Physics 208: Electricity and Magnetism
Common Exam 2, October 17th 2016

Print your name **neatly**:

First name: | | | | | | | | | | | | | | | | | | | | | | |

Last name: | | | | | | | | | | | | | | | | | | | | | | |

Sign your name:____

Please fill in your Student ID number (UIN): _ _ _ -_ _ - _ _ _ _

Your classroom instructor:____________________________ Your section:___________

IMPORTANT

Read these directions carefully:

• You have 75 minutes to complete the exam.

• Formulae are provided on a separate colored sheet. You may NOT use any other formula sheet. *Please take the formula sheet with you. Do not turn it in.*

• You may use only an SAT approved calculator.

• When calculating numerical values, be sure to keep track of units. Results must include proper units.

• Be alert to the number of significant figures in the information given. Results must have the correct number of significant figures.

• You do not need to show work for the Multiple Choice questions.

• Show your work for the Problems 1 to 3. Without supporting work, the answer alone is worth nothing.

• Mark your answers clearly by drawing boxes around them.

• Please write clearly. You may gain marks for a partially correct calculation if your work can be deciphered.

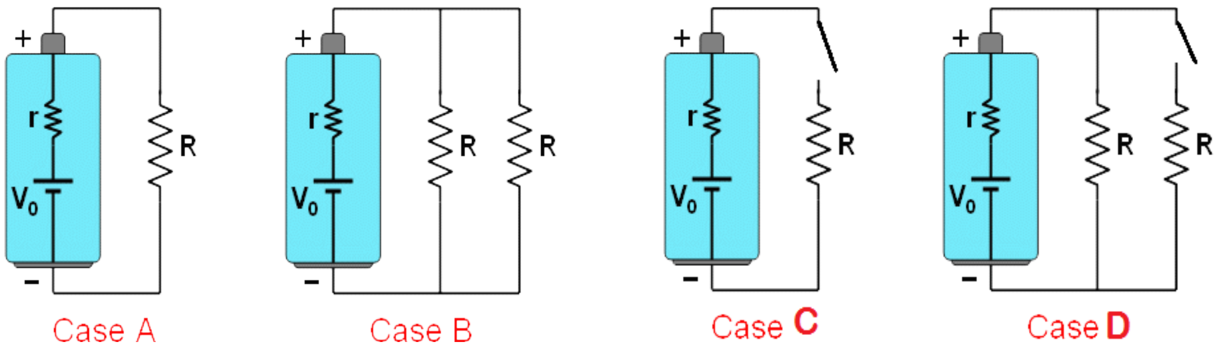
• If you need additional space to answer a problem, indicate/ mark on the main page of the problem that you are continuing on another page. Staple together all the extra sheets that contain your work to be graded.

For grading only:

Problem	Score
Multiple Choice	
Problem 1	
Problem 2	
Problem 3	
TOTAL	

Multiple Choice Questions

MC1. (5 pts) The real batteries and the resistors in all four cases illustrated below are identical. In which case is the voltage output across the terminals of the battery closest to the ideal battery *emf* V_0?

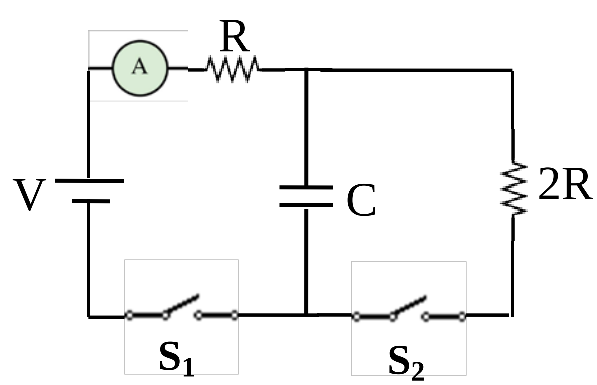


A.) The voltage across the terminals of the battery is closest to *emf* in Case A
B.) The voltage across the terminals of the battery is closest to *emf* in Case B
C.) The voltage across the terminals of the battery is closest to *emf* in Case C
D.) The voltage across the terminals of the battery is closest to *emf* in Case D
E.) The voltage across the terminals of the battery is the same in all cases.

MC2. (5 pts) Two capacitors, C_1 and C_2, are connected in series across an electric source of constant voltage output. With the electric source still connected, a dielectric is now inserted between the plates of the capacitor C_1. What happens to the charge on capacitor C_2?

A.) The charge on C_2 increases.
B.) The charge on C_2 decreases.
C.) The charge on C_2 remains the same.
D.) The answer depends on the value of the capacitance C_1.
E.) There is not enough information.

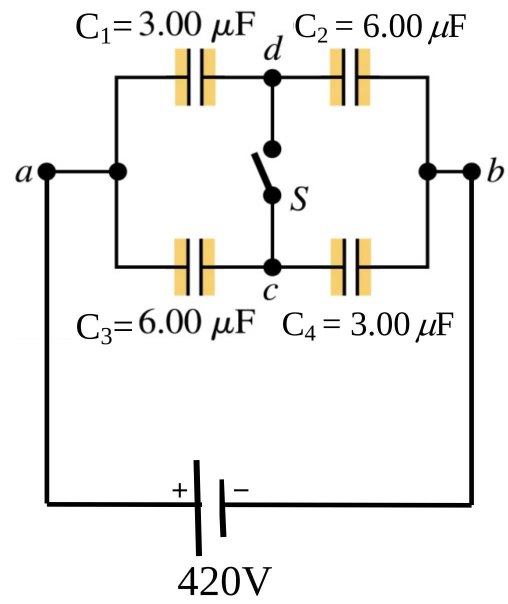
MC3. (5 pts) The capacitor in the circuit shown is initially uncharged. The switches S_1 and S_2 are closed simultaneously at t=0. What is the current through the ideal ammeter i) at t=0 and ii) for $t \to \infty$, respectively?



A.) V/3R; V/3R
B.) 0; V/3R
C.) V/R; 0
D.) V/3R; 0
E.) V/R; V/3R

Work *neatly*.

1. **(30 pts)** The capacitors are connected, as in the diagram, with the switch ***initially open***. The applied potential difference V_{ab} = +420 V.



a) What is the potential difference V_{cd}?

After the switch S is ***closed***:

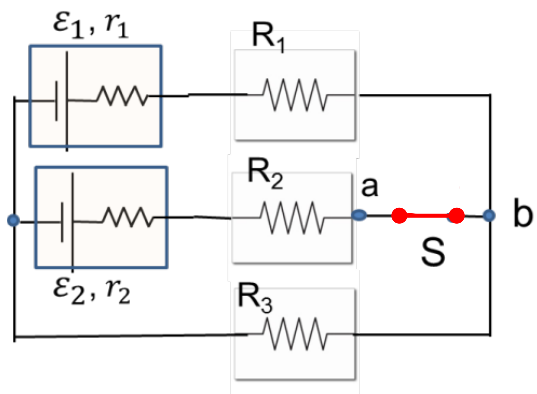
b) What is the potential difference across each capacitor?

c) How much charge flowed through the switch when it was closed?

Work *neatly*.

2. (25 pts) The DC circuit in the figure contains two batteries, one of *emf* ε_1 and internal resistance r_1, and the other of *emf* ε_2 and internal resistance r_2. The switch **S** is initially **closed**.

a) Write enough symbolic equations for calculating the currents (I_1,I_2, and I_3) through each resistor. Include only the known constants (ε_1, ε_2, r_1, r_2, R_1, R_2, *and* R_3) and the unknown currents.



b) Calculate the current through each resistor ***and*** the power output of the lower battery (ε_2,r_2) for the following set of numerical values: $\varepsilon_1 = 2.0V$, $\varepsilon_2 = 10.0V$, $r_1 = 1.0\Omega$, $r_2 = 2.0\Omega$, $R_1 = 3.0\Omega$, $R_2 = 2.0\Omega$, and $R_3 = 4.0\Omega$.

c) After the switch S is ***opened***, write a symbolic equation for the voltage $\mathbf{V_{ab}}$ of the contact **a** with respect to the contact **b**. Include only the known constants: ε_1, ε_2 , r_1, r_2, R_1, R_2, and R_3.

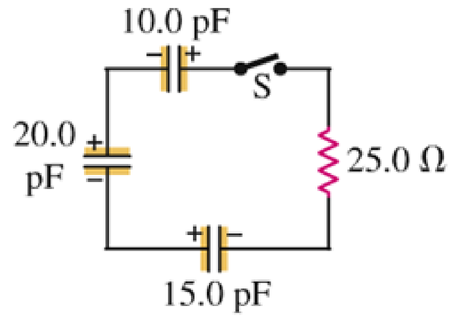
Work *neatly*.

3. (30 pts) In the electric circuit below, each capacitor has an initial charge $\boldsymbol{Q}$=7.00 nC on its plates.

a) Calculate the total energy stored in this circuit while the switch is open.

b) Calculate the current through the resistor immediately after the switch S is closed.

c) After the switch S is closed, calculate the current through the resistor at the instant that the capacitors have ***lost*** 80% of their initial stored energy.



Work *neatly*.

Work *neatly*.