
Physics 208 - Exam II

Fall 2018 (525-528; 531-535; 561-565) October 15, 2018.

Please fill out the information and read the instructions below, but
do not open the exam until told to do so.

Rules of the exam:

1. You have 75 minutes (1.25 hrs.) to complete the exam.
2. Formulae are provided to you with the exam on a separate sheet. Make sure you have one before the exam starts. You may not use any other formula sheet.
3. Check to see that there are 6 numbered (3 double-sided) pages plus a blank page for additional work if needed, in addition to the scantron-like cover page. Do not remove any pages.
4. If you run out of space for a given problem, the last page has been left blank and may be used for extra space. Be sure to indicate at the problem under consideration that the extra space is being utilized so the graders know to look at it!
5. You will be allowed to use only non-programmable calculators on this exam.
6. **NOTE** that you **must** show your work clearly to receive full credit.
7. Cell phone use during the exam is strictly prohibited. Please turn off all ringers as calls during an exam can be quite distracting.
8. Be sure to put a box around your final answer(s) and clearly indicate your work. Credit can be given only if your work is legible, clearly explained, and labelled.
9. All of the questions require you show your work and reasoning.
10. Have your TAMU ID ready when submitting your exam to the proctor.

Fill out the information below and sign to indicate your understanding of the above rules

Name: _____
(please print legibly)

UIN: _____

Signature: _____

Section Number: _____

Instructor: Webb
(circle one)

Kocharovskaya

- A. A DC battery maintains a constant voltage V_0 on a parallel plate capacitor. The plates have an area A and the distance between plates is d . The battery remains connected to the capacitor throughout this problem. Answer the following in terms of the constants given.
- If there is air between its plates, what (i) charge and (ii) energy does the capacitor store?
 - If a slab of dielectric constant K would completely fill the space between plates, what (i) charge and (ii) energy does the capacitor store?
 - If there is any difference of energy between configuration a) and configuration b), explain this difference.

LO	P	F
28.1		
29.1		
28.2		
31.1		
28.3		
31.2		
32.1		
34.1		

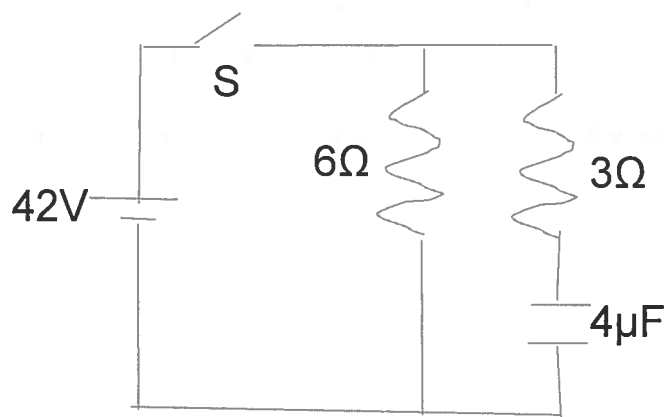
- B. A 120-V, 60-W light bulb, a 120-V, 120-W light bulb, and a 120-V, 240-W light bulb are connected in series as shown and connected to a 120 V DC power source. In this configurations, which bulb will have the greatest voltage drop?



LO	P	F
36.1		
40.1		
36.2		
40.2		
36.3		
40.3		
41.1		

C. The capacitor is initially uncharged.

- i) Immediately after the switch is closed what are the currents through each resistor?
- ii) The switch was closed for a long time. What are the currents through each resistor?



LO	P	F
3.1		
41.2		
45.1		
3.2		
41.3		
45.2		

Problem 1.

The capacitances in the figure below have the values $C_1 = 10\mu\text{F}$ and $C_2 = 40\mu\text{F}$. The charging battery provides $V_{ab} = 10\text{V}$ to this system of two capacitors.

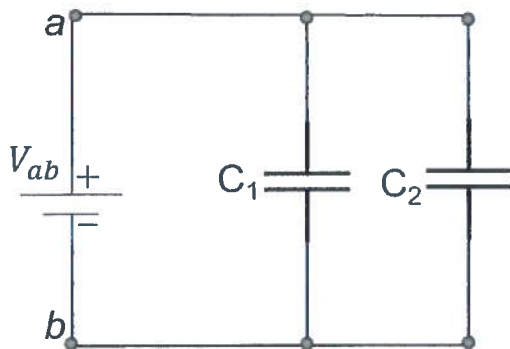
- What is the total electric charge stored by this system of two capacitors?
- What is the total energy stored by this system of two capacitors?

The battery is now unplugged from the system. The capacitors are disconnected from each other, **without any loss of electric charge**, then reconnected to each other such that the plates of opposite sign are in electric contact.

- What is the voltage across each capacitor in this new situation?
- What is the total energy stored by the reconfigured system of two capacitors?

Is the energy stored in the reconfigured system equal, greater, or less than the energy calculated in part b)?

- If any difference of stored energy, explain where it came from (or went to). If no difference in stored energy, explain why should be so.



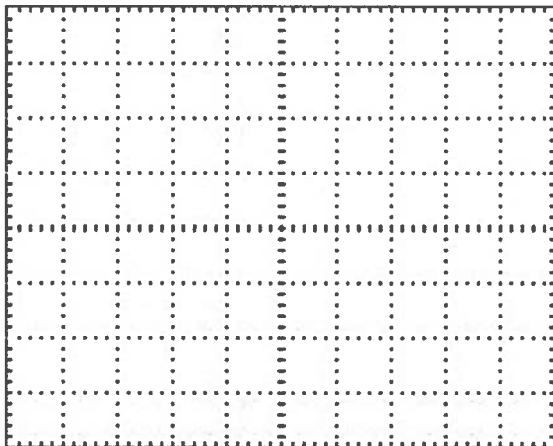
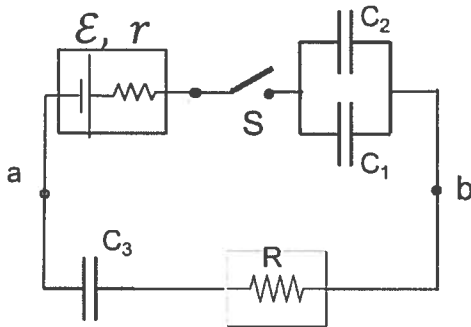
LO	P	F
3.3		
31.3		
3.4		
28.4		
30.1		
4.1		
28.5		
30.2		
28.6		

31.4
34.2

Problem 2.

In the electric circuit in shown in the figure below, the values are $\mathcal{E} = 120\text{V}$, $r = 1\Omega$, $R = 1\Omega$, $C_1 = 3\mu\text{F}$, $C_2 = 3\mu\text{F}$, and $C_3 = 6\mu\text{F}$. The switch S is initially open and the capacitors are uncharged. Calculate the difference of electric potential between the points (a) and (b), where $V_{ab} = V_b - V_a$ for the following situations.

- Immediately after the switch S is closed.
- After a very long time from the moment when the switch S is closed for $t \rightarrow \infty$.
- When the current through this circuit reaches $1/3$ of its maximum possible value.
- Sketch the current as a function of time on the template below. (Please label important times and current values in your sketch.)

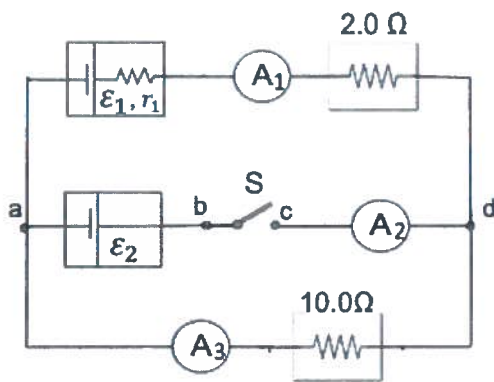


LO	P	F
3.5		
41.4		
30.3		
30.4		
43.1		
45.3		
43.2		
45.4		
43.3		
45.5		
45.6		

Problem 3.

In the electric circuit in figure below, the first battery, emf $\mathcal{E}_1 = 15V$, and has an internal resistance $r_1 = 1.0 \Omega$. The second battery has emf $\mathcal{E}_2 = 30.0 V$ and no internal resistance. The ammeters shown in the circuit are *ideal*.

- A) When the switch S is open calculate:
1. The currents through the ammeters A_1 , A_2 , and A_3 .
 2. The voltage between the points b and c.
- B) When the switch S is closed, calculate:
1. The currents through the ammeters A_1 , A_2 , and A_3 .
 2. The power output of each battery.



LO	P	F
3.6		
38.1		
41.5		
43.4		
44.1		
43.5		
4.3		
42.1		
42.2		
42.3		
39.1		
40.4		
40.5		