Physics 211 Quiz 2

December 9, 2004

Your name:

ID number:

Time given: 60 minutes

Please provide your reasoning for each step of your solution (providing an answer without a solution is not enough)

Problem 1

The circuit shown on the Figure 1 consists of 3 batteries with the voltages $\Delta V_1 = 5V, \Delta V_2 = 10V, \Delta V_3 = 15V$ and two resistors $R_1 = 5\Omega$ and $R_2 = 10\Omega$ Find the currents through each of the resistors.

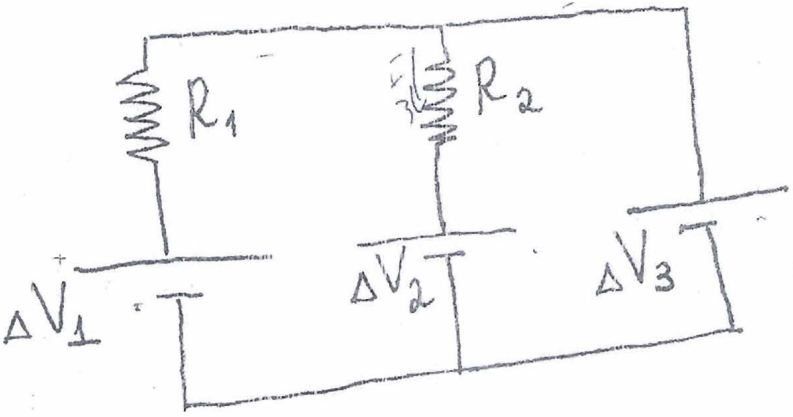

Figure 1

Problem 2

The RC-circuit consists of the battery with the voltage ΔV, the capacitor C, two resistors R and $2R$ and the switch, as shown on the Figure 2. Initially the capacitor is not charged. The switch is turned on at the moment of time $t = 0$. Find the electric current through the battery as the function of time.

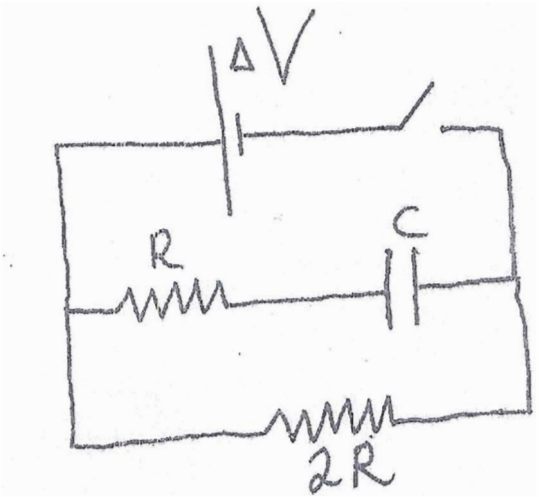

Figure 2

24

Problem 3

A closed conducting contour of a certain unknown shape carries unknown constant electric current. The contour is placed in the constant external magnetic field given by $\vec{B} = (\vec{i}+2\vec{j}+3\vec{k})Teslas$. It is known that the difference between the minimal and maximal values of the potential energy for various possible orientations of the contour in this magnetic field is equal to $\Delta W = 20J = 20N \times m$ (the mechanical potential energy of the frame due to its mass can be neglected) Find the magnitude of the torque acting on the contour due to the magnetic field, when the contour is located in the xy-plane.

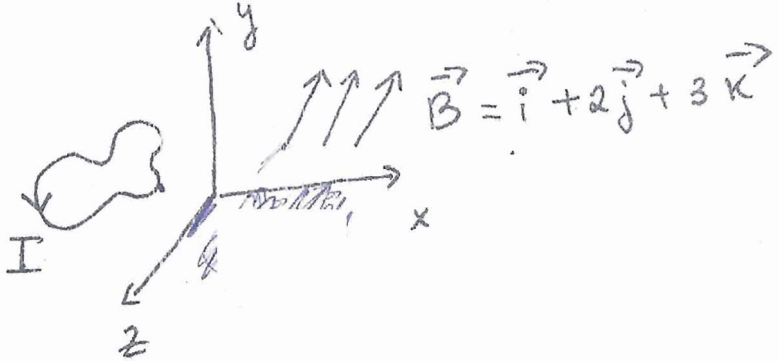

Figure 3

Problem 4

A charged particle 1 has the mass M and the charge Q and a charged particle 2 has the mass $2M$ and the charge $3Q$. Both particles are first accelerated by the same potential difference ΔV and then enter the region with the constant magnetic field B. The direction of the magnetic fiield is perpendicular to the directions of the velocities of the both particles. Find the radius of the orbit of the particle 2 if the radius of the particle 1's orbit is equal to R.