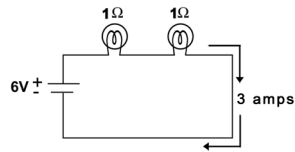


Skill and Practice Sheet Answer Key

13A Series Circuits

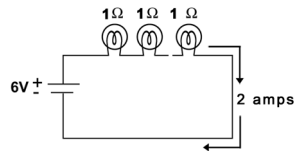
1. Answers are:

- 6 volts
- 2 ohms
- 3 amps
- 3 volts
- Diagram:



2. Answers are:

- 6 volts
- 3 ohms
- 2 amps
- 2 volts
- Diagram:



3. The current decreases because the resistance increases.

4. The brightness decreases because the voltage across each bulb decreases and the current decreases. Since power equals voltage times current, the power consumed also decreases.

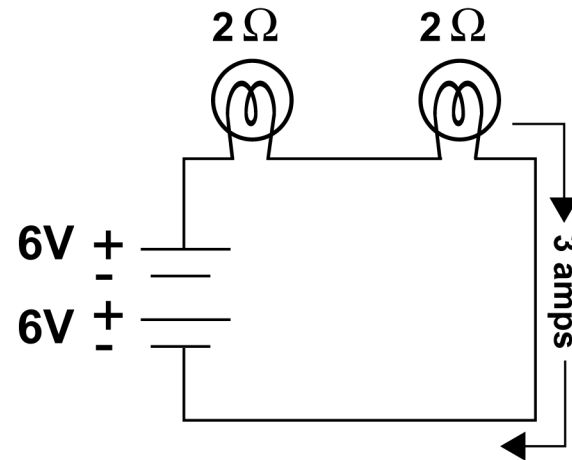
5. Answers are:

- 3 ohms
- 2 amps
- 1 ohm bulb: 2 volts; 2 ohm bulb: 4 volts

6. Answers are:

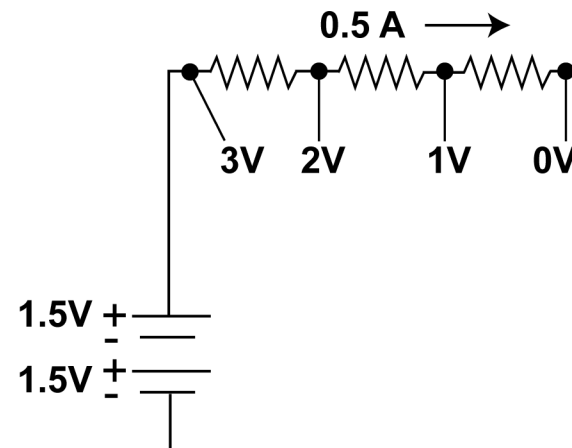
- 12 volts

- 4 ohms
- 3 amps
- 6 volts
- Diagram:



7. Answers are:

- 2 ohms
- 1 volt
- Diagram:



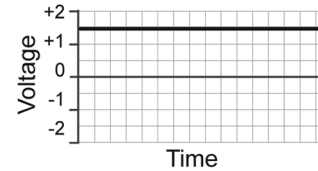
8. Answers are:
- 6 ohms
 - 1.5 amps
 - 2 ohm resistor: 3 volts; 3 ohm resistor: 4.5 volts; 1 ohm resistor: 1.5 volt
 - The sum is 9 volts, the same as the battery voltage.
9. Answers are:
- Diagram A: 0.5 amps; Diagram B: 1.0 amps
 - Diagram A: 0.25 amps; Diagram B: 0.5 amps
 - The amount of current increases.

13B George Westinghouse

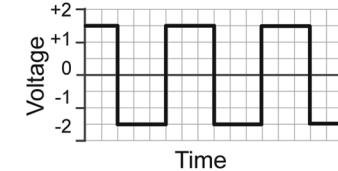
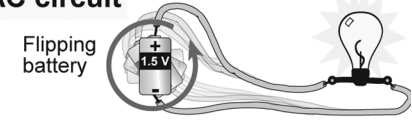
- Westinghouse first developed his talents as an inventor in his father's agricultural machine shop.
- Westinghouse enabled trains to travel more safely at higher speeds in two ways: He invented an air brake which allowed the engineer to stop all the cars at once, and he developed signaling and switching systems which reduced the likelihood of collisions.
- Westinghouse promoted alternating current because it could be transmitted over longer distances.
- Westinghouse demonstrated the potential of alternating current by lighting the streets of Philadelphia and then the entire Chicago World's Fair using this technology.
- Direct current occurs when charge flows in one direction. Batteries provide direct current. Alternating current, in contrast, switches directions. Household circuits in the United States run on alternating current that reverses direction 60 times each second. The diagrams below compare direct and alternating current.

6. Westinghouse used hydroelectric generators at Niagara Falls to provide electricity to the city of Buffalo.

DC circuit



AC circuit



- Westinghouse's Manhattan elevated trains were electrical powered using alternating current.
- Answers may vary. Some of Westinghouse's other inventions include: Apparatus for safe transmission of natural gas, the transformer, a machine that placed derailed train cars back on the tracks, and a compressed air spring.

13C Thomas Edison

- Edison's education included one-on-one tutoring from his mother, reading lots of books, and performing experiments in laboratories that he set up.
- Edison learned that in order to sell an invention, not only does it have to be a technical success, it also has to be something that people want to buy.
- Edison's research facility at Menlo Park had workshops, laboratories, offices, and a library. Edison hired a team of assistants with various specialties to work there.
- The tin foil phonograph and a practical, safe, and affordable incandescent light were developed at Menlo Park.
- Edison's invention process was to brainstorm as many ideas as possible, try everything that seems even remotely workable, record everything, and use failed experiments to redirect the project.

6. Edison was not easily discouraged by failure. Instead, he saw failed projects as providing useful information to narrow down the possibilities of what does work.
7. Students can find information about Edison's tin foil phonograph using the Internet. Here's a summary of how it worked:
Edison set up a membrane that vibrated when exposed to sound waves. The membrane (called a diaphragm) had an embossing needle attached. When someone spoke, the diaphragm would vibrate and the embossing needle would make indentations on tin foil wrapped around a metal cylinder. The cylinder was turned by a hand-crank at around 60 revolutions per minute. There was a second diaphragm-and-needle apparatus for playback. When the needle followed the "tracks" made in the tin foil, it made the diaphragm vibrate which reproduced the recorded sounds.
8. Answers will vary. Some of Edison's interesting inventions include paraffin paper, an "electric pen" (the forerunner of the mimeograph machine) a carbon rheostat, a fluoroscope, and sockets, switches, and insulating tape.

13D Lewis Latimer

1. Lewis Latimer did not attend college, but learned how to be a draftsman by studying the drawings of draftsmen while working as an office boy for a patent law firm. He was self-motivated and used any available books and tools to learn the skills needed to become an outstanding draftsman. He was also a self-taught electrical engineer. He learned all that he could about electricity while working for Hiram Maxim at U.S. Electric Lighting.
2. Latimer invented the following:
Mechanical improvements for railroad train water closets (also known as toilets)
Carbon filaments to replace paper filaments in light bulbs
An improved manufacturing process for carbon filaments
An early version of the air conditioner
A locking rack for hats, coats, and umbrellas

A book support

His most important inventions are the development of carbon fibers and improved manufacturing process to produce those filaments. The light bulb invented by Thomas Edison used a paper filament. As a result, it had a very short life span. With carbon filaments, light bulbs lasted longer, were more affordable, and could be used in a variety of ways. Latimer improved the technology so that light bulbs would become commonplace in both industry and homes.

3. A "Renaissance man" is a scholar with a depth of knowledge in a variety of areas. During the Renaissance, there were men who were accomplished in multiple disciplines including math, engineering, art, and music. Leonardo da Vinci was one of the great Renaissance men. Lewis Latimer can be called a Renaissance man because he, too, excelled in a variety of areas including science, literature, music, and art.
4. Two of Latimer's poems were titled *Friends* and *Ebon Venus*.
5. The Edison Pioneers first met on February 11, 1918. This was Thomas Edison's 71st birthday.

Excerpt from obituary:

"He was of the colored race, the only one in our organization, and was one of those to respond to the initial call that led to the formation of the Edison Pioneers, January 24, 1918. Broad-mindedness, versatility in the accomplishment of things intellectual and cultural, a linguist, a devoted husband and father, all were characteristic of him, and his genial presence will be missed from our gatherings."

13E Parallel Circuits

Practice set 1:

1. Answers are:
 - a. 12 volts
 - b. 6 amps
 - c. 12 amps
 - d. 1 ohm
2. Answers are:

- a. 12 volts
 - b. 4 amps
 - c. 8 amps
 - d. 1.5 ohms
3. Answers are:
- a. 12 volts
 - b. 2 ohm branch: 6 amps; 3 ohm branch: 4 amps
 - c. 10 amps
 - d. 1.2 ohms
4. Answers are:
- a. 9 volts
 - b. 2 ohm branch: 4.5 amps; 3 ohm branch: 3 amps; 1 ohm branch: 9 amps
 - c. 16.5 amps

Practice set 2:

1. Answers are:
- a. 4 ohms
 - b. 6 ohms
 - c. 2.67 ohms
 - d. 2.4 ohms
2. Answers are:
- a. 2.67 ohms
 - b. 1.2 ohms
 - c. 0.545 ohms

13F Electrical Power

1. Answers are:
- a. 5 kW
 - b. 10 kWh
 - c. \$1.50
2. Answers are:
- a. 300 minutes
 - b. 5 hours
 - c. 1.2 kW
 - a. 6 kW

- d. \$0.90
3. 960 W
4. 24 W
5. Answers are:
- a. 60 W
 - b. 0.06 kW
 - c. 525.6 kWh
 - d. \$78.84
6. 0.625 A
7. Answers are:
- a. 3 V
 - b. 1 A
 - c. 3 W
8. Answers are:
- a. 24 ohms
 - b. 600 W
 - c. 0.6 kW
9. Answers are:
- a. 20.5 A
 - b. 10.8 ohms
 - c. 18 kWh
 - d. \$140.40
10. Answers are:
- a. 6 ohms
 - b. 2 A
 - c. 12 W
 - d. 24 W
11. Answers are:
- a. 12 V
 - b. 4 A
 - c. 48 W
 - d. 8 A
 - e. 96 W