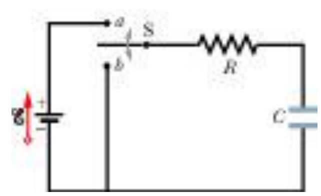
Physics 232 | Homework up to Exam 2 – 3/14/13
General Physics 2 | Weekly HW Due Mon. 3pm

Daily	Daily	Daily	Weekly
	Fri 2/8 – E5.1-2: B1, B5	Mon 2/11 – E5.3: S8 and E6.1-2: #1	Mon 2/11 – E5: S2, S3, S5, E6:S5
Wed 2/13 – E5.4-7: B10, B12	Fri 2/15 – E6.3-7: B3, B7, and #2	Mon 2/18 – E7: B2, B5	Mon 2/18 - #3-4; E5: S9; E6: S2, S4; E7: S2, S4
Wed 2/20 – E7: #5-6	Fri 2/22 – E6: B5, B10, B12	Mon 3/4 - E8: B4, B5, B6	Mon 3/4 - #7-8; E6: S7, S9; E8:S1, S4, S7
Wed 3/6 – E9: B1, B3, B5	Fri 3/8 – E9: B7, B10	Mon 3/11 – #9-10	Mon 3/11 - #11-12; E8: S6, S10; E9: S2, S4

1. Imagine that we connect a 3V battery with a wire whose length is approximately 8 cm and we measure the current using a compass. Now imagine we double the length of the wire and again measure the current. What do you expect to measure (greater, smaller, or the same as before)? By what factor? Why? Explain in detail.

2. Imagine we connect a single battery to a thin piece of Nichrome wire about 30 am long and measure the current in the wire. Next we remove the thin Nichrome wire and replace it with a thick Nichrome wire (cross-sectional area twice that of the thin wire) about 30 cm long. How does the measured current relate to the current measured in the thin case? Explain in detail.

3. The charge on an isolated capacitor does not change when a sheet of glass is inserted between the capacitor plates, and we find that the potential difference decreases (because the electric field inside the insulator is reduced by a factor of $\varepsilon_0/\varepsilon$ – see E4S.12). Suppose instead that the capacitor is connected to a battery, so that the battery tries to maintain a fixed potential difference across the capacitor.
   a. A light bulb and an air-gap capacitor of capacitance C are connected in series to a battery with known *emf*. What is the final charge Q on the positive plate of the capacitor?
   b. After fully charging the capacitor, a sheet of plastic with permittivity ε is inserted into the capacitor and fills the gap. Does any current run through the light bulb? Why? What is the final charge on the positive plate of the capacitor?

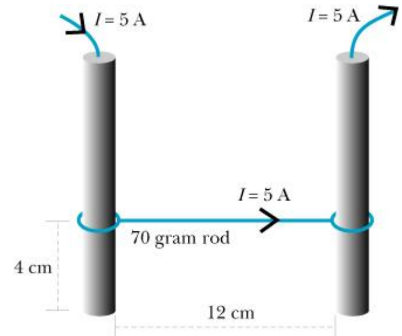


4. In the circuit shown, the *emf* is 50 V and C=2.0F; the capacitor is initially uncharged. At 4 s after the switch is closed, the voltage drop across the resistor is 20 V. Find the resistance of the resistor.

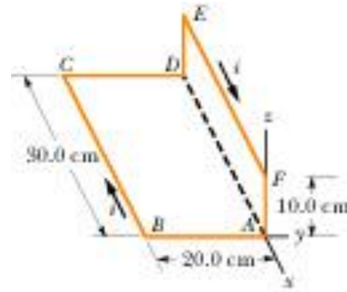
5. An object of charge q is moving in the x direction with speed v. Throughout the region there is a uniform electric field in the y direction of magnitude E. Determine a direction and magnitude B for a uniform magnetic field such that the net electric and magnetic force on the moving charge is zero. Draw $\vec{B}$ on a diagram of the situation.

6. An electron has an initial velocity of <0, 12.0, 15.0> km/s and a constant acceleration of <2.00 x 10^{12} m/s^2, 0 , 0> in a region in which uniform electric and magnetic fields are present. If B = <400 μT, 0 , 0>, find the electric field.

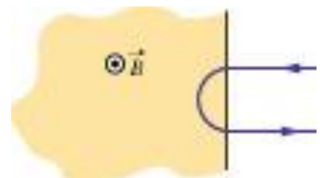
7. A metal rod of length 12 cm and mass 70 grams has metal loops at both ends, which go around two metal poles. The rod is in good electrical contact with the poles but can slide freely up and down. The metal poles are connected by wires to a battery, and a 5 A current flows through the rod. A magnet supplies a large uniform magnetic field *B* in the region of the rod, large enough that you can neglect the magnetic fields due to the 5 A current. The rod sits at rest 4 cm above the table. What are the magnitude and direction of the magnetic field in the region of the rod? Explain your work, including diagrams.



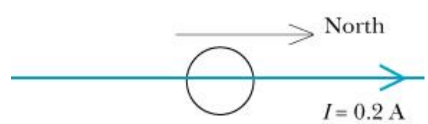
8. The figure shows a current loop *ABCDEFA* carrying a current I = 5.00 A. The sides of the loop are parallel to the coordinate axes, with *AB* = 20.0 cm, *BC* = .0.0 cm, and *FA* = 10.0 cm. Calculate the magnitude and direction of the magnetic dipole moment of this loop. (Hint: Imagine equal and opposite current in the line segment *AD*; then treat the two rectangular loops *ABCDA* and *ADEFA*.)



9. In the figure, a charged particle enters a uniform magnetic field *B* with speed v_0, moves through a half-circle in time T_0 and then leaves the field. (a) Is the charge positive or negative? (b) Is the final speed of the particle greater than, less than, or equal to v_0? (c) If the initial speed had been $0.5v_0$, would the path have been a half-circle, more than a half-circle, or less than a half-circle?



10. You place a long straight wire on top of your compass, and the wire is a height of 5 mm above the compass needle. If the conventional current in the wire is I = 0.2 A and runs left to right as shown, calculate the approximate angle the needle deflects away from the north and draw the position of the compass needle.



11. Four identical parallel current are arranged to form a square of edge length *a* as shown in the figure, except that they are all out of the page. What is the force per unit length (magnitude and direction) on any one wire?

12. A wire carrying current *I* has the configuration shown. Two semi-infinite straight sections, both tangent to the same circle, are connected by a circular arc, of central angle θ, along the circumference of the circle, with all sections lying in the same plane. What must θ be in order for B to be zero at the center of the circle?