2023 Spring Physics 2 FINAL EXAM HOMEWORK PART

About the homework:
You might use any programming language (java, python, C, mathematica, matlab etc)
Copy-paste all the necessary things (texts, scripts, outputs, solutions, figures etc) in one pdf file and upload it.
You may also upload the script as a separate file.

1. **(60) Programming*: Write code to compute these values for each question. Attach (or copy-paste) your code and the results to your homework file.**
   Point P is located X distance away from the center poing of a rod of lengh 2L and total charge of Q as in the figure. Take X=1m, Q=1 nanoC, 2L=2m (L=1m).
   a. What is the V potential at point P? Write down the formula in your code, and print the result. Lets call this result Vo. (Figure 1)
   b. Take a point charge of same Q and compute V potential X distance away (Lets call this V1) (Figure 2)
   c. Divide the total charge Q into 2 and distribute evenly for length L and compute V potential X distance away. (Lets call this V2) (Figure 3)
   d. Divide the total charge Q into 4 and distribute evenly for length L and compute V potential X distance away. (Lets call this V4) (Figure 4)
   e. Divide the total charge Q into 6 and distribute evenly for length L and compute V potential X distance away. (Lets call this V6) (Figure 5)
   f. Divide the total charge Q into 8 and distribute evenly for length L and compute V potential X distance away. (Lets call this V8) (Figure 6)
   g. Divide the total charge Q into N (N is very large, pick a large number) and distribute evenly for length L and compute V potential X distance away. (Lets call this VN (Figure 7)) You might need to "for" loop in your command. If you write this code before you can use it in part b-c-d-e-f
   h. Compare all the results. If your calculations are correct, you should find VN to be very close to V0 value.

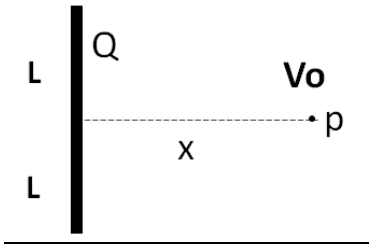


Figure 1: Vo Potential

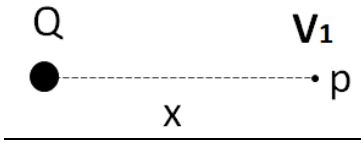


Figure 2: V1 potential

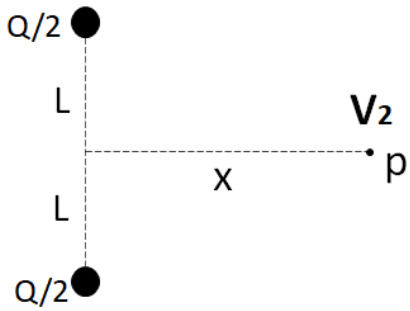


Figure 3: V2 potential

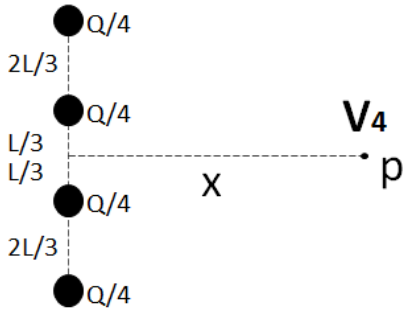


Figure 4: V4 potential

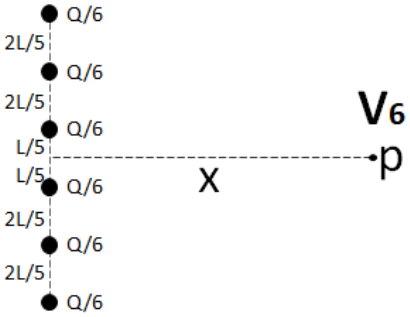


Figure 5: V6 potential

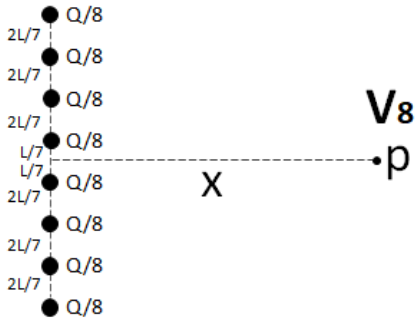


Figure 6: V8 potential

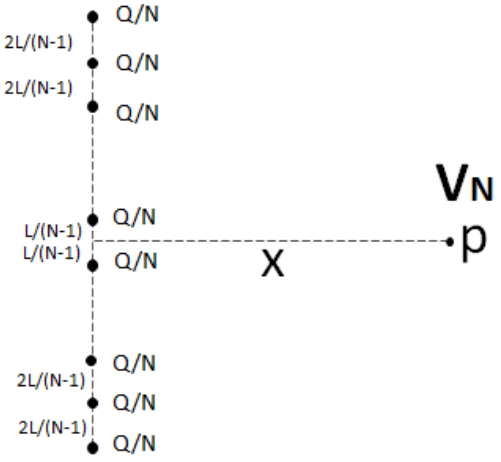
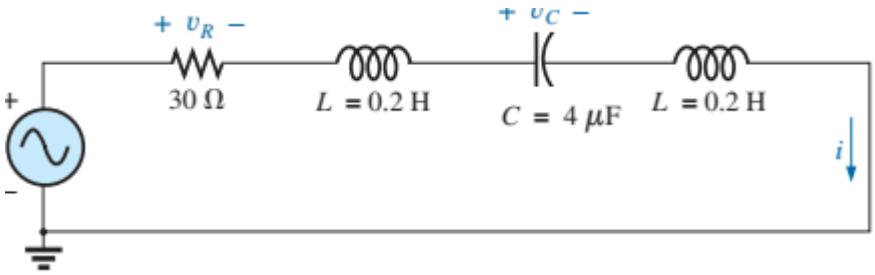


Figure 7 : VN potential

2) (10) Comment on how you would calculate and compute Electric Fields for the previous question, what would be the main differences in calculations? Explain.

3) (15) For the circuit given

a. **Calculate E, V_R** and **Vc** in phasor form.
b. Find the impedance.
c. Find the total power and power factor of the circuit. Which one is leading: Current or Voltage ?
d. **Draw E, V_R, Vc, VL and I** in phasor diagram.



$$e = \sqrt{2}(20)\sin(377t + 40°)$$

4) (15) For the circuit given,

e. **Find E, I_R** and **I_L** in phasor form.
f. Find the impedance.
g. Find the total power and power factor of the circuit. Which one is leading: Current or Voltage ?
h. Draw **I_s, I_R, I_L** currents and **E** potential on phasor diagram