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## NATURAL SCIENCES : NATS4

### LESSON 5

#### UNIT STANDARD: 7509

#### NOTES AND ACTIVITY

**THEME:** Energy and Change

**TOPIC:** Energy and its transformation

At the end of this unit, you should be able to:

1. Define what is energy?
2. Identify and distinguish various forms of energy.
3. State and explain the law of conservation of energy.
4. Illustrate how energy is transferred from one form to another.

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#### A. WHAT IS ENERGY?

1. **Energy** is the ability to do work. This means that without energy, no work can be done.
2. The measuring unit of energy is **joules (J)**, named after the English physicist – *James Prescott Joules*.

**For example:**

When children eat food with too much sugar content at night (i.e. sweets and cool drink), they tend to be hyperactive. They run around the house uncontrollably, making noise and at times climbing up and down, jumping on the bed. They do this because their body is trying to get rid of the access sugar levels in their system. As they do this, the sugar levels decreases, as such after a while they'll get tired and exhausted, and fall asleep.

3. **Work done** by the children as in the example given above, is the energy transferred or changed from one form to another. This means that energy is conserved.



## B. FORMS OF ENERGY

1. **Chemical energy** – energy stored in fuel (i.e. food) which is released when chemical reactions take place.
2. **Kinetic energy** – energy of a moving object.
3. **Potential energy** – is energy stored by virtue of an object's position or the state the object is in. No work is done by this energy unless it is released.
  - a. **Gravitational potential energy** – is the energy an object has because of its position above the ground. If you drop an object it falls due to gravity and its potential energy is changed into kinetic energy.
  - b. **Elastic potential energy** – is the energy which flexible objects release when they go back to their original shape.
4. **Electrical energy** – energy transferred by an electrical current.
5. **Thermal (heat) energy** – energy of an object due to its temperature. This is partly because of the random kinetic energy of the particles of the object.
6. **Nuclear energy** – energy stored in an atom's nucleus.
7. **Light energy** – energy transferred through waves and light particles (photons). They enable us to see.
8. **Sound energy** – energy transferred via sound waves. They enable us to hear through vibrations.
9. **Solar (radiant) energy** – energy transferred by the Sun, electric lights, fires and lightning.
10. **Mechanical energy** – is the sum total of the potential and kinetic energy that an object has.

## C. ENERGY TRANSFORMATION or CONVERSION

The total amount of energy in the universe is constant. Even though there are many forms of energy, it cannot be created or destroyed. It can, however, be **transferred** from one form to another.

### For instance:

In the example given above, the sugar, as **chemical potential energy**, in the food and cool drink the children ate is converted to **kinetic energy**; hence the children would be running up and down uncontrollably in the house. The truth of the matter is that, the child would normally heat up and sweat due to that hectic running.

This means that, the chemical potential energy is not only converted to kinetic energy but **heat energy** too. This heat energy does not have a direct effect to



why the child would behave so uncontrollably. Therefore, such energy is not wanted and is called **wasted** energy because it simply escapes or dissipates to the atmosphere.

#### D. CONSERVATION OF ENERGY

We are aware that when one form of energy is transformed, there would be a form of wasted energy that will be lost to the atmosphere or immediate surroundings. If we take this to account, it means that the total energy does not change, i.e. the total amount of energy before is exactly equal to the total amount of energy after the change.

This phenomenon is called the **Law or Principle of Conservation of Energy**, which states that:

*“Energy cannot be created nor destroyed, but it can be changed or transferred from one form to another”.*

#### FOR EXAMPLE:

Study the picture given below.



The fire wood is used to cook food on an open fire. The energy transformation that takes place the picture is:

Chemical energy (from the wood) is converted into heat energy.

- You would notice that there is also **light energy** provided by the fire. Remember that it has nothing crucial in what is happening here. The main aim is cooking and so light energy is therefore, lost to the atmosphere, hence it is **wasted energy**.

- Then, the energy is conserved because:

**Total energy before = Total energy after**  
i.e. Total chemical energy = Heat energy + Light energy



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## ACTIVITY

1. Is energy a natural or non-natural resource? Explain.
2. What is the measuring unit of work done?
3. Complete the statement:  
Energy cannot be created nor ..., but it can be ... from one form to another.
4. For each of the following, describe the energy conversion taking place and identify a possible wasted energy.
  - 4.1 A person is sewing clothes on the factory sewing machine.
  - 4.2 A television is switched on.
  - 4.3 A person using a stamper to flatten a piece of ground.
  - 4.4 A student studying using a candle during load shedding.
  - 4.5 Photosynthesis on green plants.
5. An athlete drank one 330 ml can of energy boosting drink with energy content of 133kJ per 100 ml. Calculate the total amount of energy the athlete consumed.

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