

Science 9
Unit D Electrical Principles and Technologies
Unit Test

Name: Seth

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One advantage of being a vampire is that you use electricity in the cheap non-peak hours.

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Multiple Choice/Numerical Response:

1. The most common type of energy loss in electrical devices is

- A. thermal
- B. potential
- C. chemical
- D. mechanical

Use the following to answer question 2.

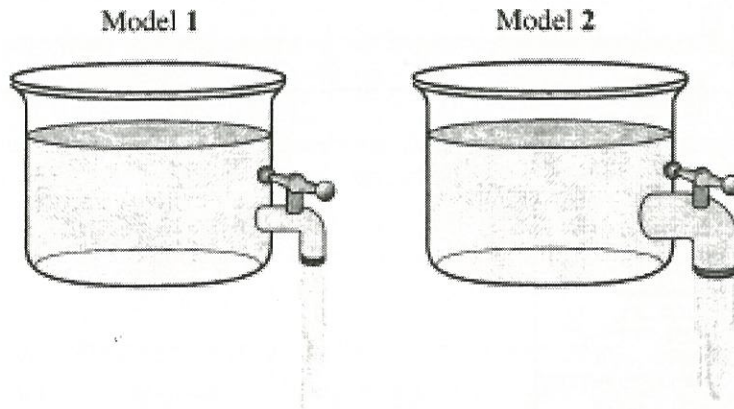
A ride in an amusement park is controlled by an operator who turns a dial to make the seats rotate faster. As the operator turns the dial, more current flows to the motors.

2. Which of the following electrical devices causes the seats on the amusement park ride to rotate faster?

- A. Variable resistor
- B. Circuit breaker
- C. Generator
- D. Ammeter

Use the following to answer questions 3 and 4.

Models That Represent Current, Voltage, and Resistance in Two Electrical Circuits



Components in the Models

| | |
|------------|---|
| I | The amount of water that flows from the spout |
| II | The force of gravity acting on the water |
| III | The amount of water in the jug |
| IV | The diameter of the spout |

3. Which of the components in the models represents resistance in a DC circuit?

- A. I
- B. II
- C. III
- D. IV

4. Which of the components in the models represents current in a DC circuit?

- A. I
- B. II
- C. III
- D. IV

Use the following to answer question 5.

Four Electrical Circuits

| | |
|------------------|--|
| Circuit 1 | 1 battery, 3 light bulbs wired in series |
| Circuit 2 | 1 battery, 5 light bulbs wired in series |
| Circuit 3 | 1 battery, 3 light bulbs wired in parallel |
| Circuit 4 | 1 battery, 5 light bulbs wired in parallel |

All of the light bulbs and batteries are identical.

5. When connected, which of the electrical circuits described above will result in the dimmest light?

- A. Circuit 1
- B. Circuit 2
- C. Circuit 3
- D. Circuit 4

6. Which of the following rows identifies the correct circuit distance, amperage, resistance, and control device of a working microelectronic circuit?

| Row | Circuit Distance | Amperage | Resistance | Control Device |
|-----|------------------|----------|------------|----------------|
| A. | Short | Low | Low | Transistor |
| B. | Short | High | High | Transistor |
| C. | Long | Low | Low | Switch |
| D. | Long | High | High | Switch |

7. Which of the following parts of a lead storage car battery is acidic?

- A. Electrode
- B. Electrolyte
- C. Positive terminal
- D. Negative terminal

Use the following to answer question 8.

Description of a Circuit

An electric pump is connected to a car battery. The speed of the pump is controlled by a dial.

Legend



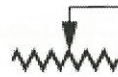
Car battery



Electric pump



Resistor



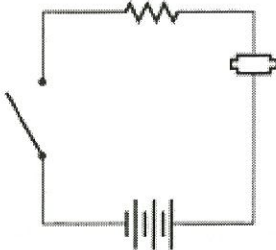
Variable resistor



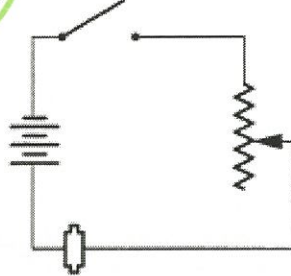
Ignition switch for car

8. Which of the following schematic diagrams **best** illustrates the circuit described above?

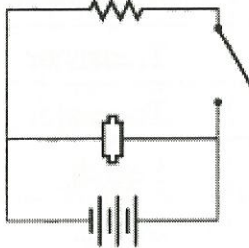
A.



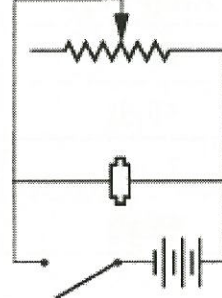
B.



C.



D.



9. Which of the following actions will **not** reduce the energy used?

- A. Adding a layer of insulation to your refrigerator
- B. Replacing incandescent bulbs with fluorescent bulbs
- C. Washing clothes in cold water rather than in hot water
- D. Watching television in the afternoon rather than in the early evening

Use the following to answer numerical response 1.

Types of Power Generation

- 1 Coal-fired
- 2 Hydroelectric
- 3 Nuclear
- 4 Solar

Numerical Response

1. Match each type of power generation listed above with one of its disadvantages, given below.

Disrupts the movement of aquatic organisms

2

(Record in the **first** column)

Emits carbon dioxide and sulfur dioxide into the air

1

(Record in the **second** column)

Is an inconsistent method of power generation

4

(Record in the **third** column)

Requires the long-term storage of hazardous waste products

3

(Record in the **fourth** column)

(Record all **four digits** of your answer in the numerical-response section on the answer sheet.)

Use the following to answer question 10.

Facts About Electricity

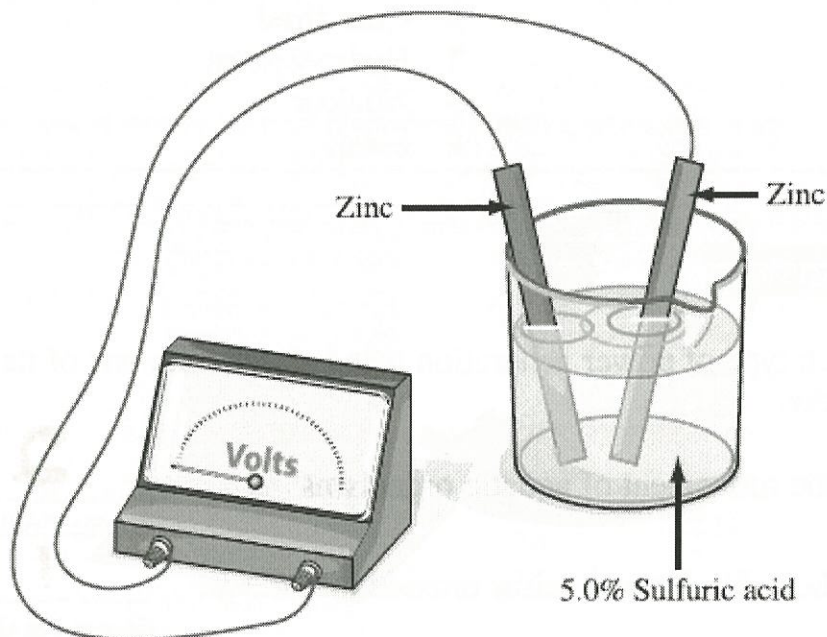
- I Electrons can be discharged when clothes are removed from a clothes dryer.
- II Electrons flow continuously through a conductor.
- III Electricity can be used to operate a motor.
- IV Electricity can build up and produce lightning.

10. Which facts describe properties of static electricity?

- A. I and III
- B. I and IV**
- C. II and III
- D. II and IV

Use the following to answer question 11.

After assembling the wet cell shown below, Roger noticed that no electricity was produced.



11. Which change could Roger make to the wet cell to produce electricity?

- A. Replace one of the zinc electrodes with copper.
- B. Increase the sulfuric acid concentration to 7.5%.
- C. Replace both of the zinc electrodes with copper.
- D. Decrease the sulfuric acid concentration to 2.5%.

12. Which of the following sequences shows the transfer of energy initiated by the flow of water in a hydroelectric power plant?

- A. Mechanical–gravitational–electrical
- B. Electrical–gravitational–mechanical
- C. Gravitational–electrical–mechanical
- D. Gravitational–mechanical–electrical

13. Which of the following sets of components in a series circuit would cause the light bulbs to shine the brightest?

| Row | Resistance | Load |
|-----|---------------------|---------|
| A. | Resistor present | 2 bulbs |
| B. | Resistor present | 3 bulbs |
| C. | No resistor present | 2 bulbs |
| D. | No resistor present | 3 bulbs |

Use the following to answer question 14.

A student explains how electric circuits function by comparing them to a traffic model. Some of the components of traffic are listed below.

Traffic Components

- I Road construction sites
- II Stop signs
- III Vehicles
- IV Roads

14. Which component of the traffic model is **most closely** related to switches found in circuits?

- A. I
- B. II
- C. III
- D. IV

Use the following to answer numerical response 2.

Kelly recorded the input energy and output energy of four electric devices.

| Device | Input Energy (J) | Output Energy (J) |
|--------|------------------|-------------------|
| 1 | 10 | 3 |
| 2 | 71 | 16 |
| 3 | 100 | 27 |
| 4 | 950 | 510 |

Numerical Response

2. When listed in order from the **most** efficient device to the **least** efficient device, the order is

4, 1, 3, and 2.

**Most
efficient**

**Least
efficient**

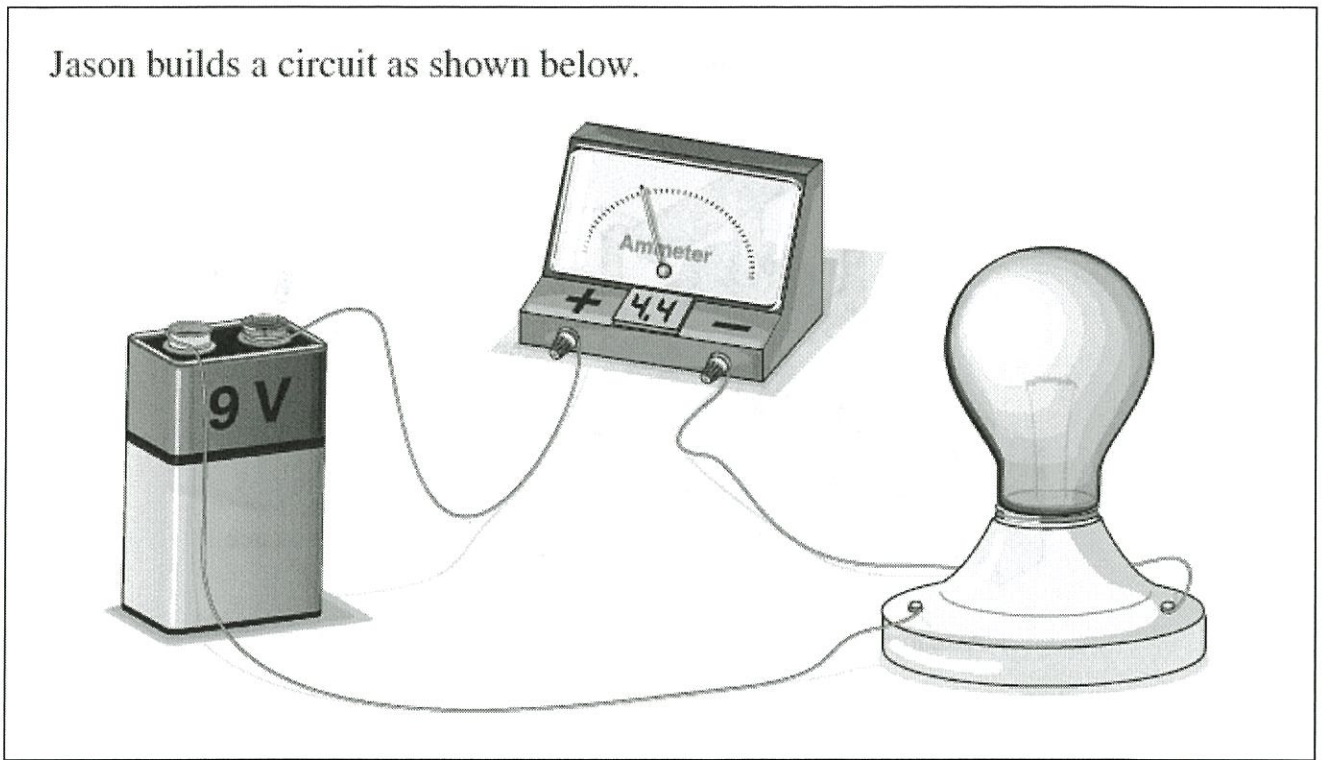
(Record all four digits of your answer in the numerical-response section on the answer sheet.)

15. Which of the following sources of energy is classified as renewable?

- A. Natural gas
- B. Biomass
- C. Coal
- D. Oil

Use the following to answer question 16.

Jason builds a circuit as shown below.



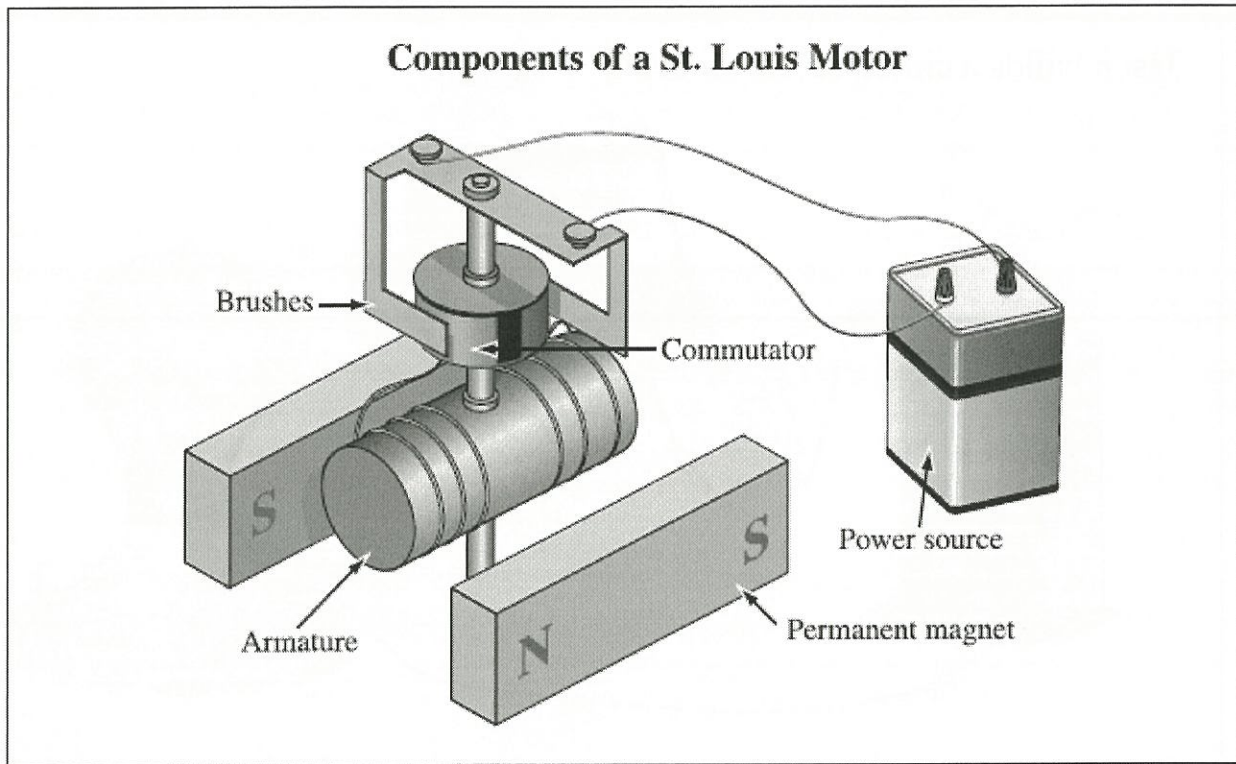
16. To the nearest tenth of a watt, how much power does the bulb consume ($P = IV$)?

- A. 0.5 W
- B. 2.0 W
- C. 13.4 W
- D. 39.6 W

17. A disadvantage of hydroelectric power generation is that it

- A. emits pollutants into the atmosphere
- B. disrupts the natural flow of waterways
- C. provides an unreliable method for producing energy
- D. produces hazardous waste that requires long-term storage

Use the following to answer question 18.



18. Which motor component functions as an electromagnet?

- A. Permanent magnet
- B. Power source
- C. Commutator
- D. Armature

19. An electrical device with low efficiency is **most likely** to produce excess

- A. heat energy
- B. light energy
- C. sound energy
- D. mechanical energy

20. When clothes are removed from a clothes dryer, sparks can be seen as the clothes are separated. These sparks are a result of

- A. current electricity
- B. an electrical discharge
- C. a buildup of neutral atoms
- D. anti-static sheets absorbing neutral charges

Use the following to answer question 21.

Joe watches television for 6.00 hours (21 600 seconds). The input power rating of his television is 200 W. The electrical energy consumed by any electrical device can be calculated using the following formula.

$$E = P \cdot t$$

E = Energy (in joules)
 P = Power (in watts)
 t = Time (in seconds)

21. The total electrical energy consumed by Joe's television is

- A. 33.3 J
- B. 108 J
- C. 1.20 kJ
- D. 4.32 MJ

22. Which of the following modifications to an electromagnet will increase its strength?

- A. Using a larger iron core
- B. Using fewer coils of copper wire
- C. Increasing the resistance of the iron core
- D. Decreasing the current passing through the coils of copper wire

Use the following to answer numerical response 3.

In order to produce 100 000 J of heat energy, a hot plate consumes 800 000 J of electrical energy.

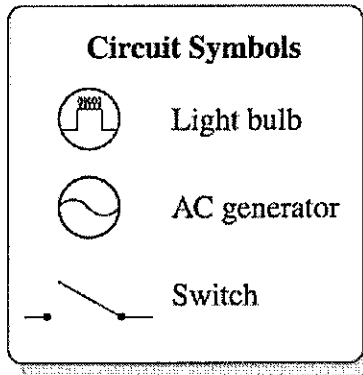
Numerical Response

3. To the nearest tenth of a percentage, the efficiency of the hot plate is 80.1 %.

(Record your answer in the numerical-response section on the answer sheet.)

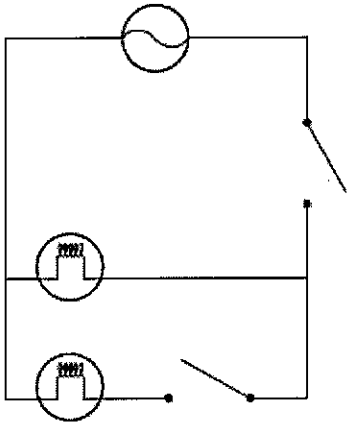
Use the following to answer question 23.

A garage is equipped with two lights and a generator, which are wired in parallel. Each light can be controlled separately, and there is a switch that can turn off both lights at once.

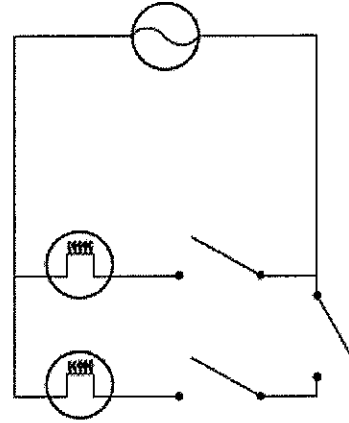


23. Which of the following diagrams represents the circuit described above?

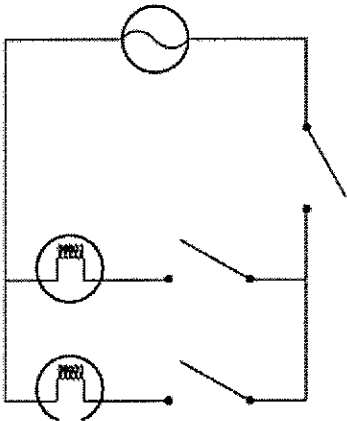
A.



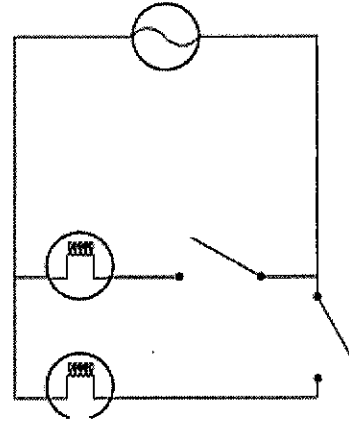
B.



C.



D.



Use the following to answer question 24.

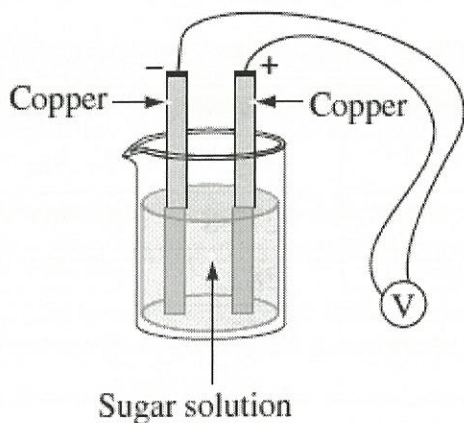
Regional Electrical Energy Generation (GW·h) by Resource, 1999–2002

| Year | Coal | Natural Gas | Hydro | Wind | Biomass and Waste | Total |
|------|----------|-------------|---------|-------|-------------------|----------|
| 1999 | 40 276.7 | 12 126.2 | 1 453.3 | 183.1 | 255.2 | 54 294.5 |
| 2000 | 40 459.2 | 15 219.9 | 1 756.3 | 71.9 | 273.8 | 57 781.1 |
| 2001 | 41 713.3 | 18 792.9 | 1 675.4 | 323.2 | 282.3 | 62 787.1 |
| 2002 | 42 541.8 | 19 462.1 | 2 188.2 | 64.6 | 335.5 | 64 592.2 |

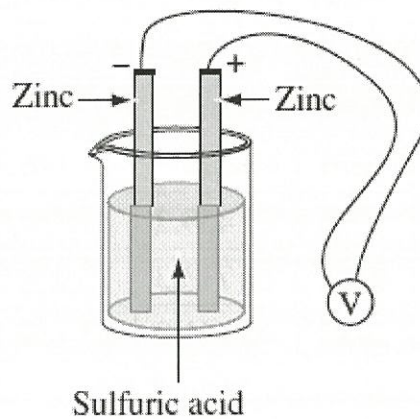
24. Which of the following statements is supported by the data in the table above?
- A. The combined production of energy from renewable and non-renewable resources decreases yearly.
 - B. The combined production of energy from renewable and non-renewable resources increases yearly.
 - C. As the generation of electrical energy from non-renewable resources increases, the generation of electrical energy from renewable resources decreases.
 - D. As the generation of electrical energy from renewable resources increases, the generation of electrical energy from non-renewable resources decreases.
-

25. Which of the following wet cells would produce the **highest** voltage?

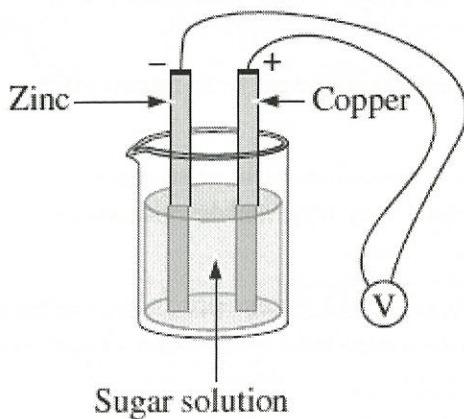
A.



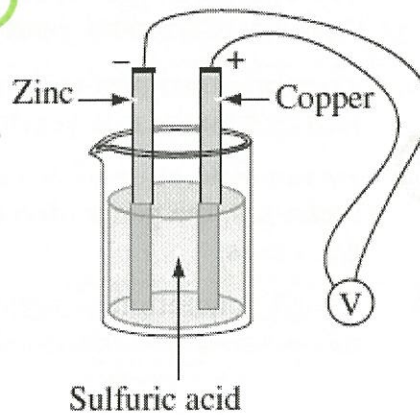
B.



C.

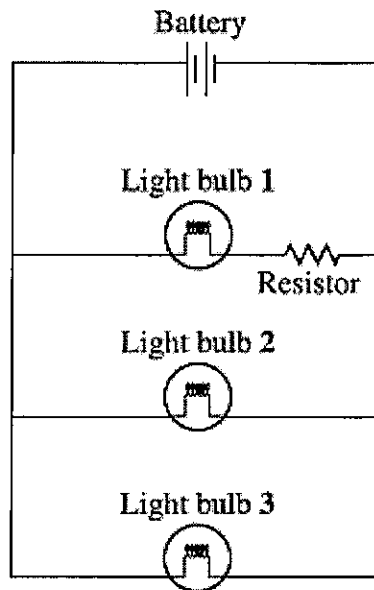


D.



Use the following to answer question 26.

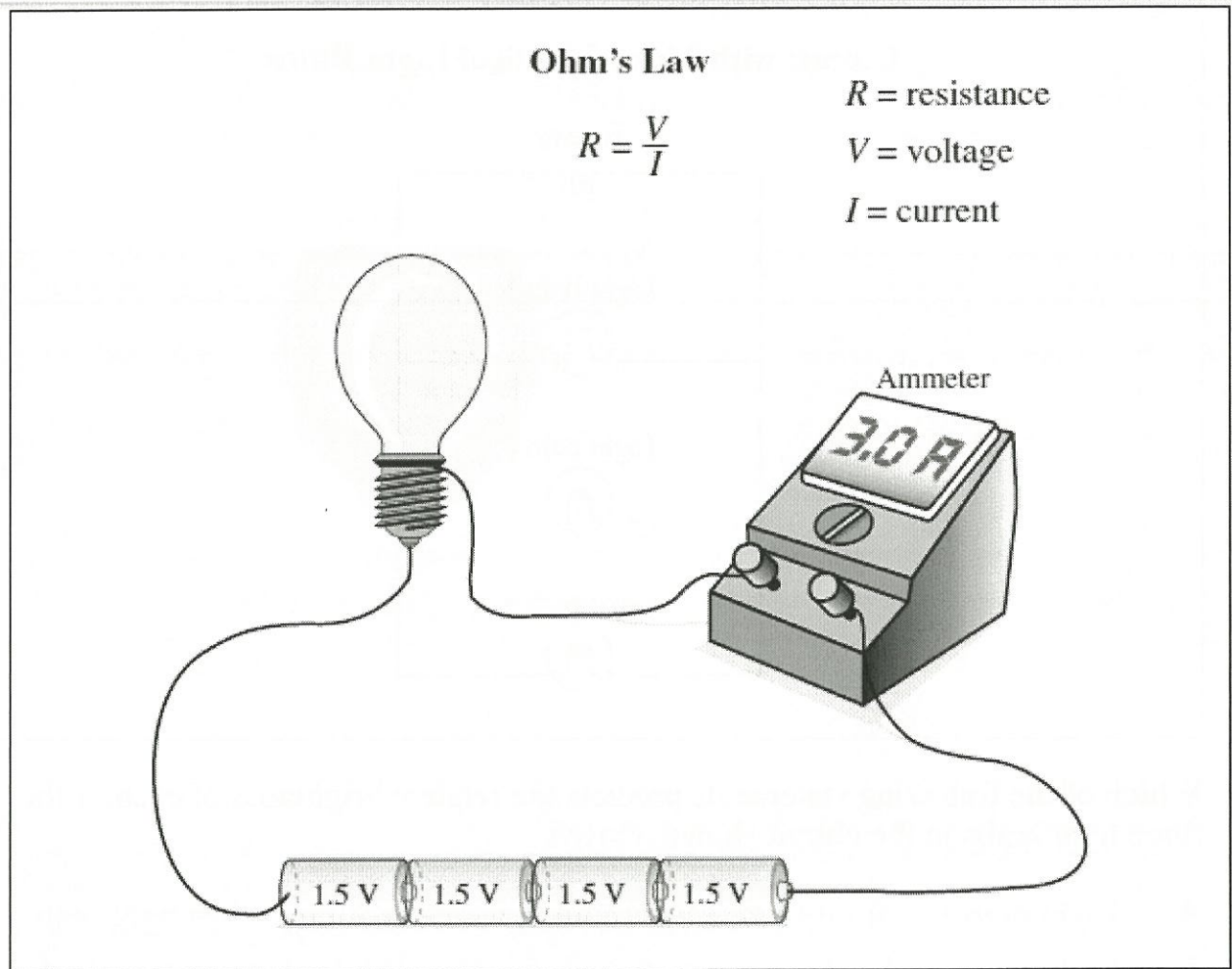
Circuit with Three Identical Light Bulbs



26. Which of the following statements predicts the relative brightness of each of the three light bulbs in the circuit shown above?

- A. Light bulb 1 is dimmer than light bulb 2, which is dimmer than light bulb 3.
- B. Light bulb 1 is brighter than light bulb 2, which is brighter than light bulb 3.
- C. Light bulb 1 is dimmer than light bulbs 2 and 3, which both have the same brightness.
- D. Light bulb 1 is brighter than light bulbs 2 and 3, which both have the same brightness.

Use the following to answer question 27.



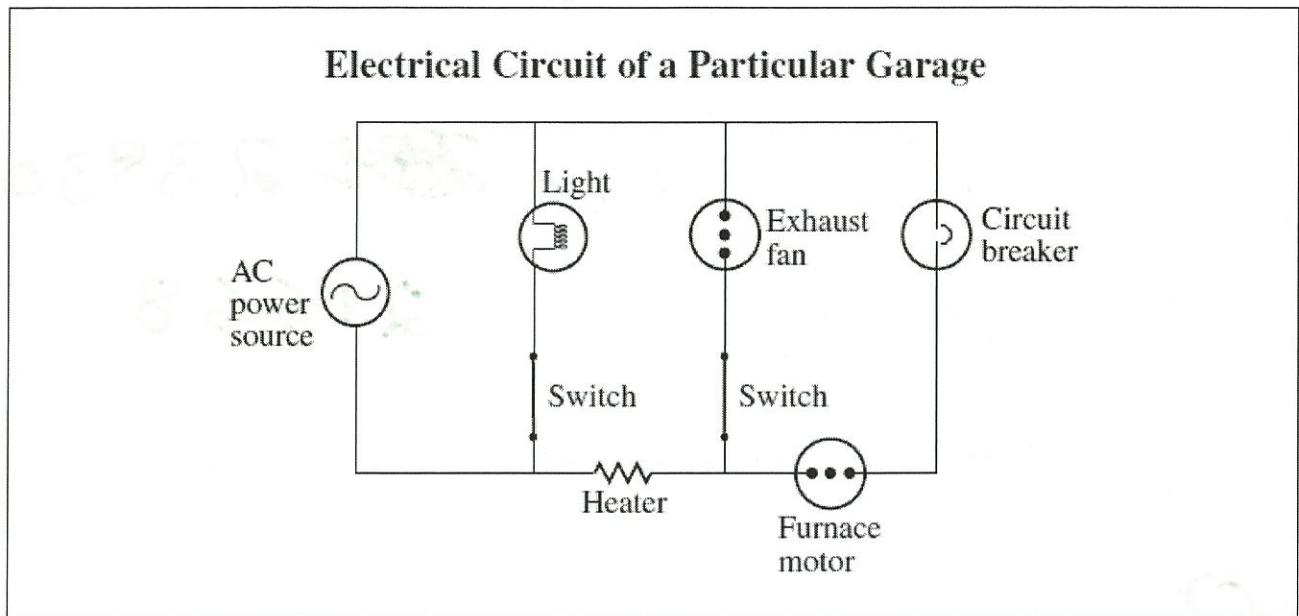
27. The resistance in the circuit shown above is

- A. 2Ω
- B. 3Ω
- C. 4Ω
- D. 6Ω

28. Tungsten is used as a filament in some light bulbs because it

- A. allows electrons to flow easily
- B. allows protons to flow easily
- C. resists the flow of electrons
- D. resists the flow of protons

Use the following to answer question 29.



29. Which component in the circuit shown above is protected by the circuit breaker when both switches are closed?

- A. Furnace motor
- B. Exhaust fan
- C. Heater
- D. Light

30. While checking all the fuses and circuit breakers, you notice that in the electrical panel, a 20A fuse has been placed in the circuit designed for a 15A fuse. This is a dangerous situation because

- A. the fuse does not fit properly
- B. the fuse may cause an electrical shock
- C. an increase in electrical current may cause the fuse to trip
- D. an increase in electrical current may cause the wires to overheat

34. A device which converts thermal energy into electrical energy is a
- A. thermostat
 - B. photoelectric cell
 - C. piezoelectric crystals
 - D. thermocouple.

Use the following to answer question 35.

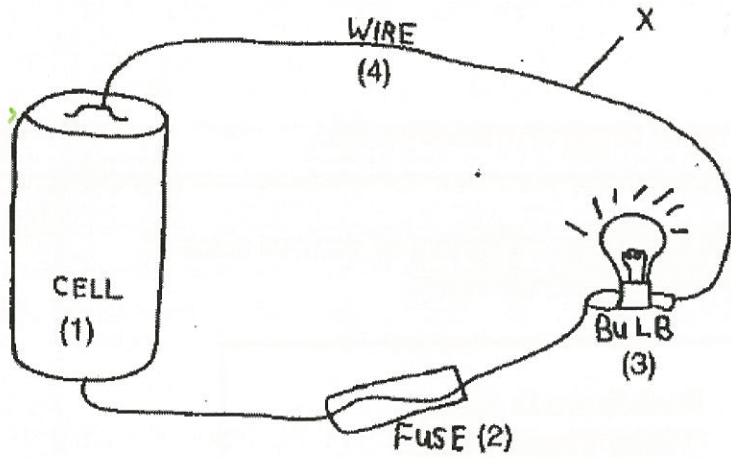
An electrician showed you a table where the resistance of various sizes of aluminum wire was measured at different temperatures.

| Diameter of Aluminum Wire (mm) | Resistance in ohms at Three Temperatures | | |
|--------------------------------|--|------|------|
| | 0°C | 20°C | 40°C |
| 0.08 | 5.20 | 5.64 | 6.31 |
| 0.10 | 3.27 | 3.55 | 3.97 |
| 0.16 | 1.29 | 1.40 | 1.57 |
| 0.20 | 0.81 | 0.88 | 0.99 |

35. The electrician asked you to determine the approximate temperature at which a 0.16 mm wire would have a resistance of 1.35 ohms. You knew that the approximate temperature is
- A. 0°C
 - B. 10°C
 - C. 20°C
 - D. 30°C

Use the following to answer numerical response 5.

A student builds a circuit with a glowing bulb. She then sketches what she has built.



5. The top of the cell in the diagram represents the positive terminal. Trace the flow of electrons through the four items in the circuit, starting from point X in the diagram. Indicate the proper order by placing the numbers of the components from left to right in the spaces below.

4 1 2 3

Written Response:

1. Draw a schematic drawing of a parallel circuit that includes a battery and: (3 marks)

- 2 lamps, each of which can be turned off separately by its own switch
- 1 motor which can be sped up or slowed down by a rheostat
- and 1 switch, which will shut everything off at once.

2. Examine the circuit diagram and then answer the questions that follow. (3 marks)

a. Which of the bulbs would be presently on the way the circuit is pictured?

B, C, D

b. If bulb C were to burn out and switch F was closed, which bulbs would be lit?

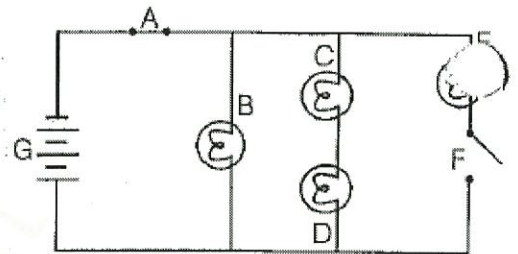
C, D, E

c. In what direction are the electrons flowing in the above diagram? (clockwise or counterclockwise?) Explain.

clockwise, neg \rightarrow pos

3. Describe three alternative ways of producing electricity that have minimal impact on the environment. Explain the reasons for your choices. (3 marks)

Solar
Wind
Nuclear



4. Describe three ways in which electric energy could be conserved with respect to home lighting. (3 marks)

- change bulbs
- turn off lights
- turn on fewer lights

5. Calculate the resistance of an electric kettle carrying a current of 9.5A from a 120V supply. (3 marks)

$$\begin{aligned} R &= \frac{V}{I} \\ &= \frac{120}{9.5} \\ &= 12.6 \Omega \end{aligned}$$

Numerical Response

Name: _____

NR 1

| | | | |
|---|---|---|---|
| | | | |
| • | • | | |
| 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 |
| 2 | 2 | 2 | 2 |
| 3 | 3 | 3 | 3 |
| 4 | 4 | 4 | 4 |
| 5 | 5 | 5 | 5 |
| 6 | 6 | 6 | 6 |
| 7 | 7 | 7 | 7 |
| 8 | 8 | 8 | 8 |
| 9 | 9 | 9 | 9 |

NR 2

| | | | |
|---|---|---|---|
| | | | |
| • | • | | |
| 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 |
| 2 | 2 | 2 | 2 |
| 3 | 3 | 3 | 3 |
| 4 | 4 | 4 | 4 |
| 5 | 5 | 5 | 5 |
| 6 | 6 | 6 | 6 |
| 7 | 7 | 7 | 7 |
| 8 | 8 | 8 | 8 |
| 9 | 9 | 9 | 9 |

NR 3

| | | | |
|---|---|---|---|
| | | | |
| • | • | | |
| 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 |
| 2 | 2 | 2 | 2 |
| 3 | 3 | 3 | 3 |
| 4 | 4 | 4 | 4 |
| 5 | 5 | 5 | 5 |
| 6 | 6 | 6 | 6 |
| 7 | 7 | 7 | 7 |
| 8 | 8 | 8 | 8 |
| 9 | 9 | 9 | 9 |

NR 4

| | | | |
|---|---|---|---|
| | | | |
| • | • | | |
| 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 |
| 2 | 2 | 2 | 2 |
| 3 | 3 | 3 | 3 |
| 4 | 4 | 4 | 4 |
| 5 | 5 | 5 | 5 |
| 6 | 6 | 6 | 6 |
| 7 | 7 | 7 | 7 |
| 8 | 8 | 8 | 8 |
| 9 | 9 | 9 | 9 |

NR 5

| | | | |
|---|---|---|---|
| | | | |
| • | • | | |
| 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 |
| 2 | 2 | 2 | 2 |
| 3 | 3 | 3 | 3 |
| 4 | 4 | 4 | 4 |
| 5 | 5 | 5 | 5 |
| 6 | 6 | 6 | 6 |
| 7 | 7 | 7 | 7 |
| 8 | 8 | 8 | 8 |
| 9 | 9 | 9 | 9 |



