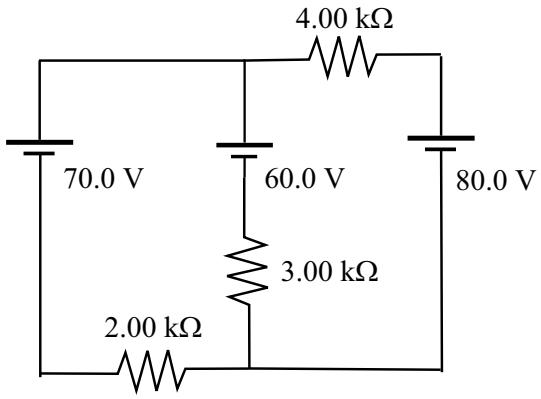
Name_____

Phys 2020 (NSCC), Spring 2008
Problem Set #4

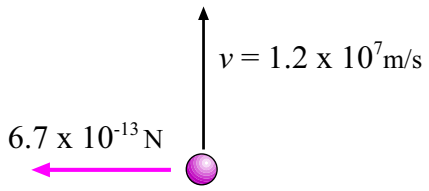
1. For the circuit shown at the right, assign currents to the three branches and write down an equation expressing the junction rule (from the Kirchhoff rules).



2. For the circuit in Problem 1 write down two equations expressing the loop rule (from the Kirchhoff rules). Together with the answer to 1 the three equations should allow one to solve for the three currents.

3. A proton moves in a uniform magnetic field. Its velocity is in the plane of the page, with a speed of $1.2 \times 10^7 \frac{\text{m}}{\text{s}}$, upward. It experiences a force of 6.7×10^{-13} N to the left (as shown).

Find the magnitude and direction of the magnetic field.



4. At the equator, near the surface of Earth, the magnetic field is approximately $50.0\,\mu$T northward and the electric field is about $100\,\frac{\text{N}}{\text{C}}$ downward in fair weather. Find the gravitational, electric and magnetic forces on an electron with an instantaneous velocity of $6.00 \times 10^6 \frac{\text{m}}{\text{s}}$ directed to the east in this environment.

5. A proton is moving freely in a circular path of radius 0.15 m perpendicular to a uniform magnetic field of strength 0.20 T. What is the speed of the proton? (The proton has a mass of 1.67×10^{-27} kg.)

6. A singly charged positive ion (that is, charge $+e$) has a mass of 2.50×10^{-26} kg. After being accelerated through a potential difference of 250 V, the ion enters a magnetic field of 0.500 T, in a direction perpendicular to the field. Calculate the radius of the path of the ion in the field.

7. A current-carrying wire of length 1.0 m with current $I = 15$ A directed along the $+x$ axis is perpendicular to a uniform magnetic field. The magnetic force on the wire is 0.12 N in the $-y$ direction. Calculate the magnitude and direction of the magnetic field in the region through which the current passes.

8. A cardiac pacemaker can be affected by a static magnetic field as small as 1.7 mT. How close can a pacemaker wearer come to a long straight wire carrying 20 A ?