Exam 2 – white version

Physics 2760

Fall 2012

Please identify your Lab section
Lab Section #
Name of TA:

Last Name Solutions

First Name_____

ID # _____

This is a closed book exam. I understand, pursuant to University Regulations on academic honesty, that I am not to use any notes or consult with peers during the examination.

Signature_____

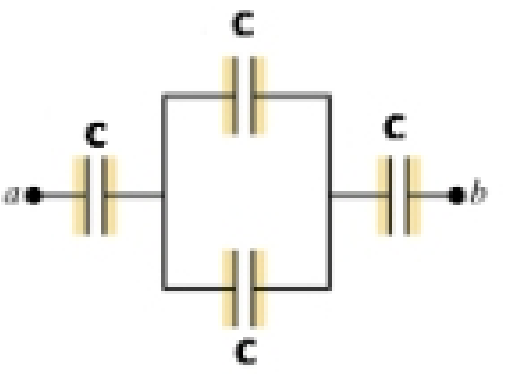
For multiple choice questions, please make sure that you circle the letter for the answer which you believe to be correct and only that answer. If more than one answer is circled for the same problem or there are any ambiguities, you will not receive credit for it. Don't get hung up on questions. They should take only one or two minutes each. If you find yourself spending more than a few minutes on a multiple choice question you are probably looking at it the wrong way. You should skip it for now and come back to it later.

For full credit show your work for solutions to questions that require calculations. Explain from where you start to solve the problem and show your math flowing from it for full credit. **No shown work, no credit!**

Relax, read carefully, think – and then read everything again.

During the exam, if you have questions please raise your hand and the TA or the instructor will come to you and provide help.

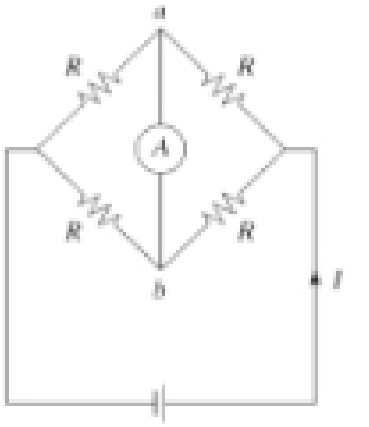
1. (5 points) Four capacitors having the same capacitance "C" are connected as shown in the figure. The equivalent capacitance across terminals *a* and *b* is



Everyone gets 5 point here.
The correct answer is: 2/5 C

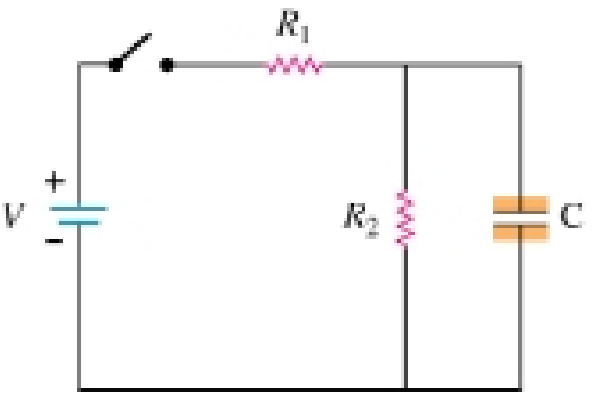
(a) 2C/3
(b) 3C/2
(c) 4C
(d) 2C

2. (5 points) An ammeter *A* is connected between points *a* and *b* in the circuit below, in which the four resistors are identical. The current through the ammeter is



a) zero
b) $I/2$
c) I/4
d) need more information

3. (5 points) In the diagram below, the two resistors, R_1 and R_2, are identical and the capacitor is initially uncharged with the switch open. How does the current through R_1 compare with the current through R_2 *a very long time after* the switch is closed?

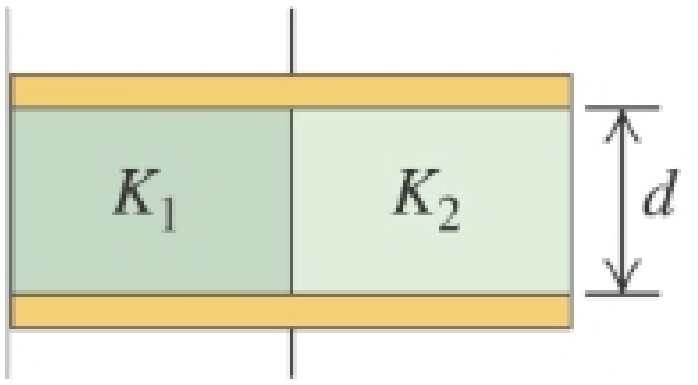


(a) current through R_1 is greater than through R_2
(b) current through R_1 is less than through R_2
(c) they are the same

4. (5 points) A cylindrical wire has a resistance R and resistivity ρ. If its length and diameter are both cut in half, its resistivity will now be:

a) 4ρ
b) ρ/2
c) 2ρ
d) ρ

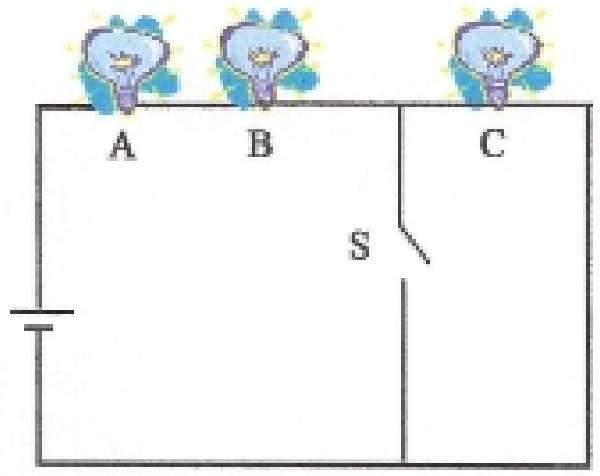
5. (5 points) A parallel plate capacitor has the space between the plates filled with two slabs of dielectric, one of constant K_1 and the other with constant K_2. The thickness of each slab is the same as the plate separation d, and each slab fills half the volume between the plates. The capacitance (C) is given by



a) $[2\varepsilon_0 A K_1 K_2]/[d(K_1+K_2)]$
b) $[\varepsilon_0 A(K_1+K_2)]/2d$
c) $[4\varepsilon_0 A K_1 K_2]/[d(K_1+K_2)]$
d) $[4\varepsilon_0 A(K_1+K_2)]/d$

Problem 6

12 points **(a)** A series circuit consists of 3 identical lamps connected as shown in the figure. When the switch S is closed, what happens (increases, decreases or no effect; justify your answers briefly)



(i) to the current in the circuit?

Increases, since the total resistance decreases

(ii) to the intensity of lamp C ?

decreases, does not light at all

(iii) to the intensities of lamps A and B?

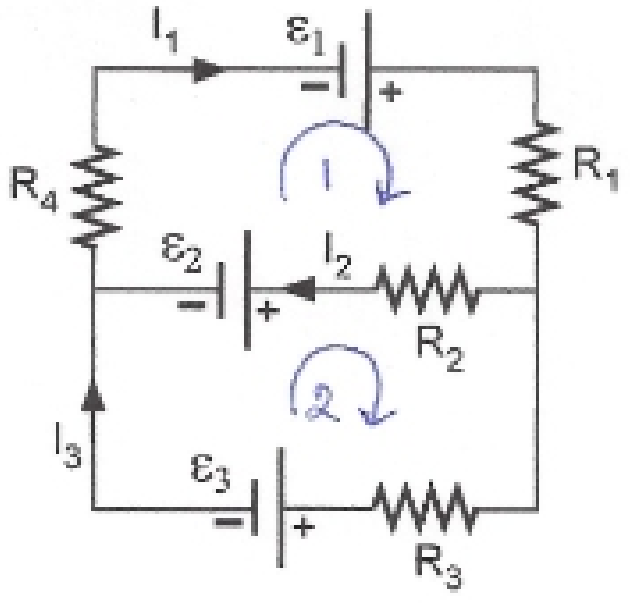
increases; the overall current is higher

(iv) to the voltage drop across each lamp?

V across C = 0

V across A and B increases

13 points **(b)** Write Kirchhoff's Laws for the circuit provided below such that you can determine the currents (I_1, I_2, I_3) through each resistor. Make sure to indicate the direction in which you go around the loop. Also, you should have at least as many equations as the number of unknowns.



junction

$I_1 = I_2 + I_3$

loop 1:

$\mathcal{E}_1 - I_1 R_1 - I_2 R_2 - \mathcal{E}_2 - I_1 R_4 = 0$

loop 2:

$\mathcal{E}_2 + I_2 R_2 - I_3 R_3 - \mathcal{E}_3 = 0$