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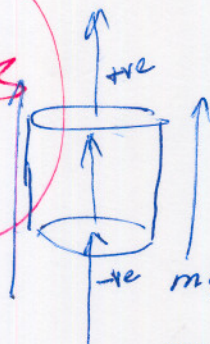
BCV  
8/7/18

I. A

Surface A: +ve

Surface B: zero

Surface C: -ve



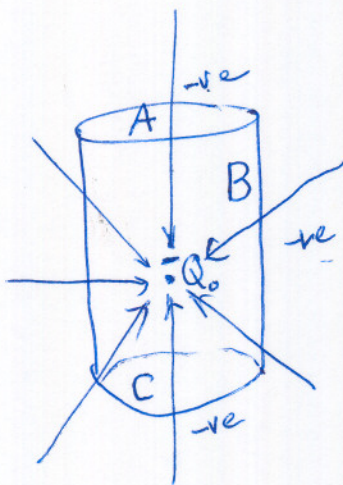
magnitude =  $\pi a^2$

magnitude = ~~zero~~ zero

magnitude =  $\pi a^2$

Net flux is zero

I. B



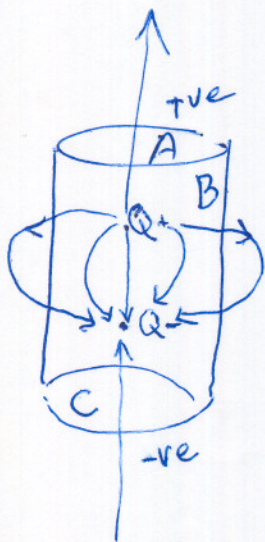
sign A = -ve

sign C = -ve

sign B = -ve

Net flux is negative

I. C



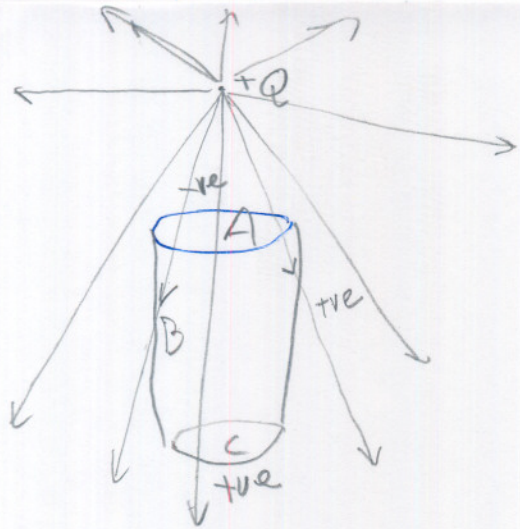
sign A = +ve

sign C = -ve

sign B = zero net.

Net flux is zero

## I.D



sign A = -ve  
sign C = +ve  
sign B = zero

Net flux is  $\phi = 0$

Net is +ve because flux through A is the same as flux via C, and these cancel out. for surface B flux in is the same as flux out. hence zero.

## II A

correct. we get net flux zero, and there is No net charge inside. verified.

for cases with  $-Q$ , we get -ve flux. verified.

for case with  $+Q, -Q$ , we get zero net. correct.

for case with  $+Q$  outside, we get zero net.  
corr.

## II.B

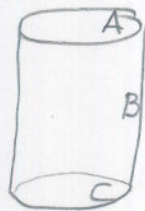
1. from Gauss law  $\Phi_E = \frac{\text{charge enclosed}}{\epsilon}$

but charge enclosed is zero  $\Rightarrow \Phi_E = 0$

2.  $\Phi_A = -10 \text{ Nm}^2/\text{C}$

$\Phi_C = 2 \text{ Nm}^2/\text{C}$

$\Phi_B = ?$



since  $\Phi_{\text{Total}} = 0$

Then  $0 = \Phi_A + \Phi_C + \Phi_B$

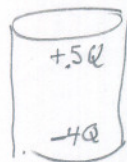
$\Phi_B = -\Phi_A - \Phi_C = 10 - 2 = 8 \text{ Nm}^2/\text{C}$

## II.C



Net flux is zero since charges inside the closed surface is zero

2.



Net charge inside is  $+Q$ . so Net flux is  $\frac{1Q}{\epsilon_0}$  and is positive.

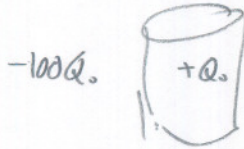
## II C

3.



Net flux is  $\frac{+q_0}{\epsilon}$

4.



Net flux is  $\frac{+q_0}{\epsilon}$

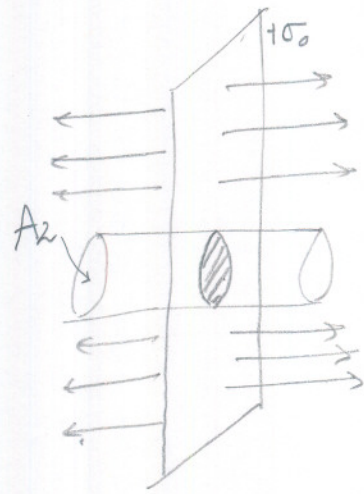
## II D

Student 1 is correct. because flux is independent of radius, and also we only consider charge enclosed inside a surface.

### III. A

A

1. Net charge =  $+A_2 \sigma_0$



2.

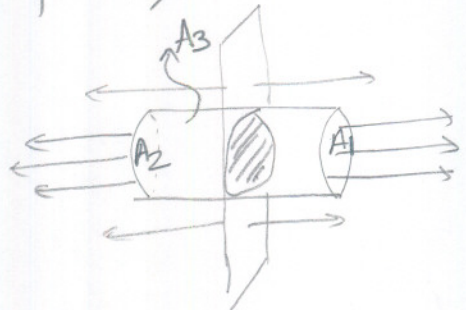
see

No. it does not affect field lines. since  
No additional charge enclosed.

3. same magnitude, since area is equal.

4. same areas since a cylinder.

4.  $A_1$  and  $A_2$ , since field is normal to area.  $A_3$  is tangent to field, hence zero net flux.

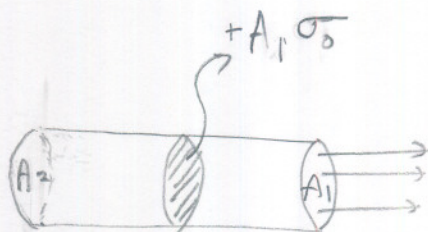


$$\Phi_E = \Phi_{A_1} + \Phi_{A_2} + \Phi_{A_3}$$

$$= \frac{A_1 \sigma_0}{\epsilon_0} + \frac{A_2 \sigma_0}{\epsilon_0} + \text{zero}$$

$$= \frac{2A_1 \sigma_0}{\epsilon_0} \quad (\text{since } A_1 = A_2)$$

III.5

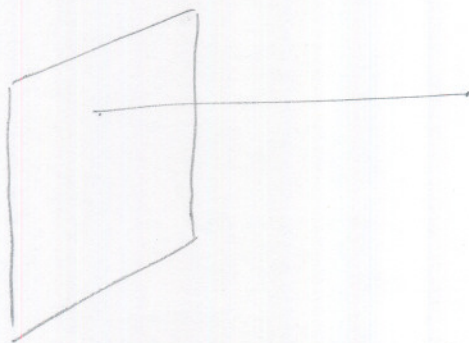


$$E = \frac{\Phi_E}{A} = + \frac{A_1 \sigma_0}{A_1} = + \frac{\sigma_0}{\epsilon}$$

positive since leaving surface.

on left end is the same.

so Total E is  $\frac{2\sigma_0}{\epsilon}$ .

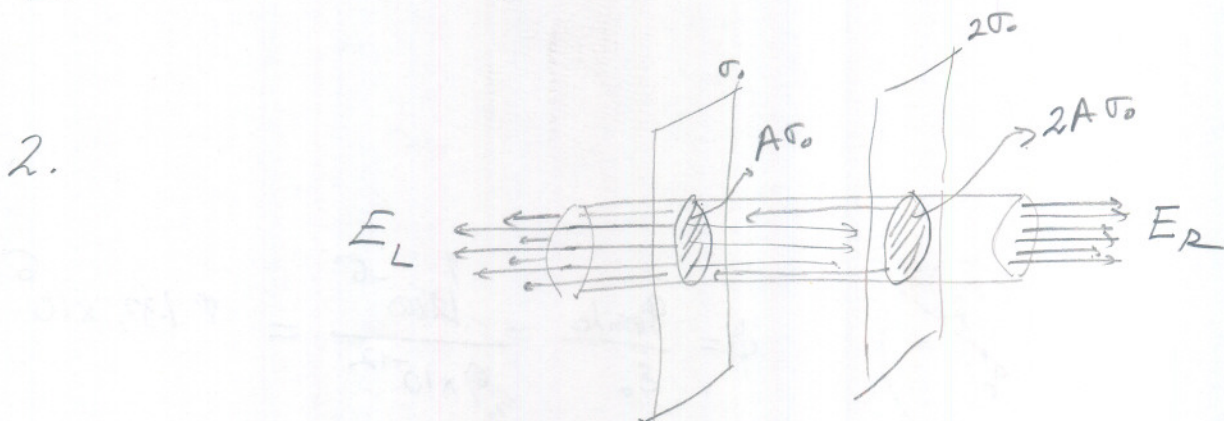


field does Not  
change at any  
distance

yes. consistency. since no distance term involved.

### III B

1. Net charge =  $3A_2\sigma_0$



$E_L = E_R$ . Since Total Number of field lines crossing each area is the same.

Gauss Law  
 $\Phi = \oint \vec{E} \cdot d\vec{A}$   
 $\Phi = EA$

3.  $E = \frac{\Phi_E}{A}$

$$E_R = \frac{\frac{3A\sigma_0}{\epsilon_0}}{A} = \frac{3\sigma_0}{\epsilon_0}$$

$$E_L = \frac{3\sigma_0}{\epsilon_0}$$

so  $E_{\text{Total}} = \frac{6\sigma_0}{\epsilon_0}$

4. at distance  $L_0$  is the same as  $\frac{3\sigma_0}{\epsilon_0}$  since do not change.

yes