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**UNIT ONE -MEASUREMENT**

**What is science- Come to conclusion after performing researches & experiments is called science**

**What is Physics - Physics is the study of the laws of nature from the observed events.**

**Introduction of Physics**

Physics is an important part in the study of science. It is related to all sections of science and ***its extent has no limitations.*** As examples, one can cite the involvement of medical physics in human biology. engineering physics in engineering technology, astrophysics in planetary movements. The concepts and laws of physics are easily explained with the help of trigonometry, algebra , geometry and co-ordinate geometry. Theoretical principles of mechanics form the basis of applied mathematics and,; physics has close affiliation to mathematics.

Experimental investigation is the basic foundation of science. The study of physics explain, the properties of matter, the phenomena of energy transformations and the natural occurrences of the universe. ***In short, the Knowledge of physics has become of paramount importance to the uplift of human life.***

**Energy Transformations**

An energy transformation is the change of energy from one form to another. Energy transformations occur everywhere every second of the day. There are many different forms of energy such as electrical, thermal, nuclear, mechanical, electromagnetic, sound, and chemical. Because the law of conservation of energy states that energy is always conserved in the universe and simply changes from one form to another, many energy transformations are taking place constantly.

**Examples of Energy Transformations:**

1. A toaster transforms electrical energy into thermal energy.

2. A blender transforms electrical energy into mechanical energy.

3. The sun transforms nuclear energy into ultraviolet, infrared, and gamma energy all forms of electromagnetic energy.

4.Chemical energy from food is converted to mechanical energy when the food is broken down and absorbed in the muscles. The chemical energy from food can also be converted to thermal energy to keep the body warm.

5.When lightning strikes a tree, electrical energy is converted to thermal energy. Chemical energy stored within batteries can be converted to electrical energy. Electrical energy can be converted to light energy when a light is switched out.

6.Electrical energy can also be converted to sound energy when it is used to power a loudspeaker. Sound energy is converted to electric energy in a microphone.

7.At hydroelectric water plants, gravitational potential energy is converted to electrical energy when water falls from a height. Wind turbines convert the mechanical energy from the wind into electrical energy. Solar panels convert light energy into electrical energy.

8.Electrical energy can be converted to mechanical and sound energy in a blender. Chemical energy is converted to mechanical energy in cars when gasoline undergoes combustion to power the engine. When fuels such as gasoline are combusted, chemical energy is converted to heat and light energy. Nuclear energy is converted to heat and light energy in a nuclear reaction as seen in the sun and in atomic bombs.

9.Plants convert light energy to chemical energy through photosynthesis. During bungee jumps, gravitational potential energy is converted to elastic potential energy. Friction converts kinetic energy to thermal energy. Waves convert mechanical energy to electrical energy. Geothermal energy in geologically active regions of the world can be harnessed as electrical energy.

**Physics in everyday life**

 (1) The edge of a knife is sharpened before we cut an object, say an orange. Why is it done? It is to minimize the area of contact between aha knife edge and the orange. The force necessary to cut is decreased and helps cutting easy since pressure increases .

(2) To lift a rock from the ground a crowbar is used, to load a heavy :body in to a lorry an inclined plane is used. These are mechanical processes to do work effortlessly.

(3) The rain, drops, the water drops on the leaves found in the early mornings, are spherical in shape. Spherical shapes have the least surface area and are due to the effect of surface tension. Hence the drops assume spherical in shape always.

 (4) The ghee in a bottle is normally frozen. To make it flow the bottle is placed near the hearth for some time. The viscosity of the ghee decreases with rise of temperature and ghee becomes to flow when the bottle is tilted

(5) When constructing railway lines, gaps are left between the rails so as to allow expansion to take place during summer.

**Importance of Physics in the Field of communication**

Humans are all about communication. We communicate with our families, we communicate with our coworkers, we communicate with strangers. The communities we develop could not have been sustained without good communication. And today, where the entire world is connected, communication continues to be vital. But in order to communicate over huge distances at different times of the day and night we need some tricks up our sleeves.

Understanding **physics is so integral** to those tricks that really there is no example of communication technology that isn't an application of physics. After all, physics is the science concerned with the nature and properties of energy and matter; it attempts to explain everything in the universe. The telephone was an application of physics. Going back further, so was the telegraph. But for this lesson, we'll focus on some modern communications technology and their origins in physics. To send a communication from one place to another, a signal (or data) must pass between the locations. There are two main types of signals: analog and digital.

**Analog Signals & Electromagnetic Waves**

An **analog signal** in physics is just a wave. There are lots of types of waves, but for communication most of the important ones are part of the electromagnetic spectrum. The electromagnetic spectrum includes light, radio waves, microwaves, infrared, ultraviolet, x-rays and gamma rays.

An example of sending analog communication would be satellite communication. **Satellites** are artificial objects in orbit around the planet like the Earth. We use satellites for many things, but communication is probably the most common. One of the first uses of a satellite was when the president of the United States was able to broadcast a Christmas message in 1958 - the first message to be transmitted via space. Today communication satellites are used to transmit messages across the whole world, for businesses, between world leaders, for news reports, and even phone calls and Internet connections.

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| **Satellite** |
| The signals satellites send are radio waves. Those radio waves are used to send our communications into space, and then the satellites transmit them back down to the Earth, again as radio waves. The pattern of the wave represents the exact audio being transmitted. A large peak might be a loud sound, for example, and a small one a quiet sound. But the computers that send and receive those signals are not analog - they're digital. And the physics of digital signals is quite different.  |
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**Digital Signals & Electrons**

The computers used to send and receive the signals work on physics principles; they turn analog radio waves into digital signals represented by electrons whizzing along circuit boards. **Digital signals** contain a series of ones and zeros, otherwise known as binary. Computers understand this language perfectly. The electric current (flow of electrons) varies to represent these ones and zeros.

But just to confuse things, digital signals can also be sent using electromagnetic radiation. This is usually done through a communication technology called fiber optics.

**Fiber optic cables** are cables containing translucent materials called optical fibers that can carry electromagnetic waves - usually infrared. That infrared light reflects off the sides of the cable to continue down the length until it reaches its destination. These signals are digital just like the electrons: a pulse of light represents a one, and the absence of a pulse represents zero. Computers can receive these pulses and make sense of them.

Fiber optic cables are often used to send audio signals in home theater systems, and for Internet connections. But really, fiber optic cables can be used to transmit any kind of information including telephone calls. They're often used in important connections like expensive business communication links or long-distance links.

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| **Fiber optic cable** |

And then there's the Internet. The **Internet** is a worldwide system of connected computers allowing the transfer of information, and communication like emails, audio conversations, and video chats. The Internet is probably one of the biggest advances of the last 30 years. It has revolutionized the way we communicate, do business, and learn about our world.

**Importance of Physics in the Field of Medicine**

Ever wonder why physics is important in the field of medicine? Well, there are numerous reasons why it is very vital to this field. One reason is “medical physics”, it is one of the branches of physics.
Medical physics is a branch of [applied physics](http://en.wikipedia.org/wiki/Applied_physics) concerning the application of [physics](http://en.wikipedia.org/wiki/Physics) to [medicine](http://en.wikipedia.org/wiki/Medicine). It generally concerns physics as applied to [medical imaging](http://en.wikipedia.org/wiki/Medical_imaging) and [radiotherapy](http://en.wikipedia.org/wiki/Radiotherapy). And what is medical imaging? Medical imaging refers to the techniques and processes used to create [images](http://en.wikipedia.org/wiki/Image) of the human body (or parts thereof) for clinical purposes ([medical procedures](http://en.wikipedia.org/wiki/Medical_procedure) seeking to reveal, [diagnose](http://en.wikipedia.org/wiki/Diagnose) or examine [disease](http://en.wikipedia.org/wiki/Disease)) or medical science (including the study of normal anatomy and function. Under this are the following:

[**MRI**](http://en.wikipedia.org/wiki/MRI) **scan**

[Diagnostic radiology](http://en.wikipedia.org/wiki/Diagnostic_radiology), including [x-rays](http://en.wikipedia.org/wiki/X-ray), [fluoroscopy](http://en.wikipedia.org/wiki/Fluoroscopy), [mammography](http://en.wikipedia.org/wiki/Mammography), [Dual energy X-ray absorptiometry](http://en.wikipedia.org/wiki/Dual_energy_X-ray_absorptiometry), [angiography](http://en.wikipedia.org/wiki/Angiography) and [Computed tomography](http://en.wikipedia.org/wiki/Computed_tomography) [Ultrasound](http://en.wikipedia.org/wiki/Ultrasound), including [intravascular ultrasound](http://en.wikipedia.org/wiki/Intravascular_ultrasound)
[Non-ionising radiation](http://en.wikipedia.org/wiki/Non-ionising_radiation) ([Lasers](http://en.wikipedia.org/wiki/Lasers), [Ultraviolet](http://en.wikipedia.org/wiki/Ultraviolet) etc.) [Nuclear medicine](http://en.wikipedia.org/wiki/Nuclear_medicine), including [SPECT](http://en.wikipedia.org/wiki/SPECT) and [positron emission tomography](http://en.wikipedia.org/wiki/Positron_emission_tomography) (PET) [Magnetic resonance imaging](http://en.wikipedia.org/wiki/Magnetic_resonance_imaging) (MRI), including [functional magnetic resonance imaging](http://en.wikipedia.org/wiki/Functional_magnetic_resonance_imaging) (FMRI) and other methods for [functional neuroimaging](http://en.wikipedia.org/wiki/Functional_neuroimaging) of the [brain](http://en.wikipedia.org/wiki/Neuroimaging).
For example, [nuclear magnetic resonance](http://en.wikipedia.org/wiki/Nuclear_magnetic_resonance) (often referred to as [magnetic resonance imaging](http://en.wikipedia.org/wiki/Magnetic_resonance_imaging) to avoid the common concerns about [radiation](http://en.wikipedia.org/wiki/Radiation)), uses the phenomenon of nuclear [resonance](http://en.wikipedia.org/wiki/Resonance) to image the human body.

**ECG trace**

Used to monitor and measure various physiological parameters. Many physiological measurement techniques are [non-invasive](http://en.wikipedia.org/wiki/Non-invasive) and can be used in conjunction with, or as an alternative to, other [invasive](http://en.wikipedia.org/wiki/Invasive) methods.
[**Electrocardiography**](http://en.wikipedia.org/wiki/Electrocardiography)[**Electromyography**](http://en.wikipedia.org/wiki/Electromyography)[**Blood pressure**](http://en.wikipedia.org/wiki/Blood_pressure) **measurement**

You see physics is a great help in the field of medicine without it, we are not able to enjoy what we are enjoying today in terms of treating our diseases.