



Grade 9 Tech. Module

Energy and Power



Introduction

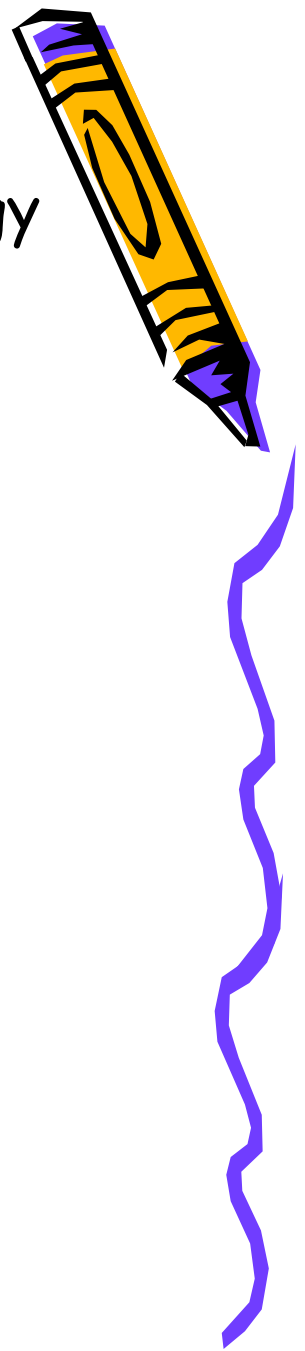
Energy and power technology refers to systems that convert energy from one form to another to perform useful tasks.

The system may:

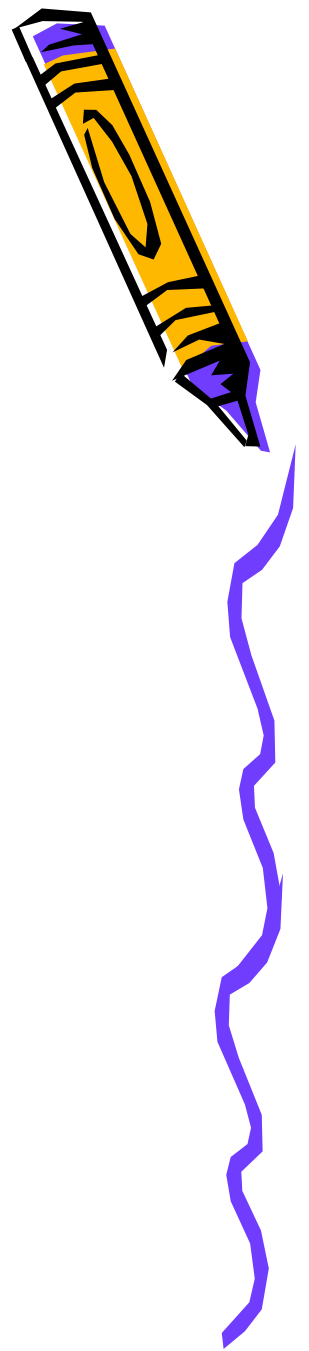
- convert chemical energy into heat energy (ie. a propane fireplace)



- convert mechanical energy into electrical energy (ie. windmill),



- or convert radiant energy into electricity (ie. photovoltaic cell).



Can you name some others?

Introduction

- Unit 1 - Big Ideas
- Unit 2 - Basic Skills
- Unit 3 - Design Activity





Grade 9 Tech. Module

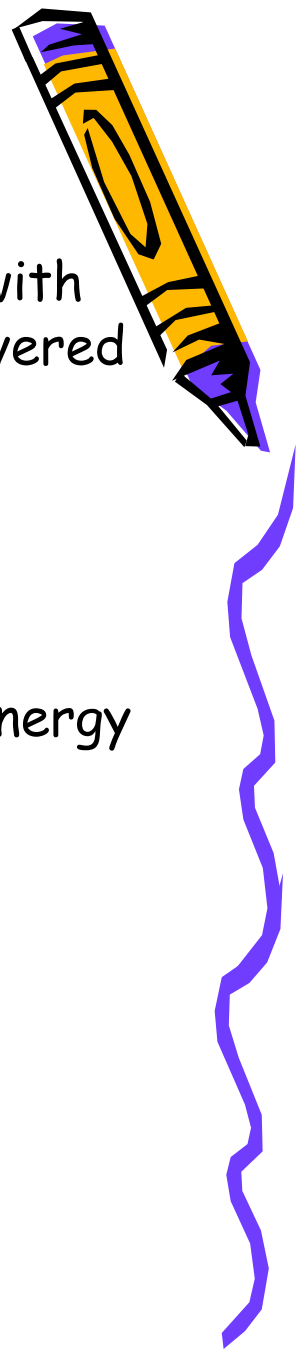
Unit 1-Big Ideas



Introduction

The purpose of the big ideas section is to provide students with an introduction to the ideas, terminology and concepts covered in the module.

- Topic 1: Mass and Force
- Topic 2: Work Energy and Power
- Topic 3: Sources Forms Conversion and Transmission of Energy
- Topic 4: Sources of Energy for Electrical Generation
- Topic 5: Career Connections






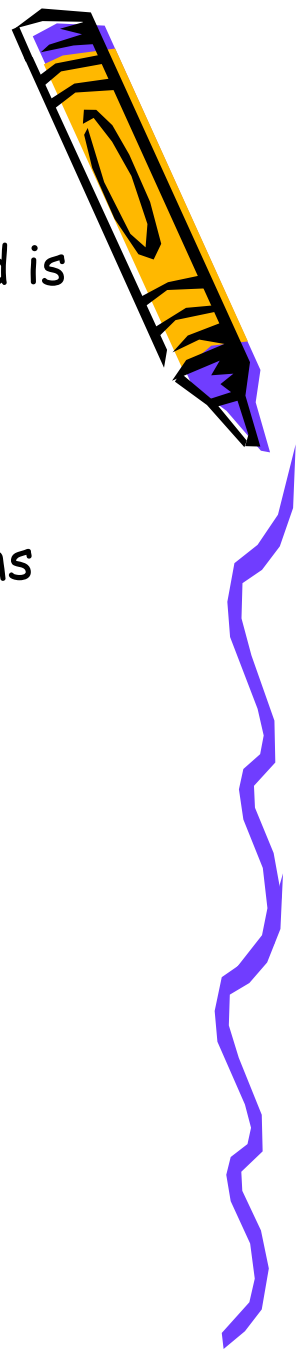
Topic 1: Mass and Force

Mass is a measure of the amount of matter in an object and is measured in kilograms (Kg).

What is matter?

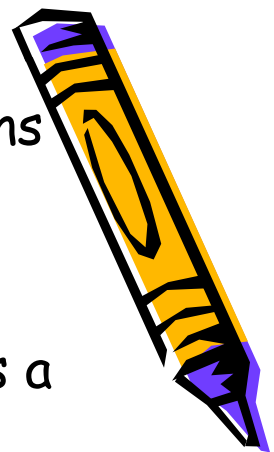
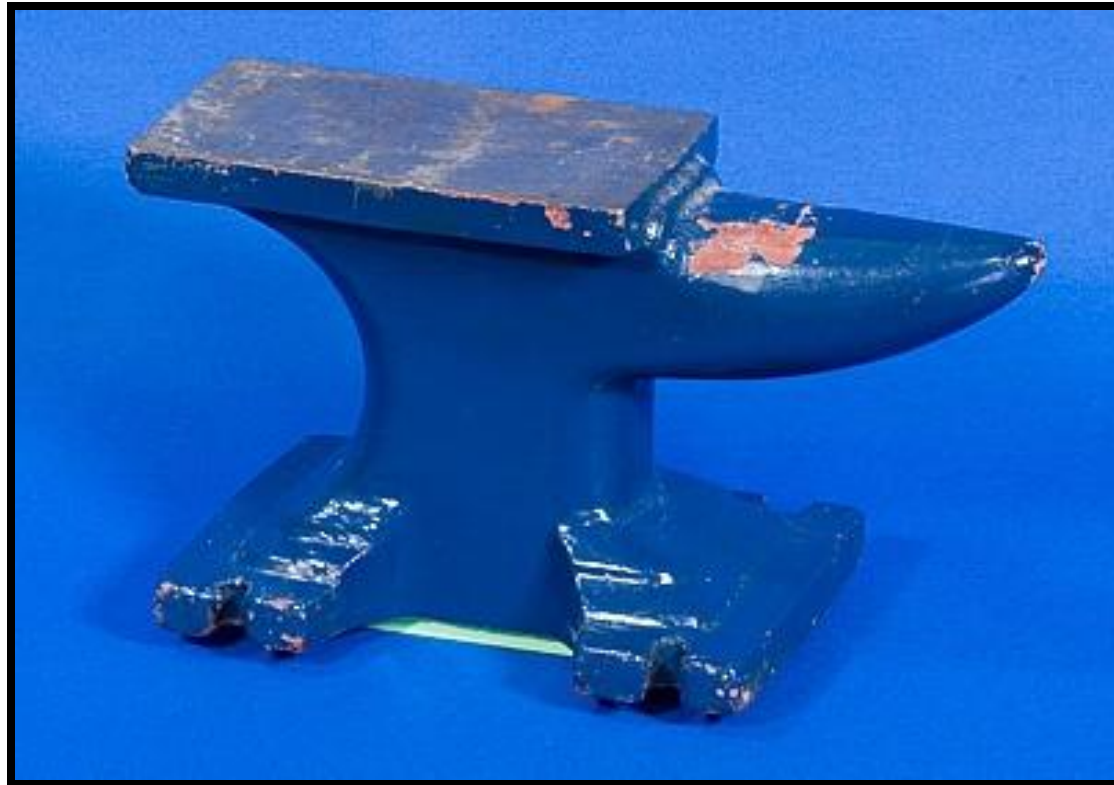
As you already know, everything is made up of atoms. Atoms are constructed from neutrons, protons, and electrons.

Hydrogen	Iron	Lead
		
1 Proton 1 Electron	26 Protons 30 Neutrons 26 Electrons	82 Protons 125 Neutrons 82 Electrons



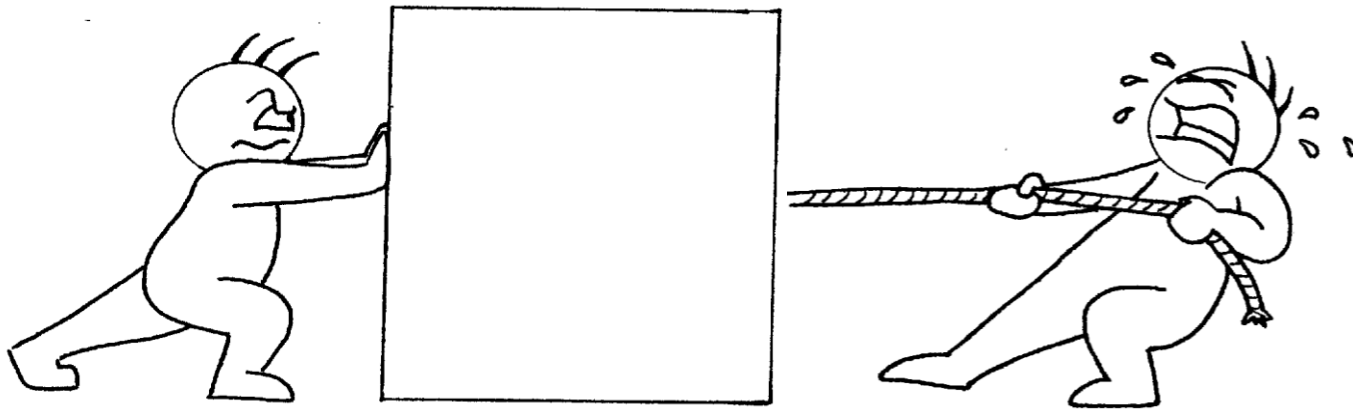
The mass of an atom is determined by the number of neutrons and protons that make up the atom.

Iron atoms have a lot of mass, and consequently the anvil has a lot of mass.

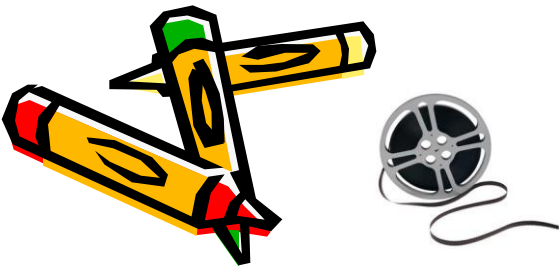


A **force** is the measurement of influences that change the direction of an object.

Basically "a push or pull exerted on an object".



- Who is pushing? Who is pulling?



Watch the Video: Push and Pull



There are many other types of forces: buoyant, magnetic, electrostatic, gravitational, elastic, and frictional.

- Look at the pictures below. Identify the type of force shown in each picture. (click on the picture)



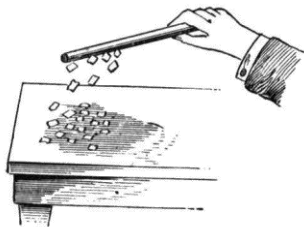
Buoyant



Magnetic



Gravity and Friction



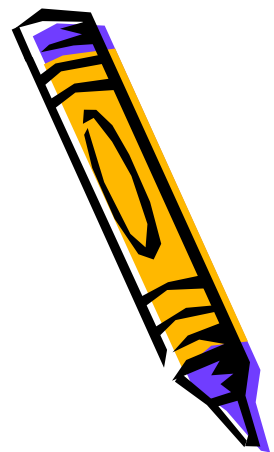
Static



Elastic



Friction



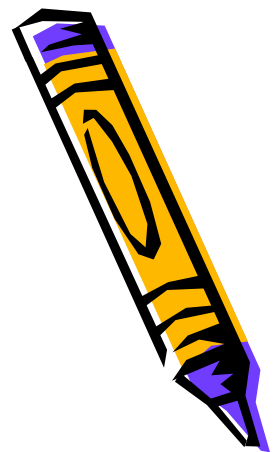
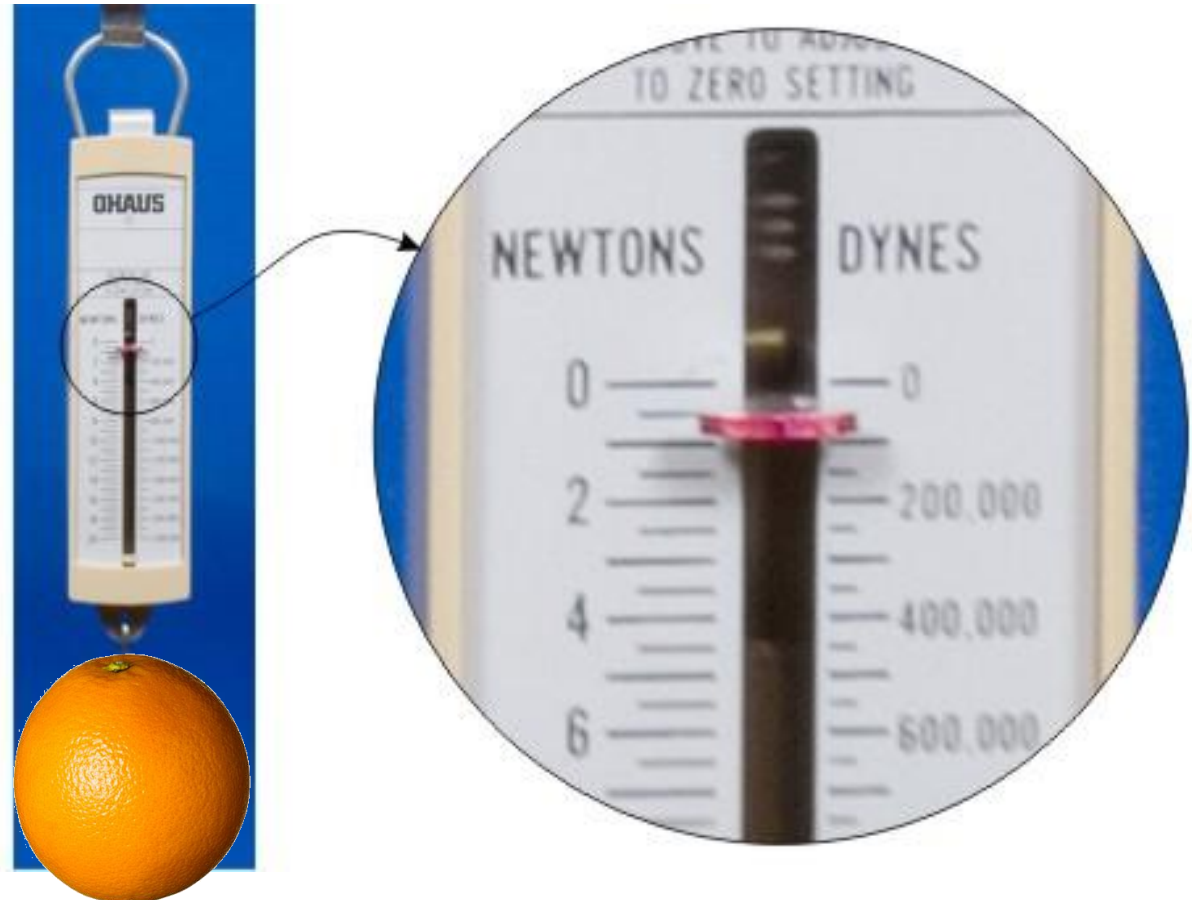
Measuring Force

The standard unit of force is the Newton (N). Named after Isaac Newton



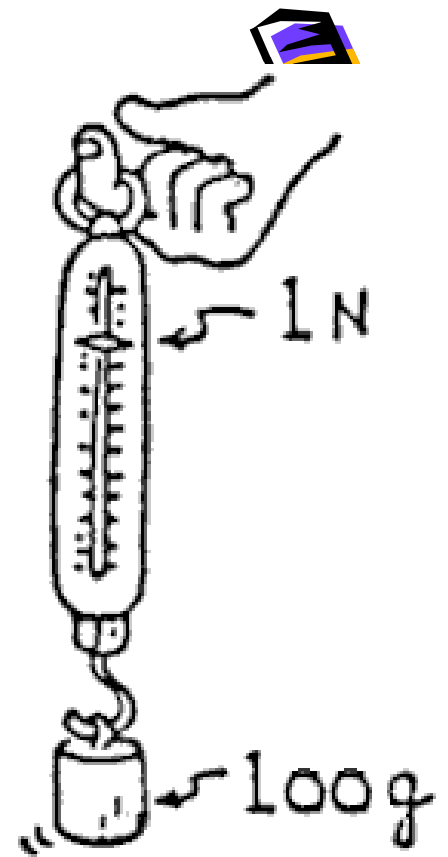
Measuring Force

1 N is approximately the same as the amount of gravitational force the Earth exerts on an object with a mass of 100 grams (ex. An Orange) ($1 \text{ N} = 100 \text{ g}$).

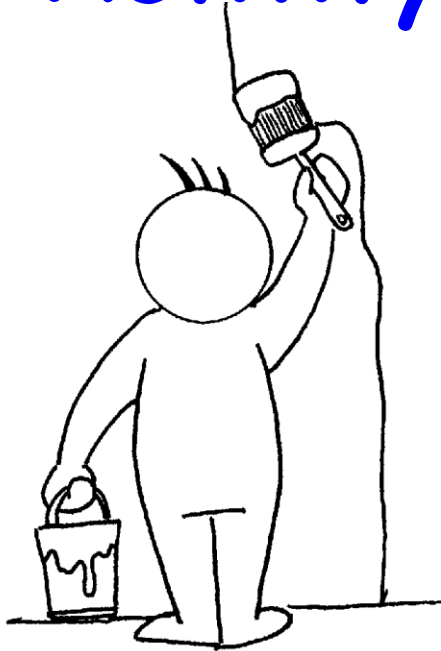


Try it :

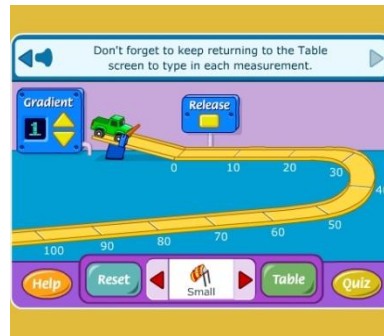
- Use a spring scale to demonstrate 1 Newton of force.
- Estimate the approximate force required to support objects of varying masses.



Activity



Forces in action

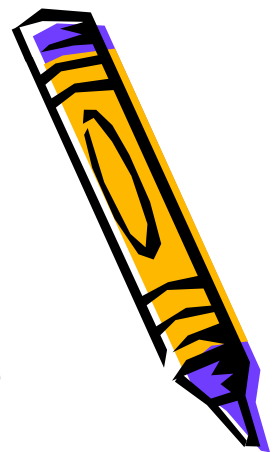


Shockwave Flash
Object

Forces and motion

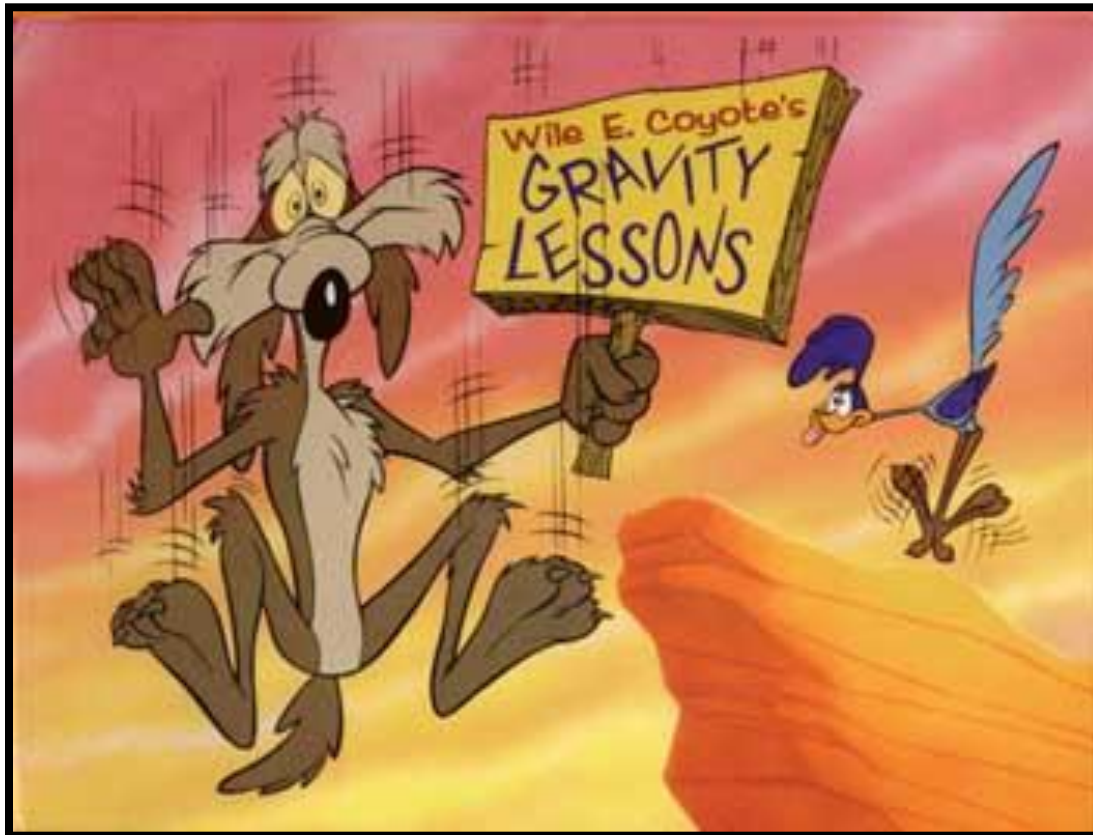


[Click Here](#)



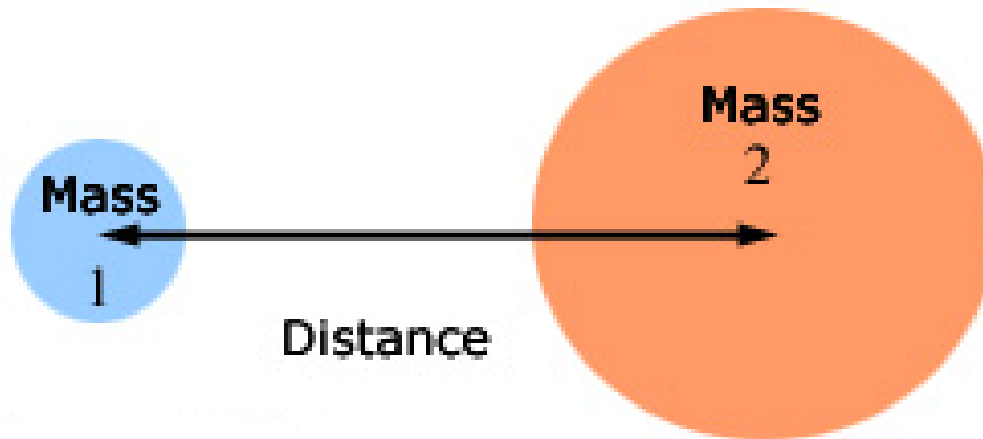
Gravity

- What factors effect the gravitational force experience between two objects?



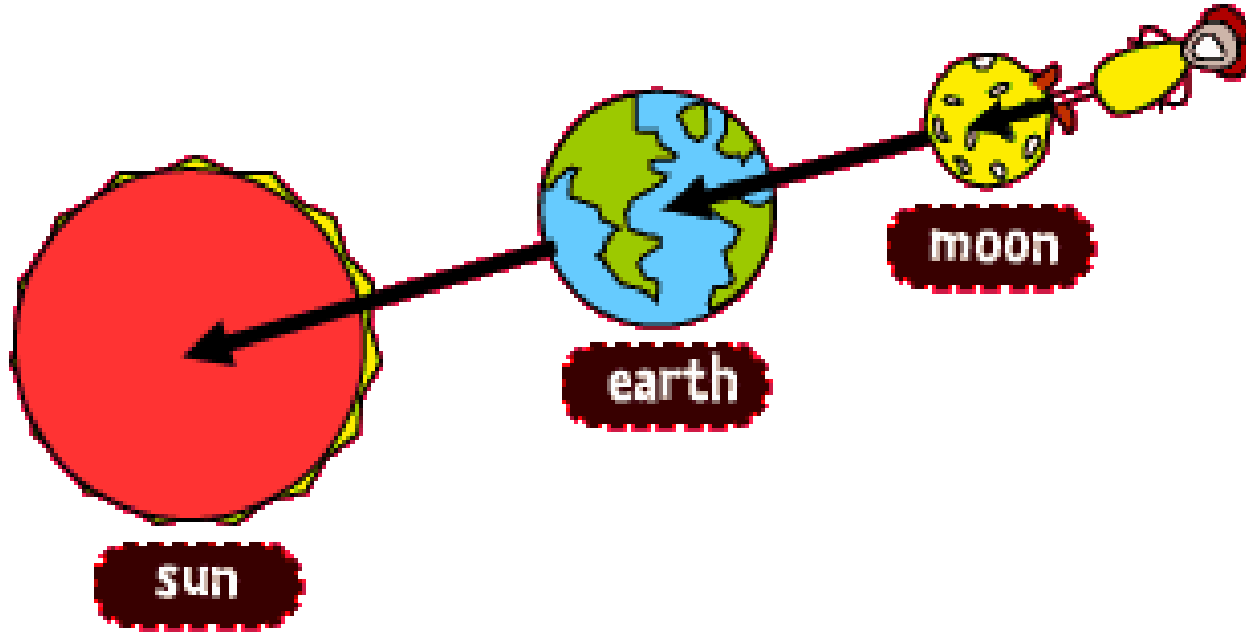
Gravity

Gravity is the force of attraction between two objects having mass.

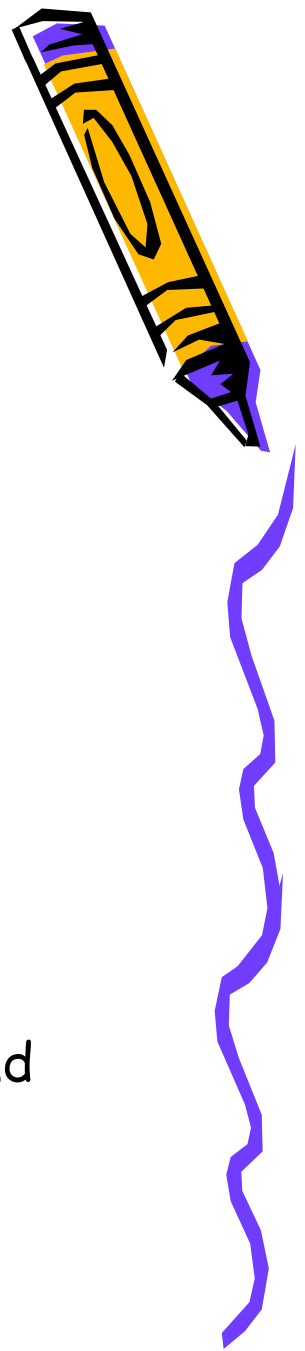


Gravitational force is denoted by the symbol g . Gravitational force at sea level on earth is 9.8 newtons per 1 kg of mass.





- The amount of gravitational force between two objects is related to the mass of the objects and the distance separating them.



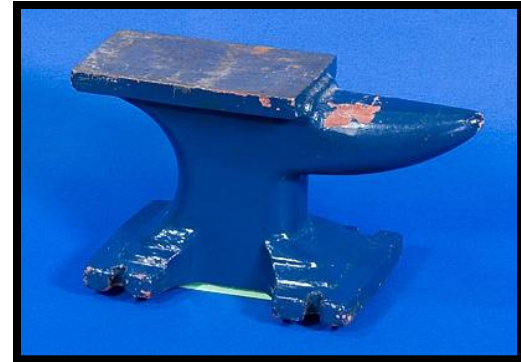
The **weight** (N) of an object is merely a measure of gravity.

- The more massive a body is the stronger its gravitational force.

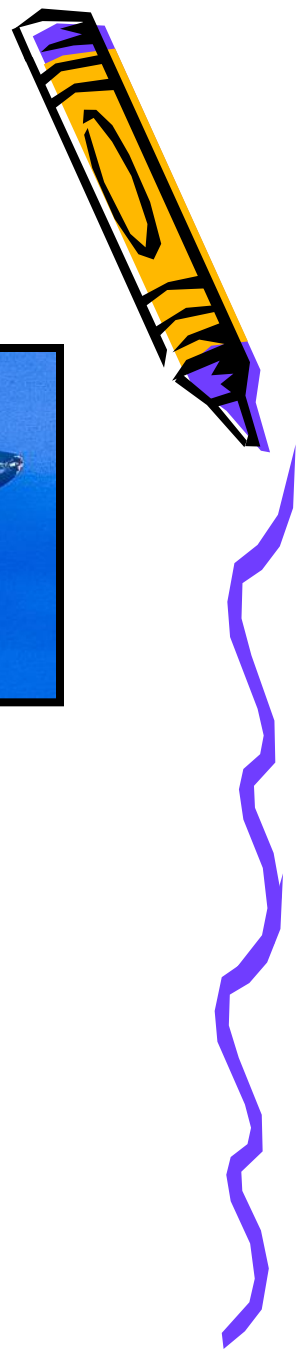
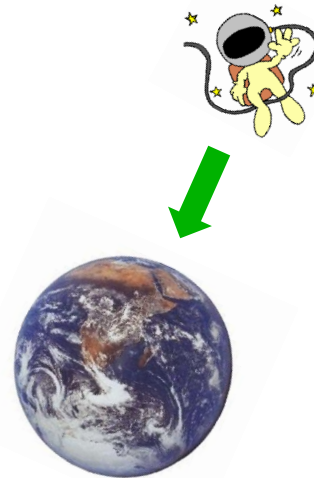


How are weight and mass different?

Mass is a measurement of the amount of matter something contains,

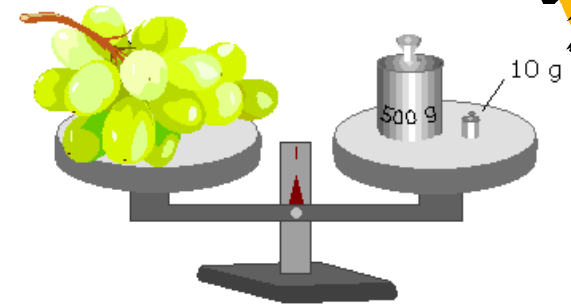


Weight is the measurement of the pull of gravity on an object.



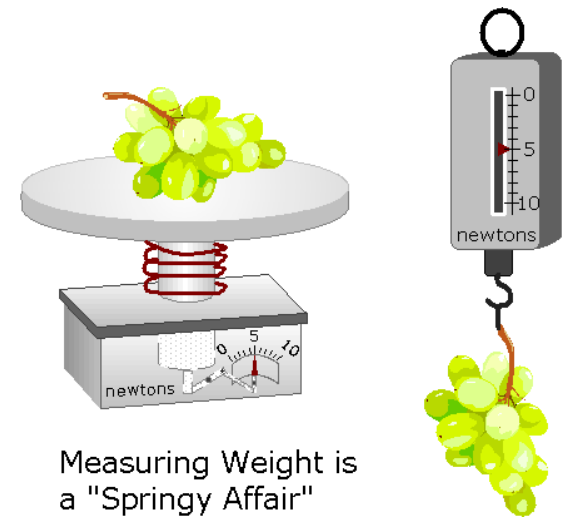
How are weight and mass different?

Mass is measured by using a balance scale.



Measuring Mass is a "Balancing Act"

Weight is measured on a spring scale.

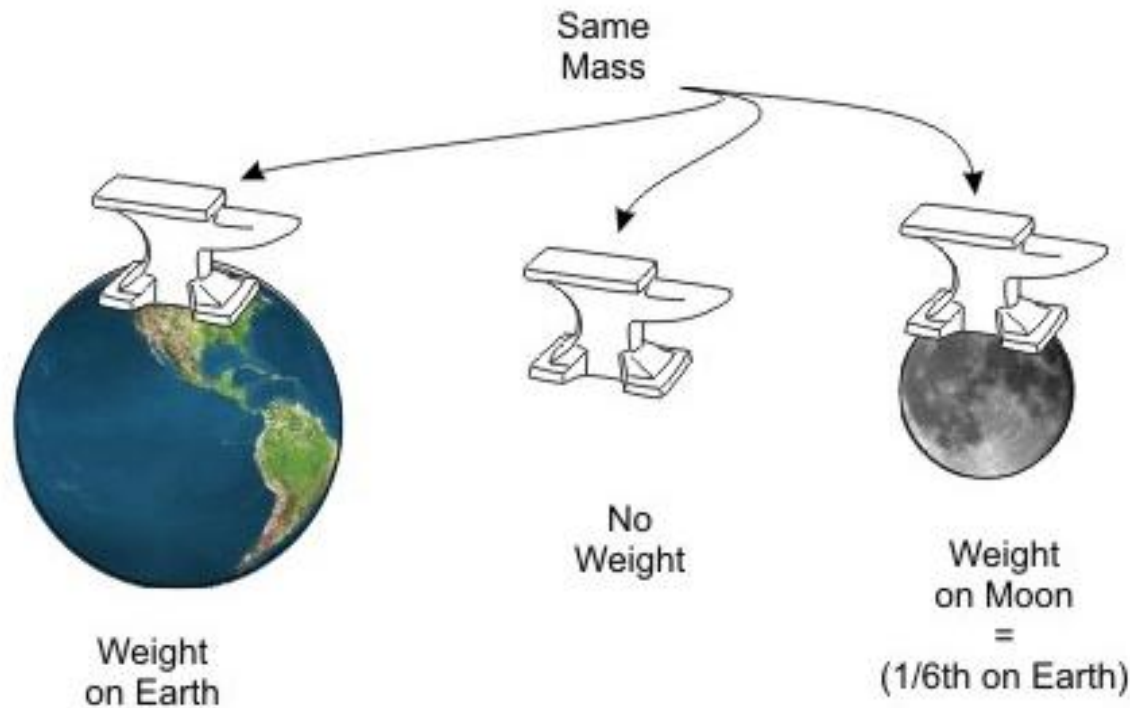


Measuring Weight is a "Springy Affair"

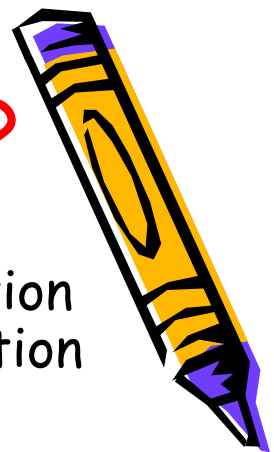


How are weight and mass different?

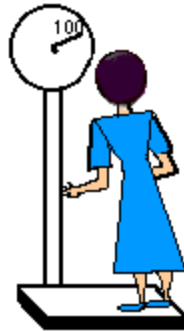
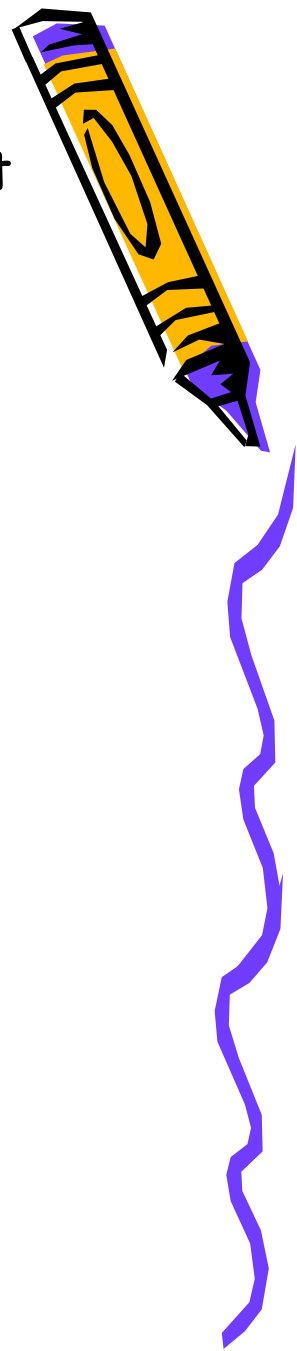
The Mass of an object doesn't change when an object's location changes. Weight, on the other hand does change with location



The anvil is shown in three locations. In each location, its mass is the same. but its weight is very different.

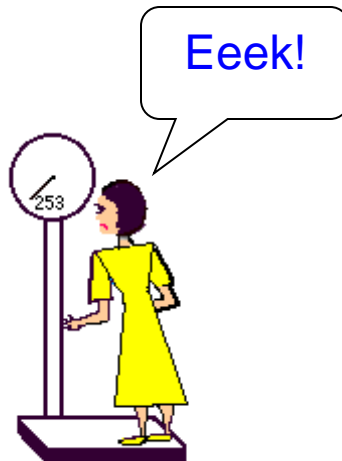


Mrs. Mini Me weighs 100 Newtons on Earth. During a recent galactic holiday she traveled to several different planets. Wishing to maintain her weight, she was careful not to overeat. Each day as she weighed herself she was astonished to discover her amazing weight gain. Can you explain what happened?



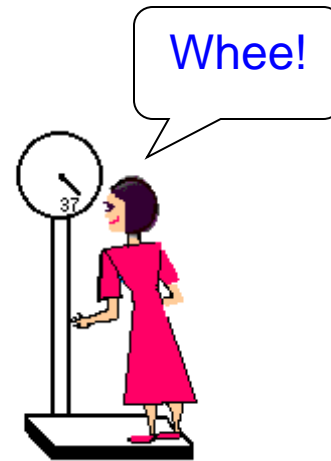
Earth

Mass: 10kg



Jupiter

Mass: 10kg



Mars

Mass: 10kg



Activity



Check it out:

- <http://www.exploratorium.edu/ronh/weight/>
- Or Web file: Calculating weight



- Videos:
 - Magic School Bus - No Gravity (26mins)
 - Weight Introduction (3 mins)
 - Weight vs mass (2 videos)
 - Gravity and Mass (2 mins)

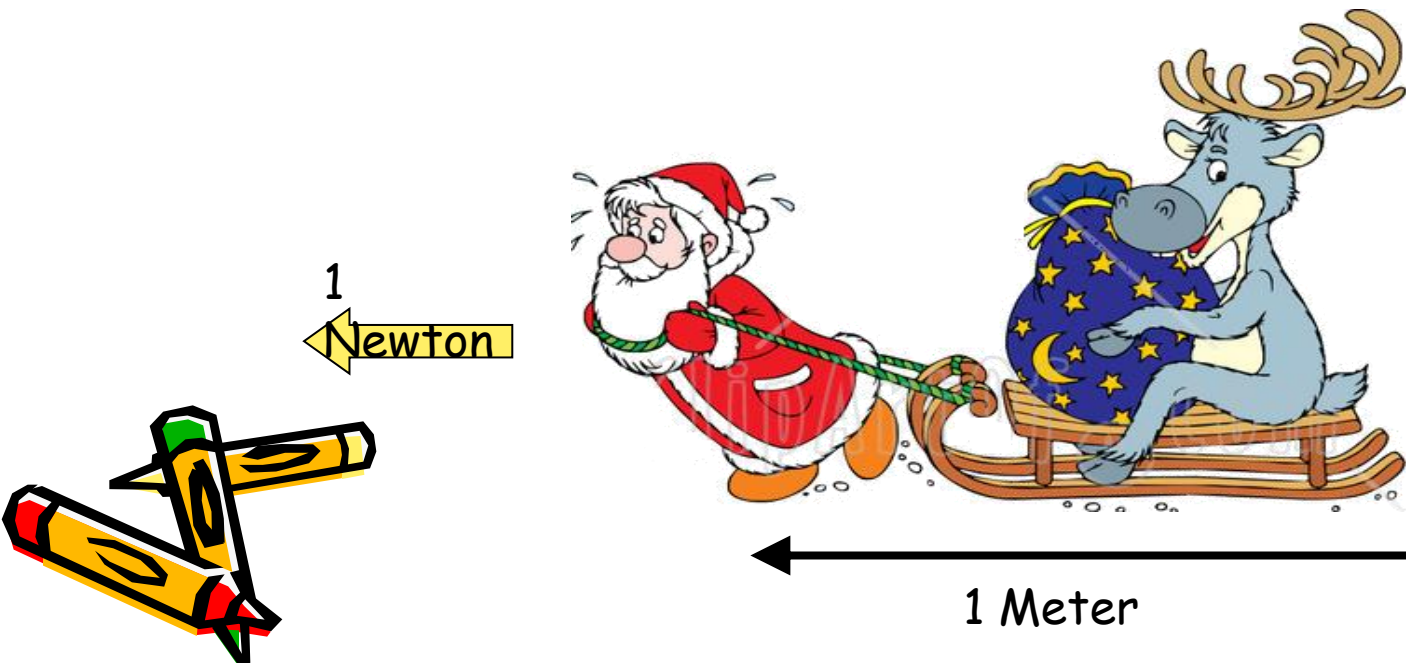


Topic 2: Work, Energy and Power

Work occurs when energy gets transferred from one object to another object.

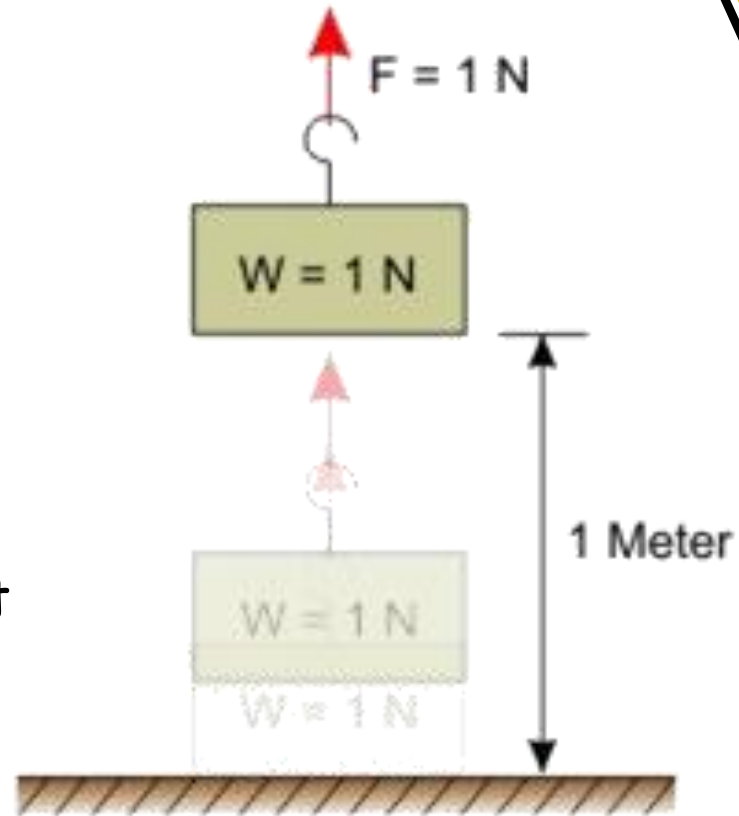
The standard unit of work is the **Joule** (abbreviated **J**).

One Joule is equivalent to one Newton of force causing a movement of one meter.



Also we may consider:

One **joule** as the amount of energy required to lift a 1 newton of weight a distance of 1 meter.



Weight of 1 newton
lifted 1 meter by a
force of 1 newton.
Energy used = 1 joule



Three Conditions for work to occur:

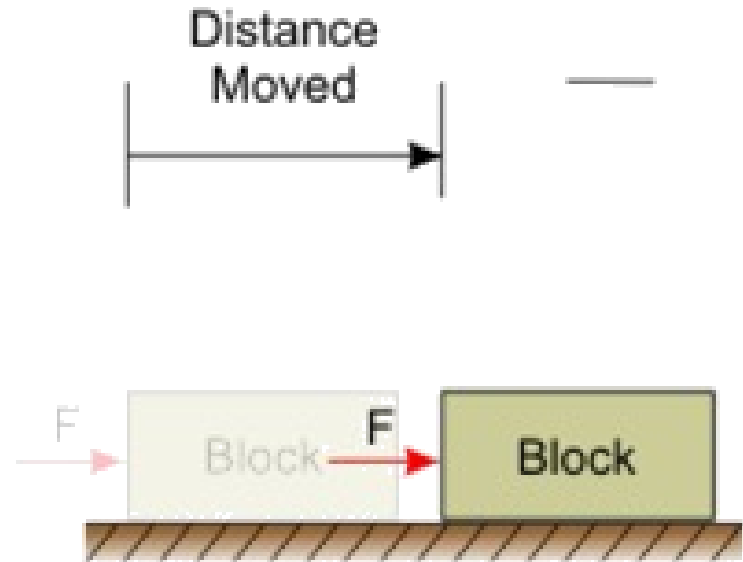
In order to do work, a force has to be applied to a mass and the mass has to be moved in the direction of the force over a distance.



Force applied, but
no movement

=

No work done on the block



Force applied, and
the block moved

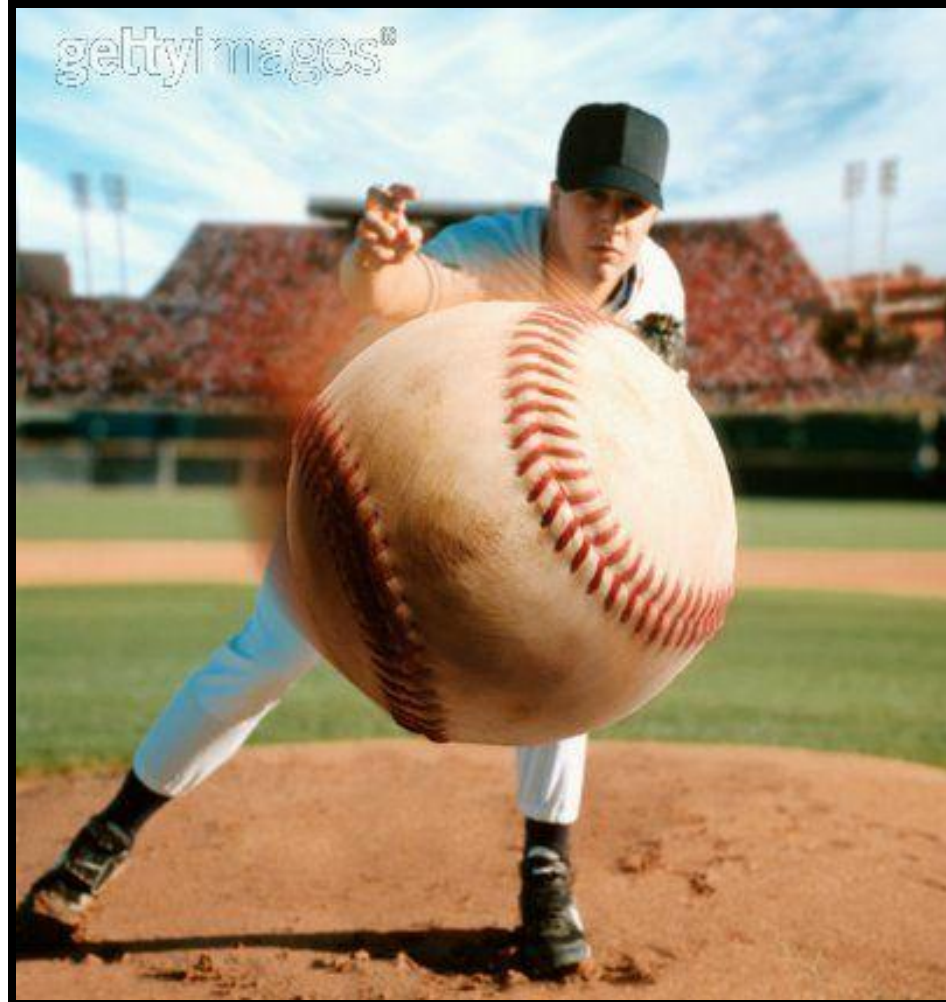
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Work done on the block

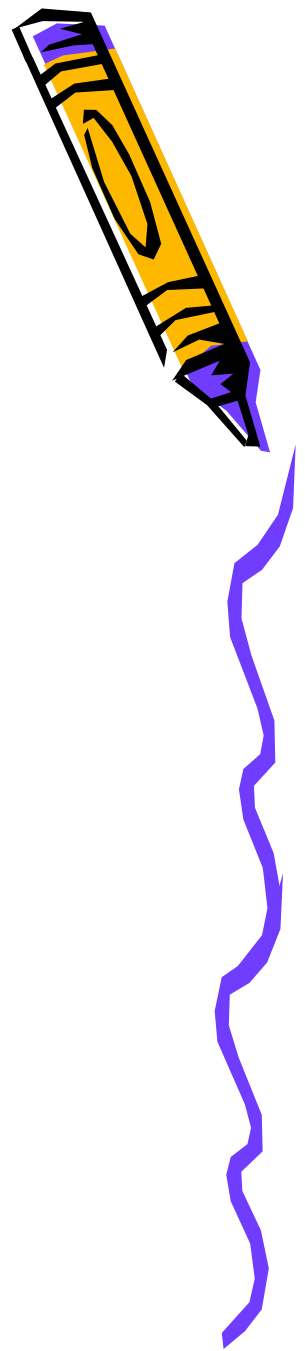


Can you determine if work was done in the following?

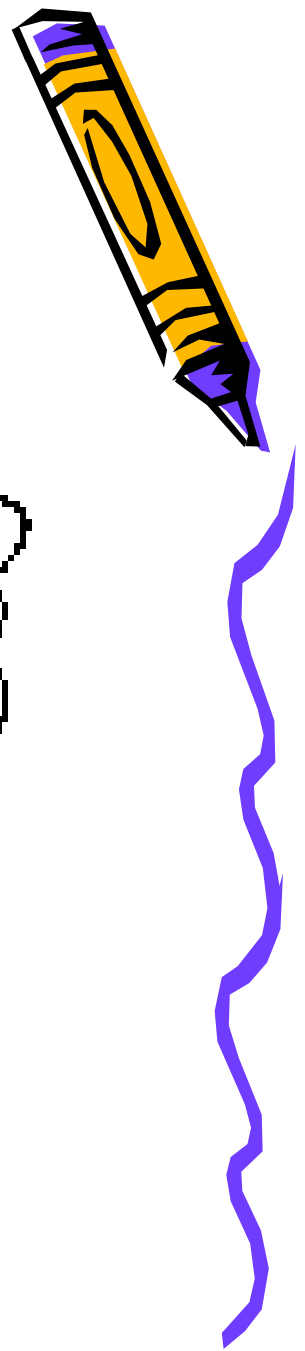
- Throwing a ball



- Lifting a book from a table to the floor



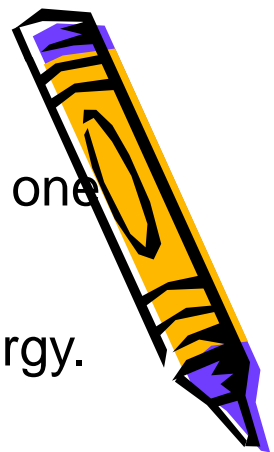
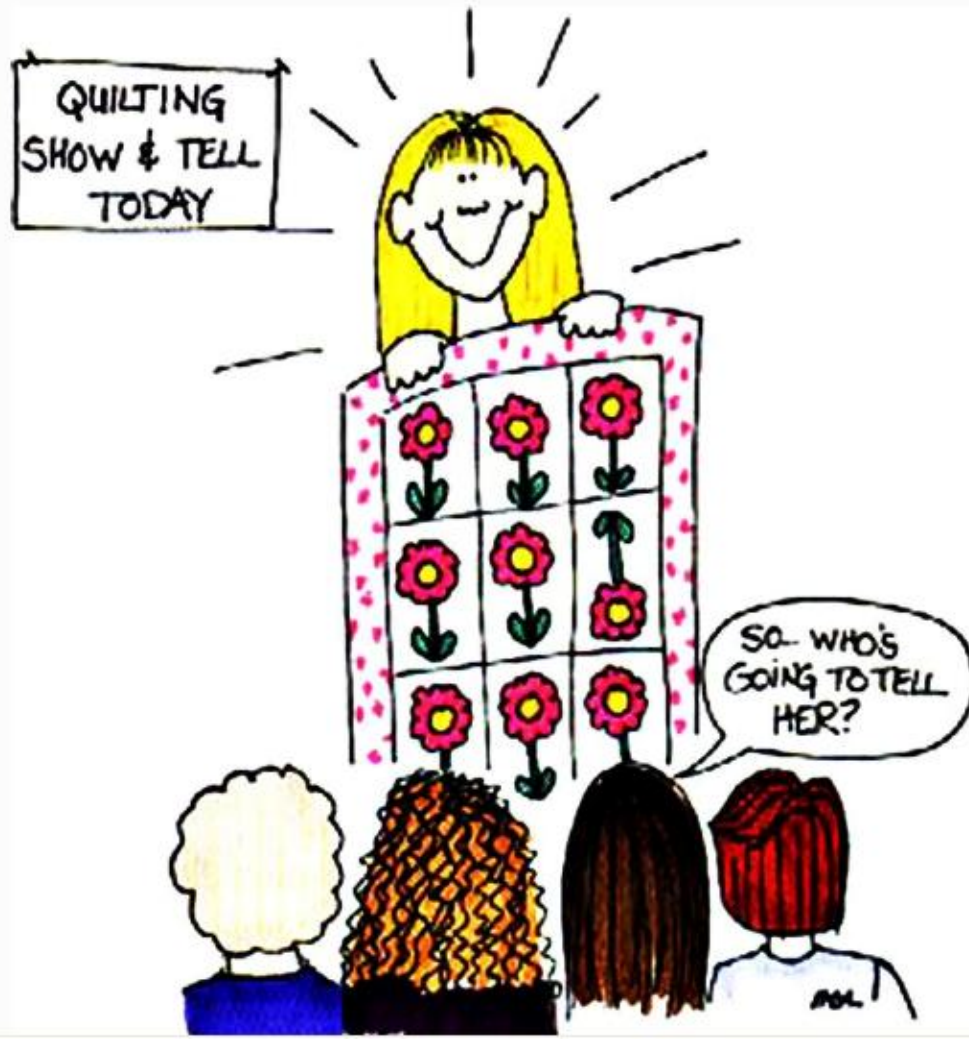
- A waiter carrying a tray of food



"Show and Tell"

Many technological devices are designed to convert energy from one form to a form suitable for a given purpose.

Next day, bring a device to class for discussion that converts energy.

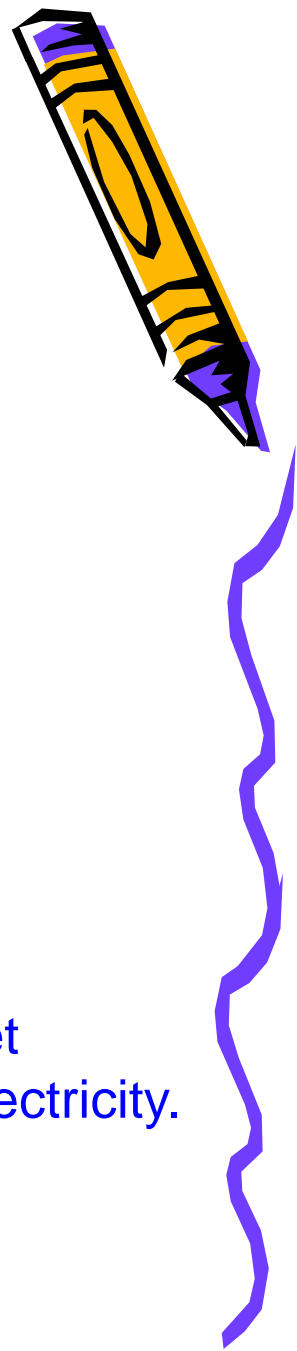


Research Assignment

Electricity can be produced in a number of ways:

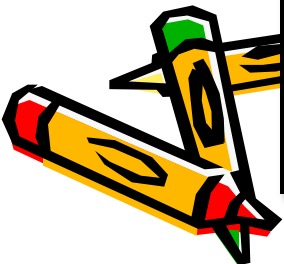
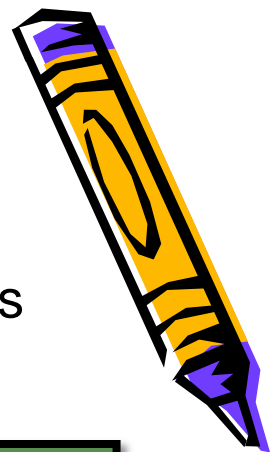
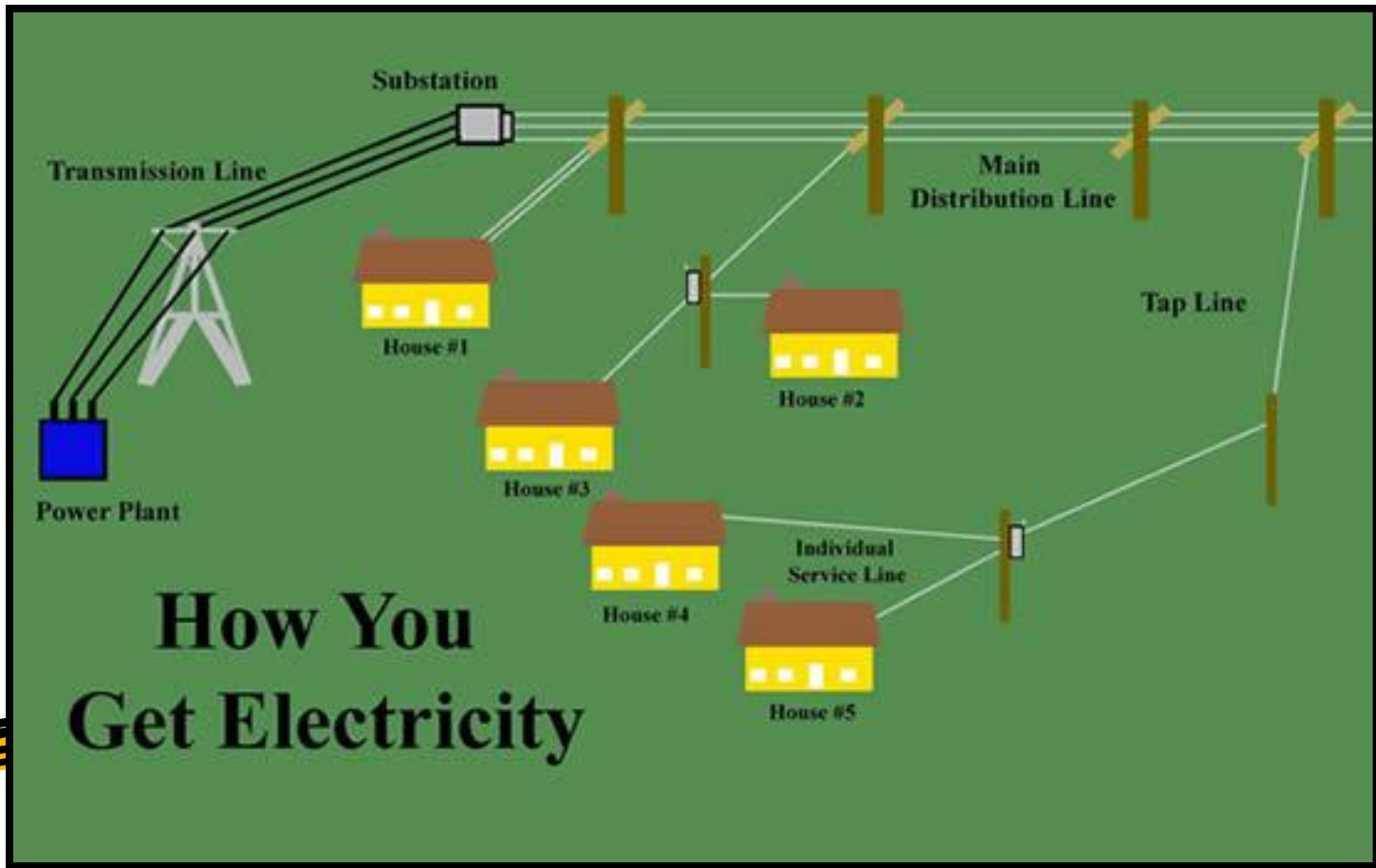
- Turbines in nuclear plants
- Hydroelectric stations
- Fossil fuels
- Solar panels/collectors
- Windmills
- Batteries
- Hydrogen cells

Select an example of an electricity source and create a pamphlet (Microsoft Publisher) explaining the system that produces the electricity.



Getting Electricity to you Home

Electricity is carried in overhead wires with very high voltages between communities. The reason for this is to reduce energy loss (the higher the voltage the less energy loss over long distance).



How Electricity Gets to Your Home

1 ELECTRICITY IS GENERATED AT A POWER PLANT



2 VOLTAGE IS INCREASED AT THE TRANSFORMER STATION



3 ELECTRICITY TRAVELS ACROSS THE PROVINCE ON TRANSMISSION LINES



4 THE NEIGHBOURHOOD TRANSFORMER STATION DECREASES VOLTAGE



5 ELECTRICITY IS CARRIED TO YOUR NEIGHBOURHOOD TRANSFORMERS ON DISTRIBUTION LINES

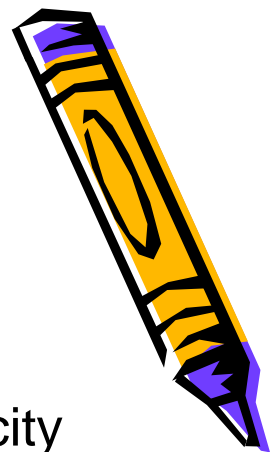
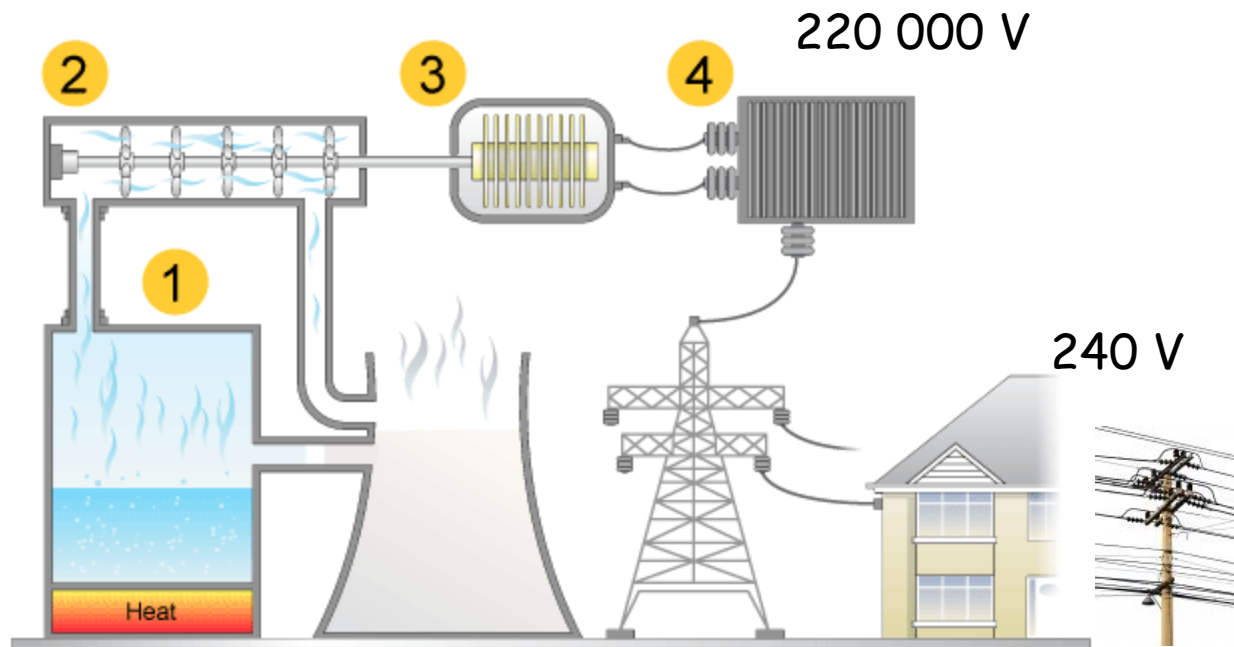


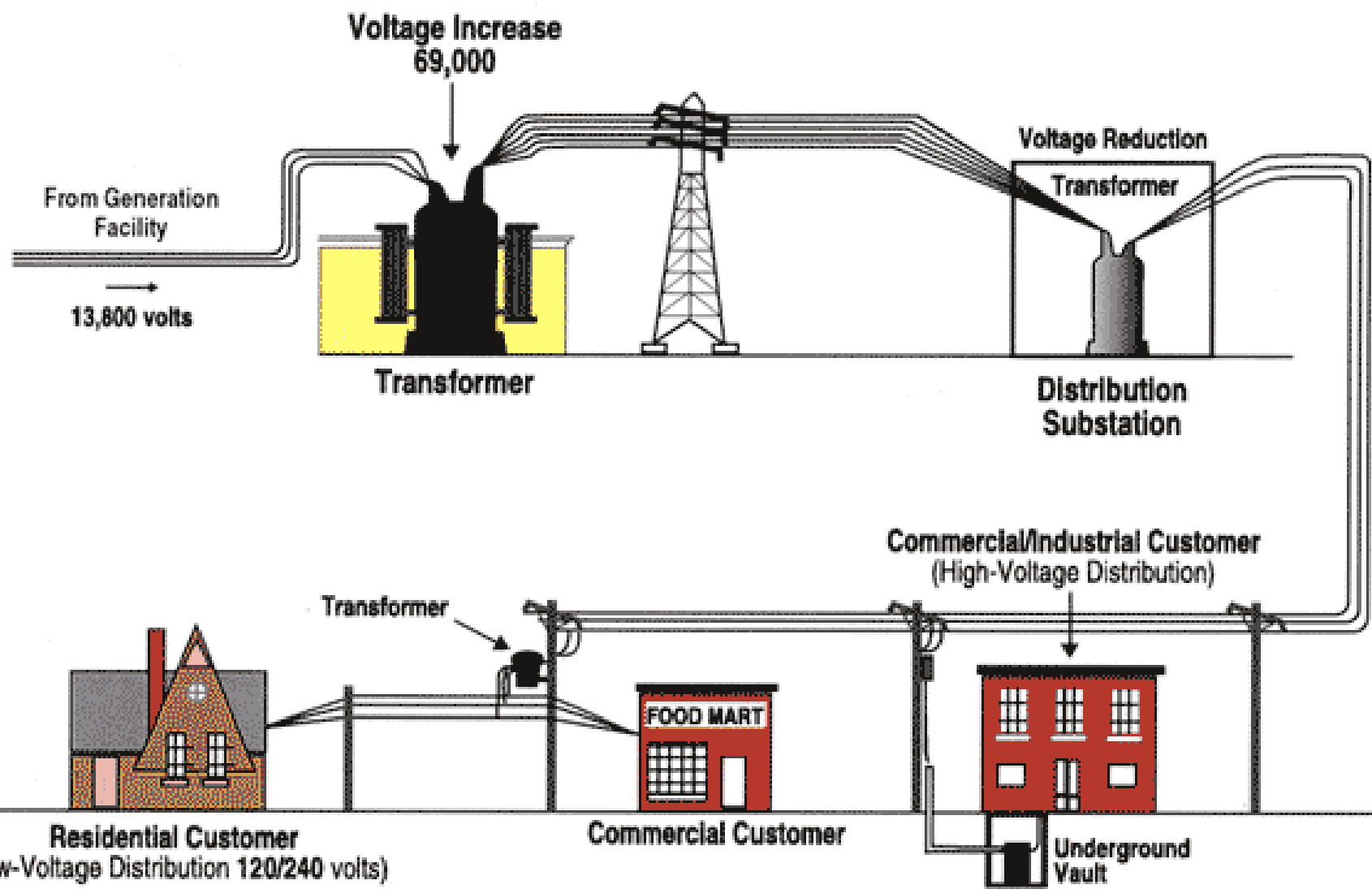
6 THE TRANSFORMER ON THE POLE DECREASES VOLTAGE BEFORE ENTERING YOUR HOUSE



In a coal plant there are four main stages:

1. the fuel is burned to boil water to make steam
2. the steam makes a turbine spin
3. the spinning turbine turns a generator which produces electricity
4. the electricity goes to the transformers to produce the correct voltage





The future: WiTricity

Imagine a future in which wireless electricity makes everyday products more convenient, reliable, and environmentally friendly.

WiTricity Corp. harnesses highly resonant magnetic coupling to transfer power over distances ranging from centimeters—to several meters.



The future: Solar Power Satellites

One suggestion for energy in the future is to put huge solar power satellites into orbit around the earth. They would collect solar energy from the sun, convert it to electricity and beam it to Earth as microwaves or some other form of transmission

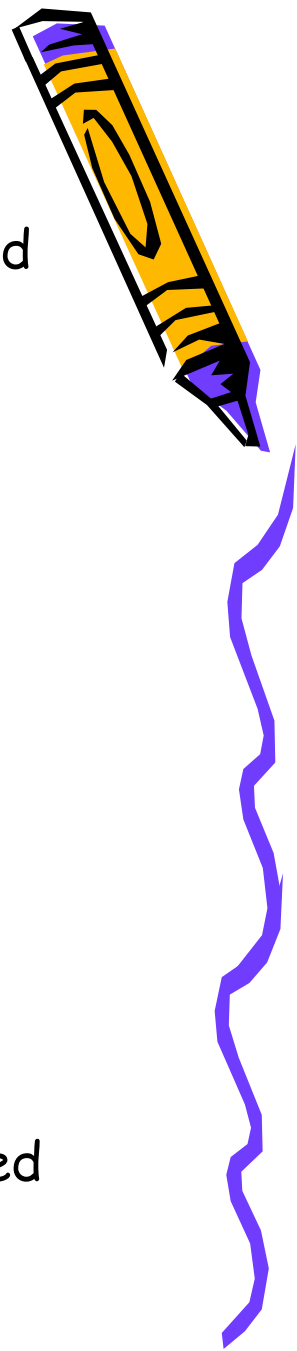


Legal, Ethical and Environmental Impacts

Every kind of generation, conversion, and transmission of energy has some legal, ethical, and environmental issue related to it.



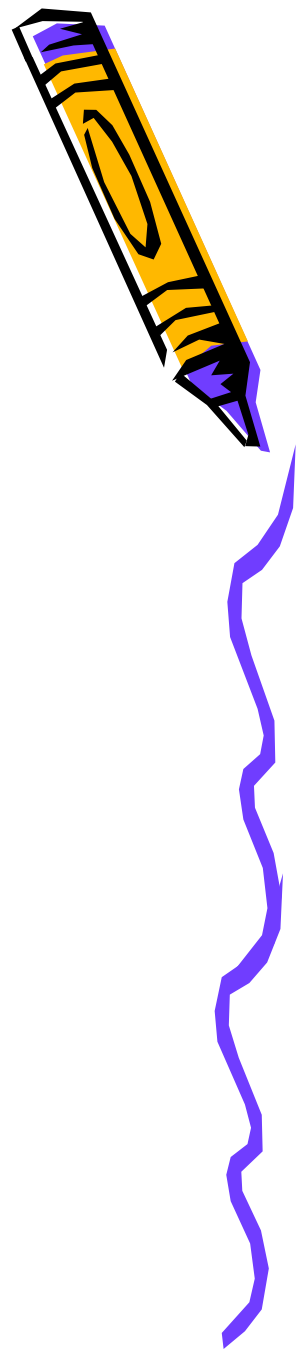
Can you name some common problems associated with the various types of Energy Sources we discussed?



Examples

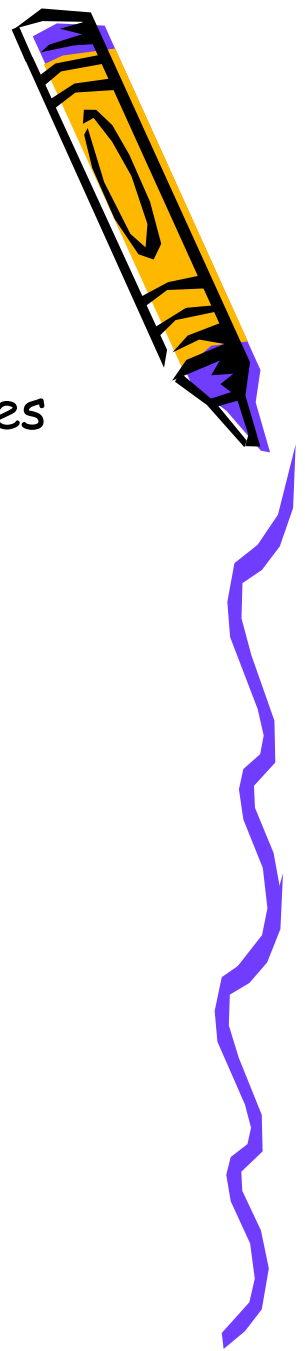
Wind farms in western Canada are affecting:

- wildlife (rare species of bats, birds),
- humans (low frequency noise damage), and aesthetics.
- Ice buildup on blades during winter months can fly off and cause property damage or injury.
- Communities can be displaced
- and natural vegetation can be destroyed..



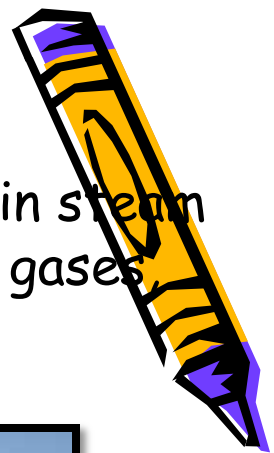
Examples

Hydroelectric reservoirs cause rotting vegetation which produces significant amounts of green house gases. In some cases the destruction of sacred native lands have caused disputes with native cultures (Three Gorges Dam, China, James Bay Project, Quebec).



Examples

Geothermal energy can cause noise pollution, dissolved solids in steam quickly erode pipes, natural steams contain many green house gases, not easily transported.

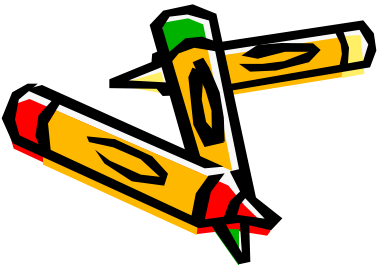
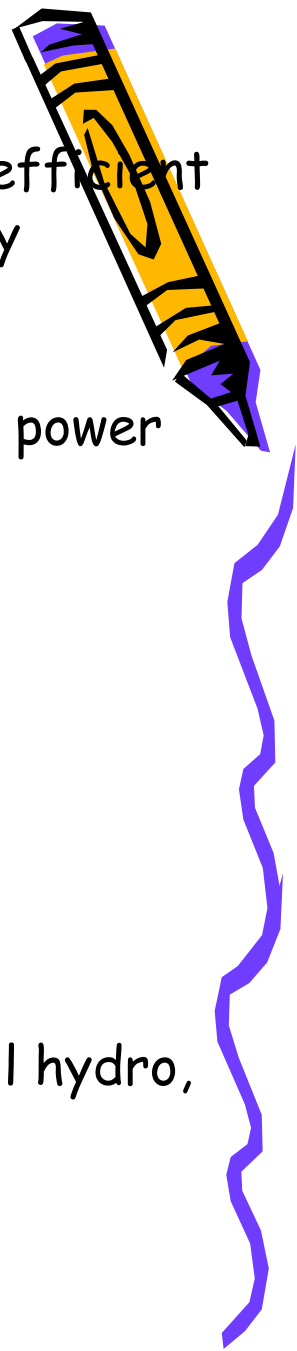


Activity: Extra Extra!

There are many new technologies that are evolving for more efficient conversion, transmission, and consumption of electrical energy

Some examples:

- Transmission issues and the re-emergence of interest in DC power
- Consumption issues and hybrid vehicles
- Miniaturizing of electronic circuitry
- Quantum computers
- The introduction of fluorescent and LED technologies
- Conversion advances with photovoltaic solar cells, wind, small hydro, and biomass technologies



Activity: Extra Extra!

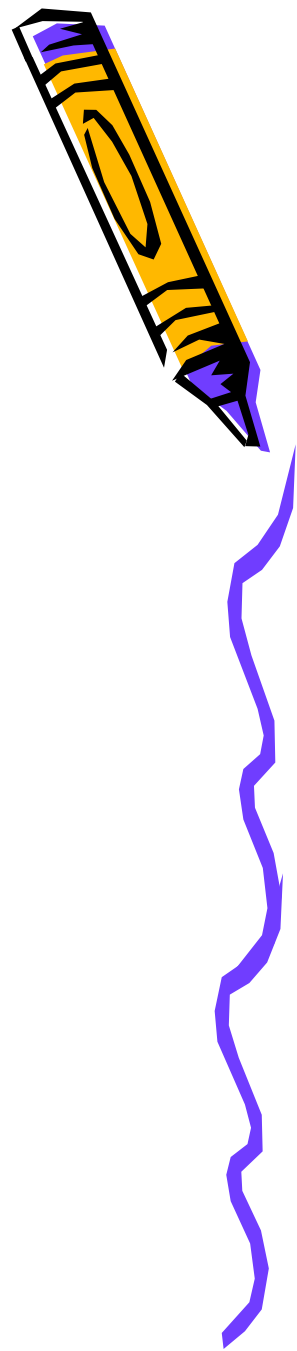
Research an emerging technologies and develop a Newspaper advertisement to sell your product.



ประกาศ
ร่วมลดปัญหาภาวะโลกร้อน
และลดค่าไฟฟ้า
แจกฟรี
หลอดตะเกียบ เบอร์ 5
800,000 หลอด
กับผู้ใช้ไฟฟ้าทุกจังหวัด ทั่วประเทศ
ส่งถึงบ้านทางไปรษณีย์

โครงการลดประหยัดไฟฟ้าเบอร์ 5
การไฟฟ้าฝ่ายผลิตแห่งประเทศไทย
มีนาคม ๒๕๕๓
กระทรวงพลังงาน
คณะกรรมการการไฟฟ้าฝ่ายผลิตแห่งประเทศไทย

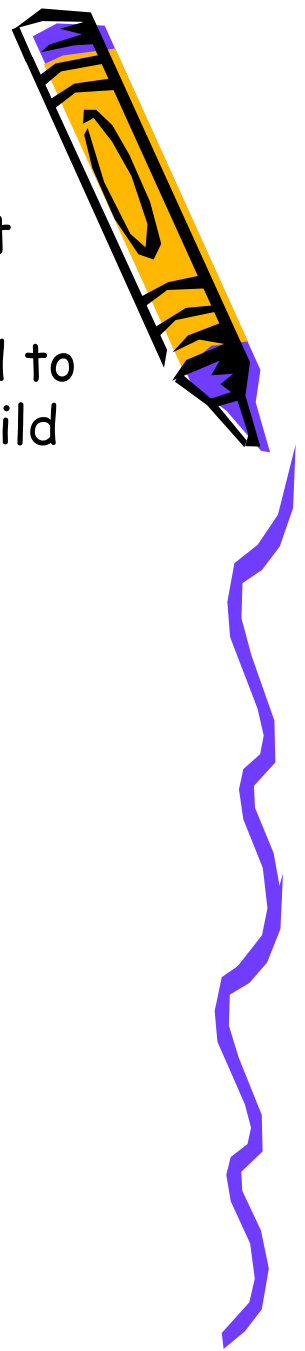
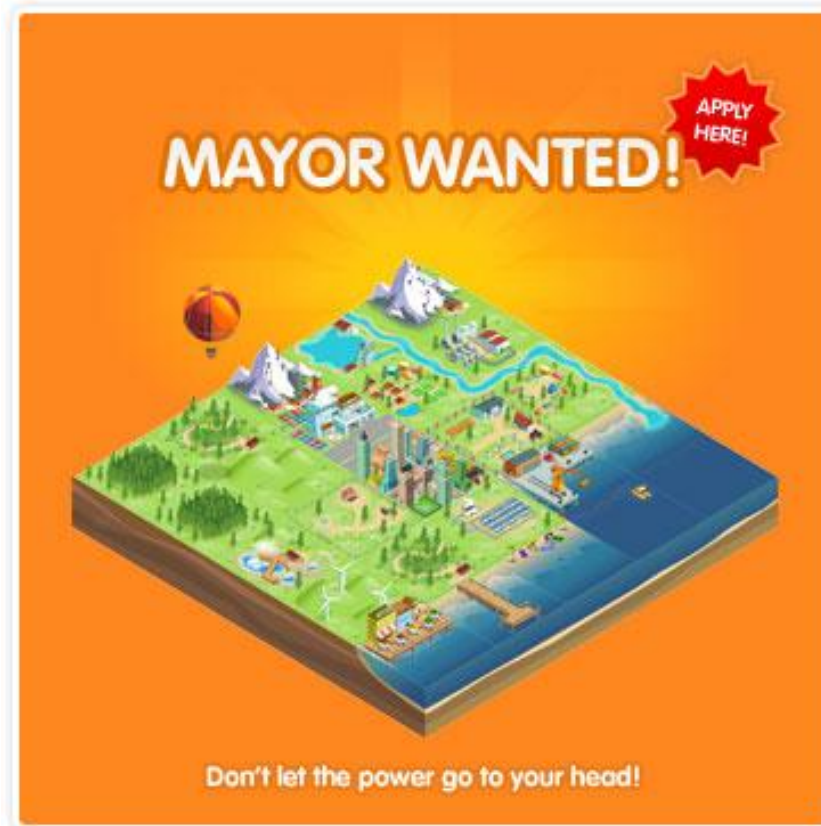
กระทรวงพลังงาน
MINISTRY OF ENERGY
กฟผ.
การไฟฟ้านครหลวง



Electro City

How is energy generated? How much does it cost? How does it affect the environment?

You will be given complete control over a small town. You need to balance your city's growth with its environmental impact to build the best city possible..



Energy Story

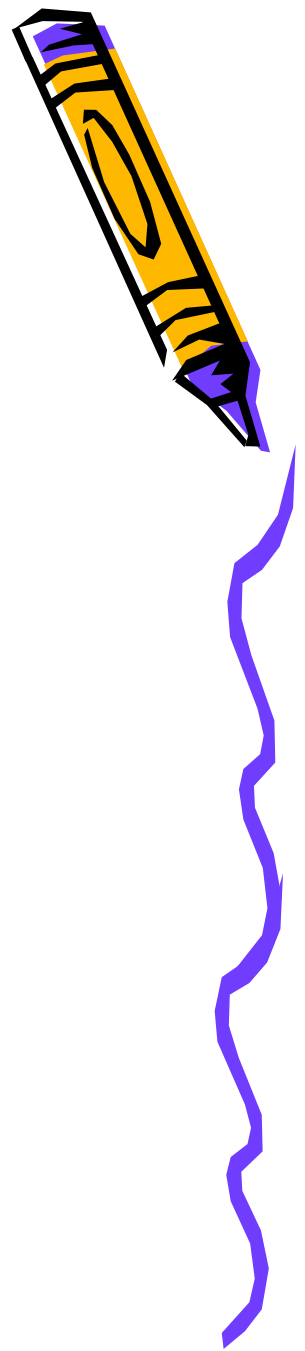
Visit the website: Energy story

<http://www.energyquest.ca.gov/story/index.html>

Browse the site and try the different activities available.

Also try: **The great green web game**

<http://go.ucsusa.org/game/>



The End



Handout: Review sheet - Unit 1

