a WOW Lab BLUEPRINT

Light-Bending Jell-O

Quebec - Achievements and Competencies

Learning Outcomes

Cycle 2 (Gr. 9-10)	Physics (Sec. 5)
Deviation of light waves	Geometric optics

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 3

MATERIAL WORLD

E. Waves
- f. Deviation of light waves
  - iii) Describes how light rays are deviated when they pass through the surface of a translucent substance

In *Light-Bending Jell-O*, students will learn about light and the way it behaves in different mediums - air and Jell-O. When light travels between these two different mediums, it travels at different speeds, resulting in refraction.

APPLIED GENERAL EDUCATION PATH

CYCLE 2 (Gr. 9-10) — Secondary 3

MATERIAL WORLD

E. Waves
- f. Deviation of light waves
  - iii) Describes how light rays are deviated when they pass through the surface of a translucent substance

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PHYSICS - Optional Program

Secondary 5

GEOMETRIC OPTICS

2. Snell's Law (refraction)
    a. Incident and refracted rays
        i) Identifies incident rays and refracted rays in a diagram or an actual situation

In *Light-Bending Jell-O*, students will identify the incident and refracted rays that are created when a laser is pointed at different coloured Jell-O samples. Students should know that the angle of incidence is the angle at which the beam hits the surface of the other medium (in this case, the Jell-O). The angle of refraction is the angle at which the beam travels within the new medium.

    b. Angle of incidence and refraction
        i) Measures the angles of incidence and the angles of refraction in a diagram or an experiment

At Station 1 in this activity, students will measure the angles of incidence and refraction.

    c. Index of refraction
        i) Defines the index of refraction of a medium as the ratio of the speed of light in a vacuum to the speed of light in that medium ($n = c/v$)

In this activity, students calculate the speed of light in Jell-O at Station 1. They measure the angle of incidence and refraction and use the index of refraction for Jell-O to calculate the speed of light in Jell-O.

        iii) Explains qualitatively and quantitatively a phenomenon using the Law of Refraction ($n_1 \sin\Theta_1 = n_2 \sin\Theta_2$) (e.g. a straw in a glass of water)

At Station 2, students use Snell's Law to calculate the critical angle of Jell-O. The data collected throughout the activity allows students to understand how Snell's Law governs the relationships between four different variables: the speed of light in air, the speed of light in different materials, the angle of incidence and the angle of refraction.

Techniques

A) TECHNOLOGY
    2. Manufacturing
        c. Machining and forming
            i) Chooses the appropriate materials, tools, techniques and processes

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)

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Strategies

A. EXPLORATION STRATEGIES

2. Distinguishing between the different types of information useful for solving the problem
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)
8. Exploring various ways of solving the problem
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
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
17. Generalizing on the basis of several structurally similar cases
18. Developing various scenarios

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
2. Dividing a complex problem into simpler subproblems
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)