**Name: Date: LG:**

**Science 9 Achievement Exam Review**

# ***Unit D: Electrical Principles and Technologies***

**Knowledge**

***I CAN:***

1. Talk about and explain how different devices to convert various forms of energy to electrical energy, and electrical energy to other forms of energy

• identify, describe and interpret examples of mechanical, chemical, thermal (heat) and electrical energy

• investigate and describe evidence of energy transfer and transformation

• investigate and evaluate the use of different chemicals, chemical concentrations and designs for batteries

• construct, use and evaluate devices for transforming mechanical energy into electrical energy and for transforming electrical energy into mechanical energy

• modify the design of an electrical device, and observe and evaluate resulting changes

2. Describe technologies for transfer and control of electrical energy

• assess the potential danger of electrical devices, by referring to the voltage and current rating (amperage) of the devices; and distinguish between safe and unsafe activities

• distinguish between static and current electricity, and identify examples of each

• identify electrical conductors and insulators, and compare the resistance of different materials to electric flow

• use switches and resistors to control electrical flow, and predict the effects of these and other devices in given applications (investigate and describe the operation of a rheostat)

• describe, using models, the nature of electrical current; and explain the relationship among current, resistance and voltage (use a hydro-flow model to explain current, resistance and voltage)

• measure voltages and amperages in circuits, and calculate resistance using Ohm’s law

• develop, test and troubleshoot circuit designs for a variety of specific purposes, based on low voltage circuits

• investigate toys, models and household appliances; and draw circuit diagrams to show the flow of electricity through them

• identify similarities and differences between microelectronic circuits and circuits in a house (e.g. compare switches in a house with transistors in a microcircuit)

3. Identify and estimate energy inputs and outputs for example devices and systems, and evaluate the efficiency of energy conversions

• identify the forms of energy inputs and outputs in a device or system

• apply appropriate units, measures and devices in determining and describing quantities of energy transformed by an electrical device (calculate the # of Watts of power consumer by an electrical device using the formula P= IV; calculate the quantity of electric energy , in Joules, transformed by an electric device, using the formula E = Pt)

• apply the concepts of conservation of energy and efficiency to the analysis of energy devices (identify examples of energy dissipation in the form of heat, and describe the effect of these losses on useful energy output)

• compare energy inputs and outputs of a device, and calculate its efficiency (compare the # of Joules of energy used with the number of Joules of work produced)

• investigate and describe techniques for reducing waste of energy in common household devices (e.g. by eliminating sources of friction in mechanical components, using more efficient forms of lighting, reducing overuse of appliances as in “over-drying” of clothes)

4. Describe and discuss the societal and environmental implications of the use of electrical energy

• identify and evaluate alternative sources of electrical energy, including oil, gas, coal, biomass, wind, waves and batteries (identify renewable and nonrenewable sources for generating electricity; evaluate the use of batteries as an alternative to internal combustion engines)

• describe the by-products of electrical generation and their impacts on the environment (identify by-products and potential impacts of coal-fired electricity generation)

• identify example uses of electrical technologies, and evaluate technologies in terms of benefits and impacts

• identify concerns regarding conservation of energy resources, and evaluate means for improving the sustainability of energy use

**Skill Outcomes** (focus on problem solving)

***I CAN:***

Ask questions about the relationships between and among observable variables, and plan investigations to address those questions

• propose alternative solutions to a given practical problem, select one, and develop a plan

• identify questions to investigate arising from practical problems and issues

• rephrase questions in a testable form, and clearly define practical

• state a prediction and a hypothesis based on background information or an observed pattern of events

• formulate operational definitions of major variables in the study of electrical circuits

**I CAN:**

Analyze qualitative and quantitative data, and develop and assess possible explanations

• test the design of a constructed device or system

• evaluate designs and prototypes in terms of function, reliability, safety, efficiency, use of materials and impact on the environment

• identify and correct practical problems in the way a prototype or constructed device functions

• identify and suggest explanations for discrepancies in data

• identify potential sources of error, and determine the amount of error in a given measurement

1. Describe the difference between static and current electricity and provide an example of each.
2. Outline the 3 laws of charges.
3. Distinguish between insulators, semi-conductors, conductors and superconductors. Give an example of each of the first 3.
4. What is an electric discharge and why is it dangerous?
5. What is a circuit, and what are the 4 basic parts of a circuit?
6. What is current, how do we measure it and what units do we use?
7. What is voltage, how do we measure it and what units do we use?
8. What is meant by resistance (with respect to electricity)?
9. Describe the relationship between conductors and resistance.
10. How do we calculate resistance?
11. What is the resistance of an electric fan that carries a current of 7.5 A when plugged into a 120 V wall outlet? Show your work!!
12. What is the difference between a series and parallel circuit?
13. Why is most of the wiring in your house done in parallel?
14. Describe how length, area, temperature and material affect the resistance of a wire.
15. Some appliances, such as furnaces, have thermocouples installed in them. These devices convert \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ energy into \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ energy. Thermocouples must be made of 2 different \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
16. What is a thermo-electric generator and how does it work?
17. Describe the piezoelectric effect and what it is used for.
18. What are LED’s and why are they used instead of incandescent light bulbs?
19. Describe the difference between energy transmission and energy transformation.
20. Describe the two parts of an electrochemical cell and how they vary between wet and dry cells.
21. What is the difference between a primary cell and a secondary cell?
22. What did Oersted and Ampere discover about the relationship between electricity and magnetism?
23. How did Faraday contribute to developments in electricity?
24. Faraday then worked with an American named Henry and found out something about wires and magnets. What did they find?
25. Why do most power plants use AC generators instead of DC?
26. Describe the difference between an electric generator and an electric motor.
27. Describe how a DC motor works. Include the important parts and follow the path of electricity throughout.
28. What is the function of a transformer?
29. What 2 devices can homes and appliances use to maintain the safety of electricity?
30. Transistors in micro-electric circuit are the equivalent of \_\_\_\_\_\_\_\_\_\_\_\_\_ in a regular electronic circuit.
31. What is meant by electrical power? What are two ways it can be calculated?
32. A current of 12.5 A runs through an electric fan that is connected to a 120 V circuit. What is the power of the fan? Show your work!!
33. A 1200 W microwave takes 10.9 A of current to run. What is the voltage to which this appliance is connected? Show your work!!
34. A 60 W light bulb produces about 6.624 x 104 J over a 6 hour period. What is the efficiency of the bulb?
35. What are 3 safety precautions to take when working with electricity?
36. What are the advantages of hydroelectric dams? Problems?
37. What are the advantages of nuclear power plants? Risks?
38. What is thermal pollution?
39. Briefly summarize how alternative energy sources such as wind, sunlight, tides and geothermal energy can be used to produce electricity. Include a brief summary of the problems with each.