8.1 Lesson 1 Energy

Introduction Questions:

1. *What is energy?*
2. *Where do we get it from?*
3. *What do we use it for?*
4. *Can it be stored?*
5. *What happens to it after we use it?*

Energy itself is hard to define but we all need it.
It comes from matter but it is not matter.
A famous equation ($E = mc^2$) represents the conversion of matter to energy in the sun and nuclear explosions.

When we say some one has "lots of energy" then we are accurately describing what energy does. It enables people to not only live (eat and breathe) but also do **work.** In fact any device that uses energy does work. Doing work means to move and change things such as a person riding a bike, an engine driving a car or chemicals making an explosion.

Energy Sources
The energy you use comes originally from a place or object.
Natural sources include the sun, wind, coal, petrol, gas, waves and tides, hot springs, rivers and water channels, plants and animals, nuclear materials.
Artificial sources include batteries, power stations, matches, lasers.

Some sources are called Renewable Energy Sources because they can be replaced every day and won't run out.
Question:
Which of the above natural sources are renewable?

In deciding the energy source required for everyday use many factors need to be considered including renewability, availability, pollution, efficiency, portability.

For more information on energy sources and energy generation see *Year 6 lesson 6.7 Generating electricity.*

Energy Forms

Energy comes in two forms; Potential Energy and Kinetic Energy

Potential Energy is stored energy.
Kinetic Energy is the energy of motion.

Potential energy can be easily converted to kinetic energy, which then does work as it changes or moves an object.

Examples of Potential Energy

1. Gravity – sitting on top of a water slide, water stored in a dam on a mountain.

2. Chemical – coal, petrol gas, wood, batteries, explosives
3. Nuclear - Uranium
4. Elastic – wind up spring, stretched rubber band
5. Static Electricity – stored in thunder cloud
6. Heat – steam or hot springs.

The advantage of potential energy is that it can be transported and used only when needed and the energy is released.

Examples of Kinetic Energy

1. Gravitational - Motion of falling
2. Throwing or shooting projectiles
3. Mechanical – motion of machines
4. Electrical – motion of electricity
5. Light – rays from the sun, torches.
6. Heat – moving through materials or rising in air
7. Sound - Moving in waves
8. Water – Moving in waves, streams, pipes and currents
9. Wind – air moving from high to low pressure or from a fan.

Kinetic energy can move or change an object but is soon used up unless a source of energy is continually producing it.

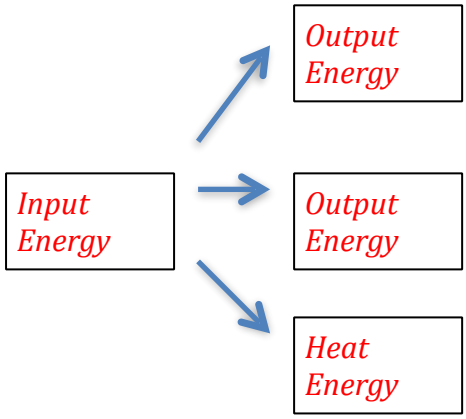
Do Experiment: 8.2 Investigating Pendulums

Energy Convertors

Convertors use energy. They are called convertors because the energy used is changed after use.
Remember Einstein's Energy Conservation Law:
Energy can never be created or destroyed (except in nuclear reactions)
So a convertor can only change energy to a different form. In the process a useful energy form is produced and some non-useful ones such as heat.

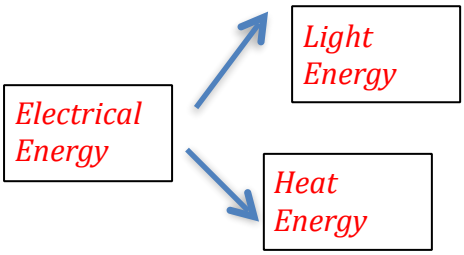
Convertor Energy Charts

All Convertors:

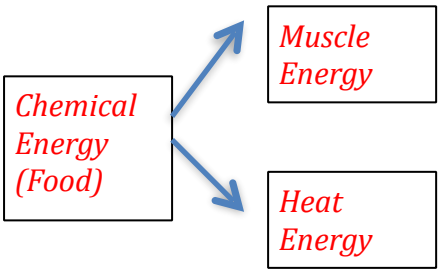


Examples:

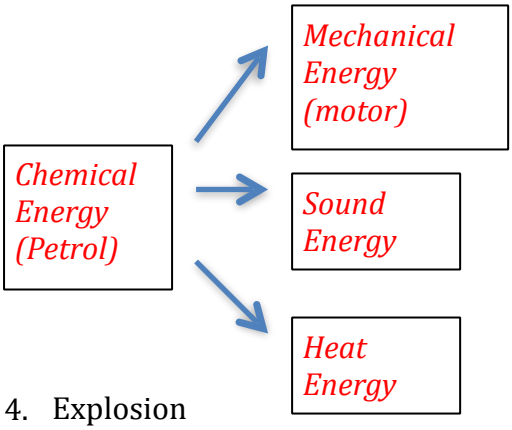
1. Light Bulb



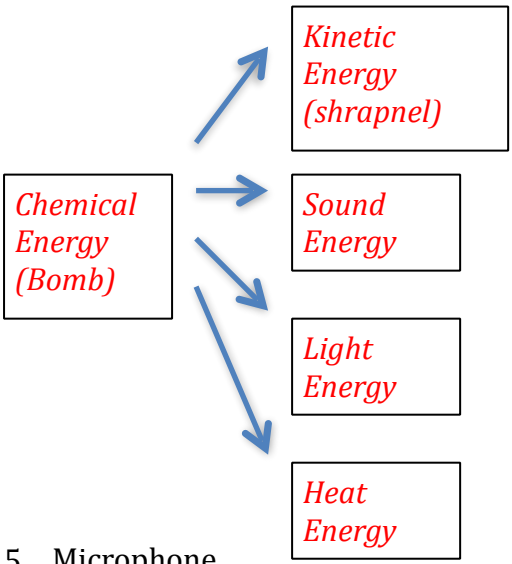
2. Human



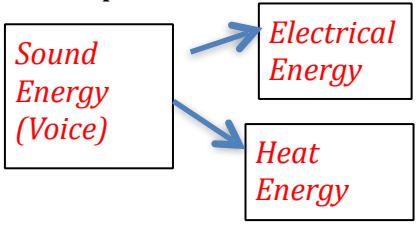
3. Car



4. Explosion



5. Microphone



Exercises

Draw energy charts for the following convertors:

1. A Burning Match
2. A Nail Gun
3. Photosynthesis in a leaf
4. A Cross Bow
5. Mobile phone call
    a. Speaking
    b. Listening
6. Name a device for the following energy conversions:
    a. Electricity ➔ Heat
    b. Kinetic ➔ sound
    c. Chemical ➔ electrical ➔ kinetic
    d. Gravitational ➔ kinetic ➔ electricity

Energy Efficiency

Energy convertors are not 100% efficient, that is they don't convert all the input energy to useful output energy. As shown in the above examples, many other forms of output energy especially heat is produced and some of the input energy is wasted.

Efficiency is measured

$$Efficiency = \frac{Useful\ output\ energy}{Input\ energy} \times 100\ \%$$

Example: Light Bulb

Electrical Input 600W → Light Output 60W + Heat Output 540 W

Efficiency = 60/600 x 100% = 10% efficient

Question

1. A Car uses 1000 J of petrol energy and produces 350J of mechanical (motion) energy, 50J of sound energy and 600J of heat. How efficient is the car for motion?
2. Why are new lights called LED lights almost 100% efficient? How does that save electricity?
3. Today energy saving appliances have an energy rating.

a) Which TV is most efficient?
b) Which TV produces the most power per year?