PHYSICS 265

Test #1

18 Feb. 1997

Name: _____ Section: _____

Part A. Choose the best answer from those given. (4 points each)

1. The electrostatic force between a negative electron and a neutral neutron is

   ☐ a) attractive.
   ☐ b) repulsive.
   ☐ c) zero.
   ☐ d) sometimes attractive and sometimes repulsive.
   ☐ e) none of these.

2. We can increase the capacitance of a parallel plate capacitor by

   ☐ a) cooling the plates.
   ☐ b) bringing the plates closer.
   ☐ c) removing the dielectric.
   ☐ d) increasing the voltage.
   ☐ e) none of these.

3. A statue of a chicken made of pure gold has a resistance of 0.10 $m\Omega$ between it's beak and tail. An exact duplicate of the piece is made in an alloy that has a resistivity 10 times greater than gold. The resistance between the same two points will now be

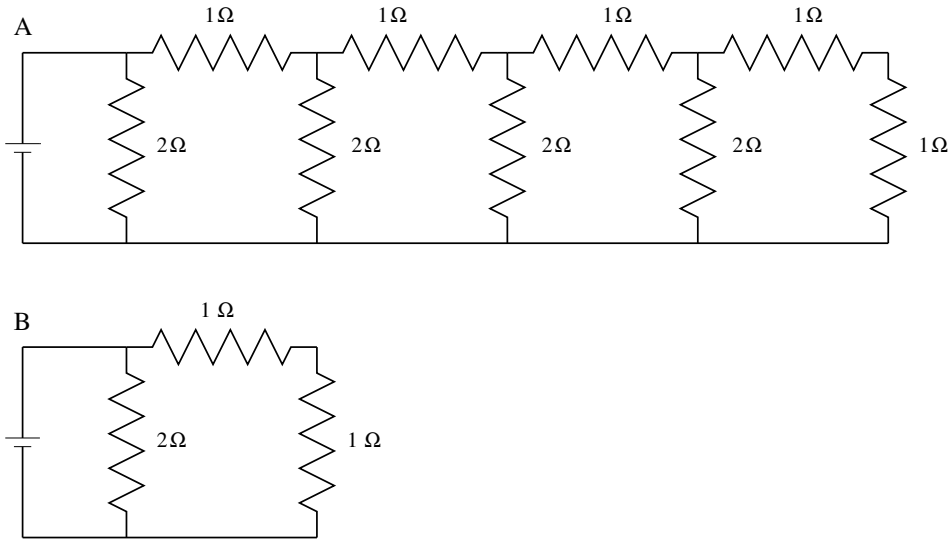
   ☐ a) 0.10 $m\Omega$
   ☐ b) 1.0 $m\Omega$
   ☐ c) 0.010 $m\Omega$
   ☐ d) 10.0 $m\Omega$
   ☐ e) none of these.

4. A metal wire has a resistance of 1.0 Ω. What is the resistance of a piece of wire made of the same material but twice as long and with half the cross sectional area?

   ☐ a) 4.0 Ω.
   ☐ b) 2.0 Ω.
   ☐ c) 1.0 Ω.
   ☐ d) 0.50 Ω.
   ☐ e) 0.25 Ω.

5. Which circuit draws more current from the battery?

- ☐ a) circuit A.
- ☐ b) circuit B.
- ☐ c) both the same.



Part B. Answer 4 of the following 5 questions. (20 points each)

1. Two 6.0 μC charges are placed on the x-axis at, one at $x = 0$ and the other at $x = 1.0\ m$. Another charge, $-3.0\ \mu C$, is also on the x-axis.

   a) What position(s) give zero net force on the $-3.0\ \mu C$ charge. (15 points)

   b) Is this a position of stable or unstable equilibrium? (Remember that in stable equilibrium, if the particle is moved slightly, it will return to the equilibrium position) (5 points)

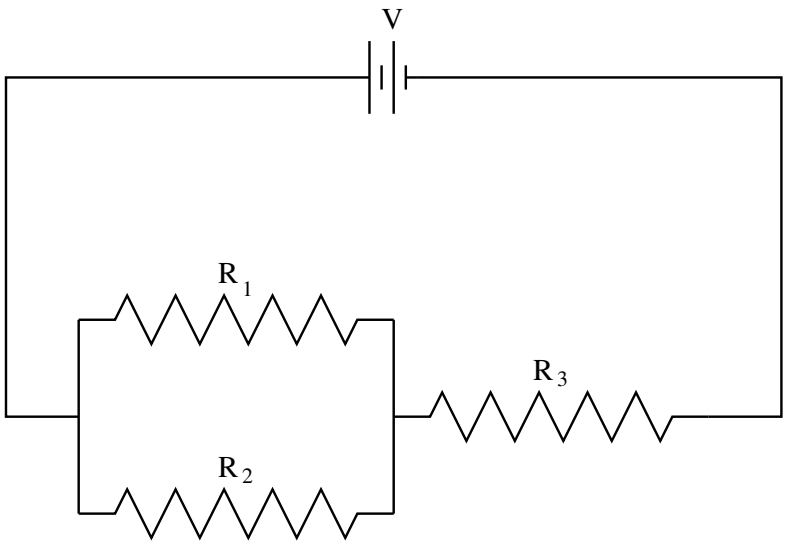
2. A capacitor is constructed with an area $A = 1.0\ cm^2$, a plate separation $d = 1.0\ mm$ and a dielectric with $K = 10$.

   a) If you connect a $9\ V$ battery across this capacitor, what is the charge on one of the capacitor plates? (10 points)

   b) Connect three capacitors, identical to the one in part a), so that the combination has 3 times the capacitance of the single capacitor in part a). (5 points)

   c) Connect three capacitors, identical to the one in part a), so that the combination has 1/3 the capacitance of the single capacitor in part a). (5 points)

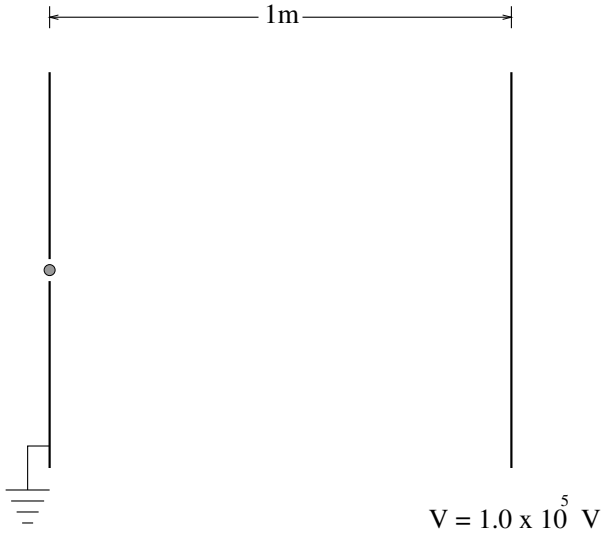
3. In the circuit shown below, $R_1 = 8\ \Omega$, $R_2 = 4\ \Omega$, $R_3 = 3\ \Omega$ and $V = 3\ V$. Find the current through, and voltage across, each resistor.



4. Two parallel plates have a potential difference $V = 1.0 \times 10^5\ V$ and are separated by $d = 1.0\ m$, as shown below. There is a hole in one plate to allow particles to enter.

   a) A proton ($m = 1.67 \times 10^{-27}\ kg$ and $q = 1.60 \times 10^{-19}\ C$) enters through the hole with an initial velocity $v_o = 3.0 \times 10^6\ m/s$ to the right. How far will the proton travel before stopping (for just an instant)? (10 points)

   b) An electron ($m = 9.11 \times 10^{-31}\ kg$ and $q = -1.60 \times 10^{-19}\ C$) is placed in the hole, at rest. What is the electron's kinetic energy just before it hits the right plate? (10 points)



5. Three charges are placed on a circle of radius 1 m; the value of $q = 5.0\ \mu C$. The charges are placed at 12 o'clock, 4 o'clock and 8o'clock (as shown in the picture below).

   a) Find V, the electrical potential, at P, the center of the circle. (15 points)

   b) Find $\vec{E}$, the electric field, at P, the center of the circle. (5 points)