

## RC CIRCUITS

You will receive no credit for items you complete after the assignment is due.

Read/study section 26-5 RC circuits and the physical principles section of the exercise in the manual... For your first reading consider EMF to be  $V$  (voltage=voltage difference for lab work) pay particular attention to the time constant and what it means for a circuit that charges a capacitor and discharges a capacitor examples 26-11, 26-12 The Math for the simple circuit may be a bit challenging but the final solutions should be studied carefully. Essentially time plays an important part in the solution of  $Q$ ,  $I$ ,  $V$  etc on the capacitor and in the circuit in general. So note the final time dependent (with exponential function) solutions.  $RC$  is called the time constant meaning it give you a measure of the timing in the circuit and you will see this by examining the solutions. Your lab exercise is to determine the time constant in different circuits. 15 time constants are produced in the end and should be in a table with appropriate comments in your lab report.

Questions: to be handed in when due.

1. Given a circuit with a resistor,  $R$ , and a capacitor,  $C$ . What is the expression for the time constant of this circuit?
2. What is the name of the Greek latter used for the time constant?
3. What are the units of the time constant?
4. The voltage on the capacitor,  $V_C$  is a function of time as it is being charged. Write the expression for the  $V_C$  in this case.
5. Define each variable in the expression in question 4?
6. The voltage on the capacitor,  $V_C$  is a function of time as it is being discharged. Write the expression for the  $V_C$  in this case.
7. What's so special about 0.63 and 0.37 in the cases of charging and discharging a capacitor with a Resistor in the circuit? Explain each case?

Problem(s): to be attached to the end of your lab report. Show all work, formulas and math used.

P1, A circuit contains a capacitor of  $480\mu\text{F}$  and a resistor of  $20\text{k}\Omega$ . Calculate the time constant for this circuit? Be sure to specify the unit!

P2. Study example 26-11 for charging a capacitor in the text on pages 688-689 of your text.

- a) What is the time constant of the circuit in figure 26-17a?
- b) What is the maximum charge the capacitor can reach?
- c) What is the maximum voltage the capacitor can reach?
- d) What voltage as a fraction of the emf will be on the capacitor after one time constant has passed?
- e) What is the actual voltage on the capacitor after two time constants have passed?