Name, Surname:	Signature:
Exam Room:	Student ID Number:

PHYS 102 General Physics II – Midterm 2

28 Nov, 2017 Monday 19:00 -20:30

Please read!

- Count to make sure that there are 5 pages in the question booklet
- Check your name and surname on front page, and student ID number on each page, and sign each page.
- This examination is conducted with closed books and notes.
- Put all your personal belongings underneath your seat and make sure that pages of books or notebooks are not open.
- Absolutely no talking or exchanging anything (like rulers, erasers) during the exam.
- You must show all your work to get credit; you will not be given any points unless you show the details of your work (this applies even if your final answer is correct!).
- Write neatly and clearly; unreadable answers will not be given any credit.
- If you need more writing space, use the backs of the question pages and put down the appropriate pointer marks.
- Make sure that you include units in your results.
- Make sure that you label the axis and have units in your plots.
- You are not allowed to use calculators during this exam.
- Only the answers in the boxes will be graded and NO partial credit will be given. No points will be given to unjustified answers. Incomplete calculations will not be graded

P102_Index:

1	2	3	4	TOTAL

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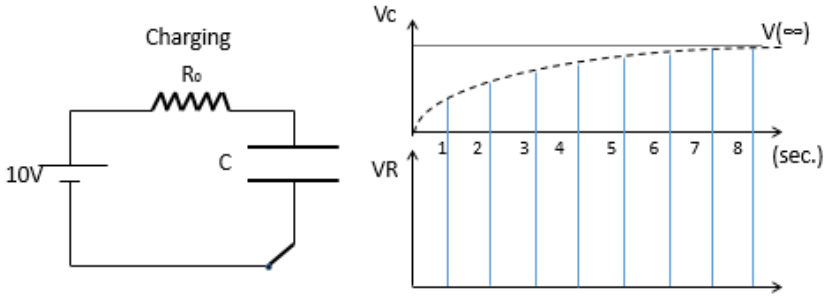
1-(25 pts) As shown in the figure, a simple RC circuit is powered by a **10 V** batterey. A capacitor is initially **uncharged**. During charging, the recorded voltage across the capacitor is given below. (R0= 1 ohm, e^{-1}=0.367, e^{-2}=0.135, e^{-3}=0.049, e^{-4}=0.018, e^{-5}=0.006). Show all your calculations.



time (sec)	Vc(Volt)	VR
0	0	
1	6.33	
2	8.65	
3	9.51	
4	9.82	
5	9.94	

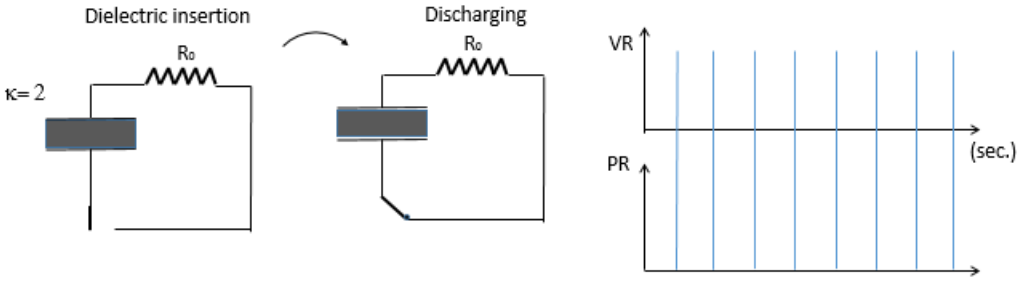
a) Calculate the time constant of the RC circuit.

b) Calculate the VR(t) voltage across the resistor R0, and voltage across the capacitor Vc(t)

VR(t)=

c) Plot VR(t) as a function of time on the graph above.

The **fully charged capacitor** is isolated from the charging circuit and then a dielectric material (K=2) is inserted into the capacitor. As shown in the figure a capacitor with a dielectric material is discharded using the same resistor (R0=1 ohm).



c) **Calculate** and **plot VR(t)** the voltage across the resistor during discharging.

VR(t) =

d) **Calculate** and **plot P(t)** the power disipation on the resistor during discharging.

P(t)=

e) Calculate the **total energy dissipated (E)** on the resistor.

E=

Solution continues on the back side of the page **Yes** □ **No** □

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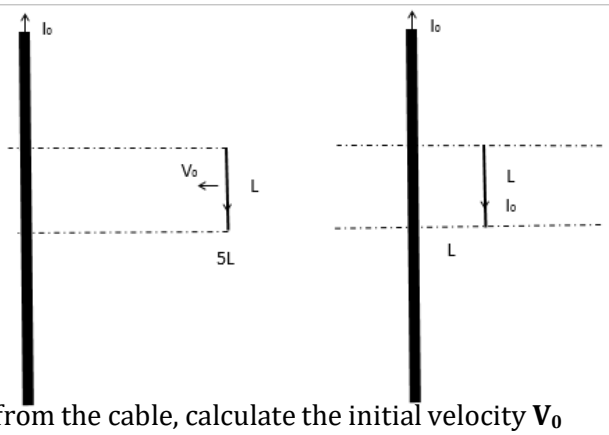
2- (25 pts) A cylindrical and infinitely long cable with a radius **R** carries a current $\mathbf{I_0}$. The current is uniformly distributed over the cross sectional area and the cable is held in a stationary position. The second thin current-carrying wire is projected toward the cable with initial velocity $\mathbf{V_0}$. The length of the wire is **L** and the mass is $\mathbf{m_0}$. Assume that initially the wire is located at the distance **5L** away from the cable.

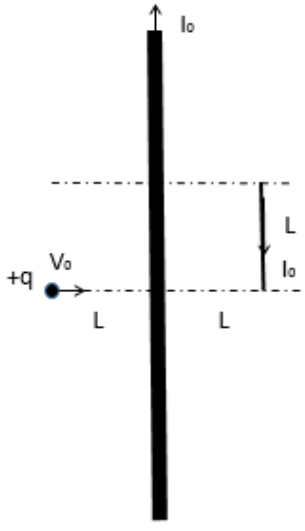


a) In order to place **the wire** to the position **L** away from the cable, calculate the initial velocity $\mathbf{V_0}$ of the wire. (Assume that **L > R**)

$\mathbf{V_0}$=

Then, as shown in the figure the positively charged particle **q** is projected toward the cable with initial velocity $\mathbf{V_0}$ from the opposite direction. Assume that the positions of the cable and wire are held fixed.

b) Calculate the magnitude and the direction of the total magnetic force applied on the charged particle at distance **L** away from the cable.



B=

 Solution continues on the back side of the page **Yes** □ **No** □

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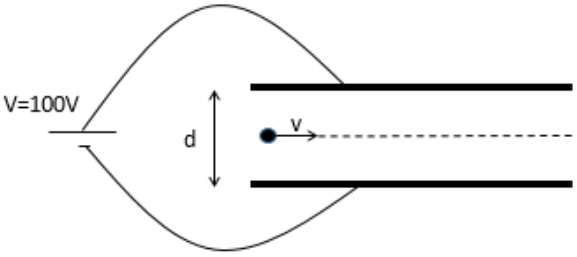
3- (25 pts) As shown in the figure, a positively charged particle (q_0, mass m_0) is moving with a velocity V_0 in the presence of both an **electric field** and **magnetic field**. Electric field is generated by very large parallel plates. The potantial differences between the two plates is 100V. The particle is following a **straight trajectory**. Calculate the magnitude and the direction of magnetic field between the plates.



B=

Solution continues on the back side of the page **Yes** □ **No** □

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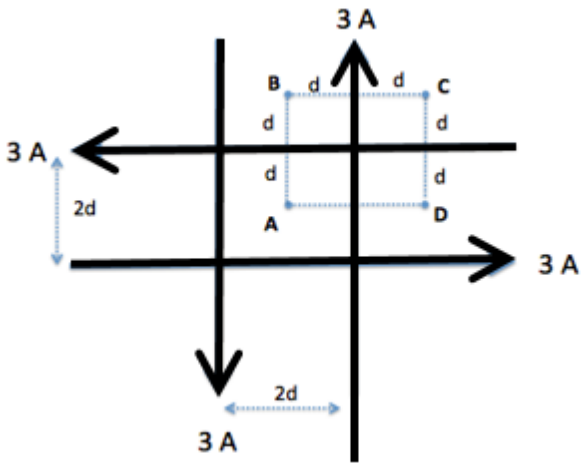
4- (25 pts) Four very long current-carrying wires (I=3A) in the same plane intersect to form a square, as shown in the figure. Find the magnitude and the direction of the net magnetic fields at points A, B, C and D.



B_A =

B_B =

B_C =

B_D =

Solution continues on the back side of the page **Yes** □ **No** □