Physics 2212G/J Test form **433** Name _____
Fall 2016
Test 3 Recitation Section (see back of test):_____

A

1) Print your name, test form number (above), and nine-digit student number in the section of the answer card labeled "STUDENT IDENTIFICATION".

2) Bubble your test form number (**ABOVE**) in columns 1-3, skip column 4, then bubble in your student number in columns 5-13.

3) For each free-response question, show all relevant work supporting your answer. **Clearly box or underline your final answer.** "Correct" answers which are not supported by adequate calculations and/or reasoning will be counted wrong.

4) For each multiple-choice question, select the answer most nearly correct, **circle this answer on your test**, and bubble it in on your answer card. **Show all relevant work on your quiz.**

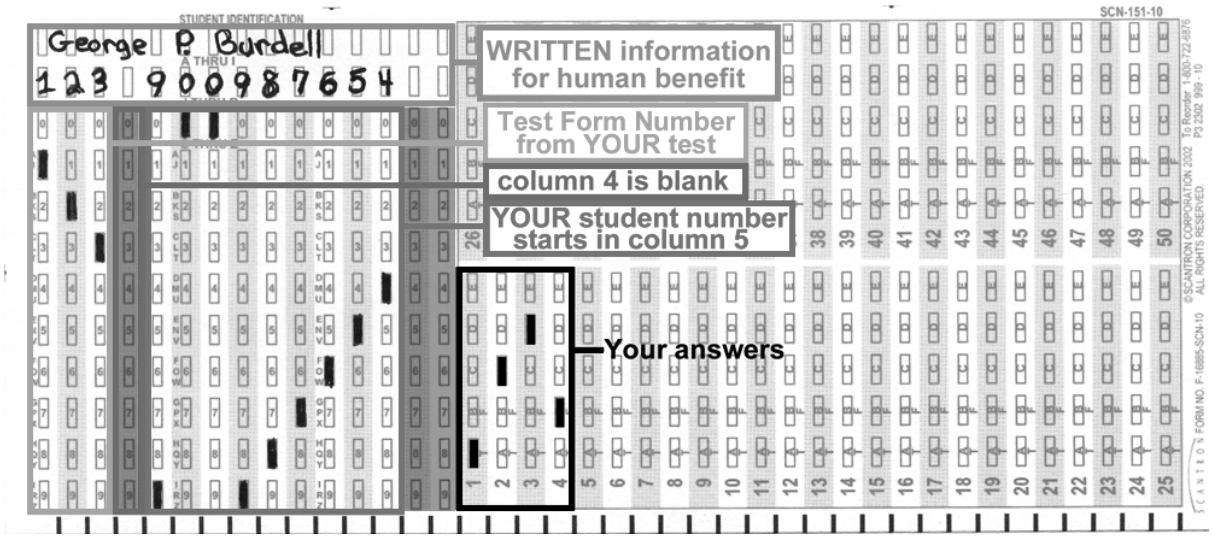
5) Be prepared to present your Buzzcard as you turn in your test. Scores will be posted to WebAssign after they have been been graded. **Quiz grades become final when the next quiz is given.**

6) You may use a simple scientific calculator capable of logarithms, exponentials, and trigonometric functions. **Programmable engineering calculators with text or graphical capabilities are not allowed. Wireless devices are prohibited.**

Numerical Constants:

$k = 8.99\times10^{9}$ N·m^2/C^2	$e = 1.60\times10^{-19}$ C	$m_e = 9.11\times10^{-31}$ kg
$\varepsilon_o = 8.85\times10^{-12}$ C^2/N·m^2	$g = 9.81$ m/s^2	$m_p = 1.67\times10^{-27}$ kg

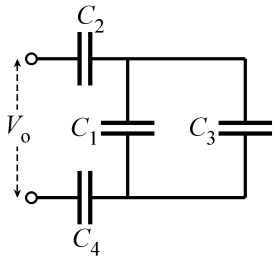
Your test form is: 433



Our next test will be on Tuesday, November 29

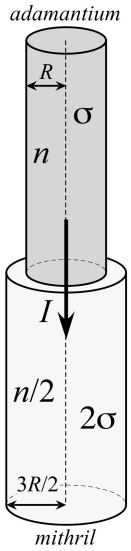
The following problem will be hand-graded. *Show all your work for this problem.* *Make no marks and leave no space on your answer card for it.*

[I] *(20 points)* Four capacitors $C_1 = C$, $C_2 = 2C$, $C_3 = 3C$ and $C_4 = 4C$ are arranged in the network at right. A potential difference of magnitude V_o is applied across the terminals, and the capacitors are allowed to charge up to equilibrium. Determine the amount of charge stored on each capacitor. Express each answer in terms of the parameters C and V_o.



The following problem will be hand-graded. Show all your work for this problem. Make no marks and leave no space on your answer card for it.

[II] *(20 points)* Adamantium is a metal having conductivity σ and charge carrier density n. Mithril is a metal having conductivity 2σ and charge carrier density n/2. In the figure at right, an adamantium wire of radius R is spliced onto a mithril wire of radius $3R/2$, and an electric current I is is driven through the junction.

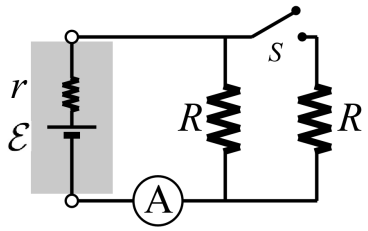


(i) Compare the electric fields in the two halves of the wire, by determining the electric field magnitude E_A in adamantium as a fraction (or multiple) of E_M, the electric field magnitude in mithril.

(ii) Compare the drift speeds of electrons in the two halves of the wire, by determining the drift speed v_A in adamantium as a fraction (or multiple) of v_M, the drift speed in mithril.

The following problem will be hand-graded. *Show all your work for this problem*. *Make no marks and leave no space on your answer card for it.*

[III] *(20 points)* A real battery having known emf $\mathcal{E}$ and unknown internal resistance r is attached across a pair of identical load resistors R as show at right. When switch S is open, ammeter A measures a current I_o. When the switch is closed, the ammeter reads a current I_c = 7/4 I_o. Determine the internal resistance r of the battery. Express your answer as a fraction or multiple of the resistance R.



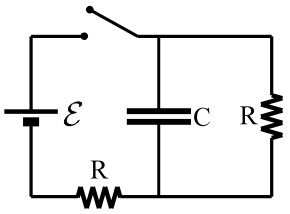
[Hint: when the switch is closed the two load resistors can be replaced by their single equivalent resistance.]

[

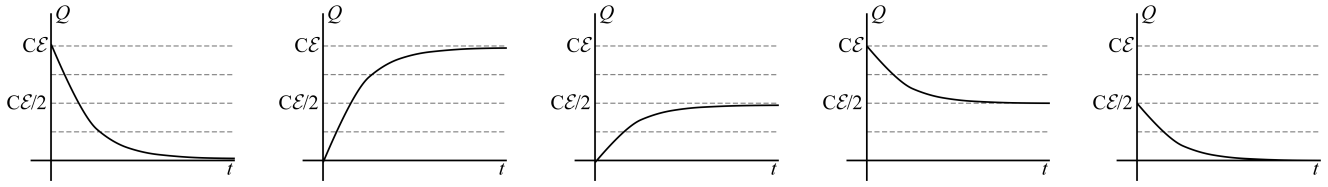
[Bonus: 4 points]
With the switch closed, what will be the terminal potential across the battery? Express your answer as a fraction of $\mathcal{E}$.

Question value 8 points

(1) In the circuit at right, the switch has been open for a very long time. If the switch is suddenly closed, which of the graphs below best depicts the potential charge stored on the capacitor as a function of time? Assume that $t = 0$ corresponds to the the moment the switch is closed.



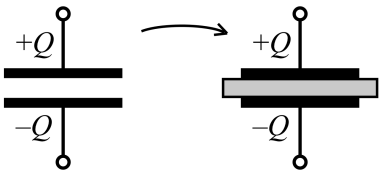
Hint: What current flows in each branch after the switch has been closed for a long time?



(a) (b) (c) (d) (e)

Question value 8 points

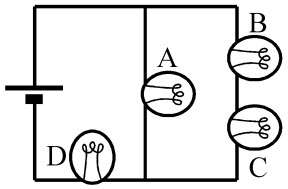
(2) An isolated capacitor has a total charge Q placed upon it. A dielectric material is carefully inserted into the space between the capacitor plates, without disturbing the charge on the capacitor. What will happen to the magnitude of the electric field E between the capacitor plates, and to the energy U stored in the capacitor?



(a) E will increase and U will remain the same.
(b) E will decrease and U will increase.
(c) E will remain the same and U will decrease.
(d) E will decrease and U will decrease.
(e) E will increase and U will increase.

Question value 8 points

(3) Four identical bulbs are placed in the circuit shown at right. Rank the four bulbs in brightness, from greatest to least.



(a) $A = D > B > C$

(b) $A = D > B = C$

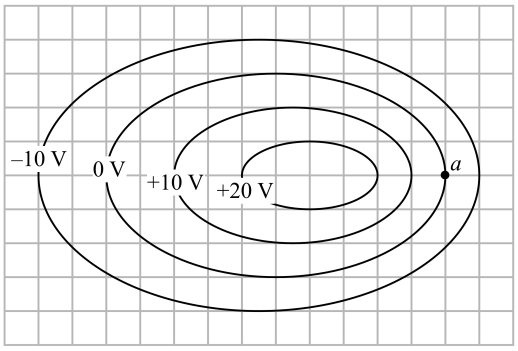
(c) $D > A > B > C$

(d) $A > B > C > D$

(e) $D > A > B = C$

Question value 8 points

(4) The figure at right displays a series of equipotential curves. The grid spacing is 1.0 cm per square. What is the magnitude and direction of the electric field at point *a*?



(a) 500 N/C, to the left.

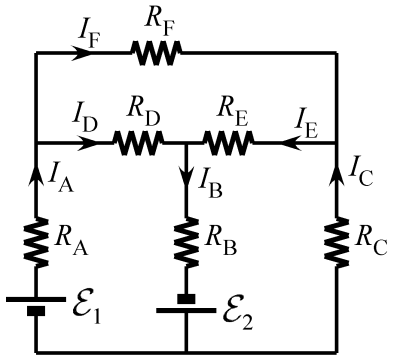
(b) The field is zero at *a*.

(c) 1000 N/C, to the left.

(d) 1000 N/C, to the right.

(e) 500 N/C, to the right.

The next two questions both involve the following situation:
Two ideal emfs and six resistances are arranged in the circuit shown at right. In each branch of the circuit, the assumed direction of current flow is also indicated.



Question value 4 points

(5) Which of the equations below is a valid application of the Loop Rule to the circuit?

(a) $-I_D R_D - I_B R_B + \mathcal{E}_2 + \mathcal{E}_1 - I_A R_A = 0$

(b) $+\mathcal{E}_1 - I_A R_A - I_F R_F - I_C R_C = 0$

(c) $+\mathcal{E}_2 + I_B R_B + I_D R_D - I_F R_F = 0$

(d) $+I_D R_D + I_E R_E - I_B R_B = 0$

(e) $-I_C R_C - I_F R_F - I_D R_D - I_B R_B + \mathcal{E}_2 = 0$

Question value 4 points

(6) Which of the equations below is a valid application of the Junction Rule to the circuit?

(a) $I_A + I_D + I_F + I_C = I_B + I_E$

(b) $I_A = I_B + I_C$

(c) $I_E = I_C + I_F$

(d) $I_A + I_D = I_C + I_B$

(e) $I_F + I_E = I_D$

PHYS 2212 G/J Recitation TA and Room Assignments

	Howey S-104	Howey S-106	Howey S-107
WEDNESDAY			
1:05 pm		J01 Zhou, Boli	
2:05 pm		G01 Zhou, Boli	G02 Daum, Marcus
3:05 pm		G06 Zhou, Boli	J02/J05 Daum, Marcus
4:05 pm		G08 Kim, Sirwoo	
5:05 pm	J09 Daum, Marcus	G03/J06 Kim, Sirwoo	
THURSDAY			
12:05 pm			G04 Daum, Marcus
1:05 pm			J10 Daum, Marcus
2:05 pm		G09 Zhou, Boli	J03/J08 Daum, Marcus
3:05 pm		G10/J07 Zhou, Boli	
4:05 pm		J04 Thoreson, Megan	
5:05 pm		G05 Zhou, Boli	G07 Bernardes, Sarah

Tests will be returned in recitation, in the week *after* the test. In order to ensure that you receive your test back as soon as possible, please enter your recitation section from the table above (G01–G10) on the front of this test.