Physics 302
Winter Quarter 1991
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George Williams

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SECOND MIDTERM

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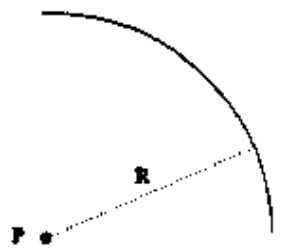
Discussion Instructor (circle one): Davis DeTienne Hamed Molina Paul Zhang

Discussion Section #_____

REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES!
Use the conversion constants and data given on the front page.

(a) Calculate the electric potential (in volts) at the center of a quarter circle of charged wire if the charge density is $\lambda = 4.20 \times 10^{-9}$ c/m and the radius R is 15.0 cm.



$V = k\frac{q}{R}$ $\quad q = \lambda\frac{\pi R}{2}$

$V = \frac{k\lambda\pi}{2}$

$V = (9.00\times10^{9}\ N\cdot m^2/c^2)(4.2\times10^{-9}\ c/m)\,\pi/2 = \boxed{59.4\ V}$

(b) If the potential is in the form $V = Ay^2z^3$, calculate the x component of the electric field at the point (1,2,3).

$E_x = -dV/dx = 0$

.0641 V

(c) Calculate the electric potential difference needed to give an electron a velocity of 1.5×10^5 m/s.

6.41×10^{-2} V

$u = eV = \frac{1}{2}mv^2$; $V = \frac{1}{2}mv^2/e = \frac{1}{2}\frac{(9.11\times10^{-31}\ kg)(1.5\times10^{5}\ m/s)^2}{1.6\times10^{-19}\ C} = \boxed{64.1\ mV}$ J/C

(d) An electron is released from rest in a uniform electric field of 1.75×10^{6} V/m. Calculate its velocity after 1.5 seconds has passed.

$F = qE = ma$ $\quad v = at = \frac{qEt}{m} = \frac{(1.6\times10^{-19}\ C)(1.75\times10^{6}\ V/m)(1.5\ s)}{(9.11\times10^{-31}\ kg)} = \boxed{4.61\times10^{5}\ m/s}$

461 km/s

(e) In moving a charge of $|q| = 4.0 \times 10^{-12}$ C from A to B, 6.5×10^{-7} J of work is done. Calculate the potential difference between A and B.

$u = qV$ $\quad V = \frac{u}{q} = \boxed{1.63\times10^{5}\ V}$

163 kV

λ sig figs
1 units

C/m ?