PHY 102 Quiz #2 Name _____

Score _____

Instructions:
1. Do all of your work on this sheet.
2. **Show all of your steps** in problems for full credit.
3. **Be clear and neat** in your work. Any illegible work, or scribbling in the margins, will not be graded.
4. Place your **answers in a box.**
5. If you need more space, you may use the back of the page and write **On back** in the problem space.

1. **Multiple Guess (3 pts)** Find the answer which best fits the question and write it in the space provided.

a. One connects a voltmeter in _____ with a resistor.
a) series. b) parallel. b

b. The length, width, and the spacing between the plates of a parallel plate capacitor are doubled. The capacitance
a) increases by a factor of 2. b) increases by a factor of 4.
c) increases by a factor of 8. d) decreases by a factor of 4.
e) decreases by a factor of 2 a

c. The resistance of a wire is directly proportional to the
a) length. b) emf. c) current. d) area. e) none of these. a

2. **AC Circuits (3 pts)** A voltage of $V = 25.0\sin(1256t)$ volts runs through a $75.0\,\Omega$ resistor. Including units, what is

a. The peak voltage? 25.0 V

b. The frequency? 200 Hz

c. The rms-current? 0.24 A

$I_{rms} = \frac{V_{rms}}{R} = \frac{25}{75\sqrt{2}}$

Bonus: A 24.0 V battery with an internal resistance of $5.0\,\Omega$ is connected to a $75.0\,\Omega$ resistor. How much energy is lost in the resistor in one second?

$W = Pt = I^2Rt = V^2/R$

$V = 24 - Ir$

$I = \frac{24}{80} = .3A \quad W = I^2R = 6.75$ J

Constants:

$\varepsilon_0 = 8.85\times10^{-12}\ C^2/N\text{-}m^2$ $\quad m_e = 9.11\times10^{-31}\ kg$

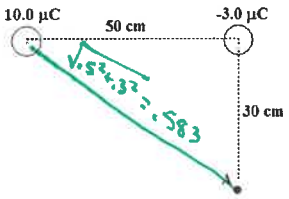
3. **Problems (14 pts)**

a. Find the total electric potential at point A.

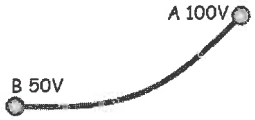
$V = k\frac{q_1}{r_1} + k\frac{q_2}{r_2}$

$= 9\times10^9\times10^{-6}\left(\frac{-3}{.3} + \frac{10}{.583}\right)$

$= 6.44\times10^4$ V



b. An electron at rest moves ~~from~~ to point A (at 100.0V) ~~to~~ from point B (50.0 V). How fast is it moving at point B?



$\frac{1}{2}mv^2 = q\Delta V$

$v^2 = \frac{2(1.6\times10^{-19})(50)}{9.11\times10^{-31}}$

$= 17.56\times10^{12}$

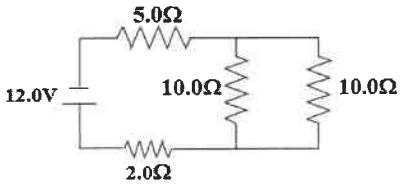
$v = 4.19\times10^6$ m/s

c. The temperature of a 0.50 Ω resistor wire is increased by 30°C. If the coefficient of thermal resistance is 5.0×10^{-3} $(°C)^{-1}$, then what is the new resistance?

$R = R_0[1 + \alpha\Delta T]$

$= .50\,[1 + 5\times10^{-3}(30)] = .575\,\Omega$

d. Use the circuit below for the remaining questions.



i. What equivalent resistance can replace the 4 resistors?

$R_p = \frac{1}{\frac{1}{10} + \frac{1}{10}} = 5.0\,\Omega$

$R_s = 5.0 + 5.0 + 2.0 = 12.0\,\Omega$

ii. Determine the currents in the $5.0\,\Omega$ and $10.0\,\Omega$ resistors.

$I_1 = \frac{12.0V}{12.0\,\Omega} = 1.0$ A

$I_2 = I_3 = 0.5$A