# DO NOT TURN THIS PAGE!!!!!

Name: _____

Physics 4B
Winter 2018
EXAM 2

***Partial credit will be given, so do what you can, and show all your work in complete detail with appropriate units. NO CREDIT WILL BE GIVEN IF NO WORK IS SHOWN!***

1. The region between two concentric conducting spheres with radii $a$ and $b$ is filled with a conducting material with resistivity $\rho$. **(10 pts)**

   a) Show that the resistance between the spheres is given by:

   $$R = \frac{\rho}{4\pi}\left(\frac{1}{a} - \frac{1}{b}\right)$$

   b) Derive an expression for the current density as a function of radius, in terms of potential difference $V_{ab}$ between the spheres.

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2. The capacitors in the circuit shown in the figure below are initially uncharged. **(15 pts)**
   a) Calculate the initial value of the battery current when the switch S is closed?
   b) Calculate the battery current after switch S has been closed for a long time.
   c) Calculate the final charges on the capacitors.
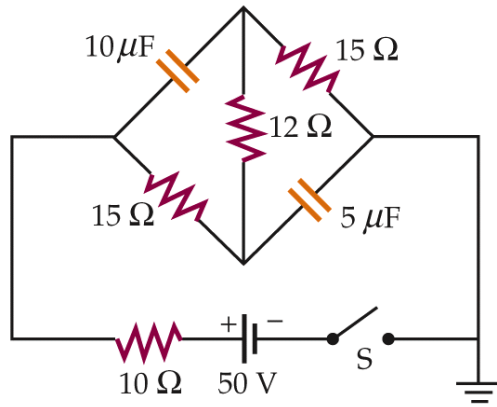
**3.** In the circuit shown below:     **(10 pts)**

a) Find current in each resistor.
b) Find the potential difference between points *c* and *f* and specify which point is at a higher poterntial.
c) Calculate the power delivered to the 2KΩ resistor.        (10 pts)
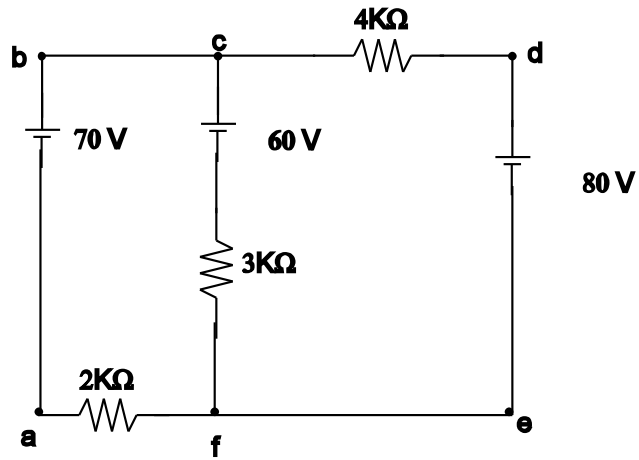
4. While studying for the exam that you are currently taking, you were reading your lecture notes and came across ………

*Placing a dielectric material between the plates of a capacitor serves three functions:*

1) *Maintains a small separation between the plates.*
2) *Increases the capacitance.*
3) *Increases the maximum operating voltage between the plates.*

Using a proper atomic description of dielectrics provide a detailed explanation of the last two properties. That is, explain why the capacitance and maximum operating voltage increases. **(10 pts)**