Energy Transformations

1. George holds a magnet above a pile of paperclips. The paperclips move toward the magnet and stick to it before the magnet actually touches it.

A magnet is surrounded by ________, which applies a push or a pull to an object without actually touching it.

- A. an electric current
- B. a magnetic field
- C. a simple machine
- D. a generator

2. Electrical circuits require a complete loop through which the electrical charges can pass. Which of the following is a complete parallel circuit?

- A. W
- B. X
- C. Y
- D. Z
3. Jacques moves a bar magnet near a circle of copper wire. Moving the magnet creates a changing magnetic field passing through the copper loop.

What happens to the copper wire because of the moving magnet?

- A. The copper wire carries an electric current.
- B. The copper wire develops a positive electric charge.
- C. The copper wire develops a negative electric charge.
- D. The copper wire loses its magnetic charge.

4. Which of the following has the ability to turn light energy into chemical energy?

- A. an automobile
- B. a tree
- C. water
- D. a book

5. In a combustion engine, fuel is burned to produce mechanical energy. Which of the following shows that an energy transformation has taken place?

- A. heat is produced
- B. there is no change
- C. matter is created
- D. matter is destroyed

6. Stored _____ energy in a flashlight's batteries becomes light energy when the flashlight is turned on.

- A. heat
- B. chemical
- C. sound
- D. mechanical

7. Electrical circuits require a complete loop through which the electrical charges
can pass. Which of the following is a complete series circuit?

8. Which of the following sequences correctly displays the energy transformation from the inside of a battery to the igniter inside a car's engine?

- A. Electrical Energy---->Chemical Energy---->Heat Energy
- B. Chemical Energy---->Electrical Energy---->Heat Energy
- C. Chemical Energy---->Mechanical Energy---->Heat Energy
- D. Heat Energy---->Electrical Energy---->Chemical Energy
The motions of the toy robot shown above are driven by an electric motor. The power source for the toy's motor is a pair of batteries.

Based on this information, which of the following best summarizes the energy transformations taking place in the toy robot?

A. Mechanical energy is transformed into light energy, and the light energy is transformed into electrical energy.

B. Light energy is transformed into electrical energy, and the electrical energy is transformed into mechanical energy.

C. Electrical energy is transformed into chemical energy, and the chemical energy is transformed into mechanical energy.

D. Chemical energy is transformed into electrical energy, and the electrical energy is transformed into mechanical energy.

10. In a circuit, electrons travel in

A. the same direction.
B. a circular path.
C. alternating directions.
D. different directions.

11. The strength of an electromagnet can be altered by

A. increasing the diameter of the wire wrapped around the core.
B. using DC current.
C. using AC current.
D. increasing the number of coils around the core.
12. A microwave works by focusing microwave light on the food inside of it.

Which type of energy transformation takes place in a microwave?

☐ A. Heat energy is transformed into light energy.

☐ B. Electrical energy is transformed into light energy.

☐ C. Light energy is transformed into electrical energy.

☐ D. Heat energy is transformed into electrical energy.

13. Lucas plugs a lamp into the wall. The light bulb in the lamp turns on. What kind of energy transformation is this?

☐ A. Electrical energy is transformed into mechanical and heat energy.

☐ B. Light energy is transformed into mechanical and heat energy.

☐ C. Light energy is transformed into electrical and mechanical energy.

☐ D. Electrical energy is transformed into light and heat energy.

14. The image above shows a group of wind turbines, which help produce electrical energy for humans to use. Several transfers of energy must occur to produce
this electrical energy. Fill in the blanks below to summarize these energy transfers.

An uneven transfer of _______ energy to Earth's atmosphere produces wind energy. As the wind rotates the blades of a turbine, _______ energy is transferred to the turbine. This transferred energy turns generators inside the turbine to produce electrical energy.

☐ A. coal; gasoline
☐ B. mechanical; solar
☐ C. gasoline; coal
☐ D. solar; mechanical

15. Which of the following are true about electricity and magnetism?

I. An electric current can be produced by a changing magnetic force.

II. A magnetic force can be produced by an electric current.

III. Energy cannot be transferred by an electric current.

IV. A magnetic force can attract a metal object only if the object is touching the magnet.

☐ A. II and III only
☐ B. I, III, and IV only
☐ C. I, II, III, and IV
☐ D. I and II only

16. Into what kinds of energy does a toaster convert electrical energy?

☐ A. light and heat
☐ B. mechanical and light
☐ C. heat and chemical
☐ D. solar and chemical

17. Energy is constantly converted into different forms. In which of the following scenarios is chemical energy converted into mechanical energy?
A. Light from the Sun strikes a solar cell, which generates an electric current.

B. A girl uses her muscles to lift a box off of the floor.

C. Electric current flows through a light bulb filament.

D. A match is struck and ignites.

18. Between steps 2 and 3, the chemical energy in the coal is converted to

- A. mechanical energy
- B. transitional energy
- C. heat energy
- D. electrical energy

19. A car uses stored chemical energy in gasoline to move. The engine changes chemical energy into heat and ____ energy to power the car.

- A. wind
- B. mechanical
- C. light
- D. sound
20. Lance is rubbing two sticks together. The friction causes the kinetic energy from rubbing the two sticks to be converted into

- A. heat energy.
- B. potential energy.
- C. chemical energy.
- D. electrical energy.

21. Between steps 4 and 5, the mechanical energy of the turbine is converted to

- A. mechanical energy
- B. heat energy
- C. electrical energy
- D. transitional energy
22. What type of energy transfer occurs when a light bulb is turned on?

- A. Electrical energy is transformed into heat and mechanical energy.
- B. Potential energy is converted into kinetic energy.
- C. Electrical energy is transformed into heat and light energy.
- D. Mechanical energy is converted into kinetic energy.

23. Taylor mixed two liquids together in a beaker. The beaker quickly heated up. What does this indicate about the reaction that took place in the beaker?

- A. that there was no energy transfer
- B. that energy was created
- C. that energy was destroyed
- D. that energy was transformed

24. In a complete circuit, several factors can have an effect on the current that is transferred through a circuit. A greater number of receivers makes the current ________________.

- A. change based on the situation
- B. have no change
- C. lower
- D. higher

25. Maya is playing the guitar. She strums the strings and the guitar produces noise. Maya is transforming ______ energy into ______ energy.

- A. electrical; sound
- B. mechanical; sound
- C. mechanical; light
- D. electrical; mechanical
26. Animals can change the energy in food into energy the animals can use. What type of energy is in the food before the animals change it?

- A. heat energy
- B. light energy
- C. chemical energy
- D. energy of motion

27. Animals are able to run because they can change the chemical energy in food into

- A. potential energy.
- B. energy of motion.
- C. light energy.
- D. stored energy.

28. Electromagnets are the result of

- A. generators.
- B. two positively charged ends.
- C. the Earth's magnetic poles.
- D. an electrical charge.
29. Between steps 3 and 4, the heat energy in the steam is converted to

- A. heat energy
- B. mechanical energy
- C. transitional energy
- D. electrical energy

30. A circuit is

- A. the complete path of an electrical current.
- B. an open path of an electrical current.
- C. the incomplete path of an electrical current.
- D. a switch that interrupts an electric current.

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Answers
Explanations

1. A magnet is surrounded by a magnetic field, which applies a push or a pull to an object without actually touching it. The magnetic field also surrounds the electric current that creates it.
2. A parallel circuit is a circuit in which two or more components are connected parallel to each other. The circuit gives each component the same voltage, but the current can flow in separate paths to get to different components. Image X shows a complete parallel circuit.

3. Magnets can cause electric currents. Moving a magnet near a circle of conducting wire will cause the copper wire to carry an electric current.

4. Light energy (from the Sun) is turned into chemical energy during the process of photosynthesis.

5. The production of heat shows that an energy transformation has occurred. In a combustion engine, the chemical energy from the fuel is converted into heat energy. The heat energy is then transformed into mechanical energy.

6. Batteries store chemical energy. When the flashlight is turned on, chemicals in the batteries begin to react. The chemical energy is converted to electrical energy. The electrical energy then becomes light energy.

7. A series circuit is a circuit in which all of the parts are connected in a single loop. This type of circuit lets the electric current flow in only one path. Image Y shows a complete series circuit.

8. There are chemicals inside a battery. They produce electrical energy (you can tell this because batteries have positively-charged and negatively-charged ends). Electrical energy is then transformed into heat energy so the igniter will work.

9. Chemical energy from the batteries is transformed into electrical energy, and the electrical energy is transformed into mechanical energy using the electric motor.

10. A circuit can use either AC or DC. This question does not specify, therefore it is impossible to determine if the electrons are traveling the same direction, as in DC, or in different, alternating directions, as in AC. Electrons do travel in a circular path in a circuit regardless of AC or DC.

11. There are different ways to increase the strength of an electromagnet: increasing the amount of current, coiling the wire at a greater distance from the iron core and increasing the number of coils.

12. A microwave transforms electrical energy into light energy. The microwave light is then used to heat the food inside of the oven.

13. When Lucas plugs the lamp into the wall it receives energy from an electric current. The light bulb inside of the lamp transforms this electrical energy into light and heat energy.

14. Solar energy heats the Earth's atmosphere unevenly, which causes different air masses to have different temperatures. Winds form as hotter air masses rise and cooler air masses sink.
Wind that encounters wind turbines turns the turbines' blades. This transfers mechanical energy from the wind to the turbine. As the blades rotate, they turn an axle inside the turbine. This axle turns a generator, which converts the rotational mechanical energy to electrical energy for humans to use.

15. Electricity and magnetism are two different parts of the same phenomenon. A moving electric field creates a magnetic field, and a moving magnetic field creates an electric field. When an electric current is moving along a wire, a magnetic force is produced. Likewise, a moving magnetic force also produces an electrical current.

Electricity is the movement of charged particles, or electrons. An electric current transfers energy in the form of electrical energy.

Magnetism is a force that acts at a distance and cannot be seen. A magnet does not have to touch a metallic object in order to attract the object.

**Only I and II** are true about electricity and magnetism.

16. A toaster changes electrical energy into **heat and light energy** as shown by the glowing wires inside the toaster.

17. When a match is struck, chemical energy is converted into heat and light energy. When current flows through a light bulb, electrical energy is converted into heat and light energy. When sunlight strikes a solar cell, light energy is converted into electrical energy. **When a person lifts a box or does any other physical activity**, the food you have eaten gets converted from chemical energy to mechanical energy to fuel your muscles.

18. The Sun is involved in the formation of most of the energy sources on Earth. It is even involved in the formation of fossil fuels. Thus, the Sun is the ultimate source of energy for any energies derived from the fossil fuels.

Fossil fuels are made when plants use solar energy to make chemical energy in the form of sugar. When the plants die, they are compressed and form coal.

When the coal is burned, the chemical energy in the coal is converted into **heat energy** which is used to make steam. The steam causes a turbine (i.e., a very large fan blade) to turn thus producing mechanical energy. As the turbine turns, electrical energy is generated which can then be transmitted through power lines.

19. Mechanical energy is the energy of motion. Since a car uses stored chemical energy in gasoline so that it can move, it is appropriate to say that a car converts chemical energy in gasoline to mechanical energy.

20. Friction is causing the sticks' kinetic energy to be converted into **heat energy**. In fact, it is even possible to start a fire when two sticks are rubbed together the right way for a long time.

Friction is also what causes the hands to warm up when they are rubbed together.
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22. This picture shows that when the switch is closed or turned on, the light bulb will turn on.

Because this circuit contains a battery and a light switch, electrical energy must be involved. This electrical energy is transformed into heat and light energy as indicated by the light coming out of the light bulb.

23. When Taylor mixed the two liquids, heat was generated. This indicates that a reaction occurred and that energy was transformed. Some of the energy from the reaction was transformed into heat energy, causing the beaker to heat up.

Energy cannot be created or destroyed, only transformed from one type to another.

24. A greater number of receivers makes the current lower.

More receivers (fans, lightbulbs) means that there are more objects to get energy to, so the current will be lower.

More energy sources (batteries) will provide more current.

Higher resistance in transfer wires (such as using iron wire instead of copper wire) makes the current lower.

25. Maya strums the strings with her fingers. This is a form of mechanical energy. Whenever she strums the strings, they produce sound energy in the form of music.

26. Food contains a type of stored energy called chemical energy. This energy is transformed into heat and motion by living things using chemical reactions.

27. The energy that an animal has when it is running is energy of motion. The animal is able to move its muscles and run because it is changing chemical energy from food into energy of motion.

28. Electromagnets can be created using AC or DC current. The greater the charge, the greater the strength of the electromagnet. When the electrical charge is discontinued, the electromagnet loses its magnetism.

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30. In order for a circuit to function, it must have a complete and connected path on which an electrical current (electrons) can travel. Electrons cannot travel over a break in the path.