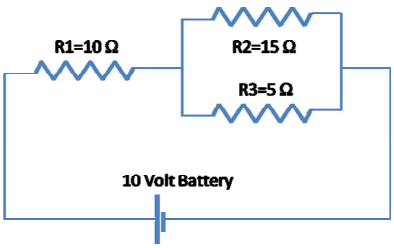
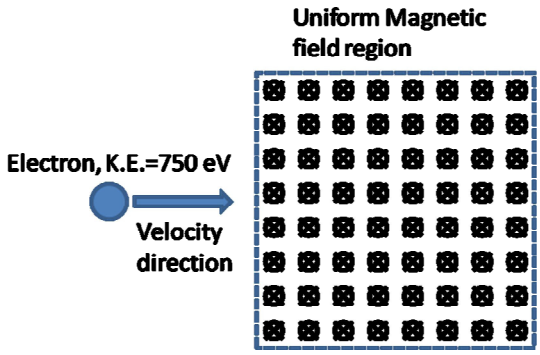
| NAME: _____ | Quiz #5: Phys142 |
|---|---|

1. [4pts] Find the resulting current through R1 in the following circuit:




2. An electron with a kinetic energy of 750 eV is fired into a region of uniform magnetic field which is restricted to the square region shown below. The magnetic field points into the page, and the electron is initially traveling directly to the right as depicted in the diagram. A uniform electric field is applied such that the magnetic force on the electron is counteracted by the electric force. The electron continues onward in a straight line even in the region of uniform magnetic field.
   (a)[ 2 pt] Draw the required direction of the electric field on the diagram below
   (b) [4 pts] What is the magnitude of the electric field required? [Note that 1 eV = $1.9 \times 10^{-19}$ J]



## Some Physical Constants[a]

| Quantity | Symbol | Value[b] |
|---|---|---|
| Atomic mass unit | u | $1.660\,538\,73\ (13) \times 10^{-27}$ kg<br>931.494 013 (37) MeV/$c^2$ |
| Avogadro's number | $N_A$ | $6.022\,141\,99\ (47) \times 10^{23}$ particles/mol |
| Bohr magneton | $\mu_B = \frac{e\hbar}{2m_e}$ | $9.274\,008\,99\ (37) \times 10^{-24}$ J/T |
| Bohr radius | $a_0 = \frac{\hbar^2}{m_e e^2 k_e}$ | $5.291\,772\,083\ (19) \times 10^{-11}$ m |
| Boltzmann's constant | $k_B = \frac{R}{N_A}$ | $1.380\,650\,3\ (24) \times 10^{-23}$ J/K |
| Compton wavelength | $\lambda_C = \frac{h}{m_e c}$ | $2.426\,310\,215\ (18) \times 10^{-12}$ m |
| Coulomb constant | $k_e = \frac{1}{4\pi\epsilon_0}$ | $8.987\,551\,788\ \ldots \times 10^{9}$ N·m$^2$/C$^2$ (exact) |
| Deuteron mass | $m_d$ | $3.343\,583\,09\ (26) \times 10^{-27}$ kg<br>2.013 553 212 71 (35) u |
| Electron mass | $m_e$ | $9.109\,381\,88\ (72) \times 10^{-31}$ kg<br>$5.485\,799\,110\ (12) \times 10^{-4}$ u<br>0.510 998 902 (21) MeV/$c^2$ |
| Electron volt | eV | $1.602\,176\,462\ (63) \times 10^{-19}$ J |
| Elementary charge | $e$ | $1.602\,176\,462\ (63) \times 10^{-19}$ C |
| Gas constant | $R$ | 8.314 472 (15) J/K·mol |
| Gravitational constant | $G$ | $6.673\ (10) \times 10^{-11}$ N·m$^2$/kg$^2$ |
| Josephson frequency–voltage ratio | $\frac{2e}{h}$ | $4.835\,978\,98\ (19) \times 10^{14}$ Hz/V |
| Magnetic flux quantum | $\Phi_0 = \frac{h}{2e}$ | $2.067\,833\,636\ (81) \times 10^{-15}$ T·m$^2$ |
| Neutron mass | $m_n$ | $1.674\,927\,16\ (13) \times 10^{-27}$ kg<br>1.008 664 915 78 (55) u<br>939.565 330 (38) MeV/$c^2$ |
| Nuclear magneton | $\mu_n = \frac{e\hbar}{2m_p}$ | $5.050\,783\,17\ (20) \times 10^{-27}$ J/T |
| Permeability of free space | $\mu_0$ | $4\pi \times 10^{-7}$ T·m/A (exact) |
| Permittivity of free space | $\epsilon_0 = \frac{1}{\mu_0 c^2}$ | $8.854\,187\,817\ldots \times 10^{-12}$ C$^2$/N·m$^2$ (exact) |
| Planck's constant | $h$ | $6.626\,068\,76\ (52) \times 10^{-34}$ J·s |
| | $\hbar = \frac{h}{2\pi}$ | $1.054\,571\,596\ (82) \times 10^{-34}$ J·s |
| Proton mass | $m_p$ | $1.672\,621\,58\ (13) \times 10^{-27}$ kg<br>1.007 276 466 88 (13) u<br>938.271 998 (38) MeV/$c^2$ |
| Rydberg constant | $R_H$ | $1.097\,373\,156\,854\,9\ (83) \times 10^{7}$ m$^{-1}$ |
| Speed of light in vacuum | $c$ | $2.997\,924\,58 \times 10^{8}$ m/s (exact) |