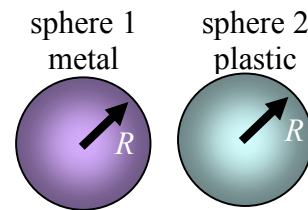


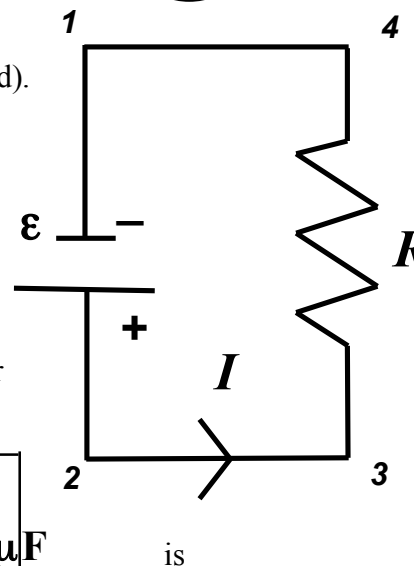
Midterm I SAMPLE

Part I – Concept Questions (10 points each).

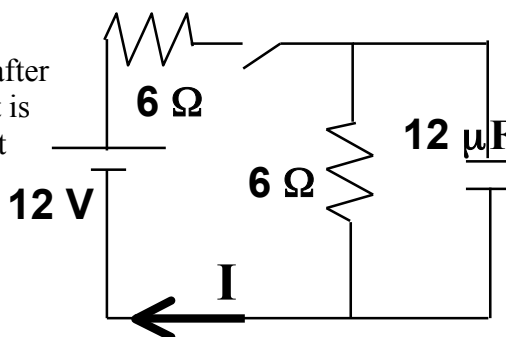
- Consider 2 spheres on equal radius a , each carrying a total charge Q . Sphere 1 is made of metal and sphere 2 of plastic (uniformly distributed). (a) What are the electric fields inside both spheres? (b) About outside the spheres? (c) Explain your results in terms of how charges behave.



- Find C for a cylindrical capacitor of length L inner radius a and outer radius b . (Hint: first, use Gauss's Law to get the electric field).
- Consider the circuit on the right. (a) Draw the potential V from point 1 to point 4. (b) Draw the current between 1 and 4.
- We have two identical light bulbs. First I hook them up in series. Then I hook them up in parallel. In which case are the bulbs brighter? (The resistors represent light bulbs whose brightness is proportional to $P = I^2 R$ through the resistor.). Please explain your answer.



- Consider the circuit at right after the switch is closed (a) What is the initial current I ? (b) What is the current I after 2 minutes?



Part II – Analytical Problem (50 points)

A circuit consists of a 12 V battery with internal resistance of 2Ω connected to a resistance of 10Ω . The current in the resistor is I , and the voltage across it is V . The voltmeter and the ammeter can be considered ideal; that is, their resistances are infinity and zero, respectively. What is the current I and voltage V measured by those two instruments? What is the power dissipated by the battery? By the resistance? What is the total power dissipated in the circuit? Comment on these various powers.

- Draw a diagram that includes all the relevant quantities for this problem. What quantities do you need to find v and y_{\max} ? (10 pts)
- What concepts and equations will you use to solve this problem? (10 pts)
- Solve for I , V , and the various powers in terms of symbols. (15 pts)
- Solve I , V , and the various powers in terms of numbers. (10 pts)
- Verify the units, and verify if your values are plausible. (5 pts).

