**Physics 212 Eighth week assignment:**

Reading: Study sections 12 through 16 of chapter 19 and sections 1 and 2 of chapter 20.

Tues, Oct 17: Lecture.

Homework problems to be handed in at the beginning of the Workshop on Wed, Oct 18: problems 43, 62 and 68 of chapter 19.

Wed, Oct 18: In this Workshop you will consider questions 45 and 52 on page 880 and discuss an old exam 2.

Thurs, Oct 19: Exam 2. Please find your seat number on the wall list and wait for the paper with your name on it.

Homework problems to be handed in at the beginning of the Workshop on Fri, Oct 20: Problem 56 of chapter 19 and the "wallpaper problems" 1 through 5 of chapter 20.

Fri, Oct 20: In this Workshop you will consider question 7 on page 934, problem 64 of chapter 19 as well as problems 6, 9 and 12 of chapter 20.

SAMPLE EXAM 2

**1 Multiple choice questions; 25 points.**

**(a) A battery is inserted into a circuit so terminal A is at a potential of −24 V and terminal B is at a potential of −18 V. Which terminal of the battery should be labeled with a + symbol?**

A. A.

B. B.

C. Both A and B must have − symbols here.

D. Since V = 0 is arbitrary, this is also arbitrary.

E. None of these.

**(b) When a potential difference of 6.0 volts exists across a 10 microfarad capacitor, the absolute value of the charge stored on each plate of the capacitor is:**

A. 6.0 volts.

B. 1.3 microcoulomb.

C. 60 microcoulomb.

D. $6.0 \times 10^5$

E. None of these.

**(c) You studied the formula for current in a wire, I=qnAv (q= charge on each current carrier, n = number of charge carriers per unit volume, A = cross section area, v = velocity of each charge carrier). Consequently, if the current through a wire increases, this is most likely due to:**

A. an increase in q.

B. an increase in n.

C. an increase in v.

D. changing from + to − charge carriers.

E. none of these.

**(d) When two 100 Ω resistors and one 1000 Ω resistor are all connected together as three parallel resistors, the equivalent resistance of this combination is :**

A. 0.021 Ω .

B. 47.6 Ω .

C. 1100 Ω .

D. 1200 Ω .

E. none of these.

**(e) When a positively charged particle has velocity, v = (+v)j and enters a magnetic field, B = (+B) i , the magnetic force, F will be described by the expression: [F>0]**

A. (+F) j .

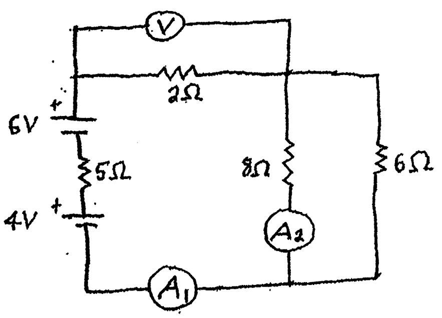
B. (-F) j .

C. (+F) k .

D. (-F) k .

E. zero.

**2. (25 points). The circuit shown below contains two batteries, four resistors, two ammeters and one voltmeter.**




(a) What is the reading of ammeter $A_1$?

(b) What is the reading of ammeter $A_2$?

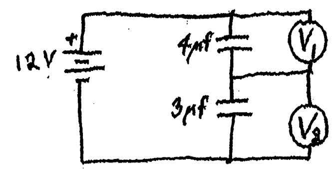
(c) What is the reading of the voltmeter?

(d) How much power is dissipated in the 6 Ω resistor?

(e) The 2 Ω resistor is a cylinder of length 0.1 m and radius 0.02 m. It is made of some unknown substance. What is the resisitivity of this substance?

**3. (25 points) Capacitors**

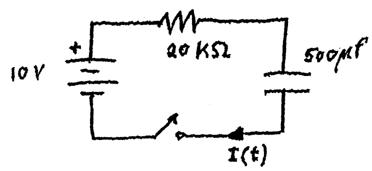
**(a) In the circuit below a 4 μf and a 3μf capacitor are connected together in series to a battery. $V_1$ and $V_2$ are ideal (in other words you can neglect their effect on the circuit) voltmeters. What is the equivalent capacitance of the two capacitors in series?**




(b) What are the readings of voltmeters $V_1$ and $V_2$?

(c) What is the charge on each capacitor?

**(d) In the circuit below, the capacitor shown is initially uncharged and the switch is closed at time, t=0. A current depending on time, I(t) will then flow to charge up the capacitor. Since there is initially no voltage drop across the capacitor (because there is initially no charge on it) you can find the initial current by using Ohm's law and the Kirchhoff loop law. What is that initial current, I(0)?**



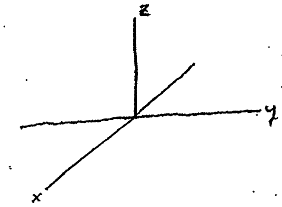

(e) Make a sketch (labeling the axes) of I(t) versus t. At what time will the current become equal to (1/e) times I(0)? (Note that 1/e is approximately 0.37.)

4. (25 points)

(a) Consider a small electric dipole ( with dipole moment, **p** ) in a uniform electric field, **E**. The dipole is free to change its position by rotating in the field. Remember that the torque on the dipole is given by **τ = p x E** and that the potential energy of the dipole in the field is given by (pot. energy) = - **p·E**. Take the electric field to be **E** = $E_0$ **k** and the dipole moment vector to be initially **p** = ($p_0$/√2 ) ( **i** + **k** ). What is the angle between **E** and the initial **p**? What is the potential energy for the dipole in its initial position?

$$p = \frac{p_0}{\sqrt{2}}(i + k)$$

(b) What is the torque (vector) which initially acts on the dipole? Express your answer in terms of $E_0$ , $p_0$ and the appropriate unit vectors. Show the vectors **E**, **p** and **τ** on the coordinate system provided. Given the direction of the torque vector how do you expect the dipole moment vector (in other words, the dipole) to move?




(c) As the dipole starts to move under the influence of the electric field, the magnitude of the dipole moment will remain the same but the angle it makes with **E** can vary. Denoting this angle by θ, find the potential energy of the dipole as a function of theta (using the formula given in part (a)). Sketch this function for θ ranging from −90 degrees to + 90 degrees. Where do you think the dipole would like to end up?

(d) (10 points). The ammeter in the circuit shown reads 3 amperes. What is the value of R?