# SPH3U UNIVERSITY PHYSICS

ENERGY & SOCIETY

- Introduction (P.216-219)

## Energy Use & Production

*Canada is one of the leading producers of energy in the world, and is also one of its biggest users. We use energy for many purposes, including transportation, heating, cooling, industrial production, and leisure. Most of the energy produced in Canada is from coal, crude oil (including gasoline and diesel), natural gas, and radioactive elements such as uranium.*

***NOTE!***

*Not only does the extraction of these resources from the ground create problems but when they are used to generate electricity, gases are released into the atmosphere, contributing to climate change.*



## Energy Use & Production

*As a result, we are constantly searching for cleaner and "greener" ways of producing electricity. One promising solution is to use wind to produce electricity. Wind turbines provide an environmentally friendlier way of generating electricity. Large groups of turbines, called wind farms, may provide electricity for an entire community.*

***NOTE!***

*Wind turbines are not without controversy. Their location as well as the health effects have come under scrutiny in many communities that have been identified as suitable locations.*

## Energy Use & Production

*Wind turbines are only one of many exciting technologies being designed to reduce our reliance on non-renewable resources. Other alternative energy technologies include solar cells, geothermal systems, tidal turbines, and biofuels.*

***NOTE!***

*With increasing energy costs, companies must use energy effectively and effectively to be productive. Reducing energy use and minimizing energy waste are also important issues.*



## Overall Expectations

By the end of this unit, students will:

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



## Big Ideas

Concepts that students should retain long after this course are:

- Energy can be transformed from one type to another.
- Energy transformation systems often involve thermal energy losses and are never 100% efficient.
- Although technological applications that involve energy transformations can affect society and the environment in positive ways, they can also have negative effects, and therefore must be used responsibly.

## Getting Started: Useful Concepts & Skills

**CONCEPTS REVIEW**

1. Look at the drawing below.
   (a) List all the forms of energy you can find in the drawing.



## Getting Started: Useful Concepts & Skills

**CONCEPTS REVIEW**

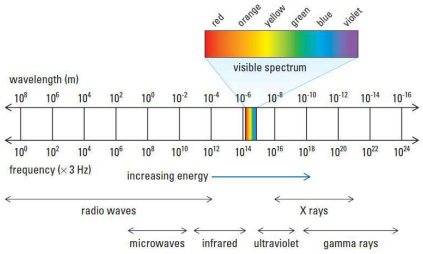
1. (b) List several examples of energy transformations you can tell are happening in the drawing. (For example, the TV is changing electrical energy into sound energy and light energy.)



## Getting Started: Useful Concepts & Skills

**CONCEPTS REVIEW**

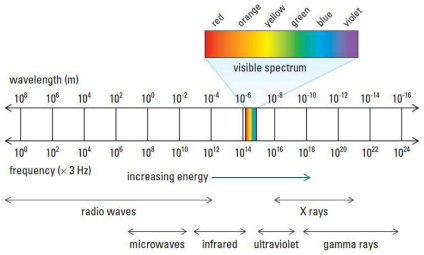
2. (a) What characteristics do the components of the electromagnetic spectrum have in common?



## Getting Started: Useful Concepts & Skills

**CONCEPTS REVIEW**

2. (b) How does visible light differ from the other components of the electromagnetic spectrum?






## Getting Started: Useful Concepts & Skills

**CONCEPTS REVIEW**

3. Energy can be transferred by conduction, by convection, and by radiation. Sketch a diagram, based on the drawing given, and use symbols (for example, particles and waves) to show how these three methods relate to what is happening in the drawing.




## Getting Started: Useful Concepts & Skills

**CONCEPTS REVIEW**

4. (a) Complete the missing data.

| Device | Input Energy (J) | Output Energy (J) | Efficiency (%) |
|---|---|---|---|
| lever | 100 | 90 | 90 |
| incandescent light bulb | 200 | 10 | 5 |
| car | 1000 | 250 | 25 |

## Getting Started: Useful Concepts & Skills

**CONCEPTS REVIEW**

4. (b) Why is the efficiency of a device never 100%? In other words, why is the output energy always less than the input energy?

| Device | Input Energy (J) | Output Energy (J) | Efficiency (%) |
|---|---|---|---|
| lever | 100 | 90 | 90 |
| incandescent light bulb | 200 | 10 | 5 |
| car | 1000 | 250 | 25 |



## Getting Started: Useful Concepts & Skills

**CONCEPTS REVIEW**

5. Describe two advantages and two disadvantages of each of the following systems for generating electrical energy.
   (a) hydroelectric power plant
   (b) nuclear power plant
   (c) coal- or oil-fired power plant





## Getting Started: Useful Concepts & Skills

**SKILLS REVIEW**

6. In an investigation, a student takes a 50 g ice cube from the freezer at a temperature of -6°C and puts it in a cup of water at 70°C. The mass of liquid water present is 50 g. The goal is to determine the final temperature of the water in the cup, assuming there is no loss of energy to the surroundings.
   (a) What other equipment would you need to perform this experiment?
   (b) Make a prediction for the final temperature of the water. Explain.
   (c) What are some possible sources of error in this experiment?
   (d) Describe a way to reduce the error in this experiment.