a WOW Lab BLUEPRINT

Invisible Energy

Quebec - Achievements and Competencies

Learning Outcomes

Cycle 2 (Gr. 9-10)
Electricity
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
        b. Static electricity
            i) Describes static electricity as the transfer of electrons from one body to another

In *Invisible Energy*, students will describe how an electric charge works, and how the static electricity produced creates an electric field. This electric field allows the fluorescent light bulb to illuminate when it is held radially to the Van de Graaff.

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)
        ii) Describes the energy transformations that take place in electrical or electronic appliances (e.g. in a cell phone, electricity is transformed into light for the display and vibrations for the sound)

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In this activity, students will use a Van de Graaff generator and learn how it works and how it could be used to light up a fluorescent light bulb. They should recognize the transformation of energy that takes place in this activity, learning that when the bulb is held radially, it intersects different equipotential surfaces, resulting in a voltage difference which illuminates the tube and causes it to give off light and heat energy.

STE Secondary 4

MATERIAL WORLD

F. Electricity and electromagnetism
  1. Electricity
    g. Electrical field
      i) Describes qualitatively the effect of an electrical field on electrically charged particles

In *Invisible Energy*, students will describe how an electric charge works, and how the static electricity produced creates an electric field. This electric field allows the fluorescent light bulb to light up when it is held radially to the Van de Graaff. Students should analyze and describe the interaction of the electric field and the fluorescent bulb to explain how the light bulb becomes illuminated.

    h. Coulomb's Law
      i) Applies the mathematical relationship between the electrical force, the magnitude of the electrical charges and the distance separating these charges ($F = kq_1q_2/r^2$)

In this activity, students apply Coulomb's Law to describe the electrostatic interaction between electrically charged particles.

APPLIED GENERAL EDUCATION PATH

CYCLE 2 (Gr. 9-10) — Secondary 4

MATERIAL WORLD

F. Electricity and electromagnetism
  1. Electricity
    b. Static electricity
      i) Describes static electricity as the transfer of electrons from one body to another

In *Invisible Energy*, students will describe how an electric charge works, and how the static electricity produced creates an electric field. This electric field allows the fluorescent light bulb to light up when it is held radially to the Van de Graaff.

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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)
  - ii) Describes the energy transformations that take place in electrical or electronic appliances (e.g. in a cell phone, electricity is transformed into light for the display and vibrations for the sound)

In this activity, students are using the Van de Graaff to illuminate a fluorescent light bulb. They will learn how the Van de Graaff works and how it could be used to light up a fluorescent light bulb. They should recognize the transformation of energy that takes place in this activity, learning that when the bulb is held radially, it intersects different equipotential surfaces, resulting in a voltage difference which illuminates the tubes and causes it to give off light and heat energy.

Techniques

B. SCIENCE
- a. Safely using laboratory materials and equipment
  - i) Uses laboratory materials and equipment safely (e.g. allows hotplate to cool, uses beaker tongs)

Strategies

A. EXPLORATION STRATEGIES
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
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
16. Collecting as much scientific, technological and contextual information as possible to define a problem or predict patterns

B. INSTRUMENTATION STRATEGIES
3. Using technical design to illustrate a solution (e.g. diagrams, sketches, technical drawings)
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)