

DATE:

NAME: *Key*

CLASS:

UNIT 4

BLM 4-27

ASSESSMENT

Unit 4 Test

Goal • Assess your understanding of the terms, concepts, and information studied in Unit 4.

What to Do

Follow the instructions for each set of questions below. Answer each question in the space provided.

Fill in the Blanks

Use the terms at the beginning of each section to complete the sentences that follow. There will be some terms left over in each list.

Electric Current

insulators conductors semiconductors galvanometer voltmeter volt
electric current amperes potential difference electric current

1. Electric charges move easily through conductors and less easily through semiconductors. Electric charges cannot move freely at all in insulators.
2. Moving charges form a/an electric current. The rate of charge movement can be measured by a galvanometer in standard units called amperes.
3. Changes in the electrical energy of charges moving through a circuit are called a/an potential difference, which can be measured by a/an voltmeter in standard units called volts.

Producing Electricity

thermocouple photovoltaic cell electrodes electrolyte heat
electrochemical cell fuel cell

4. Electrical energy can be produced from heat by a thermopile or a/an thermocouple and from light by a/an photovoltaic cell. Chemical energy can be transformed into electricity by a/an electrochemical cell, which contains two solid electrodes, each surrounded by a liquid or paste electrolyte.

Electricity and the Environment

greenhouse gases thermal pollution nuclear fission fission products
scrubbers cogeneration systems cooling water

5. Thermo-electric generating plants use scrubbers to remove some harmful chemicals from their exhaust, but some greenhouse gases are still released. Atomic power plants, which use nuclear fission as an energy source, also produce radioactive fission products. Both processes use large amounts of cooling water, which can produce thermal pollution when it is released into lakes and rivers.

The Power Grid

transformers fuses circuit breakers short circuit
branch circuits alternating current direct current

6. A transformer outside your home reduces the voltage of alternating current from the power grid. Overheating of the electrical cables in branch circuits in your home, which could be caused by a short circuit, is prevented by fuses or circuit breakers, which cut off excess current.

House Wiring

7. Complete the table using the colours and names listed below.

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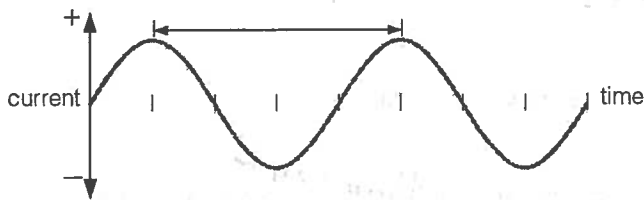
Unit 4 Test (continued)

colors: black	green	white	yellow
names: branch	ground	hot	neutral

function	wire color	wire name
supply high-energy electricity to appliances	(a) black	(b) hot
return low-energy electricity from appliances	(c) white	(d) neutral
ground the case of appliances to prevent electric shock	(e) green	(f) ground

Alternating and Direct Current

8. Classify each statement as applying to direct current (DC) or alternating current (AC).

DC (a) flows in one directionAC (b) voltage is easily changed by a transformerAC (c) used in the power gridDC (d) produced by electrochemical cells and batteriesDC (e) generated by dynamosDC (f) supplied to generators and motors through a split-ring commutatorAC (g) generated by the alternator in a carAC (h) resembles the graph below

Matching

Match the contribution in column A with a name in column B. Write the letter of the correct response in the proper blank. There will be one name left over.

- | | |
|---|---|
| <p><u>D</u></p> <p><u>B</u></p> <p><u>F</u></p> <p><u>E</u></p> <p><u>C</u></p> | <p>A</p> <p>9. observed a compass deflection near a current-carrying wire</p> <p>10. discovered the basic principles of electromagnetism</p> <p>11. built the first electric battery</p> <p>12. discovered the principles of electrical resistance</p> <p>13. developed the idea of positive and negative electric charge</p> |
|---|---|

- B
- (a) Einstein
- (b) Faraday
- (c) Franklin
- (d) Oersted
- (e) Ohm
- (f) Volta

Multiple Choice

Circle the letter of the best answer to each question.

14. A negatively charged rod attracts
- (a) only positively charged objects
- (b) only negatively charged objects
- (c) neutral and positively-charged objects
- (d) neutral and negatively-charged objects

Unit 4 Test (continued)

15. If a balloon develops a positive electric charge, this means that it has
- (a) gained positive charges
 - (b) lost positive charges
 - (c) gained negative charges
 - (d) lost negative charges
16. Which of the following devices is *not* used to prevent damage from electrostatic discharge?
- (a) a variable resistor
 - (b) an ionizer
 - (c) antistatic packaging
 - (d) a grounding strap
17. Which statement best describes a good conductor of electricity?
- (a) low resistance; easy for charge to move
 - (b) low resistance; difficult for charge to move
 - (c) high resistance; easy for charge to move
 - (d) high resistance; difficult for charge to move
18. Which statement best describes series and parallel circuits?
- (a) Series circuits have one current path but parallel circuits have several.
 - (b) Series circuits have several current paths, but parallel circuits have only one.
 - (c) Both series and parallel circuits have one current path.
 - (d) Both series and parallel circuits have several current paths
19. Two light bulbs are connected in series and attached to a dry cell. One bulb is unscrewed from its socket. What happens to the brightness of the other bulb?
- (a) It remains the same.
 - (b) It gets brighter.
 - (c) It gets dimmer.
 - (d) It does not glow.
20. According to Ohm's Law, the relationship between current, voltage, and resistance in a circuit can be stated as
- (a) $V = IR$
 - (b) $I = \frac{V}{R}$
 - (c) $R = \frac{V}{I}$
 - (d) All the above answers are correct.
21. In a series circuit the current is ...
- (a) the same at every point
 - (b) largest through the load
 - (c) largest at the positive terminal of the battery
 - (d) largest at the negative terminal of the battery

Unit 4 Test (continued)

22. Household appliances are connected in parallel so that they ...
- (a) all use the same power
 - (b) all carry the same current
 - (c) all have the same resistance
 - (d) can continue to work even if one fails or is disconnected
23. What is the difference between an electrochemical cell and a battery?
- (a) A battery is made up of several cells.
 - (b) A cell is made up of several batteries.
 - (c) A cell is rechargeable, but a battery is not.
 - (d) A battery is rechargeable, but a cell is not.
24. Which combination of characteristics describes a wire that carries the most current without overheating?
- (a) large diameter, as long as possible
 - (b) large diameter, as short as possible
 - (c) small diameter, as long as possible
 - (d) small diameter, as short as possible
25. Which of the following devices do *not* use electromagnets?
- (a) maglev trains
 - (b) electric motors and generators
 - (c) magnetic compasses
 - (d) MRI medical imaging machines
26. A voltage is induced in a wire that is ...
- (a) held still near a magnet
 - (b) moved parallel to a magnet
 - (c) moved at an angle to a magnet
 - (d) wrapped tightly in a coil around a magnet
27. Which characteristic is typical of digital electronic devices?
- (a) have no electrical resistance
 - (b) are based on electronic switches called transistors
 - (c) require AC power
 - (d) are seldom used in modern computers
28. If a halogen light bulb is 18% efficient, this means that most of the input electrical energy
- (a) is transformed into waste heat
 - (b) is transformed into light
 - (c) passes right through the bulb without being changed
 - (d) is grounded to prevent electrical shocks

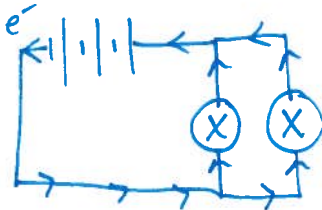
Unit 4 Test (continued)

29. Fuel cells make electricity by ...
- a chemical reaction that produces water
 - using sunlight to get charges moving
 - using two different metal strips in an electrolyte
 - using water pressure to move a turbine
30. Thermo-electric generating stations produce steam to turn generators by using energy released from ...
- sunlight
 - splitting atoms
 - ocean tides
 - burning fuels
31. What current flows in a 20 ohm electric toaster connected to a 120 volt source?
- 0.166 A
 - 6.0 A
 - 100 A
 - 2400 A

Extended Response

Show appropriate diagrams, including labels, or problem-solving methods for each question below.

32. Draw a circuit diagram showing three cells in series connected to two lamps in parallel with each other. Included a switch that can shut down all current in the circuit. Show the direction of electron flow in each current path on your diagram.



33. Calculate the resistance of an electric kettle carrying a current of 9.5 A from a 120 V supply.

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

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34. A small electric hot plate transfers 45 kJ of thermal energy into a cup of water each minute. To do this, the hotplate requires 85 kJ of electrical energy. Calculate the efficiency of the hotplate.

$$\begin{aligned} \text{Eff} &= \frac{45}{85} \times 100\% \\ &= 53\% \end{aligned}$$

35. During the winter, Amos leaves his 750 watt electric car heater running continuously for ten hours each night. If electrical energy costs 9.6 cents per kilowatt-hour, how much does it cost Amos to operate the heater during a 21-day cold snap?

$$750 \text{ W} = 0.750 \text{ kW}$$

$$h = 10 \times 21$$

$$\text{kWh} = (0.750)(210)$$

$$= 210 \text{ h}$$

$$= 157.5 \text{ kWh}$$

$$\text{Cost} = (157.5)(0.096)$$

$$= \$15.12$$