

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Period: \_\_\_\_\_

Graded problems are worth 2 points each. This assignment is graded out of **24** points.

- 1) In a series circuit, if the total voltage is 3 V, and the total resistance is 0.5  $\Omega$ , what is the current in the circuit?
  
  
  
  
  
  
  
  
  
  
- 2) **Graded.** In a series circuit, if the total voltage is 12 V, and the total resistance is 3  $\Omega$ , what is the current in the circuit?
  - a. 0.25 A
  - b. 4 A
  - c. 15 A
  - d. 9 A
  
  
  
  
  
  
  
  
  
  
- 3) In a series circuit, the current is 3.5 A. The total resistance of the circuit is 12  $\Omega$ . What is the total voltage in the circuit?
  
  
  
  
  
  
  
  
  
  
- 4) **Graded.** In a series circuit, the current is 5 A. The total resistance of the circuit is 8  $\Omega$ . What is the total voltage in the circuit?
  - a. 0.625 V
  - b. 1.6 V
  - c. 40 V
  - d. 13 V
  - e. 3 V
  
  
  
  
  
  
  
  
  
  
- 5) In a series circuit, the current is 1.5 A. The total voltage of the circuit is 15 V. What is the total resistance of the circuit?

- 6) **Graded.** In a series circuit, the current is 60 A. The total voltage of the circuit is 120 V. What is the total resistance of the circuit?
- 2  $\Omega$
  - 60  $\Omega$
  - 180  $\Omega$
  - 0.5  $\Omega$
- 7) **Graded.** What happens to the current in a series circuit if the resistance increases, but the voltage remains the same?
- the current increases
  - the current decreases
  - the current stays the same
  - the current changes direction
- 8) **Graded.** What happens to the voltage in a series circuit if the resistance increases and the current increases?
- the voltage increases
  - the voltage decreases
  - the voltage stays the same
  - not enough information
- 9) What happens to the voltage in a series circuit if the resistance increases, but the current decreases?
- the voltage increases
  - the voltage decreases
  - the voltage stays the same
  - not enough information
- 10) **Graded.** What happens to the resistance in a series circuit if the current increases and the voltage remains the same?
- the resistance increases
  - the resistance decreases
  - the resistance stays the same
  - not enough information
- 11) If you wish to increase the amount of current flowing through a series circuit by changing only one thing, then you should:
- increase the resistance
  - reduce the resistance
  - reduce the voltage
  - none of the above

For questions 12) through 16), consider a series circuit consisting of a battery, a bulb, and a resistor. The voltage of the battery is 1.5 V, the resistance of the bulb is  $0.5 \Omega$ , and the resistor has a resistance of  $3.5 \Omega$ .

12) Sketch a circuit diagram of this circuit.

13) What is the total resistance in the circuit?

14) What is the current in the circuit?

15) What is the voltage drop across the bulb?

16) What is the voltage drop across the resistor?

Imagine replacing the resistor in the previous circuit with another resistor that has a resistance of  $10\ \Omega$ . (Otherwise, the circuit is the same as above.)

17) What would happen to the total resistance of the circuit?

18) What would happen to the total voltage of the circuit?

19) What would happen to the total current in the circuit?

20) What would happen to the bulb?

- a. it would get brighter
- b. it would get dimmer
- c. it would remain the same
- d. not enough information

For questions 21) through 27), consider a series circuit consisting of a battery, two bulbs (bulb A and bulb B), and a resistor. The voltage of the battery is  $12\ \text{V}$ ; the resistance of bulb A is  $1\ \Omega$ ; the resistance of bulb B is  $3\ \Omega$ ; the resistor has a resistance of  $10\ \Omega$ .

21) Sketch a circuit diagram of this circuit.

22) **Graded.** (*See previous page*) What is the total resistance in the circuit?

23) **Graded.** What is the current in the circuit?

24) **Graded.** What is the voltage drop across bulb A?

25) **Graded.** What is the voltage drop across bulb B?

26) **Graded.** What is the voltage drop across the resistor?

27) **Graded.** Imagine adding another resistor to the circuit (still a series circuit). Which of the following would most likely occur?

- a. The bulbs would get brighter
- b. The bulbs would get dimmer
- c. The bulbs would stay the same brightness
- d. One bulb would get brighter, and the other would get dimmer

## Selected Answers

- 1) In a series circuit, if the total voltage is 3 V, and the total resistance is 0.5  $\Omega$ , what is the current in the circuit?

$$I = \frac{V_{total}}{R_{total}} = \frac{3 \text{ V}}{0.5 \Omega} = 6 \text{ A}$$

- 3) In a series circuit, the current is 3.5 A. The total resistance of the circuit is 12  $\Omega$ . What is the total voltage in the circuit?

$$V_{total} = I \times R_{total}$$

$$V_{total} = 3.5 \text{ A} \times 12 \Omega = 42 \text{ V}$$

- 5) In a series circuit, the current is 1.5 A. The total voltage of the circuit is 15 V. What is the total resistance of the circuit?

$$R_{total} = \frac{V_{total}}{I} = \frac{15 \text{ V}}{1.5 \text{ A}} = 10 \Omega$$

- 9) What happens to the voltage in a series circuit if the resistance increases, but the current decreases?

*There is not enough information.*

*If we look at Ohm's Law,  $V = IR$ , then we can see that an increase in  $R$  (resistance) will cause  $V$  to decrease, but that an increase in  $I$  (current) will cause voltage to increase.*

*Whether the increase in resistance has more of an effect than the decrease in current will depend on how much each actually changes.*

- 11) If you wish to increase the amount of current flowing through a series circuit by changing only one thing, then you should:

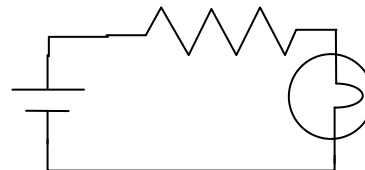
*Reduce the total resistance of the circuit.*

*By rearranging Ohm's law to solve for current, we get:  $I = \frac{V_{total}}{R_{total}}$ . If the resistance (in the denominator) increases, then the value of  $I$  will increase. Of the options given, this is the only one that would cause the current to increase. If increasing the voltage were an option, that would work, too.*

For questions 12) through 16), consider a series circuit consisting of a battery, a bulb, and a resistor. The voltage of the battery is 1.5 V, the resistance of the bulb is 0.5  $\Omega$ , and the resistor has a resistance of 3.5  $\Omega$ .

- 12) Sketch a circuit diagram of this circuit.

*The order of the devices in the circuit is not critical. As long as all three devices are present, and there is only a single possible path connecting all three of them, then the circuit diagram will be correct.*



- 13) What is the total resistance in the circuit?

$$R_{total} = R_1 + R_2 + R_3 + \dots$$

$$R_{total} = 0.5 \Omega + 3.5 \Omega = 4.0 \Omega$$

14) What is the current in the circuit?

$$I = \frac{V_{total}}{R_{total}} = \frac{1.5 \text{ V}}{4.0 \Omega} = 0.375 \text{ A}$$

15) What is the voltage drop across the bulb?

*Here, remember to use the resistance of the bulb only, not the total resistance of the circuit.*

$$V_{bulb} = I \times R_{bulb}$$

$$V_{bulb} = 0.375 \text{ A} \times 0.5 \Omega = 0.19 \text{ V}$$

16) What is the voltage drop across the resistor?

*Here, remember to use the resistance of the resistor only, not the total resistance of the circuit.*

$$V_{resistor} = I \times R_{resistor}$$

$$V_{resistor} = 0.375 \text{ A} \times 3.5 \Omega = 1.31 \text{ V}$$

Imagine replacing the resistor in the previous circuit with another resistor that has a resistance of  $10 \Omega$ . (Otherwise, the circuit is the same as above.)

17) What would happen to the total resistance of the circuit?

*The total resistance will increase.*

*Because the total resistance of the circuit is the sum of the resistances of the devices on the circuit, if we replace one device's resistance with a greater resistance, then the sum of the resistances will also increase.*

18) What would happen to the total voltage of the circuit?

*The voltage in the circuit is controlled by the battery in this case, which is not affected by the change of a resistor. So, the total voltage in the circuit would not change.*

19) What would happen to the total current in the circuit?

*The current would decrease.*

*Because current =  $\frac{\text{voltage}}{\text{resistance}}$ , if the resistance increases and the voltage stays the same (see #18), then the current will decrease.*

20) What would happen to the bulb?

*It would get dimmer.*

*Bulbs generally will glow brighter when there is more current running through them. In fact, they may not glow at all if there is not enough current flowing through them, and if there is too much current running through them, they will burn so brightly that they will burn out (break).*

For questions 21) through 27), consider a series circuit consisting of a battery, two bulbs (bulb A and bulb B), and a resistor. The voltage of the battery is  $12 \text{ V}$ ; the resistance of bulb A is  $1 \Omega$ ; the resistance of bulb B is  $3 \Omega$ ; the resistor has a resistance of  $10 \Omega$ .

21) Sketch a circuit diagram of this circuit.

*Again, the specific order of the devices is not essential. Both of these examples are correct for the information given.*

