

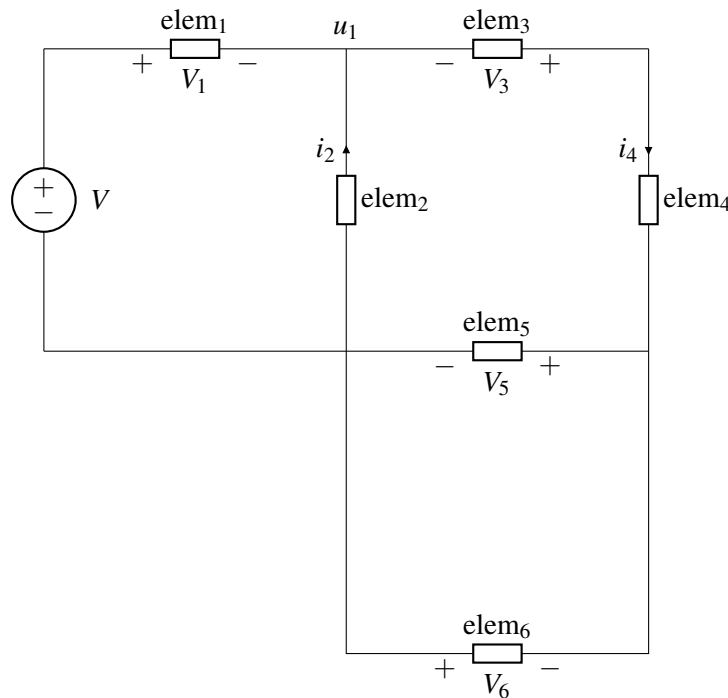
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EECS 16A    Designing Information Devices and Systems I    Exam Prep 7A  
Spring 2023

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**1. KCL and KVL (Spring 2022 Midterm 2 Question 3)**

- (a) Given the circuit below, label all the missing **element** voltages and currents using passive sign convention. You do not need to label the voltage source or node voltages.

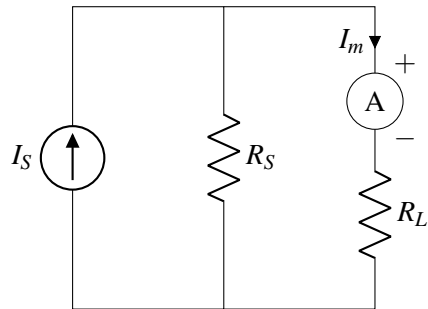


- (b) Using your labeled voltages/currents, write the KCL equation for node  $u_1$ .

- (c) Using your labeled voltages/currents, write the KVL equation for the loop containing  $\text{elem}_2$ ,  $\text{elem}_3$ ,  $\text{elem}_4$  and  $\text{elem}_5$ .

**2. Why is the ammeter so hot? (Fall 2022 Midterm 2 Question 3)**

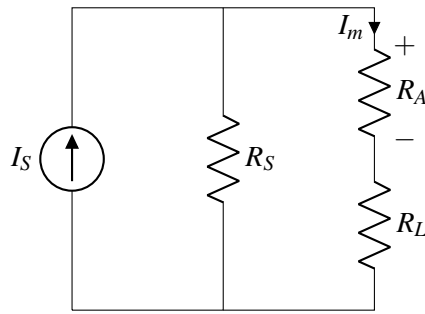
In the following circuit, we would like to measure the current  $I_m$  through resistor  $R_L$  using an ammeter.



- (a) (4 points) If  $I_S = 4\text{ A}$ ,  $R_S = 3\text{ m}\Omega$ , and  $R_L = 1\text{ m}\Omega$ , then what is the measured current  $I_m$ ? Assume an ideal ammeter.

- (b) Now suppose we have different values of  $I_S$  and  $R_S$  such that  $I_m = 2\text{ A}$ , then **what is the power dissipated by  $R_L = 1\text{ m}\Omega$ ? How much energy does  $R_L$  dissipate in 20 seconds?**

- (c) Now assume the ammeter is not ideal and can instead be modeled with equivalent resistance  $R_A$ . That is, we can replace the ammeter with a resistor  $R_A$ :



If  $I_S = 4\text{ A}$ ,  $R_S = 3\text{ m}\Omega$ ,  $R_L = 1\text{ m}\Omega$ , and the current measured by the ammeter (i.e., the current through  $R_A$ ) is  $I_m = 2\text{ A}$ , then **what must be the internal resistance  $R_A$  of the ammeter? How much power is dissipated by the ammeter?**