socrative
by MasteryConnect

Name: Solutions Date:

Quiz name: Circuits

1. Which of the following light bulbs has the largest current through it when operated at the voltage for which it's rated?

(A) 4.0 W, 7.5 V $4/7.5 = 0.53$ A
(B) 30 W, 15 V $30/15 = 2$ A $P = I \cdot \Delta V$ $I = \frac{P}{\Delta V}$
(C) 20 W, 23 V 0.87 A
(D) 40 W, 30 V $40/30 = 1.33$ A

2. Which of the following light bulbs has the largest resistance when operated at the voltage for which it's rated?

(A) 6.4 W, 12 V $12^2/6.4 = 22.5\ \Omega$
(B) 48 W, 24 V $24^2/48 = 12\ \Omega$
(C) 32 W, 36 V $36^2/32 = 40.5\ \Omega$
(D) 64 W, 48 V $48^2/64 = 36\ \Omega$

$P = \frac{(\Delta V)^2}{R}$ $R = \frac{(\Delta V)^2}{P}$

3. A copper wire is stretched so that its length increases and its diameter decreases.

(A) The wire's resistance decreases, but its resistivity stays the same.
(B) The wire's resistivity decreases, but its resistance stays the same.
(C) The wire's resistance increases, but its resistivity stays the same.
(D) The wire's resistivity increases, but its resistance stays the same.

correct
Thanks, Insha ♡

$R = \rho \frac{l}{A}$ (l ↑, A ↓)

4. The potential difference (voltage) across a length of wire is increased. Which of the following does not increase as well?

(A) The power dissipated in the wire.
(B) The resistance of the wire.
(C) The current in the wire.

Resistance of an object is set by its manufacturing. It won't change if V or I change

5. A stereo amplifier creates a 7.0V potential difference across a speaker. To double the power output of the speaker, the amplifier's potential difference (voltage) must be increased to

(A) 9.9 V
(B) 20 V
(C) 14 V
(D) 49 V

Resistance of the speaker won't change.

$P = \frac{(\Delta V)^2}{R} \rightarrow \Delta V = \sqrt{P \cdot R}$ } If P doubles, ΔV increases by a factor of $\sqrt{2}$.

$7\sqrt{2} = 9.9$ V

6. A resistor connected to a 3.0 V battery dissipates 1.0 W. If the battery is replaced by a 6.0 V battery, the power dissipated by the resistor will be

(A) 1 W
(B) 2 W
(C) 3 W
(D) 4 W

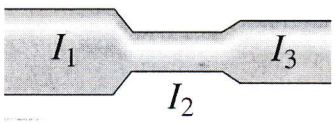
Resistance of the resistor won't change.

$P = \frac{(\Delta V)^2}{R}$ } If ΔV doubles, P will increase by a factor of 4

7. The figure shows a side view of a wire of varying circular cross section. Rank in order the currents flowing in the three sections

(A) $I_1 > I_2 > I_3$
(B) $I_3 > I_2 > I_1$
(C) $I_1 = I_2 = I_3$
(D) $I_1 > I_3 > I_2$

Since they are in series with each other, current must be the same.



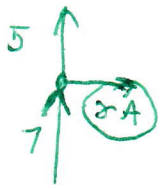
8. A person gains weight by adding fat - and therefore adding girth - to his body and his limbs, with the amount of muscle remaining constant. How will this affect the electrical resistance of his limbs?

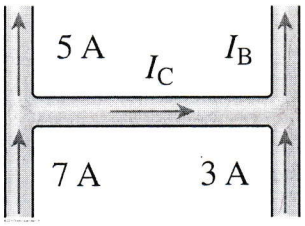
(A) he resistance will increase
(B) the resistance will decrease
(C) the resistance will stay the same

9. What is the current through I_C

(A) 2 A
(B) 3 A
(C) 5 A
(D) 7 A
(E) 12 A

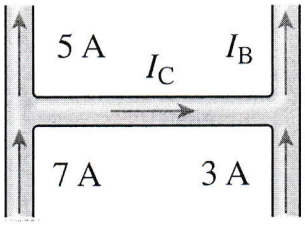
whatever current goes into the node must split into parts which add up to original, so if 7A goes into the node, 7A must come out.

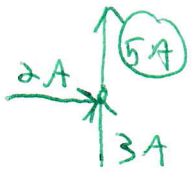




10. What is the current through I_B

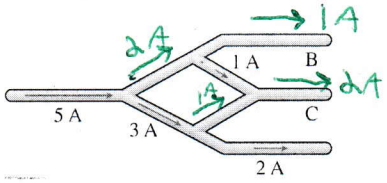
(A) 2 A
(B) 3 A
(C) 5 A
(D) 7 A
(E) 12 A





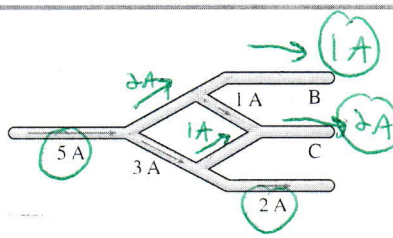
11. What is the current through section B?

(A) 1 A
(B) 2 A
(C) 3 A
(D) 4 A
(E) 5 A



12. What is the current through section C?

(A) 1 A
(B) 2 A
(C) 3 A
(D) 4 A
(E) 5 A



Note that 1+2+2=5

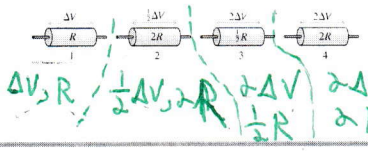
13. Which of these has the most current?

1) $I = \frac{\Delta V}{R}$ 2) $I = \frac{\Delta V}{4R}$ 3) $\frac{4\Delta V}{R}$ largest

4) $\frac{\Delta V}{R}$

(A) 1
(B) 2
(C) 3
(D) 4

using Ohm's Law

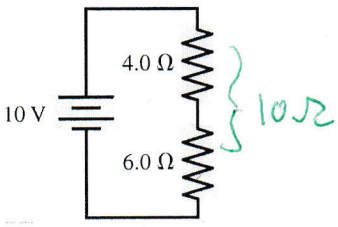


14. What is the current in the circuit of the figure?

(A) 1.0 A
(B) 1.7 A
(C) 2.5 A
(D) 4.2 A

$\Delta V = IR$

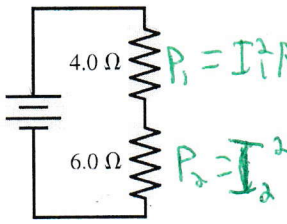
$I = \frac{\Delta V}{R} = \frac{10}{10} = 1\ A$



15. Which resistor in the figure dissipates the most power?

(A) The 4 Ω resistor
(B) The 6 Ω resistor
(C) Both dissipate the same power

Current is the same in both and Resistance is set by each, so look at: $P = I^2R$

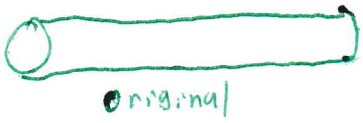


$P_1 = I_1^2 R_1 = (1)^2(4) = 4\ W$

$P_2 = I_2^2 R_2 = (1)^2(6) = 6\ W$

16. A metal wire of length L and resistance R is cut into two pieces of equal length. The two pieces are connected together side by side. What is the new resistance?

(A) R/4
(B) R/2
(C) R
(D) 2R
(E) 4R



$R = \rho \frac{l}{A}$

Note by cutting it in half, you have decrease l by half and by placing them next to each other, you have doubled area.

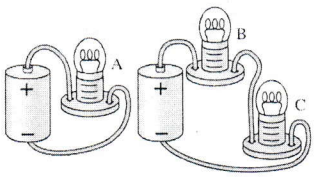
17. Does the bulb light?

(A) Yes
(B) No

Nothing is attached to the negative end!

18. The three bulbs are identical and the two batteries are identical. Compare the brightnesses of the bulbs.

(A) A > B > C
(B) A > C > B
(C) A > B = C
(D) A < B = C
(E) A = B = C



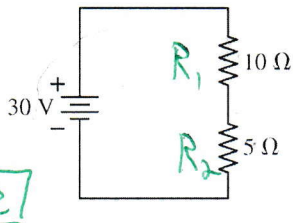
19. The potential difference across the 10 resistor is

= voltage

$\Delta V_t = I_t R_t$

$I_t = \frac{\Delta V_t}{R_t} = \frac{30}{15} = 2\,A$

$\Delta V_1 = I_1 R_1 = (2)(10) = 20\,\Omega$



$\{ R_t = 15$

(A) 30 V

(B) 20 V

(C) 15 V

(D) 10 V

(E) 5 V

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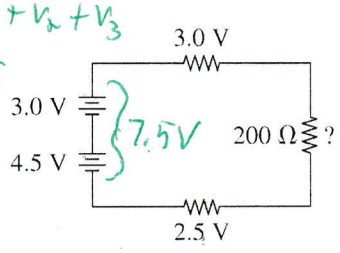
20. The diagram below shows a circuit with two batteries and three resistors. What is the potential difference across the 200 Ω resistor?

7.5

Series: $V_t = V_1 + V_2 + V_3$

$7.5 = 3 + V_2 + 2.5$

$V_2 = 2\,V$



(A) 2.0 V

(B) 3.0 V

(C) 4.5 V

(D) 7.5 V

(E) There is not enough information to decide.

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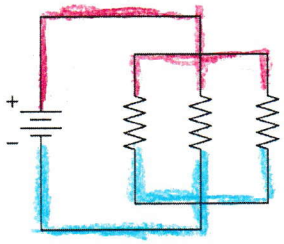
21. What things about the resistors in this circuit are the same for all three?



(A) Current I

(B) Potential difference ΔV

(C) Resistance R

(D) A & B

(E) B & C

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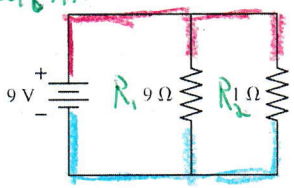
22. Which resistor dissipates more power?

ΔV is the same for both and R is set for each.

$P = \frac{(\Delta V)^2}{R}$



$P_1 = \frac{(\Delta V_1)^2}{R_1} = \frac{9^2}{9} = 9\,W$

$P_2 = \frac{(\Delta V_2)^2}{R_1} = \frac{9^2}{1} = 81\,W$

(A) The 9 Ω resistor

(B) The 1 Ω resistor

(C) The dissipate the same power

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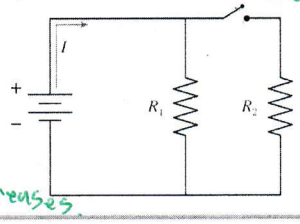
23. When the switch closes the battery current

When switch is open, It is just R_1 in the circuit.

When switch is closed, we have R_1 & R_2 in parallel, so resistance has decreased. So current increases.



(A) increases

(B) stays the same

(C) decreases

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24. The lightbulbs are identical. Initially both bulbs are glowing. What happens when the switch is closed?

Open Closed

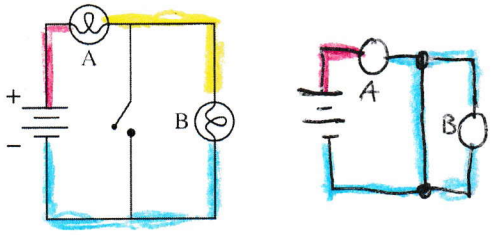
(A) Nothing

(B) A stays the same; B gets dimmer.

(C) A gets brighter; B stays the same.

(D) Both get dimmer.

(E) A gets brighter; B goes out.



25. What does the ammeter read?

(A) 6 A

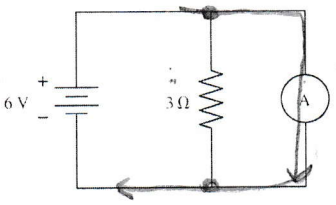
(B) 3 A

(C) 2 A

(D) Some other value

(E) Nothing because this will fry the meter.

Ammeters have "0" resistance. This has created a short Circuit!



26. Every minute, 120 C of charge flow through this cross section of the wire.

(A) 240 A

(B) 120 A

(C) 60 A

(D) 2 A

(E) Some other value

60 sec ↓ $I = \frac{Q}{t} = \frac{120}{60} = 2A$

27. The wires shown next carry currents as noted. Rate the currents I_A, I_B, and I_C.

(A) $I_A > I_B > I_C$

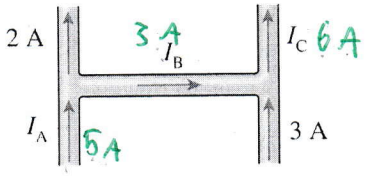
(B) $I_B > I_A > I_C$

(C) $I_C > I_A > I_B$

(D) $I_A > I_C > I_B$

(E) $I_C > I_B > I_A$

If you have trouble, just set I_A to some random number and see what happens.



$I_C > I_A > I_B$

28. Conside the junction: The current in the fourth wire is

(A) 16 A to the right.

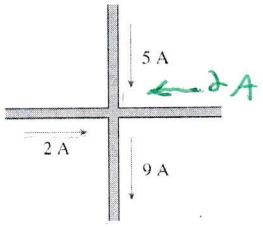
(B) 4 A to the left.

(C) 2 A to the right.

(D) 2 A to the left.

(E) Not enough information to tell

$I_{in} = I_{out}$



29. A battery is connected to a wire, and creates a current in the wire. Which of the following changes would increase the current?

(A) Increasing the length of the wire

(B) Keeping the wire the same length, but making it thicker

(C) Using a battery with a lower emf (voltage)

(D) Making the wire into a coil, but keeping its dimensions the same

(E) Changing the wire material from copper to nichrome

$R = \rho \frac{l}{A}$

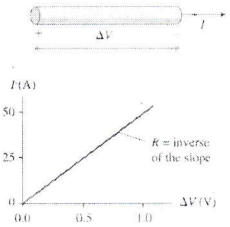
thicker wires mean less resistance which means more current.

30. The current through a wire is measured as the potential difference ΔV is varied. What is the wire's resistance?

(A) 0.01 Ω
(B) 0.02 Ω
(C) 50 Ω
(D) 100 Ω
(E) Some other value

$\Delta V = IR$ so on an I vs. ΔV graph, the slope would be $\frac{1}{R}$

$I = \frac{1}{R}(\Delta V)$



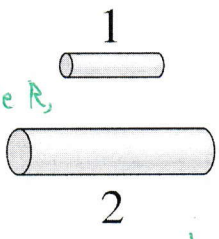
Slope = 50

$\rightarrow R = \frac{1}{50} = 0.02\ \Omega$

31. Wire 2 is twice the length and twice the diameter of wire 1. What is the ratio R2/R1 of their resistances?

(A) 1/4
(B) 1/2
(C) 1
(D) 2
(E) 4

$R = \rho \frac{l}{A} = \rho \frac{l}{\pi r^2}$



- If you double length you double R,
- But if you double r, you decrease R by a factor of $\frac{1}{4}$, so overall $R_2 = \frac{1}{2} R_1$

32. Several light bulbs, different rated voltages, powers. Which one has highest resistance?

(A) A
(B) B
(C) C
(D) D
(E) E

$P = \frac{(\Delta V)^2}{R}$

$R = \frac{(\Delta V)^2}{P}$

Bulb	Voltage across Bulb	Power Dissipated by Bulb
A	10 V	1 W
B	8 V	1 W
C	12 V	2 W
D	6 V	2 W
E	3 V	3 W

33. Which has a larger resistance, a 60 W lightbulb or a 100 W lightbulb, assuming they are both rated for a 120 V socket.

(A) The 60 W bulb
(B) The 100 W bulb
(C) Their resistances are the same.
(D) There's not enough information to tell.

$P = \frac{(\Delta V)^2}{R}$ $R = \frac{(\Delta V)^2}{P}$

$R_1 = \frac{120^2}{60} = 240\ \Omega$

$R_2 = \frac{120^2}{100} = 144\ \Omega$

34. What would the slope of a Current (y-axis) vs Voltage (x-axis) represent?

(A) R
(B) 1/R
(C) P
(D) 1/P

The slope of a Voltage vs. Current graph is resistance. So the slope of a current vs. voltage graph would be $\frac{1}{R}$

35. What would the area under a Voltage (y-axis) vs Current (x-axis) represent?

(A) R
(B) 1/R
(C) P
(D) 1/P

$P = I \cdot \Delta V$

Power is the product of Voltage and current.

36. What would the slope of a Power (y-axis) vs. Current (x-axis) represent?

(A) V
(B) 1/V
(C) R
(D) 1/R

$P = I \Delta V$ $\quad 0$

$y = m \cdot x \quad \cancel{+b}$

or $P = \Delta V \cdot I$