Name ____

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PH 102-1 / LeClair — Summer II 2008

Quiz 2

Useful Things

$$\vec{\mathbf{F}}_{e,12} = k_e \frac{q_1 q_2}{r_{12}^2}\,\hat{\mathbf{r}} \qquad \vec{\mathbf{F}}_{\text{net}} = m\vec{\mathbf{a}}$$

$$\Delta V = IR = [\text{Volts}] \qquad v_d = \frac{-e\tau}{m_e}E = [\text{m/s}]$$

$$I = \frac{\Delta Q}{\Delta t} = [\text{Amps}] \qquad I = nqAv_d = \frac{\Delta V}{R}$$

1. A "free" electron and a "free" proton are placed in an identical electric field. Which of the following statements are true? *Check all that apply.* Note that the electron mass is 9.11×10^{-31} kg, and the proton mass is 1.67×10^{-27} kg.

- □ Each particle is acted on by the same electric force and has the same acceleration.
- □ The electric force on the proton is greater in magnitude than the force on the electron, but in the opposite direction.
- □ The electric force on the proton is equal in magnitude to the force on the electron, but in the opposite direction.
- □ The magnitude of the acceleration of the electron is greater than that of the proton.
- □ Both particles have the same acceleration.

2. Two isolated identical conducting spheres have a charge of q and $-3q$, respectively. They are connected by a conducting wire, and after equilibrium is reached, the wire is removed (such that both spheres are again isolated). What is the charge on each sphere?

- □ q, $-3q$
- □ $-q$, $-q$
- □ 0, $-2q$
- □ $2q$, $-2q$

3. When we power a light bulb, are we using up charges and converting them to light?

- □ Yes, moving charges produce "friction" which heats up the filament and produces light
- □ Yes, charges are emitted and observed as light
- □ No, charge is conserved. It is simply converted to another form such as heat and light.
- □ No, charge is conserved. Moving charges produce "friction" which heats up the filament and produces light.

4. In semiconductors such as Si, the number of carriers is not fixed, it depends on *e.g.,* temperature. For a certain sample of Si, the number of carriers doubles but their drift velocity decreases by 10 times. By how much does the sample's resistance change?

- □ 2 times lower
- □ 5 times lower
- □ 5 times higher
- □ 2 times higher

5. An electric current of 1 mA flows through a conductor, which results in a 150 mV potential difference. The resistance of the conductor is:

- □ $150\,\Omega$
- □ $6.7\times10^{-4}\,\Omega$
- □ $1.5\times10^{-6}\,\Omega$
- □ $6.7\,\Omega$