**Energy In the Grade 11 Curriculum**



Concept Presentation

By Sean Henderson

**Background Information:**

The Energy and heat unit falls in both the grade 11 and grade 12 university curriculum as the second unit covered in both grades. The Unit is traditionally a breath of fresh air for students as it is less cumbersome than the dynamics unit beforehand.

This presentation will investigate how to make the Energy heat unit fun and interesting for students, while also grounding it in a “real life” framework, in which students will get to reflect and debate the pros and cons of technology in today’s society.

**Map of Concept through Curriculum**

* Grade 1

Understanding Matter and Energy “Energy in our Lives”

Focus: Responsible Energy consumption

* Grade 7

Understanding Earth and Space Systems “Conservation of Energy and Resources”

Focus: Energy creation

* Grade 11 University level

Energy and Heat

Focus: Efficiency and societal implications of technology

* Grade 12 University level

Energy and Momentum

Focus: Energy in collisions

**Overall Expecations**

Grade 11

* D1. analyse technologies that apply principles of and concepts related to energy transformations, and assess the technologies’ social and environmental impact;
* D2. investigate energy transformations and the law of conservation of energy, and solve related problems;
* D3. demonstrate an understanding of work, efficiency, power, gravitational potential energy, kinetic energy, nuclear energy, and thermal energy and its transfer (heat).

Grade 12

* C1. analyse, and propose ways to improve, technologies or procedures that apply principles related to energy and momentum, and assess the social and environmental impact of these technologies or procedures;
* C2. investigate, in qualitative and quantitative terms, through laboratory inquiry or computer simulation, the relationship between the laws of conservation of energy and conservation of momentum, and solve related problems;
* C3. demonstrate an understanding of work, energy, momentum, and the laws of conservation of energy and conservation of momentum, in one and two dimensions.

**Misconceptions**

**Misconception # 1:** Energy can be created or destroyed

Students struggle with the concept of the conservation of energy, especially when “real life” situations seem to show that energy can disappear.

Gizmos or simulated experiments that show that the kinetic and potential energy initially and finally are the same can help students beat this misconceptions. Graphs aid students greatly in comprehending this.

**Misconception # 2:** Work and its connection between unit 1 and unit 2

The concept of work is difficult for students to initially grasp because the definition is different from the way in which they hear it every day. Work links the first unit of force to the second unit of energy through the formulas W=F\*d and W = ΔE. However, the extra step can be difficult for students who struggle with formulas.

Focusing on the fact that work is a name for a change in Energy can help students link Energy with forces.

**Misconception # 3:** Students struggle with the concept of efficiency. They do not intuitively understand that electrical energy is lost as heat.

Light bulbs, and videos illustrating how energy can be lost in collisions help students conceptualize efficiency.

**Misconception # 4:** Students tend to love technology and though they may have a vague understanding of the limitations or negative aspects of the use of technology, often they do not fully understand the implications being wasteful may have to our livelihoods.

This is an excellent opportunity to have class debates, to encourage student enlightenment and activism in the area of energy conservation.

**Advance Preparation/Materials Needed**

1. Prepare demonstrations

*Four stations activity*

Materials needed: rulers, tennis ball, squash ball, weight, DI dice and an Ipod.

Print out instructions beforehand and place them at four separate locations in the room.

*Motion Video Analysis*

Materials needed: Loggerpro (board license, can be downloaded free by IT, email the instructional leader with the serial code of the computer), camera.

Students can create their own videos or download them from the internet.

*Gizmos*

Materials needed: Computer, website is board licensed (IL will give you a login), [www.explorelearning.com](http://www.explorelearning.com).

*Team-Game Tournament*

Materials needed: 30 Questions and answers, numbers, practice questions.

**Applications and Societal Implications**

Power Generation

What kind of power should society be using?

Conservation, how can we limit our use?

Efficiency- Why is it better to buy energy saving light bulbs and appliances?

Athletics

How does the knowledge of energy help manufactures aid athletes in breaking records?

Automotive

How does the transfer of energy in a crash help save lives?

**Lesson Sequence**

*Day 1- Introduction to Energy*

Ask riddle and tell joke. Ask students to describe the physics behind the joke in a literacy activity.

Introduce the concepts of Potential and Kinetic Energy. Solve simple problems.

*Day 2- Law of Conservation of Energy*

Pendulum gizmo- ask students to describe how energy changes in a pendulum.

Introduce the Law of Conservation of Energy. Solve simple problems.

*Day 3- Motion Video Analysis*

Students download a portion of their favorite action movie and analyze whether it obeys the law of conservation of energy.

Concept of Work as a change in Energy is introduced.

*Day 4- Efficiency*

Students calculate the efficiency of simple household items.

Societal implications of Energy loss are introduced.

Students debate the merits of technology within society fishbowl style.

*Day 5- Stations*

Students select 3 of 4 stations to visit to test their understanding of work and energy.

Connection between Energy and Forces is highlighted. More difficult questions are assigned.

*Day 6 – Issue Based Case Study*

Students debate the question “What kind of power should Ontario be generating in the future?”

*Day 7- Team Game Tournament*

*Day 8- Test*

**Assesment and Evaluation**

*Assessment*

Students will have several opportunities to assess their own learning during the unit. Self Assessments will include:

TGT- students test their knowledge of the unit, and during the process review individually and in groups.

Gizmos- students are quized at the end of each gizmo, and are corrected with an explenation if any answers are incorrect.

Peer assessment in group activites- students will assess each others learning in the stations excercises.

Homework checks- allow students to assess their understanding with scafolding and aid from the teacher.

*Evaluation*

Students will be evaluated based on an issue based case study, and a unit test.

Issue-Based Case Study- Students will reasearch various methods of power generation and will come prepared to debate “What power source should Ontario be using in the future?” A written analysis of their findings will be handed in for evaluation.

**Annotated References**

1. Ministry of Education. “Science.” The Ontario Curriculum Grades 1-8 (2007)

Ministry of Education. “Science.” The Ontario Curriculum Grades 9 and 10 (2007)

Ministry of Education. “Science.” The Ontario Curriculum Grades 11 and 12 (2007)

The curriculum documents outline the expectations set by the Ontario Ministry of Education. These expectations are in place in order to focus the classroom teacher’s practice in order to educate the students in the 3 Big Ideas highlighted by the ministry.

1. Website: Gizmos provided by Explore Learning

www.explorelearning .com

This site provides an interactive online simulations that allow students to make predictions, manipulate variables and test their understanding of various concepts in science. The site allows teachers to set up interactive classrooms and observe student progress through the online assessments that accompany the gizmos.

1. O’Mahony, Meg. “Teams-Games-Tournament” October: 2006.

Handout outlining the rules and set up to the TGT cooperative learning review. The Outline, available on TEL, is a teacher friendly resource that makes implementation a breeze. The game allows students to assess their knowledge in a safe yet competitive atmosphere.

1. Website: movietrailers.com

A website that allows visitors to download movie trailers, which students can use in the motion video analysis to see if the physics used in the movie was computer animated or not.

1. Website: www.dispatch.com

A website for the Columbus Dispatch newspaper that had an article relating modern entertainment technology to the societal implications of energy consumption.