B - V_A) = (5\times10^{-6}C)(200V - 100V)$$

$$\boxed{W = 5\times10^{-4}\,J}$$

b) path II $W = Q(V_B - V_A) = (5\times10^{-6}C)(300V - 100V)$

$$\boxed{W = 1\times\times10^{-3}J}$$

c) $W_{path\,II} + W_{path\,III} = ?$ (Compare to $W_{path\,I}$)

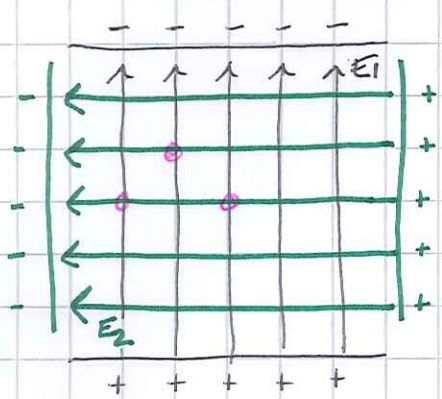
$$W_{path\,III} = Q(200V - 300V) = -5\times10^{-4}J$$

$$+\,1\times10^{-3}\,J$$

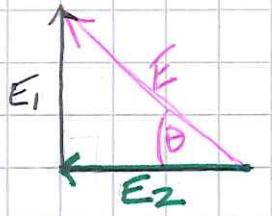
$$\boxed{W_{path\,II+III} = +5\times10^{-4}J = W_{path\,I}}$$

(- cont'd on next sheet)

(11) Two uniform E. fields $E_1 = 115 \frac{N}{C}$ and $E_2 = 125 \frac{N}{C}$ produced by 2 sets of parallel plates.



Find magnitude and direction of net electric field at points indicated.



(SAME for ALL PTS)

$$\Sigma E = \sqrt{E_1^2 + E_2^2}$$

$$\Sigma E = \sqrt{\left(115 \frac{N}{C}\right)^2 + \left(125 \frac{N}{C}\right)^2} = 170 \frac{N}{C}$$

$$\theta = \tan^{-1}\left(\frac{115}{125}\right) = 43^\circ \text{ above } -X$$