Energy

Key terms

- Energy
- Work
- System
- Surroundings
- Kinetic energy
- Potential energy
- Law of conservation of energy

Properties of Energy

- Can cause changes in a system
- There are different forms with different characteristics
- Energy can be transferred or transformed
- Physical quantities affect different forms of energy

Types of systems

- A system is anything under observation

- **Open**: mass and energy can be lost or gained from the environment
- **Closed**: mass is conserved within the boundaries of the system, and energy can freely enter or exit the system
- **Isolated**: No interactions with other systems occur

Examples of Systems

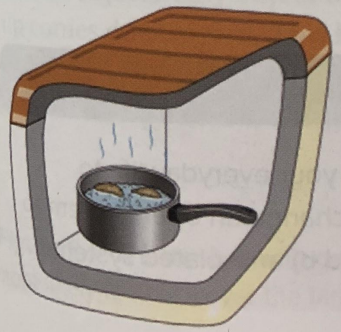
- P 207 from textbook
- Group activity: come up with own examples.

Open System

An uncovered pot of potatoes boiling on the stove is an open system. Thermal energy is transferred from the stove burner to the pot and its contents, as well as to the surrounding cooler air. As the water boils, thermal energy is also transformed into the mechanical kinetic energy of rising steam. As the steam leaves the pot, the system loses both matter and energy to the surroundings.

Closed System

A pressure cooker with potatoes boiling represents a closed system, because the tightly sealed lid prevents loss of matter and energy to the surroundings in steam. Thermal energy can be transferred into the system from contact between the pot and the stove. It also can be transferred out of the system where the pot contacts the surrounding cooler air and through transformation into radiant energy.



Isolated System

The pot of potatoes inside an insulated container represents an isolated system. In theory, the insulation prevents the exchange of any energy or matter between the system and its surroundings. In reality, energy exchange is significantly reduced, but not eliminated entirely. This is because it is hard to completely isolate a system.

2 Forms of Energy

- **Kinetic Energy**: the energy of motion

- **Potential energy**: The stored energy of an object as a result of its condition or its position

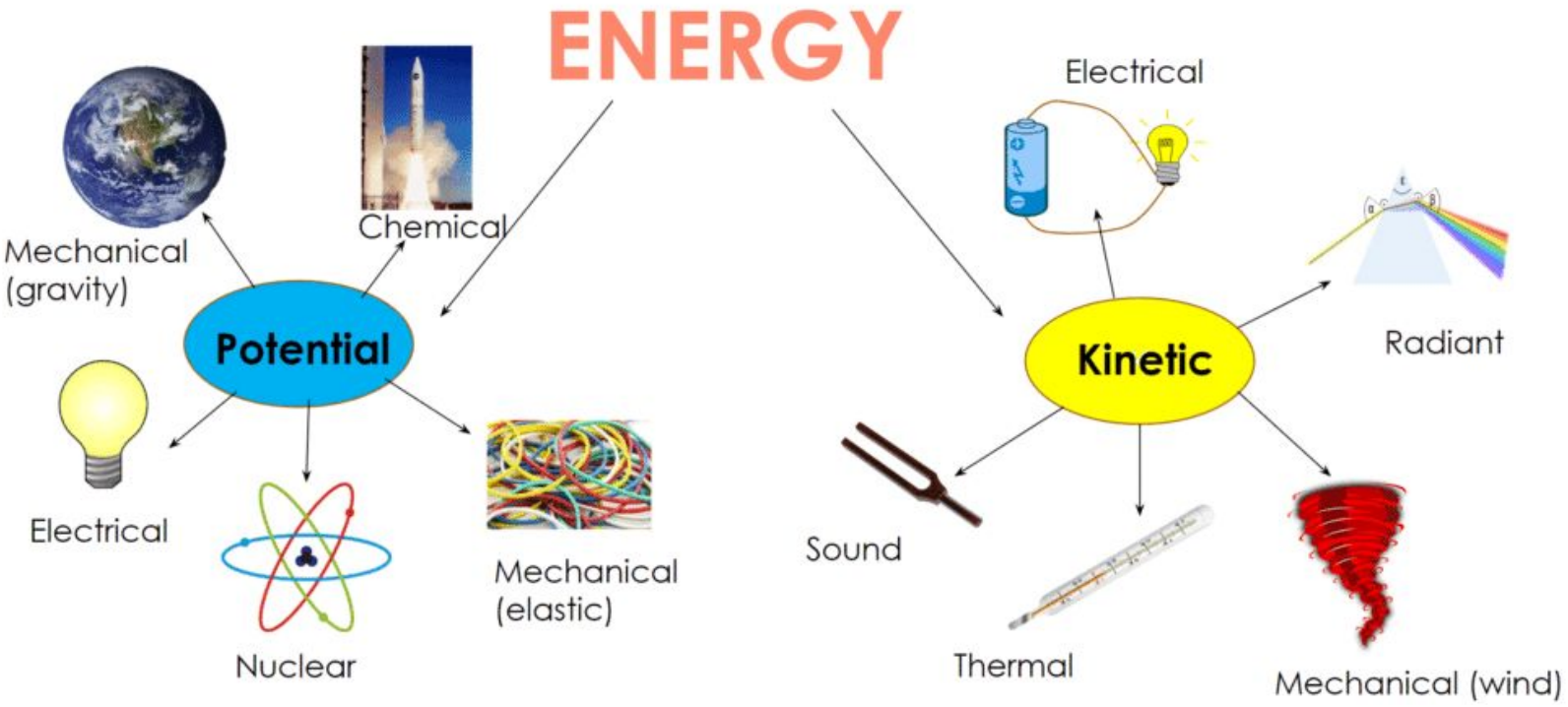
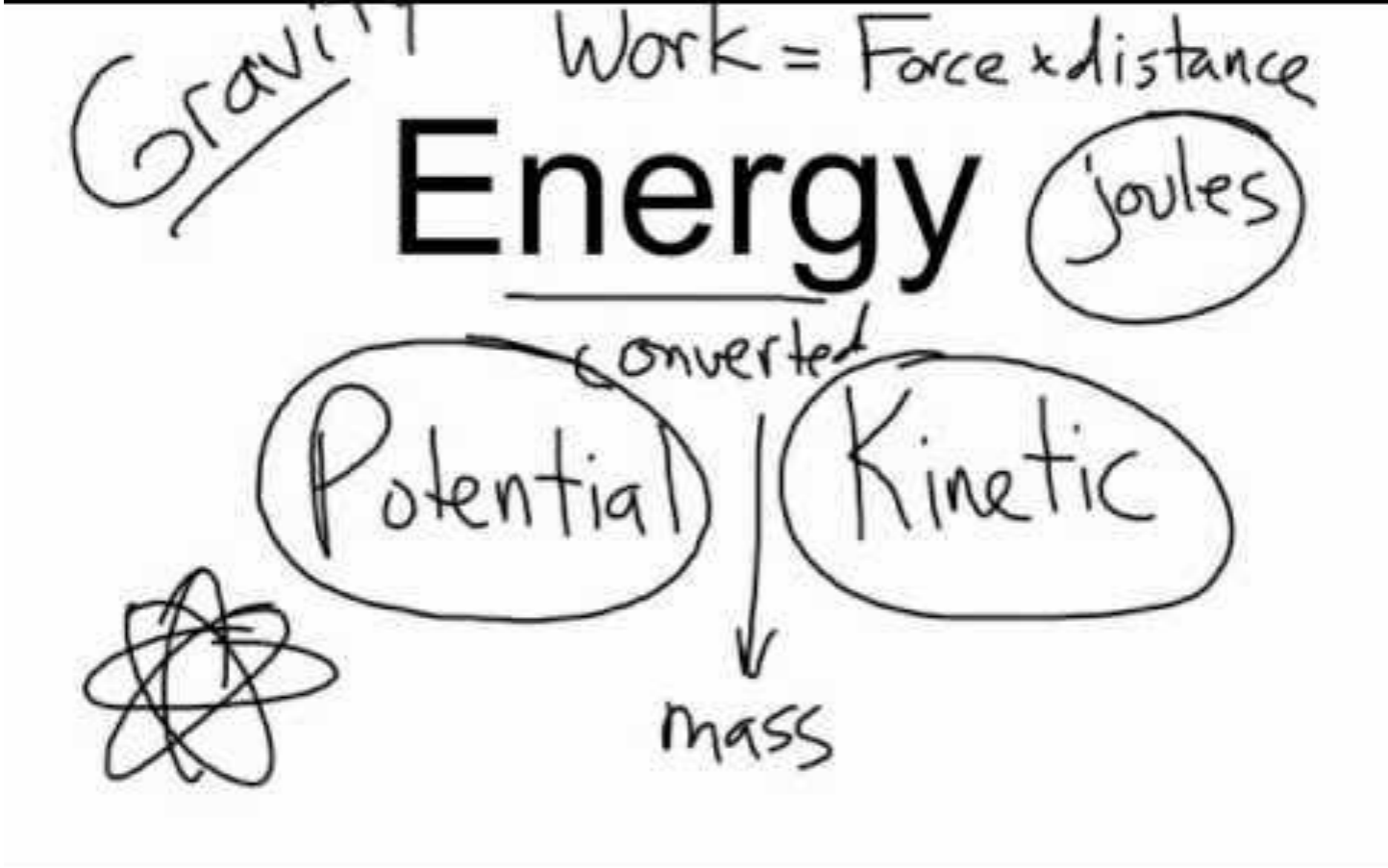


Photo from http://en.stonkcash.com/transformation-of-energy/

Video


Work = Force x distance
Energy
joules
converted
Potential
Kinetic
mass

Examples of Kinetic Energy

- See BC Sci 10 text connections p 203

1. **Mechanical Kinetic Energy**- Energy of motion

2. **Radiant Energy**- energy of electromagnetic waves that radiate from the energy source

3. **Thermal Energy**- energy of particles that make up a substance. (Example: **Heat**- thermal energy transferred from one object to another)

4. **Electrical Kinetic Energy**- energy of electrons through a conductor.

5. **Sound Energy**- Energy of vibrations (disturbances) of the particles that make up matter

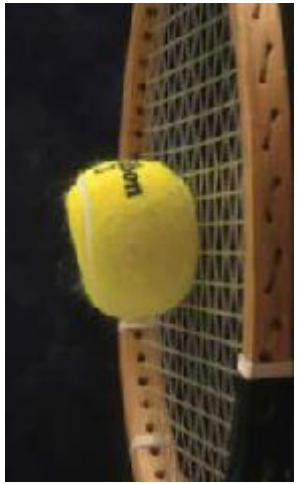
Nimkii Nookomis "Welcome Song" 2014 Great Lakes Indigenous Elders and Medicine Peoples Gathering

Play video from minute mark 1-1:20 for a snippet

Examples of Potential Energy

- See BC Sci 10 Connections p 204-205

1. **Chemical Potential Energy**- energy stored in chemical bonds



2. **Elastic Potential Energy**- energy stored in a stretched or compressed object

3. **Gravitational Potential Energy**- energy relative to a reference point, having to do with an objects position.

4. **Nuclear Potential Energy**- energy stored in the nucleus of an atom

5. **Electrical Potential Energy**- energy stored by a separation of charges (battery/cell)

6. **Magnetic Potential Energy**- energy from magnetic forces

Activity: Energy Sorting Cards

Lab: Energy Stations Lab

Activity

- BC Sci 10 Connections page 209- Energy thought experiments partner then group discussions

Energy Transfer and Transformation

Law of conservation of energy:

Energy is neither created or destroyed… but it is transformed from one type of energy to another, or transferred from one to another

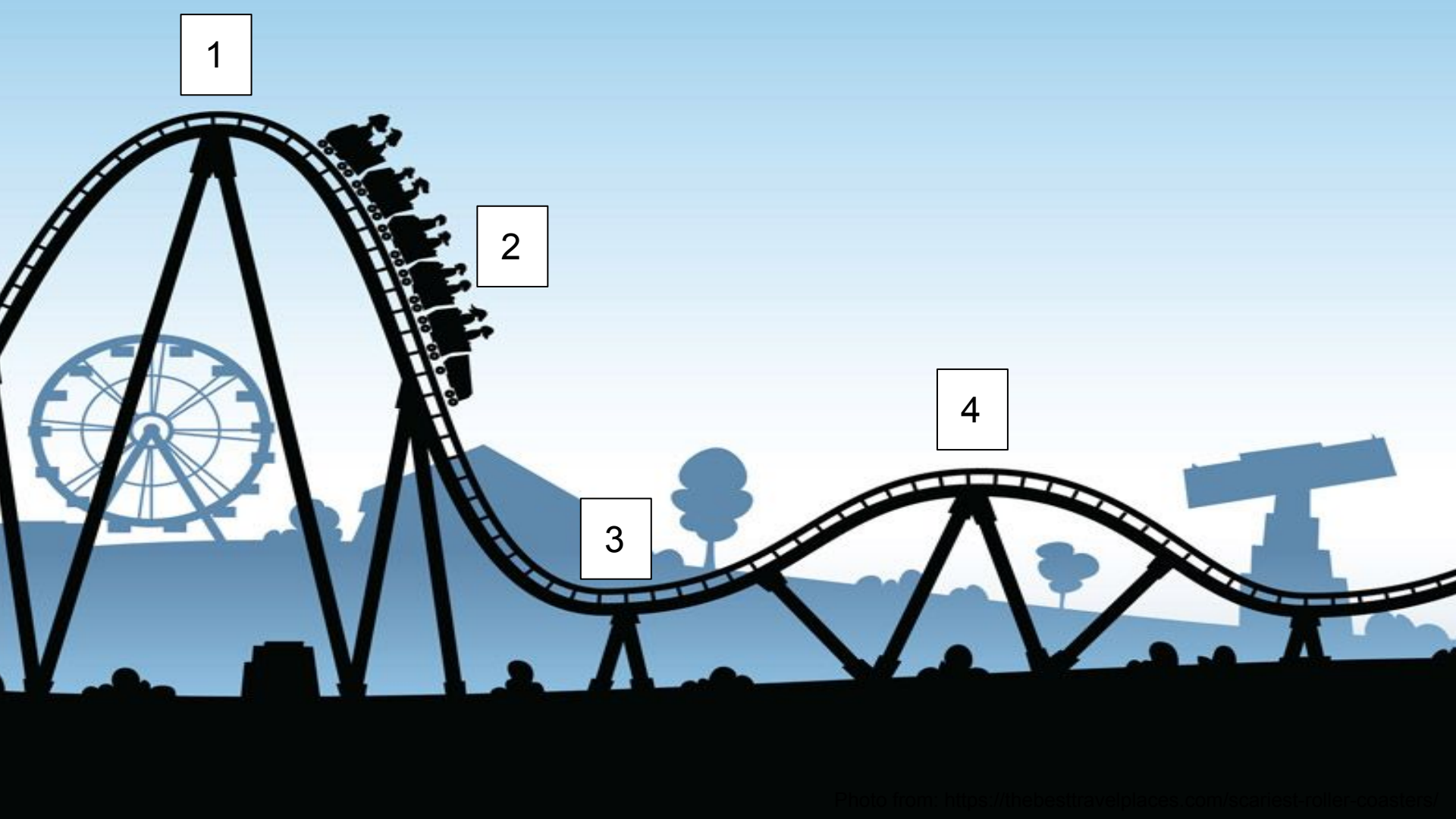


Photo from: https://thebestravelplaces.com/scariest-roller-coasters/

Modelling Conservation of Energy: Workbook Handout p 134 p 1

Calculating Kinetic Energy

$$E_K = \frac{1}{2} mv^2$$

E_K= Kinetic energy (j= joules)

m= mass (kg- kilogram)

v= velocity (m/s- metres per second)

Calculating Gravitational Potential Energy

$E_g = mg \triangle h$

E_g = Gravitational potential energy (Joules: j)

m= mass (kilograms: kg)

g= acceleration due to gravity (metres per second squared: m/s^2)

$\triangle$h= change in height (metre: m)

Practice Problems BC Sci 10 Connections textbook p 214 All questions

- Practice together as a class (#1 model, 2 all together)

- Chalk/board activity for #3, 4

Practice Problems in workbook handout 3.1

Chapter Review

Quiz coming up

Section project: Rube Goldberg Machine

INVESTIGATION 3-A

GUIDED INQUIRY

Build a Rube Goldberg Machine

Skills and Strategies

- Questioning and Predicting
- Planning and Conducting
- Processing and Analyzing
- Evaluating
- Communicating

What You Need

- materials your team's design requires

Rube Goldberg was a prize-wining cartoonist famous for his drawings of fun machines that perform simple tasks in the most complicated way imaginable. Rube Goldberg machines usually employ a lot of different energy transfers and transformations to get the job done.

Question

How can you design and build a machine that uses many different energy transformations and transfers to perform a simple task?

Procedure

1. With your group, choose a task you want to carry out.
2. Design your machine. Sketch your design, complete a list of materials that you will need, and record any safety precautions.
3. Have your teacher approve your sketch, materials list, and safety precautions. Collect the materials you need and build your machine.
4. Test your machine, making any required modifications to improve its performance.

Process and Analyze

1. Identify each different energy transfer and/or transformation that occurs when you run your machine.

Evaluate and Communicate

2. a) Did your machine perform its task as planned? Explain.
   b) How might you change your design to improve its performance?