Science 9 - Unit D Review Sheet

Learning Outcomes

Can you?

- distinguish between static and current electricity and identify evidence of each
- assess the potential danger of an electrical device by checking its voltage and amperage
- distinguish between safe and unsafe activities when dealing with electricity
- identify electrical conductors and insulators
- evaluate the use of different chemicals, chemical concentrations, and designs for electrical storage cells
- identify electrical conductors and resistors
- compare the resistance of different materials
- use switches and resistors to control current
- predict the effects of switches, resistors, and other devices
- use models to describe and relate electrical current, resistance, and voltage
- measure voltages and amperages in circuits
- calculate resistance using Ohm's law
- develop, test, and troubleshoot circuit designs
- draw circuit diagrams for toys, models, and household appliances
- compare and contrast microelectronic circuits and circuits in a house
- identify, describe, and interpret examples of mechanical, chemical, thermal, and electrical energy
- describe evidence of energy transfer and transformation
- identify forms of energy inputs and outputs
- apply appropriate units, measures, and devices in determining and describing quantities of electrical energy
- construct, use, and evaluate devices for transforming mechanical energy to electrical energy and electrical energy to mechanical energy
- evaluate modifications to electrical devices
- apply the concepts of conservation of energy and efficiency to the analysis of energy devices
- compare energy inputs and outputs of a device, and calculate its efficiency
- describe techniques for reducing energy waste in common household devices

Unit at a Glance

- Excess electrons on an object create a negative charge. A shortage of electrons creates a positive charge.
- The Laws of Charge state that:
    - unlike charges attract
    - like charges repel
    - charged objects attract uncharged (neutral) objects
- Conductors allow electric charge to move freely. Insulators prevent charge from moving freely.
- The basic parts of all electric circuits are a source of electric energy, conductors, a load, and a control device.
- Quantity of charge is measured in coulombs.
- Current is measured in amperes.
- Voltage (potential difference) is a measure of the energy of a standard unit of charge, and is measured in volts.
- Resistance is the property of substances that hinders charge motion and converts electric energy into heat. Resistance is defined as the ratio of voltage to current (Ohm's Law).
- A series circuit has one current path. A parallel circuit has more than one path along which current can flow.
- Thermocouples convert thermal energy to electric energy.
- Piezoelectric materials generate a small voltage when the pressure on them changes.
- Photovoltaic (solar) cells convert light energy to electric energy.
- Alessandro Volta observed that two different metals in a solution could generate a voltage. These observations led to the development of electrochemical cells and batteries, which consist of several cells connected together.
- Electric generators convert mechanical energy to electric energy. Their operation is based on the relationship between magnetism and electricity.
- Direct current (DC) flows in only one direction. Alternating current (AC) reverses direction periodically.
- The power grid generates and distributes AC electricity using transformers to change voltage
- for efficient power transmission.
- In homes, electric current travels through an electric meter and a service panel to branch circuits. Circuit breakers or fuses in the service panel cut off excessive current before wiring can overheat.
- Electric power is the product of voltage and current. Power measures the quantity of energy transfer each second.
- All electronic devices convert some input energy into waste heat, so they are not perfectly efficient.

Unit D: Electrical Principles and Technologies

Science 9 Review

Wherever necessary, answer questions on a separate sheet of paper.

1. With electrical technology all around us, it is usually our own responsibility to be safe around electricity. For example, you should always be careful to stay clear of power lines.

   Describe two other behaviours that minimize risk when dealing with electricity. Explain how the behaviours keep you safer around electricity.

2. Metals can be coated using the process of electroplating. Sketch an electroplating cell that is used to place a coating of nickel onto an iron bar. Label the following in your sketch.

   - electricity source
   - positive and negative electrodes
   - electrolyte
   - direction of electron flow
   - movement of metal atoms

3. Use the space below to draw two circuit diagrams. Each circuit should have a three-cell battery, and three bulbs and a motor. In the first diagram, connect each bulb and the motor in series. In the second diagram, connect each bulb and the motor in parallel.

4. Electrical circuits are in many of the devices that we use every day. What features are included in the electrical circuits of the devices to make them more convenient?

5. Why is it important to consider power rating when shopping for a new appliance?

6. Describe how a generator works to create electricity.

7. Creating an efficient device that transforms electrical or chemical energy into mechanical energy is challenging.
   Discuss the problems faced in creating an efficient device, and how those problems might be overcome.

8. How does a well-insulated oven, fridge, or house help to reduce pollution?

9. Describe how digital transmission and storage of information has created both opportunities and problems for society.

10. Compare the energy transformations in an oven and in a thermocouple. How are they similar? How are they different?

11. List the four parts of an electric motor. What is the function of each part?

12. Describe one application of electrochemistry

13. Consider the following three charged objects. Objects A and B are fixed in position, but object C is free to move.

A. Will object C move? Explain your answer.

B. If you think object C will move, use an arrow to show its path of movement. Explain why you think object C would take the path you have indicated.

14. Explain why you sometimes feel a shock when reaching for a doorknob after walking across carpet.

15. Describe the difference between current and static electricity.

16. Describe three ways you can protect yourself from electrical shock.

17. Name two sources of energy. Describe briefly how each can be used to make electricity.

18. Draw a diagram of a parallel circuit that has a two-cell battery, two bulbs and a motor. Add a switch or switches that allow you to turn off all three items at once. The switch or switches must also allow you to turn the motor off while the light bulbs remain on.

19. Describe how you would make or construct a wet cell. What basic parts would you need? How would you use them to produce voltage?

20. Describe one thing you could do in your own home to conserve energy.

21. The lamp in the circuit puts out approximately 112 J of light energy for every 2000 J of electrical energy put into it. What is the efficiency of the lamp?
    A. 17.9%
    B. 5.6%
    C. 0.056%
    D. 0.179%

22. Which of the following devices uses the most energy?
    A. a 600-W microwave oven used for 20 minutes
    B. a 100-W bulb left on for 8 hours
    C. a 1150-W hair dryer used for 8 minutes
    D. a 900-W hot plate used for 15 minutes

23. The most appropriate unit for reporting the amount of electrical energy used by a family every month would be the
    A. watt
    B. joule
    C. kilowatt hour
    D. volt

24. Which of the following would be most likely to approach 100% efficiency as an energy converter?
    A. an alkaline dry cell
    B. a halogen lamp

C. a gasoline-electric hybrid vehicle
D. an electric heater

25. A series circuit has three 15 Ω resistors. What is the total resistance of the circuit?
    A. 0.2 W
    B. 5 W
    C. 15 W
    D. 45 W

26. A series circuit consists of two loads and a 6 V power source. Readings are taken to measure the resistance of each load. The 6 V power source is then replaced by a 9 V power source. How does the resistance of each load change after the change in power supply?
    A. The resistance of each load remains the same
    B. The resistance of each load increases by a factor of 1.5
    C. The resistance of each load decreases by a factor of 1.5
    D. The resistance of the first load increase, but the resistance of the second load decreases.

Use the table below to answer the following numerical response question.

A vacuum cleaner connected to a 120-V wall socket draws 9.6-A of current

Numerical Response

1 The total electrical resistance of the vacuum cleaner is _____ Ω.

Use the table below to answer the following numerical response question.

A hair dryer provides 20 Ω of total resistance. The dryer is connected to a 240-V electrical outlet 

Numerical Response

2 The amount of current drawn by the clothes dryer is _____ A.

Use the table below to answer the following numerical response question.

A new compact fluorescent light bulb offers 120 J of light energy for every 680 J of electrical energy.

Numerical Response

3. The energy efficiency of the fluorescent light bulb is _____ %.