This print-out should have 37 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

Reading assignment: Hecht Sections 18-1, 18-2, 18-3 and 18-5

001 10.0 points

Kirchhoff's loop rule for circuit analysis is an expression of which of the following?

1. Conservation of energy

2. Ohm's law

3. Ampère's law

4. Faraday's law

5. Conservation of charge

002 10.0 points

A battery having an emf of 11.61 V delivers 108 mA when connected to a 60.8 Ω load.

Find the internal resistance of the battery.

Answer in units of Ω.

003 10.0 points

When you turn the ignition key in a car, you complete a circuit from the negative battery terminal through the electric starter and back to the positive battery terminal.

About how long does it take electrons starting from the negative terminal to reach the positive terminal?

1. several minutes

2. less than human reflex time

3. 1/2 second

4. several seconds

5. several hours

004 (part 1 of 5) 10.0 points

A string of 26 identical Christmas tree lights are connected in series to a 120 V source. The string dissipates 63 W.

What is the equivalent resistance of the light string?

Answer in units of Ω.

005 (part 2 of 5) 10.0 points

What is the resistance of a single light?

Answer in units of Ω.

006 (part 3 of 5) 10.0 points

What power is dissipated in a single light?

Answer in units of W.

007 (part 4 of 5) 10.0 points

One of the bulbs burns out. The lamp has a wire that shorts out the bulb filament when it burns out, dropping the resistance of the bulb to zero.

What is the resistance R_{new} of the light string now?

Answer in units of Ω.

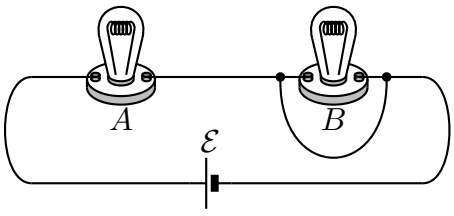
008 (part 5 of 5) 10.0 points

Find the power P_{new} dissipated by the string now.

Answer in units of W.

009 (part 1 of 2) 10.0 points

Two identical light bulbs A and B are connected in series to a constant voltage source. Suppose a wire is connected across bulb B as shown.



Bulb A

1. will burn twice as brightly as before.

2. will burn half as brightly as before.

3. will burn nearly four times as brightly as before.

4. will burn as brightly as before.

5. will go out.

---

010 (part 2 of 2) 10.0 points

and bulb B

1. will burn twice as brightly as before.

2. will go out.

3. will burn nearly four times as brightly as before.

4. will burn half as brightly as before.

5. will burn as brightly as before.

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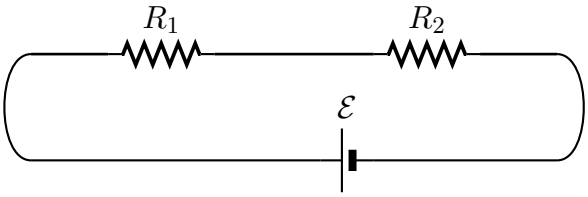
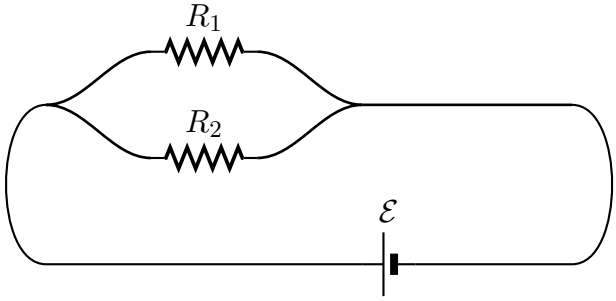
011 10.0 points

Consider resistors R_1 and R_2 connected in series



and in parallel



to a source of *emf* $\mathcal{E}$ that has no internal resistance.

How does the power dissipated by the resistors in these two cases compare?

1. It is different for each connection, but one must know the values of R_1 and R_2 to know which is greater.

2. It is greater for the series connection.

3. It is greater for the parallel connection.

4. It is different for each connection, but one must know the values of $\mathcal{E}$ to know which is greater.

5. It is the same for both connections

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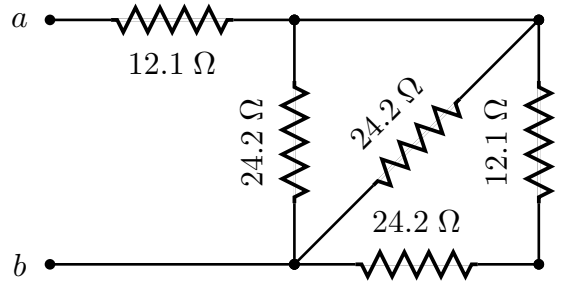
012 10.0 points

Consider the circuit



What is the equivalent resistance between the points a and b?

Answer in units of Ω.

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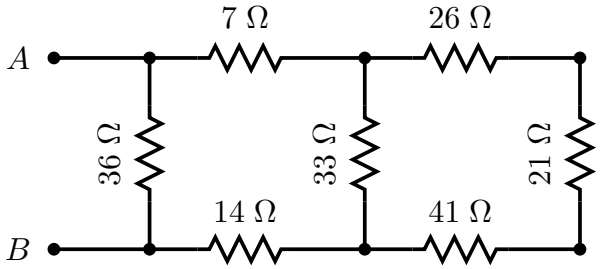
013 10.0 points

The following diagram shows part of an electrical circuit.



Find the equivalent resistance R_{eq} between points A and B of the resistor network.

Answer in units of Ω.

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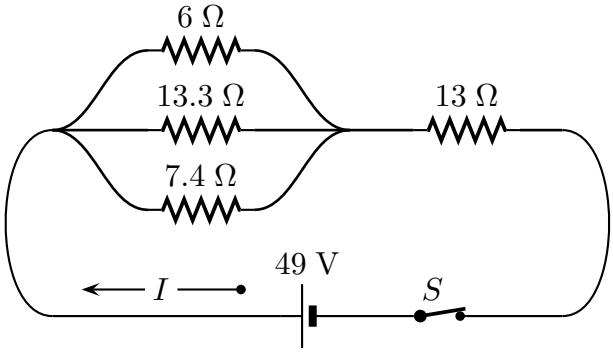
014 10.0 points

Consider the circuit

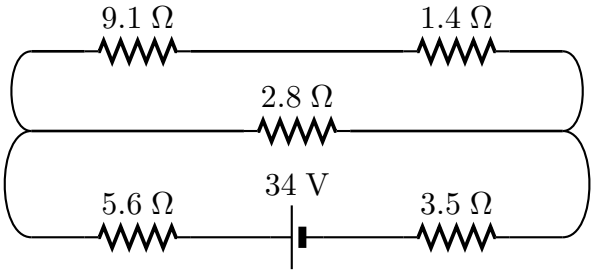


Find the equivalent resistance.

Answer in units of Ω.

015 10.0 points

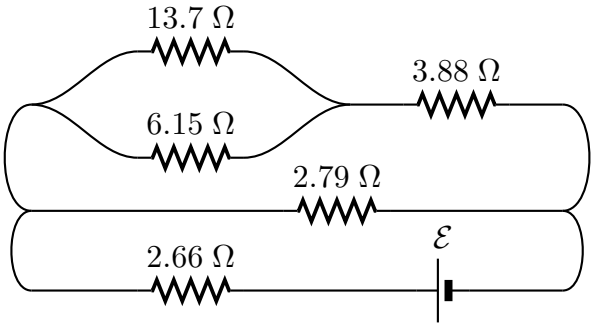
Consider the circuit



Find the equivalent resistance.
Answer in units of Ω.

016 (part 1 of 2) 10.0 points

The power supplied to the circuit is 9.85 W.



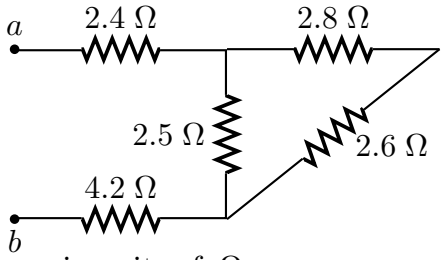
Find the equivalent resistance of the circuit.
Answer in units of Ω.

017 (part 2 of 2) 10.0 points

Find the emf across the battery.
Answer in units of V.

018 10.0 points

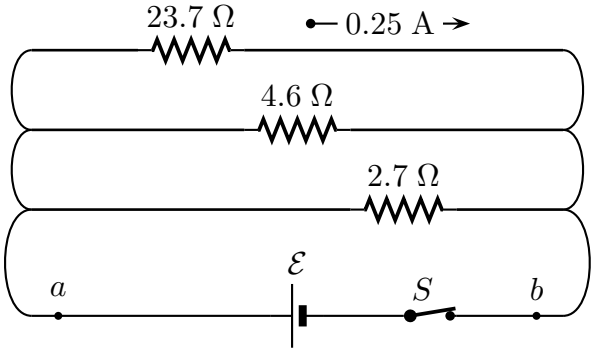
Find the equivalent resistance between points a and b in the figure.



Answer in units of Ω.

019 10.0 points

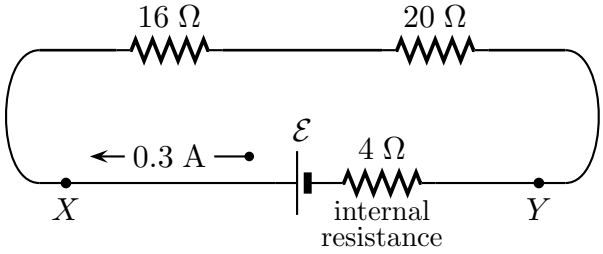
Consider the circuit.



At what rate is heat being generated in the 2.7 Ω resistor on the right?
Answer in units of W.

020 (part 1 of 3) 10.0 points

A battery with an internal resistance is connected to two resistors in series.



What is the *emf* $\mathcal{E}$ of the battery?

1. $\mathcal{E} = 6.0$ V

2. $\mathcal{E} = 10.8$ V

3. $\mathcal{E} = 13.2$ V

4. $\mathcal{E} = 12.0$ V

5. $\mathcal{E} = 1.2$ V

021 (part 2 of 3) 10.0 points

What is the potential difference across the terminals Y and X of the battery?

1. $V_{YX} = 1.2$ V

2. $V_{YX} = 6.0$ V

3. $V_{YX} = 10.8$ V

4. $V_{YX} = 13.2$ V

5. $V_{YX} = 12.0$ V

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022 (part 3 of 3) 10.0 points

What power $P_{internal}$ is dissipated by the 4 Ω internal resistance of the battery?

1. $P_{internal} = 3.6$ W

2. $P_{internal} = 0.36$ W

3. $P_{internal} = 1.2$ W

4. $P_{internal} = 3.2$ W

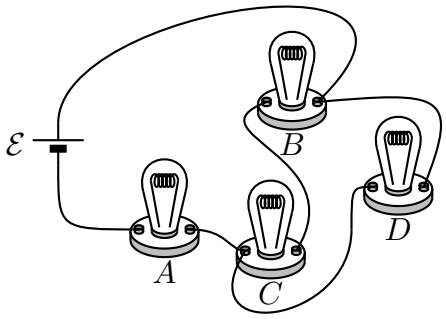
5. $P_{internal} = 4.8$ W

---

023 (part 1 of 4) 10.0 points

In the circuit shown below, A, B, C, and D are identical light bulbs.

Assume that the battery maintains a constant potential difference between its terminals (*i.e.*, the internal resistance of the battery is assumed to be negligible) and the resistance of each lightbulb remains constant.



What is the correct relationship for the brightnesses of (the power consumed by) the light bulbs?

1. $P_B = P_C > P_A > P_D$

2. $P_A > P_B > P_C > P_D$

3. $P_D > P_A > P_B = P_C$

4. $P_A > P_D > P_B = P_C$

5. $P_D > P_B = P_C > P_A$

6. $P_A > P_B = P_C > P_D$

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024 (part 2 of 4) 10.0 points

If the *emf* of the battery is 15 V and each resistance is 4 Ω, what power is consumed by bulb B?

Answer in units of W.

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025 (part 3 of 4) 10.0 points

Bulb D is then removed from its socket.

How does the brightness of bulb A change?

1. The brightness of bulb A cannot be determined.

2. The brightness of bulb A remains the same.

3. The brightness of bulb A increases.

4. The brightness of bulb A decreases.

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026 (part 4 of 4) 10.0 points

How does the brightness of bulb B change when bulb D is removed from its socket?

1. The brightness of bulb B remains the same.

2. The brightness of bulb B cannot be determined.

3. The brightness of bulb B increases.

4. The brightness of bulb B decreases.

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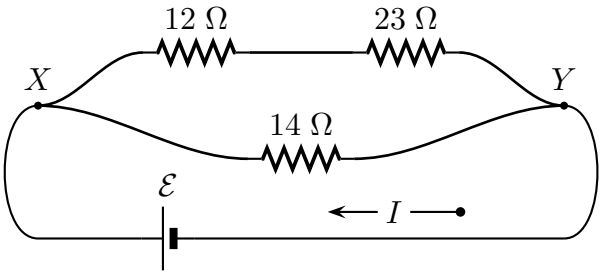
027 (part 1 of 2) 10.0 points

The following diagram shows part of a closed electrical circuit.



Find the electric resistance R_{XY} of the part of the circuit shown between point X and Y.

Answer in units of Ω.

---

028 (part 2 of 2) 10.0 points

When there is a steady current in the circuit, the amount of charge passing a point per unit time is

1. greater in the 14 Ω resistor than in the 23 Ω resistor.

2. greater in the 12 Ω resistor than in the 14 Ω resistor.

3. the same everywhere in the circuit.

4. greater in the 12 Ω resistor than in the 23 Ω resistor.

5. greater at point X than at point Y.

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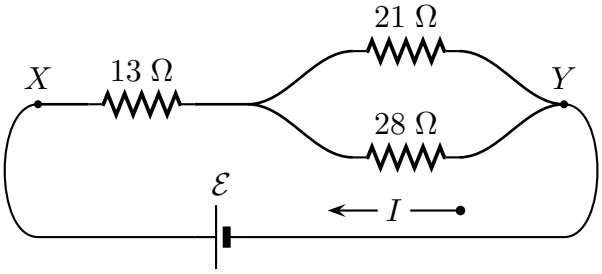
029 (part 1 of 2) 10.0 points

The following diagram shows part of a closed electrical circuit.



Find the electric resistance R_{XY} of the part of the circuit shown between point X and Y.

Answer in units of Ω.

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030 (part 2 of 2) 10.0 points

When there is a steady current in the circuit, the amount of charge passing a point per unit time is

1. the same everywhere in the circuit.

2. greater at point X than at point Y.

3. greater in the 21 Ω resistor than in the 28 Ω resistor.

4. greater in the 28 Ω resistor than in the 13 Ω resistor.

5. greater in the 21 Ω resistor than in the 13 Ω resistor.

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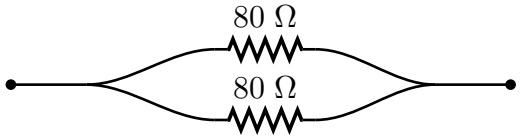
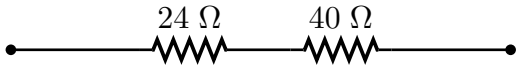
031 10.0 points

Which of the following combinations of resistors would dissipate 900 W when connected to a 240 V power supply?

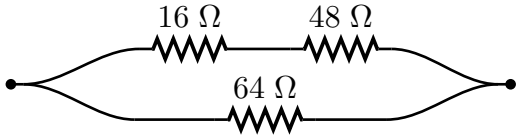
1.



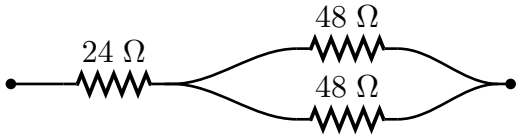
2.



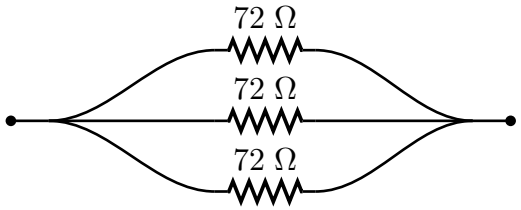
3.



4.



5.



6.

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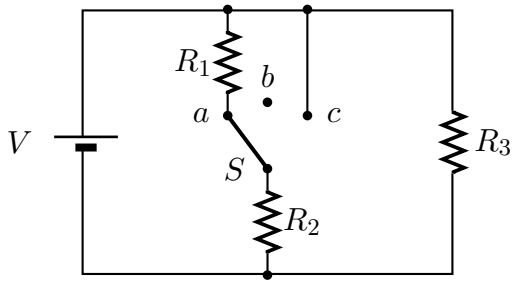
032 (part 1 of 2) 10.0 points

In the figure below the switch S is initially in position **a** .



What happens to the current through R_3 when the switch is moved to the open position **b**? $R_1 = R_2 = R_3$. Neglect the internal resistance of the battery.

1. The current through R_3 increases to three-halves its original value.

2. The current through R_3 increases to twice its original value.

3. The current through R_3 is reduced to one-half its original value.

4. The current through R_3 remains the same.

5. The current through R_3 decreases to two-thirds its original value.

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033 (part 2 of 2) 10.0 points

What happens when switch S is moved to position **c**, leaving R_2 and R_3 parallel?

1. The current through R_2 and R_3 are now the same.

2. The current through R_3 decreases.

3. The current through R_3 increases.

4. The current through R_2 remains the same as when R_1 was in the circuit.

5. The current through R_2 is half what it was with R_1 in the circuit.

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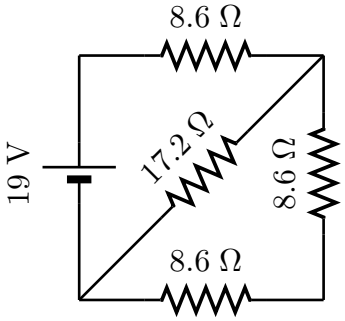
034 10.0 points

Consider the resistor network shown.



At what rate is thermal energy being generated in the 17.2 Ω resistor in the center of the circuit?

Answer in units of W.

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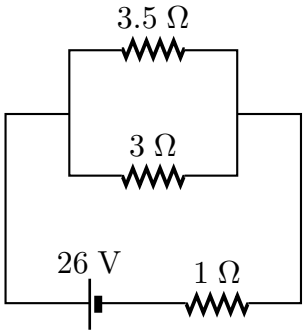
035 (part 1 of 2) 10.0 points

Consider the following circuit



What is the current through the lower resistor?

Answer in units of A.

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036 (part 2 of 2) 10.0 points

What is the current through the middle (3 Ω) resistor?

Answer in units of A.

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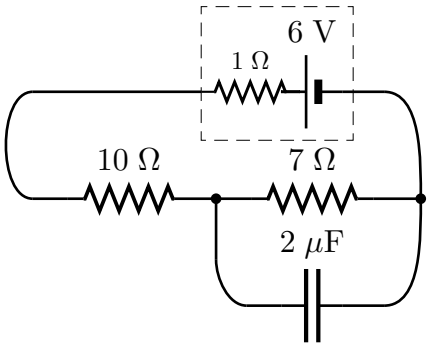
037 10.0 points

Please note that the uppermost 1 ohm resistor shown in the schematic is the internal resistance of the battery, not a separate resistor in the circuit.

In the figure below the battery has an emf of 6 V and an internal resistance of 1 Ω . Assume there is a steady current flowing in the circuit.



Find the charge on the 2 μF capacitor.
Answer in units of μC.