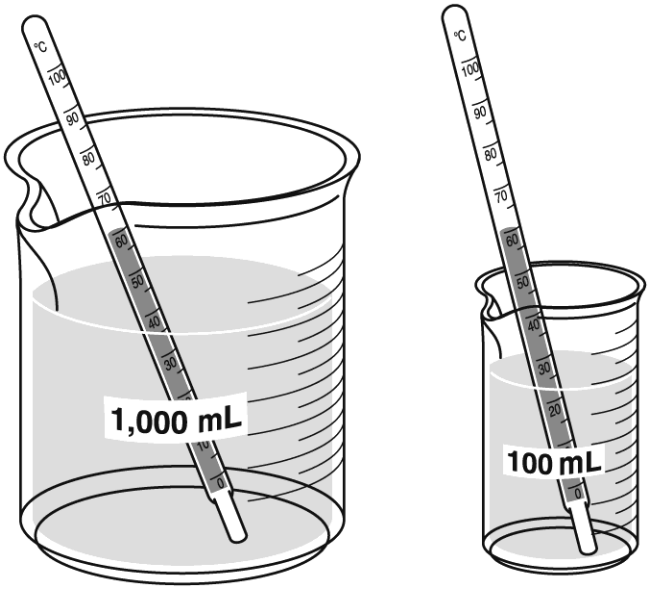
PHYSICAL SCIENCE STUDY GUIDE

Multiple Choice
Identify the choice that best completes the statement or answers the question.

____ 1. Which change of state takes place when a gas loses energy?

A. melting
B. evaporation
C. solidification
D. condensation

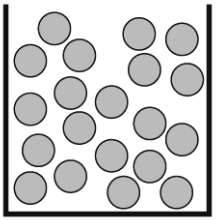
____ 2. These two beakers contain the same liquid substance at the same temperature.

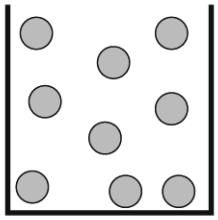


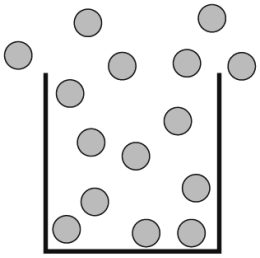
How does the thermal energy of the liquid in the larger beaker compare to the thermal energy of the liquid in the smaller beaker?

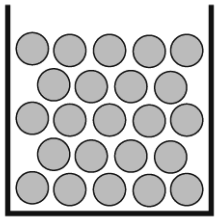
A. The liquid in the larger beaker has less thermal energy than the liquid in the smaller beaker.
B. The liquid in the larger beaker has more thermal energy than the liquid in the smaller beaker.
C. The exact volume of liquid in each beaker must be known to compare the thermal energy of the liquids.
D. The liquid in the larger beaker has the same amount of thermal energy as the liquid in the smaller beaker.

____ 3. Deval drew the models below of particles in a substance. Which model best represents the particles in a solid?

A. 

B. 

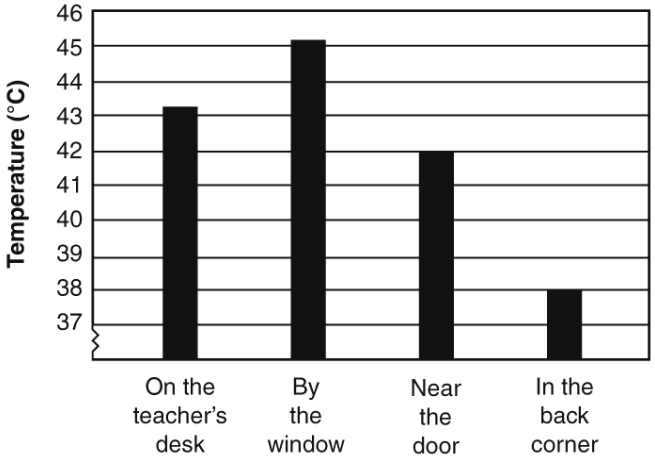
C. 

D. 

____ 4. The freezing point of corn oil is about 259 K. By how many degrees is this different from the freezing point of water on the Kelvin scale?

A. 14 K
B. 47 K
C. 114 K
D. 159 K

____ 5. Students put the same amount of water into four beakers and warm them to 60°C. They then place each beaker in different locations in the classroom. After 5 min, the students measure the temperature of each beaker of water. The results are shown in the bar graph below.



At which location do the particles of water move the slowest after 5 min?

A. near the door
B. by the window
C. in the back corner
D. on the teacher's desk

____ 6. What is an alternative energy resource?

A. an energy resource used in place of fossil fuels
B. an energy resource that can be used to make fossil fuels
C. an energy resource that is used faster than the rate at which it is replaced
D. an energy resource that can be used without any negative impact on the environment

____ 7. How is a renewable energy resource different from a nonrenewable energy resource?

A. Renewable resources come only from plants.
B. Renewable resources exist in unlimited supplies.
C. Renewable resources do not have costs associated with them.
D. Renewable resources can be replaced at the same rate at which they are used.

____ 8. Which of the following best describes electric charge?

A. a force that causes objects to heat up
B. a high-voltage material that can cause damage to objects
C. a fundamental property that causes electric and magnetic interactions
D. a particle that moves freely through matter and causes static electricity to build up on objects

____ 9. An atom loses an electron. What will happen when it approaches a positively-charged ion?

A. The ions will repel each other.
B. The ions will attract each other.
C. The ions will cancel each other out.
D. The ions will neither attract nor repel each other.

____ 10. Which of the following best describes alternating current?

A. current that constantly turns on and off
B. current in which charges change direction
C. current that gains and loses electrons
D. current that increases and decreases in temperature

____ 11. What is electric current?

A. the rate at which electric charges pass a given point
B. a material's opposition to the flow of electric charge
C. the number of electric charges that pass a given point
D. the amount of work to move a unit of electric charge between two points

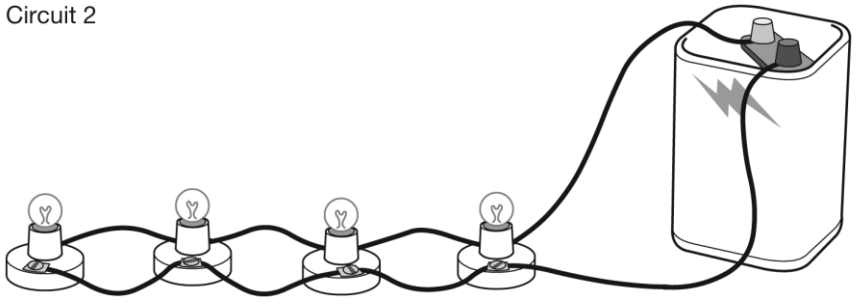
____ 12. Electric current travels along two identical metal wires. Initially, the temperature of both wires is 30°C. After 5 minutes, however, the temperature in wire A increases to 40°C and the temperature in wire B decreases to 20°C. Based on this information, which conclusion is most likely correct?

A. After 5 minutes, wire A becomes less resistant than wire B.
B. After 5 minutes, wire A becomes more resistant than wire B.
C. After 5 minutes, wire A becomes an alternating current and wire B becomes a direct current.
D. After 5 minutes, wire A becomes a direct current and wire B becomes an alternating current.

____ 13. A student is building a simple circuit with a battery, light bulb, and copper wires. When she connects the wires to the battery terminals, the light bulb does not light up. Which of the following could explain why the bulb does not light?

A. There is no energy source.
B. The circuit is open.
C. This circuit is too simple to light up a light bulb.
D. Copper wires do not conduct electric current.

____ 14. Here is a diagram of a simple electric circuit. There are four elements to the circuit. They are labeled Circuit Element 1, Circuit Element 2, Circuit Element 3, and Circuit Element 4.



What part of an electric circuit changes the electrical energy into another form of energy?

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

____ 15. Candice learns that all magnets have two magnetic poles. Which of the following observations would best support this statement?

A. When a bar magnet is cut in half, each half has a north pole and a south pole.
B. The north pole of a compass needle is attracted to the south pole of a bar magnet.
C. When an electric current flows through a wire, a magnetic field forms around the wire.
D. The strength of a horseshoe magnet's magnetic field decreases as the magnet is pulled away from another object.

____ 16. When particles from the Sun travel towards the Earth, the Earth's magnetic field pulls them towards the poles. These solar particles interact with particles in Earth's atmosphere and can create a beautiful light display in the sky. What is this light display commonly called?

A. aurora
B. geographic pole
C. radiation belt
D. solar flare

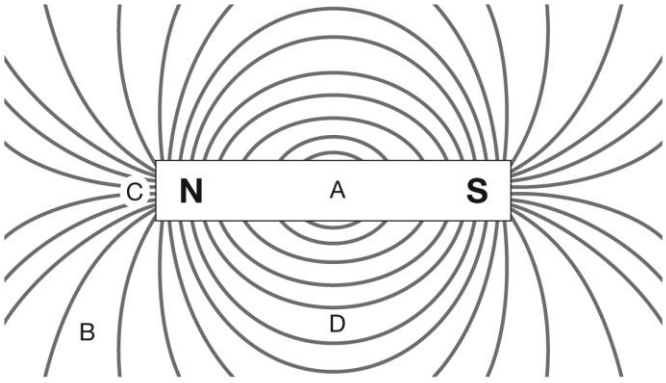
____ 17. Which of the following is a ferromagnetic material?

A. aluminum
B. copper
C. diamond
D. iron

____ 18. Which of the following determines whether or not a material is magnetic?

A. the density of the material
B. the weight of the material on Earth
C. the alignment of atoms in the material
D. the number of elements that make up the material

____ 19. Below is an image of a magnet showing the magnetic field.

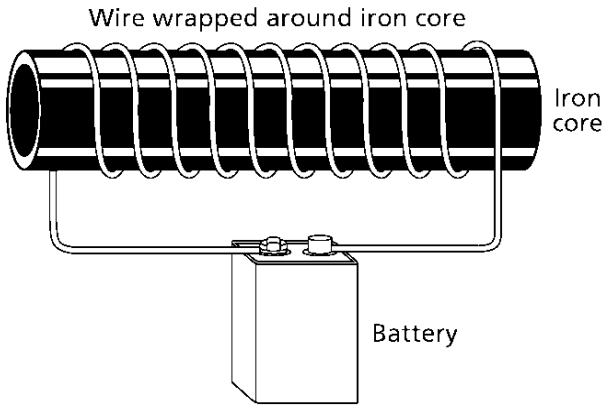


Where is the magnetic force the strongest?

A. Position A

B. Position B
C. Position C
D. Position D

____ 20. What kind of device is shown in the following diagram?



A. electric motor
B. electromagnet
C. galvanometer
D. transformer

____ 21. Which of the following does not use an electromagnet?

A. electric motor
B. galvanometer
C. hand-held compass
D. doorbell

____ 22. Astronomers study radio waves to learn about the universe. Why might radio waves be used to study objects in space?

A. They are sound waves that cause vibrations in stars and planets.
B. They are electromagnetic waves, so they don't require a medium.
C. They are mechanical waves that pass through interstellar particles.
D. They are longitudinal waves, which create compressions in the fabric of space.

____ 23. After a wave passes through a medium, how does the position of a particle in that medium compare to its original position?

A. The particle's position is about the same as its original position.
B. The particle's position is continually vibrating around its original position.
C. The particle's position moves away from its original position in the direction of the wave.
D. The particle's position moves away from its original position perpendicular to the direction of the wave.

____ 24. A jellyfish is floating in the ocean. What will happen to the jellyfish when a wave passes through the water?

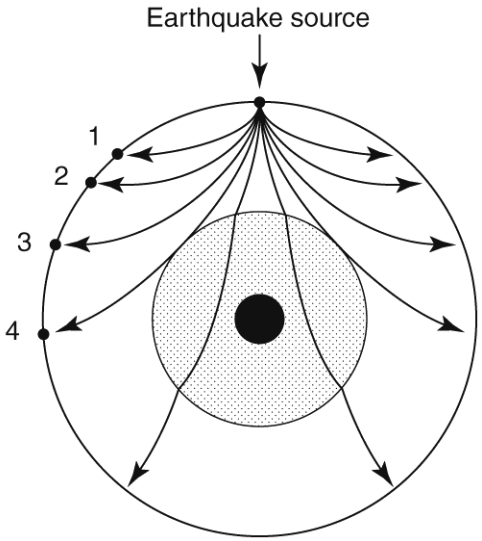
A. It will be carried away with the wave.
B. It will be moved up to the surface of the water.

C. It will not move, but the water around it will move.
D. It will move up and down, but it will return to about the same place.

____ 25. Which of the following events would produce a mechanical wave?

A. a leaf falling into a pond
B. a flashlight being turned on
C. a disturbance in a magnetic field
D. A, B, and C

____ 26. An earthquake sends out mechanical waves in all directions from its source. In answering the following question, assume the wave starts carrying energy equally in all directions. The wavefront reaches each of the different locations as shown in the diagram.



At which location does a point on the wavefront have the **least** energy?

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

____ 27. What is the speed of a wave with a wavelength of 10 cm and a frequency of 4 hertz?

A. 0.4 cm/s
B. 2.5 cm/s
C. 14 cm/s
D. 40 cm/s

____ 28. The medium through which a mechanical wave passes can be a solid, a liquid, or a gas. Properties of a wave might change when it moves from one medium to another. What happens to the speed of a wave when it moves from a gas to a solid?

A. It speeds up.
B. It slows down.
C. It remains the same.

D. It speeds up and then slows down.

____ 29. Which statement best explains what waves are?

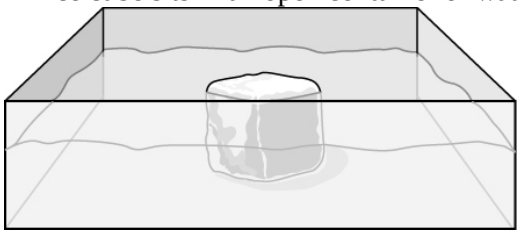
A. wavy lines on graph paper
B. disturbances that transfer energy
C. light energy that changes into particles of matter
D. circles that move out from a central place

____ 30. Which statement about the effects of medium on the speed of a mechanical wave is true?

A. Medium has no effect on the speed of a mechanical wave.
B. A mechanical wave generally travels faster in solids than liquids.
C. A mechanical wave generally travels faster in gases than liquids.
D. A mechanical wave always travels through liquids at the speed of light.

Short Answer

1. An ice cube sits in an open container of water placed outside on a sunny day.



The warmer water contacting the ice cube transfers energy to the ice cube through what process?

Use the set-up shown in the diagram to give two examples of how adding energy as heat to a system may result in a change of state.

Compare the speeds of particles in the ice, water, and air.

2. Substances freeze and boil at different temperatures.

What are the freezing and boiling points of water on the Kelvin scale?

_____

The temperature of a substance is 75 K. How much higher or lower is this from the freezing point of water and from the boiling point of water?

_____

_____

_____

3. The temperature of a beaker of water is 87°F.

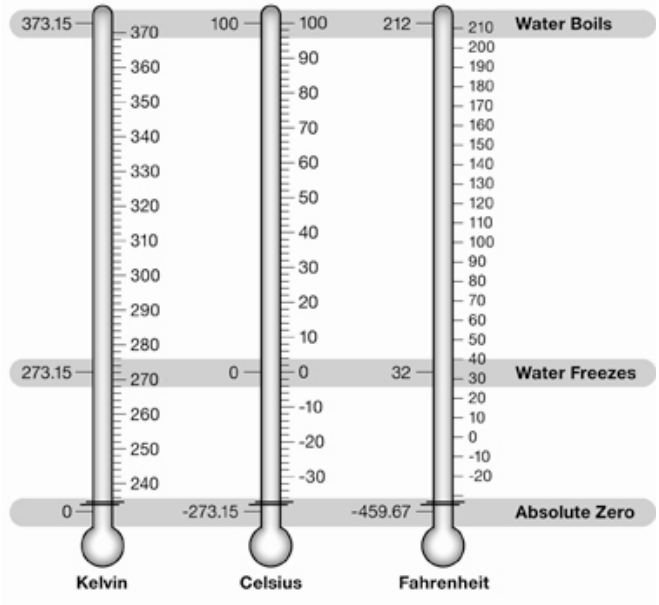
   How many degrees cooler would the water have to be to freeze?

   _____

   How many degrees warmer would the water have to be to boil?

   _____

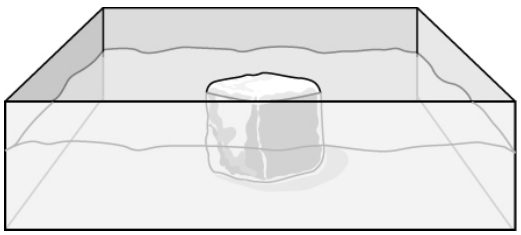
4. Three thermometers are lined up side by side.



   If the temperature outside is 60° F, what is the approximate temperature on the Celsius scale? _____ What is the temperature on the Kelvin scale? _____

   If the air temperature drops to 30°F during the night, how has the kinetic energy of the air particles changed?

5. An ice cube sits in an open container of water placed outside on a sunny day.



   The warmer water contacting the ice cube transfers energy to the ice cube through what process?

Use the set-up shown in the diagram to give two examples of how adding energy as heat to a system may result in a change of state.

Compare the speeds of particles in the ice, water, and air.

6. Describe the law of conservation of energy.

Give two examples of energy being transformed from one type to another.

7. A scientist experiments on two different pairs of objects. During the experiment, the objects in one of the pairs are brought into contact with each other; the objects in the other pair are brought close together, but they do not touch. The scientist then compares the number of electrons in each object, as recorded in the following table.

	Pair 1		**Pair 2**	
	Object A	**Object B**	**Object C**	**Object D**
After the experiment, the number of electrons:	remains constant	remains constant	increases	decreases

Which pair of objects could have experienced charging by friction? Explain your answer

_____

_____

_____

Which pair of objects could have experienced charging by induction? Explain your answer

_____

_____

_____

8. An athlete does work to lift a heavy ball to the top of a hill. He says, “I did work against a gravitational field to move a heavy ball from one location to another.” He claims that this situation is an analogy for a concept related to electricity.

For which electrical concept is this an analogy?

_____

How could you rewrite his statement so that it accurately defines this electrical concept?

_____

_____

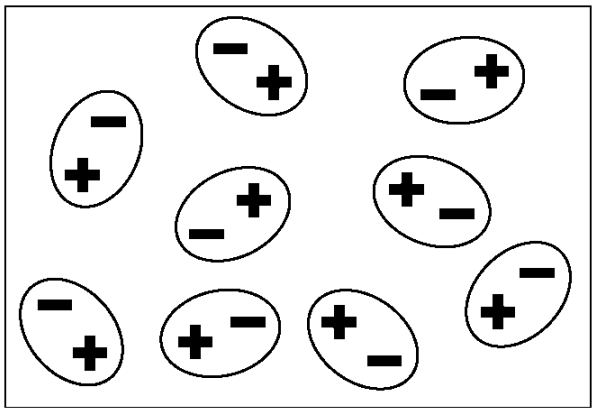
9. A household circuit breaker typically breaks when the current through the circuit reaches 15 amps. Mary's apartment has two electrical circuits. Below is a list of Mary's appliances and the current drawn by each:

   Microwave oven: 7 amps
   Washing machine: 4 amps
   Television: 1 amp
   Dishwasher: 10 amp

   Think about how Mary should organize her appliances so that she does not trip the circuit breaker in her house. Create a list showing which appliances will be placed on which circuit.
   [2 WOL]

   Add up the total current on each circuit and explain why each circuit will not break the circuit breaker.
   [3 WOL]

10. The following image models nine atoms in a material. Each of these atoms has a positive and negative pole, as shown:



   Draw a model of how these atoms would look if the material became magnetized.

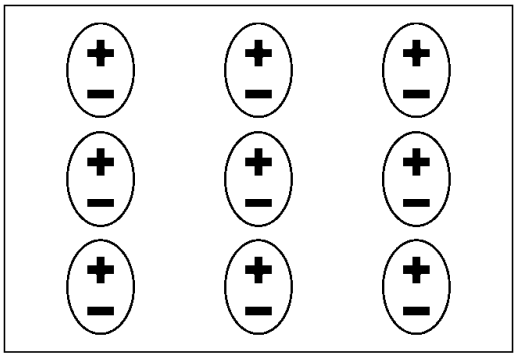
Explain why the atoms in your sketch create a magnetic material while the atoms in the sketch above do not.

_____

_____

_____

11. The following image models nine atoms in a material. Each of these atoms has a positive and negative pole, as shown:



Complete the following sentence: "All of these atoms are aligned in a _____."

_____

Describe how these atoms are aligned, and explain what effect this alignment of atoms has on the material.

_____

_____

_____

12. A student finds three unmarked bar magnets in a lab. She wants to know how strong each of the magnets is.

What property of magnets is related to the "strength" of the magnet?

_____

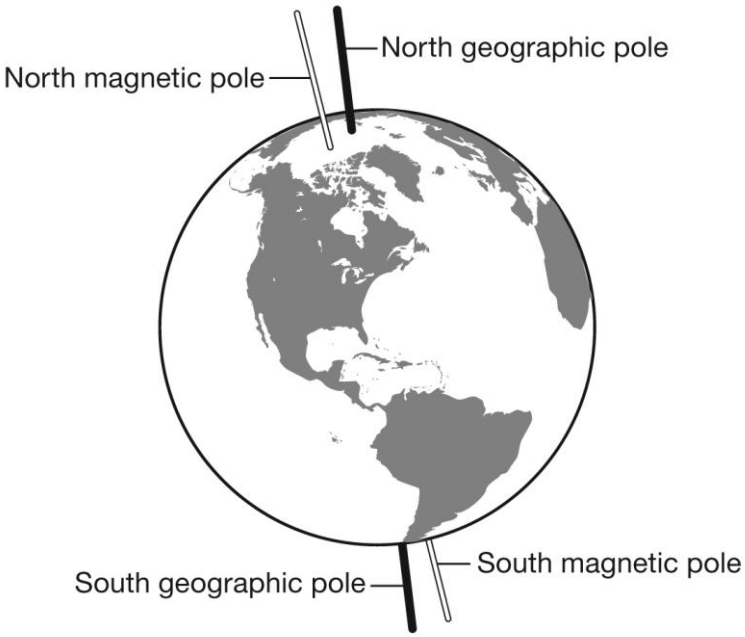
The student has a set of paperclips on hand. How could she use the paperclips to determine the strength of each magnet?

_____

_____

13. Describe three properties of magnets.

14. The image below shows Earth and its magnetic field.



What is the difference between Earth's magnetic and geographic poles? How do navigators take advantage of this?

15. Pamela created an electromagnet by wrapping a copper wire around an iron nail. When she connected the wire ends to a battery, she was able to lift 4 paperclips with her electromagnet. She decided that she wanted to modify the electromagnet so that it would lift 7 paperclips. She modified the electromagnet by removing the iron nail and replacing it with an aluminum nail. However, when she modified the electromagnet, it would not lift any paperclips.

    Why did Pamela's modification cause the electromagnet to lose its magnetic properties?

    _____

    _____

    _____

    _____

    How could Pamela modify the electromagnet so that it will lift 7 paperclips?

    _____

    _____

    _____

16. List two ways in which the strength of an electromagnet can be increased.

17. Compare the sound waves created by a tuning fork in water and in air.

_____

_____

_____

18. Andrew and his partner are divers. They are working underwater, 10 m apart, on an oil platform. Josh and his partner are working, also 10 m apart, on the part of the platform that is above water. Andrew and Josh each make a loud noise of the same volume at the same time. Whose partner hears the noise first? Explain your answer.

_____

_____

19. Some waves carry more energy than others. Which wave has more energy, a loud sound or a quiet sound? Why?

20. Tafari worked one summer on a ship that set weather buoys in the ocean. He watched how one of the buoys moved in the water.

    Which wave property describes why the buoy bobs up and down?

    Which wave property determined how fast the buoys bobbed in the water?

    He observed that when the wind blew harder, the ocean waves were larger, and the buoys moved away from the ship. What effect, if any, did the waves have on how far the buoys moved? Explain your answer.

Essay

1. A student in a science lab measures the mass and temperature of water in three different beakers. He records his results in the table shown below.

Beaker	Mass (g)	Temperature (°C)
1	100	70
2	100	50
3	50	50

Compare the temperatures of the water in each beaker.

_____

_____

Compare the average motion of the particles in each beaker.

_____

_____

Compare the thermal energy of the water in each beaker.

_____

_____

Compare the flow of energy that will occur if beaker 1 is placed next to beaker 2 with the flow of energy that will occur if beaker 2 is placed next to beaker 3.

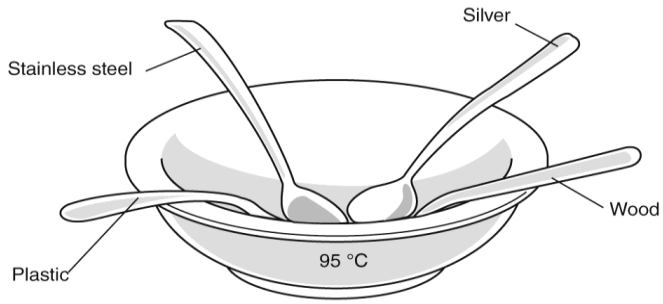
_____

_____

_____

_____

2. A student wants to test heat transfer in different materials. She places four spoons in a bowl of hot water, as shown below. She then makes a data table to record her observations.



Material	Observation
plastic	slightly warm
stainless steel	hot
silver	very hot
wood	not warm

Identify and describe the type of heat transfer that occurs between the hot water and the spoons.

_____

_____

After the spoons have been in the water for a couple of minutes, what will the student most likely observe about the temperature of each spoon?

_____

_____

Classify each of the materials that the student is testing as a conductor or an insulator.

_____

_____

_____

_____

Describe how heat transfer due to radiation could be used to affect this system.

_____

_____

3. There is a close relationship between magnetic forces and the generation of electricity. Explain how magnets can be used to generate electricity and how electric current can be used to create electromagnets. For each process, give an example of a device you would find around the home.

4. A wind turbine is a machine that spins when the wind blows. The turbine blades are attached to a magnet. When the blades spin, the magnet also spins. Around the magnet, there is a coil of copper wire.

   What happens in the coil of copper wire when the magnet starts to spin? What is the name of this process?

   _____

   _____

   _____

   A person wants to modify the machine so that the magnet remains stationary. How could the person modify the design of the machine so that it still produces the same effects? Explain why this modification will produce the same effect as the original design.

   _____

_____

_____

_____

_____

What is the name of a machine that turns mechanical energy into electrical energy?

_____

5. Your teacher challenges you to generate electricity in a circuit without using a battery. She gives you a long copper wire and a bar magnet.

   Explain how you can set up the circuit so that you can produce an electric current in the wire.

   _____

   _____

   _____

   Explain why this process produces an electric current.

   _____

   _____

   What is the name of this process?

   _____

6. There is a close relationship between magnetic forces and the generation of electricity. Explain how magnets can be used to generate electricity and how electric current can be used to create electromagnets. For each process, give an example of a device you would find around the home.

7. An alarm clock is placed in a sealed container without any air. Describe what you will observe when the alarm clock goes off. Justify your reasoning.

   _____

   _____

   _____

   _____

   _____

8. Compare the vibrations involved in creating mechanical waves and electromagnetic waves. Use a ripple in a pond and a light wave traveling though water as examples.

_____

_____

_____

_____

_____

9. Jung arrived at a concert in the park so late that the only seat she could get was almost a block from the stage. The music sounded much fainter to Jung than it did to people near the stage. She could hear the drums and bass guitar fairly well, but she had trouble hearing higher sounds from the singer. Explain the properties and behavior of waves that affected how Jung heard the music.

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