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Marble Generator

Quebec - Achievements and Competencies

Learning Outcomes

Cycle 2 (Gr. 9-10)
Electricity
Electromagnetism
Transformation of energy

The Quebec Achievements and Competencies are based on the Progression of Learning Outcomes derived from the Quebec Education Plan set by the Ministere de l'Education, du Loisir et du Sport.

Specific Expectations

GENERAL EDUCATION PATH

CYCLE 2 (Gr. 9-10) — Secondary 4

MATERIAL WORLD

F. Electricity and electromagnetism
1. Electricity
d. Electrical currents
i) Describes the function of different elements of an electrical circuit (e.g. the wires transmit electrons along the circuit, resistors transform electrical energy into another form of energy)

In *Marble Generator*, students will recognize that an electric current is induced by the magnet moving through the coiled conducting wire. This causes the LED to light up.

TECHNOLOGICAL WORLD

C. Electrical engineering
d. Transformation of energy (electricity and light, heat, vibration, magnetism)
i) Associates the transformation of energy with different components of a circuit (e.g. bulbs transform electrical energy into light and heat)

In this activity, students will recognize that the marble must be in motion in order to induce an electric current through the coiled wires. The kinetic energy of the marble is converted into electric energy because of electromagnetic induction.

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EST *Secondary 4*

MATERIAL WORLD

F. Electricity and electromagnetism
  2. Electromagnetism
    c. Magnetic field of a solenoid
      i) Describes the magnetic field produced by a solenoid (right-hand rule or left-hand rule)

In *Marble Generator*, students will recognize that an electric current is induced by the magnet moving through the solenoid (cylindrical coil of wire). Students can discuss how the magnetic field can vary if the size of the magnet is changed.

      ii) Names ways of changing the intensity of the magnetic field produced by a solenoid (nature of the core, intensity of the current, number of turns)

Students learn that the moving marble induces an electric current. When the marble moves quickly through the coil, a stronger current is produced because the magnetic field changes. If the marble is not moving at all, the magnetic field remains constant and no current is induced in the circuit.

TECHNOLOGICAL WORLD

C. Electrical engineering
  e. Other functions
    i) Describes the function of certain electronic components (condenser, diode)

In this activity, students will come to understand how the marble generator works. They can describe the function of the components involved in the generator, including the marble, coiled wire, and the LED.

APPLIED GENERAL EDUCATION PATH

CYCLE 2 (Gr. 9-10) — Secondary 4

MATERIAL WORLD

F. Electricity and electromagnetism
  1. Electricity
    d. Electrical currents
      i) Describes the function of different elements of an electrical circuit (e.g. the wires transmit electrons along the circuit, resistors transform electrical energy into another form of energy)

In *Marble Generator*, students will recognize that an electric current is induced by the magnet moving through the coiled conducting wire. This causes the LED to light up.

2. Electromagnetism
   c. Magnetic field of a solenoid
      i) Describes the magnetic field produced by a solenoid (right-hand rule or left-hand rule)

In *Marble Generator*, students will recognize that an electric current is induced by the magnet moving through the solenoid (cylindrical coil of wire). Students can discuss how the magnetic field can vary if different sized magnets are used.

      ii) Names ways of changing the intensity of the magnetic field produced by a solenoid (nature of the core, intensity of the current, number of turns)

Students learn that the moving marble induces an electric current. When the marble moves quickly through the coil, a stronger current is produced because the magnetic field changes. If the marble is not moving at all, the magnetic field remains constant and no current is induced in the circuit.

TECHNOLOGICAL WORLD

C. Electrical engineering
   d. Transformation of energy (electricity and light, heat, vibration, magnetism)
      i) Associates the transformation of energy with different components of a circuit (e.g. bulbs transform electrical energy into light and heat)

In this activity, students will recognize that the marble must be in motion in order to induce an electric current through the coiled wires. The kinetic energy of the marble is converted into electric energy because of electro-magnetic induction.

   e. Other functions
      i) Describes the function of certain electronic components (condenser, diode)

In this activity, students will come to understand how the marble generator works. They can describe the function of the components involved in the generator, including the marble, coiled wire, and the LED.

Techniques

A) Technology
   2. Manufacturing
      a. Safely using machines and tools
         i) Uses tools safely (e.g. retractable utility knife, hammer, screwdriver, pliers)
      f. Assembling and disassembling
         ii) Chooses the appropriate tools
         iv) In the case of electrical circuits, identifies and gathers the electrical components
         vii) Connects the components using wire, connectors or solders

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Strategies

A. EXPLORATION STRATEGIES

3. Referring to similar problems that have already been solved
5. Drawing a diagram for the problem or illustrating it
6. Formulating questions
7. Putting forward hypotheses (e.g. individually, in teams, as a class)
9. Anticipating the results of his or her approach
10. Imagining solutions to a problem in light of his or her explanations
11. Taking into account the constraints involved in solving a problem or making an object (e.g. specifications, available resources, time allotted)
12. Examining his or her mistakes in order to identify their source
13. Using different types of reasoning (e.g. induction, deduction, inference, comparison, classification)
14. Using empirical approaches (e.g. trial and error, analysis, exploration using one's senses)
15. Ensuring that the procedure is appropriate and safe and making the necessary adjustments

B. INSTRUMENTATION STRATEGIES

3. Using technical design to illustrate a solution (e.g. diagrams, sketches, technical drawings)
4. Using different tools for recording information (e.g. diagrams, notes, graphs, procedures, logbook)
5. Using a variety of observational techniques and tools
6. Selecting suitable techniques or tools for observation

C. ANALYTICAL STRATEGIES

1. Identifying the constraints and important elements related to the problem-solving situation
3. Using different types of reasoning (e.g. inductive and deductive reasoning, comparison, classification, prioritization) in order to process information
4. Reasoning by analogy in order to process information and adapt scientific and technological knowledge

D. COMMUNICATION STRATEGIES

3. Exchanging information
4. Comparing different possible explanations for or solutions to a problem in order to asses their relevance (e.g. full-group discussion)
5. Using tools to display information in various formats (e.g. data tables, graphs, diagrams)