

Physics 133 Homework 4
Circuits
Due Monday Nov 2

Problem 1.

A typical AA battery has a voltage of 1.5 volts, and an internal resistance of 0.4Ω . It has a capacity of 1.4 Amp-hr. If a 2.6Ω light bulb is placed across the battery,

- a) How much current flows out of the battery?
- b) What is the terminal voltage of the battery?
- c) How long can the battery keep the light bulb lit?

Problem 2.

A 1Ω , 3Ω , and two 6Ω resistors are connected as shown on the figures page. Find the equivalent resistance of the combination.

Problem 3.

Three 100Ω resistors are connected as shown on the figures page. The maximum power that can be dissipated in any one of the resistors is 25 Watts.

- a) What is the maximum voltage that can be connected across the terminals a and b ?
- b) What is the total power dissipated by the resistors in the circuit when connected to the maximum voltage allowed?

Problem 4.

Three resistors of resistance 3Ω , 6Ω and 4Ω are connected across a 24 volt battery as shown in the figures page. Find the current through and the voltage drop across each resistor in the circuit.

Problem 5.

Three resistors of resistance 4Ω , 3Ω and 2Ω are connected in a circuit with two batteries as shown in the figures page. Find the current through and the voltage drop

across each resistor in the circuit.

Problem 6.

Five resistors are connected in a Wheatstone Bridge as shown in the figures page. If a 8 volt battery is connected across the Wheatstone Bridge,

- a) How much current flows from the battery?
- b) What is the effective resistance of the Wheatstone Bridge?

Problem 7.

a) A parallel plate capacitor of Capacitance C is connected to a battery of voltage V . If the separation of the plates d is doubled while connected to the battery, what is the fractional change in the electrical energy of the capacitor?

b) A parallel plate capacitor of Capacitance C has a charge of $\pm Q$ on its plates. If the separation d is doubled keeping the charge the same, what is the fractional change in the electrical energy of the capacitor?

Problem 8.

An infinite number of resistors are connected in a "ladder" network as shown in the figures page. Each resistor has a resistance r . Find the equivalent resistance R of the infinite string of resistors. Express your answer in terms of r .

Problem 9.

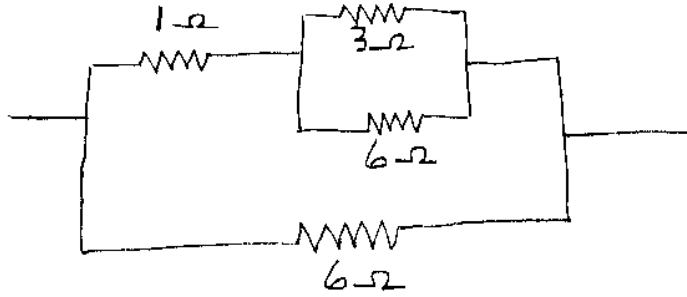
How much does it cost to operate the following appliances for the time stated?

- a) a 60 Watt light bulb for 12 hours.
- b) a 1500 Watt heater for 1/2 hour.
- c) a 2000 Watt air conditioner for 8 hours.
- d) a 100 Watt evaporative cooler (swamp cooler) for 8 hours.

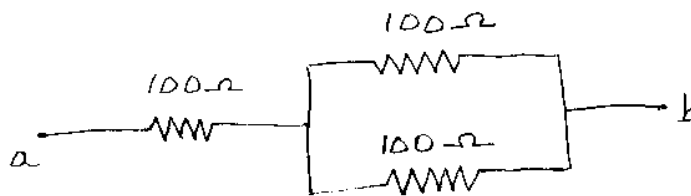
See the next two pages for the figures

FIGURES FOR HWK 4

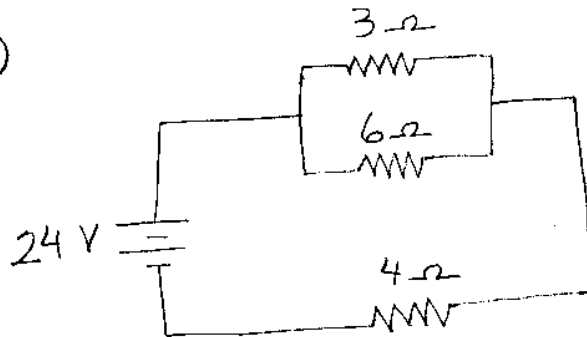
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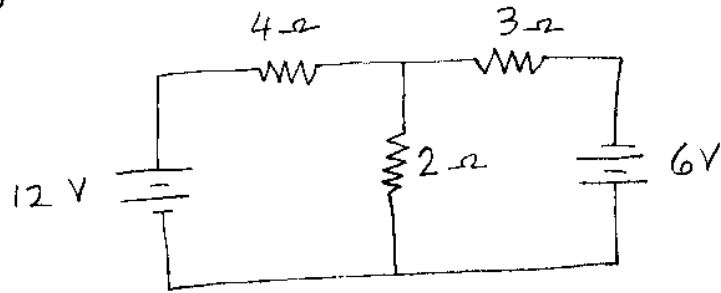
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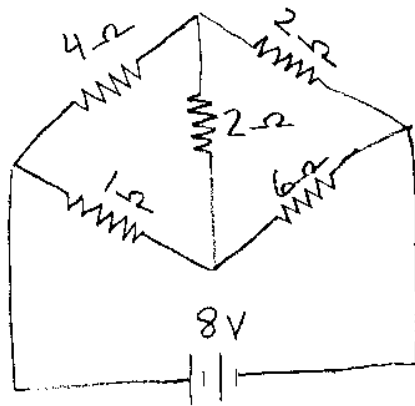
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