

Science 10 Course Outline and Lesson Plans – Mr Fuerderer



Area of Learning: SCIENCE

Grade 10

BIG IDEAS

Genes are the foundation for the diversity of living things.

5 weeks

Chemical processes require energy change as atoms are rearranged.

5 weeks

Energy is conserved and its transformation can affect living things and the environment.

5 weeks

The formation of the universe can be explained by the big bang theory.

3 week

Energy is conserved and its transformation can affect living things and the environment.

Energy is conserved and its transformation can affect living things and the environment.

Sample questions to support inquiry with students:

- Where does energy come from and what happens to it?
- How does energy in the form of radiation affect living things?
- How do energy transformations affect the environment?

- **nuclear energy and radiation:**
 - fission versus fusion
 - **technologies and applications, and implications**
- law of conservation of energy
- **transformation of potential and kinetic energy**
- local and global **impacts of energy transformations** from technologies
- **First Peoples perspectives on energy**
- nuclear energy and radiation:
 - fission versus fusion
 - **technologies and applications, and implications**

- **transformation:**
 - transfer of energy in closed and open systems
 - heat ($Q = mc\Delta T$)
 - roller coasters, pendulums
- **potential:** stored energy (e.g., gravitational PE = mgh)
- **kinetic:** energy of motion ($KE = \frac{1}{2}mv^2$)
- **impacts of energy transformations:** pollution, habitat destruction, carbon dioxide output
- **First Peoples perspectives on energy:** energy use and conservation include generational roles and responsibilities
- **radiation:** ionizing versus non-ionizing
- **technologies and applications:** stars, nuclear power, medical isotopes, tanning beds, dental X-rays, food irradiation, radioactive dating
- **implications:** positive and negative impacts, including environmental, health, economic

BC SCIENCE 10 CHAPTER 8

Kinematics is the Study of Motion

- **Activity: Walk Across Canada.**
- Problems involving the motion of objects travelling at a constant speed.
- Equation $d=vt$ where distance (d) travelled is product of velocity (v) and time (t).
- The System International unit for distance is the meter and time in seconds.
- [Direct Measurement Video: How Fast Are the Skaters?](#)
- How to convert units of m/s to km/hr. [Hewitt screencast on converting units.](#)
- **Activity: Determine the speed of a Battery Operated Toy Car.**

NMSI Energy Pilot Unit Overview Flowchart

- Discuss various types of energies, SI unit is the Joule, other units
- Students can color/hilite the flowchart as we learn about each concept/topic.

Work and Energy are both measured in SI Units called Joules.

- **Energy is the ability to do work**, which means to move something or to change its position or shape or speed. **Potential energy** means “stored energy”. Examples include chemical PE, elastic PE, and gravitational PE. **Kinetic energy** means “energy in motion”. It is related to the mass and speed of an object. **Energy and energy conservation** is one of the most important units of study in physics.
- Energy seems to be the currency of mother nature in that total energy is always conserved.
- SI unit for energy is the Joule, or KJ (thousand), or MJ (million).
- **$W=Fd$** Work done by an applied force in the direction of the displacement. Lifting at constant speed **$W=mgh$** .
- [Eureka videos on Work, Energy, Energy Conservation](#) (see the Index of videos)
 - [Eureka Episode 8: Work](#)

Kinetic Energy is the energy associated with motion. $KE = \frac{1}{2}mv^2$. Velocity plays more of a roll than mass since KE is proportional to v^2 . A golfer can use a heavier club to strike the golf ball, but a faster swing would have more of an effect on the range of the ball.

- Doubling the speed of a car quadruples its kinetic energy and it can do four times as much damage. Video: [Car Crash Tests & Safety Belts \(3 min\)](#)
- [Eureka Episode 9: Kinetic Energy](#)
- [Hewitt Drewitt video on KE and PE \(just watch the 1st few min how to calculate KE\)](#)

Gravitational Potential Energy - [see document in g-drive](#)

- There is no such thing as “absolute potential energy”, all measurements and energies are relative. They depend upon the arbitrarily chosen reference point or base level. **PE = mgh**. The base level of “the system” allows us to calculate relative potential energies because height is measured relative to that reference point. **Work done against gravity = Fd = mgh**. This last equation applies only to object being lifted at constant speed.
- [Eureka videos on Work, Energy, Energy Conservation](#) (see the Index of videos)
 - [Episode 10: Gravitational Potential Energy](#)
- Raise the recycling bin from the floor up to table. Work is positive because both force and distance point up. Returning the bin to the floor, negative work is done since force points up and distance is down. [Hewitt Drew It video: Work and Potential Energy \(6 min\)](#)
- Water travelling over a dam or down a waterfall has gravitational potential energy which decreases as the height decreases. The potential energy is converted into kinetic energy.

Transformation of Potential and Kinetic Energy (Conservation of Mechanical Energy)

- **Mechanical energy** is the sum of potential and kinetic energies of an object.
- **ME = PE + KE**. The Law of Conservation of Energy states that when friction is negligible the total mechanical energy of a system is conserved. PE can be converted to KE and back. Conservation of mechanical energy allows us to solve a variety of problems.
- [Energy Bar Charts animation for cart rolling downhill](#)
- [Phet Skate Park Basic](#) Students will work in the computer lab, one student to a computer. This simulation activity involves students creating a skateboard park and studying the potential and kinetic energies of the rider at various locations along the frictionless track. Important for students to understand the **Energy Bar Charts** which depict that energy changes from one form to another but the total energy remains constant.
- [Phet Pendulum Simulation Energy Transformations of a Pendulum and Energy Bar Charts](#)
- Demo video: [Newton's Cradle \(3min\)](#) and [Conservation of energy \(4 min\)](#)
- Myth Busters video: [Giant Cradle](#) (3 min)
- Lab: Energy Transformations of a Ball - old Science Probe 9 - the one with the bear grabbing the fish

Energy is Transformed in Chemical Reactions, and in Animals and Plants

- Classifying reactions as Exothermic and Endothermic Reactions
- Cellular Respiration and Photosynthesis

BC Science 10 Chapter 7.1 Nuclear Physics Atoms, Isotopes

NUCLEAR ENERGY (CAN BE USED TO PRODUCE ELECTRICITY)

- **Byrne Demo: Radioactive samples and the Gieger Counter.**
- **Radioactivity (decay rate) can be measured in Bq.** Anybody been injected with radioactive tracer or medicine? **Laurens strontium-90 injection and bone scan x-rays**
- **Atoms and isotopes** [Video: Atoms and Isotopes \(5 min\)](#)
- Video: [What are Isotopes](#) (8 min)
- Video: [Discovery of Radioactivity Becquerel, marie and Pierre Curie \(15 min\)](#). **Ask students to record W5 as this video covers one of the most important scientific disco**
- [Veritassium video: Radiation versus Radioactive Atoms](#) (3 min)
- [Veritassium video: The Most Radioactive Places on Earth](#) (11 min)
- [Chem Academy video: Isotopes Explained](#) (10 min)
- Video: [Atoms, Isotopes, Ions and the Periodic Table](#) (8 min)
- Video: [Isotopes and Average Atomic Mass](#) (4 min)

Nuclear Decay and Nuclear Equations

- **Alpha, Beta, Gamma Decay and nuclear equations (transmutation equations)**
- **Alpha, beta and gamma Decay. Refer to Onenote tab for lesson/examples.**
- Conservation of mass and energy
- Nuclear Equations for radioactive decay. Practice Problems pages 295, 296
- Gamma radiation, page 297 practice problems

Chapter 7.2 Half Life

- **Activity page 299 Modelling Radioactive Decay or Radioactive Popcorn**
- Carbon Dating and Radioactive decay curves. Rate of Decay is related to the slope of nuclei vs number of half-lives.
- Page 306 practice problems.
- Common isotope pairs (potassium-40 clock), page 309 practice problems
- Look over page 311 Check Your Understanding
- **Chapter 7.3 Nuclear Reactions (Fission and Fusion)**
- Subatomic particles and symbols for proton, neutron, electron, alpha particle, positron, others?
- Nuclear fission and writing equations, page 315 Reading Check, page 317 Practice Problems
- Chain Reactions and the CANDU Reactors
- **Videos on CANDU Reactors (Fuerderer DVD War in the Nuclear Age episode 6??)**
- Nuclear fusion and writing reactions
- Look over page 325 Check Your Understanding, page 326 Chapter 7 Review
- Look over page 332 Unit Review (Chem and Nuclear)

Fission and Fusion nuclear reactions (example nuclear equations)

- Tremendous amount of energy is derived from a very small quantity of mass is converted into nuclear energy. $E=mc^2$. Nuclear energy can be used to heat water and produce steam to spin the turbine in an electric generator.
- [Video: Fission and Fusion \(6 min\)](#)
- **Look for a better video, this one's not so great** [Video: Nuclear Reactors \(5 min\)](#) CANDU reactors are world-class and used around the world. What do the letters in CANDU stand for? Discuss how the nuclear waste products are still highly radioactive and storage waste challenges.
- Look over page 297 Reading Check, and page 301 Check Your Understanding
- Photovoltaic Cells convert solar energy into electrical energy. Lab to measure how angle of the solar cell affects the voltage? Or compare the brightness of cell phone flashlights via the photovoltaic cell?

Project Ideas for Radioactivity Chapter

- BC Science 10 [Activity page 309 Uses for Radioisotopes](#)
- BC Science 10 [Activity page 312 Nuclear Energy Fact of Fiction](#)
- BC Science 10 [page 323 Evaluating Nuclear Waste Options.](#)
- [Nuclear Power Plants to Produce Electricity](#)
- [Canada's Nuclear Industry \(Nuclear Power\)](#)

Earth's Atmosphere is affected by the transfer of solar energy and thermal energy

- Three methods of heat transfer are Convection, Conduction, Radiation
- The Role of GreenHouse Gases

Temperature, Thermal Energy, and Heat.

- Eureka #21: [temperature vs heat](#) (5 min). SI Unit for temperature is Celsius. Heat is Joules.
- Minute Physics: [Can Humans Really Feel Temperature](#) (3 min)
- video: [There's No Such Thing as Cold](#) (5 min)
- [Veritassium video: Misconceptions About Temperature](#) (4 min)
- [Veritassium Video: Misconceptions About Heat Baking Pan and Cake](#) (5 min)
- **Thermal Energy** is the total molecular KE, it depends upon temperature and mass.
- **Heat** is thermal energy which flows from hot to cold. Thermal energy always flows from higher temperature regions to lower temperature regions.

Specific Heat Capacity and $Q = mc\Delta T$

- Lab: burning a peanut, chip - old Science Probe lab
- PHet Simulation Energy forms and changes.
- Old Sc Probe 9 Activity 20C

Project and Research Ideas - suggest that pairs of students choose one topic below. They can create a PowerPoint, Prezi, video, model, etc to present to the class.

- Rubber Band Powered Toy Car Challenge?

- Built a Whatz It Machine that shows various energy transformations
- Build a solar powered toy car. Solar energy is absorbed by the chlorophyll in green plants and used in the process of photosynthesis to produce food and oxygen. Producers produce their own food and are at the bottom of the food pyramid which supports all life on earth. Light energy can be converted into electrical energy by a photovoltaic cell (solar cell). Students can observe how the closeness and angle of the incident light affects the motion of the solar power toy car.
- Research how fossil fuel combustion is contributing to global warming by explaining the effects of "greenhouse gases.
- Research Electric Cars. Reasons why is it taking so long for their widespread adoption?
- Research What are the pros/cons of using nuclear energy to produce electricity?
- Research Nuclear Power in Canada and Internationally. Where in Canada do we have nuclear reactors? Which other countries use nuclear energy for electricity?
- Research Nuclear waste and storage. Nuclear waste poses a long-term environmental challenge. What are some of the ways nuclear waste is stored?
- Research The Japan earthquake and tsunami damaged the Fukushima? nuclear power plant. What was the extent of the damage and how is the area dealing with the aftermath of the damage?
- Research Nuclear weapons pose a threat to our planet. History of their development and use in WW2.
- Other ideas? Discuss your ideas with the teacher before you begin any project/research.

- **local and global impacts of energy transformations from technologies**

Electrical Energy Production

- BC Hydro PowerPoint on Electrical Energy Dependence over the last 100 years.
- **Electricity energy can be produced by the transformation of various energy types into electrical energy.** Students should understand the basic principles in the production of electrical energy via these methods. In many cases thermal energy is used to produce steam which spins a turbine inside of a generator. In other cases mechanical energy is used to spin the turbine. Students should research each of the following and classify as renewable or non-renewable resource for the production of electricity. They should also compare the pros/cons of each method.
- Video: [Electricity Distribution](#) (19 min), Video: [The Power Wheel](#) (2 min)
- Alternatives to fossil fuel combustion: a discussion on Fatberg as a way of generating energy (biodiesel) from waste.
 - Wikipedia on [Fatberg](#)
 - [Youtube news story on Fatberg](#)
- Dragons Den Electricity Production Task
- Pipelines to transport oil. Can Canada's economy and society get by without oil?

[Video: Engineers Concerned About Ships Colliding with 2nd Narrows Bridge \(2 min\)](#)

- Hydroelectricity
- Fossil Fuels
- Solar
- Wind
- Tidal
- Nuclear
- others?

● **First Peoples perspectives on energy**

First Nations Perspective on Energy???

- [SD41 Aboriginal Program Supporters: Lyn Daniels & Shelly Janvier. Both are on district email.](#)
- Can Meghan (Byrne Pro-d guest speaker, Nov 25, 2016) offer us any ideas/lessons??
- Food chains and food webs