



Quebec - Achievements and Competencies

Learning Outcomes

Physics (Sec. 5)
Dynamics

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

Specific Expectations

PHYSICS - Optional Program

Secondary 5

DYNAMICS

3. Newton's Laws

- a. Describes qualitatively the law of inertia (Newton's First Law)
- b. Describes qualitatively the relationship between the force acting on a body, its mass and its acceleration (Newton's Second Law)

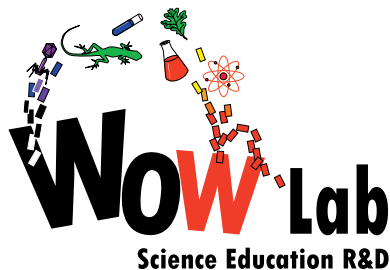
Teachers can use *The Maglev Train* to teach students about Newton's Laws. Students will observe that when an object is in motion, it will stay in motion unless outside forces act upon it. Students can discuss the motion of the train and what forces affect it. They should describe the relationship between the forces acting on the train, the mass of the train, and its acceleration. Students should explain that adding mass to the train will affect its acceleration. They can also list other factors that affect the motion of the train, such as air resistance.

- e. Explains a phenomenon or how a technical object works, using Newton's Laws

In this activity, students will learn about the Meissner effect, superconductivity, and magnetic fields. Students should demonstrate their understanding of these concepts by explaining how the levitated train moves around the track, incorporating Newton's Laws in their explanation.

4. Force of friction

- a. Explains the possible effects of a frictional force (slows down, stops or impedes the motion of a body)
- b. Names the factors that can affect the force of friction in a given situation (e.g. nature of the surfaces that are in contact, shape of a body that is moving in a fluid)



Although the train has no contact with the track, students should identify that the train still experiences the frictional force of air resistance that eventually slows it down. Students can discuss factors that may minimize the air resistance affecting the train, such as changing the body of the train to be more aerodynamic.

Strategies

A. EXPLORATION STRATEGIES

1. Studying a problem or a phenomenon from different points of view (e.g. social, environmental, historical, economic)
2. Distinguishing between the different types of information useful for solving the problem
3. Referring to similar problems that have already been solved
4. Becoming aware of his or her previous representations
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)
13. Using different types of reasoning (e.g. induction, deduction, inference, comparison, classification)
16. Collecting as much scientific, technological and contextual information as possible to define a problem or predict patterns
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

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 assess their relevance (e.g. full-group discussion)
5. Using tools to display information in various formats (e.g. data tables, graphs, diagrams)