Reading & Using an Electrical Diagram to Solve Problems

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Reading an electrical diagram is like reading a roadmap. On a roadmap the lines indicate roadways. On an electrical (schematic) diagram the lines indicate wires which are roadways for electrons. On a roadmap symbols are used to indicate bridges, schools, airports, tunnels parking-lots and the like. On a schematic diagram symbols indicate resistors, lamps, motors, batteries, switches, transistors and other related items. Once you become familiar with the electrical symbols, reading a schematic diagram is not any more difficult than reading a roadmap.

Look over the drawing of the commonly used symbols (next page). Most of these symbols are somewhat logical. To me, the only exception is the resistor symbol. It does not resemble a resistor but it is very distinctive and this helps to keep it from being confused with the other symbols.

On Schematic Diagram A there is a drawing that represents an electrical circuit for a heater (resistor) controlled by a switch; a 10 volt battery; a 6 volt incandescent lamp with a series resistor and switch plus another heater-resistor - except that this one is controlled automatically by a thermal-switch such as would be used in cold climates to keep water pipes from freezing. This switch will open at 2°C so that whenever the temperature is more than 2°C. above freezing, the switch will open and stop the flow of current through the heater-resistor. When the temperature falls below 2°C. the switch closes and the heater-resistor will draw current and dissipate heat into the pipes.

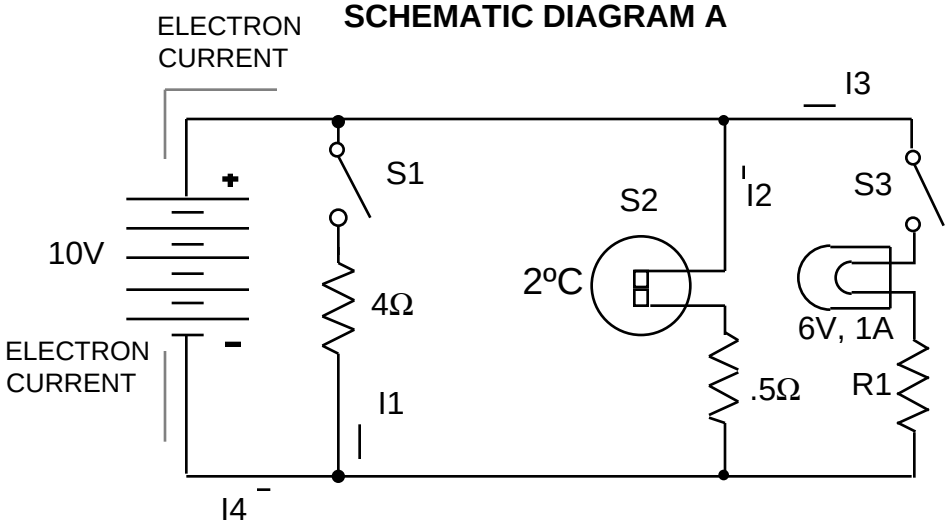
Here are some questions about Schematic Diagram A:

1. How much current (I1) flows through the 4Ω resistor when S1 is closed ?
2. If the lamp shown is rated at 6V, 1A, how many ohms is needed for R1?
3. Find I2 when the ambient temperature is 0°C and also the power dissipated by the .5Ω resistor.
4. Find I3, and I4 when the ambient temperature is 25°C, S1 is closed and S3 is open.
5. What is the largest possible current that could be drawn from the battery?

Solutions:

1. Using I=E/R: I1=10V/4Ω = 2.5A.
2. The lamp needs 6V. The battery provides 10V which is 4V

SCHEMATIC DIAGRAM A



too much. So 4V must be wasted in R1. The current that flows in R1 is the same as current in the lamp: 1A. Using R=E/I: R1=4V/1A = 4Ω.

3. The thermal-switch will be closed at 0°C. So current will be flowing in the .5Ω resistor. Using I=E/R: I2=10V/.5Ω = 20A. The power dissipated can be found by using P=IE: P=20A x 10V = 200 watts.

4. If S3 is open then I3 must be zero. At 25°C, S2 is also open so I2 is also zero. The only current that can flow must pass through S1 which was previously found to be 2.5A.

5. If S1, S2, and S3 were all closed, the total current would be 2.5A + 20A + 1A = 23.5A

Commonly Used Symbols On Schematic Diagrams