

Physics

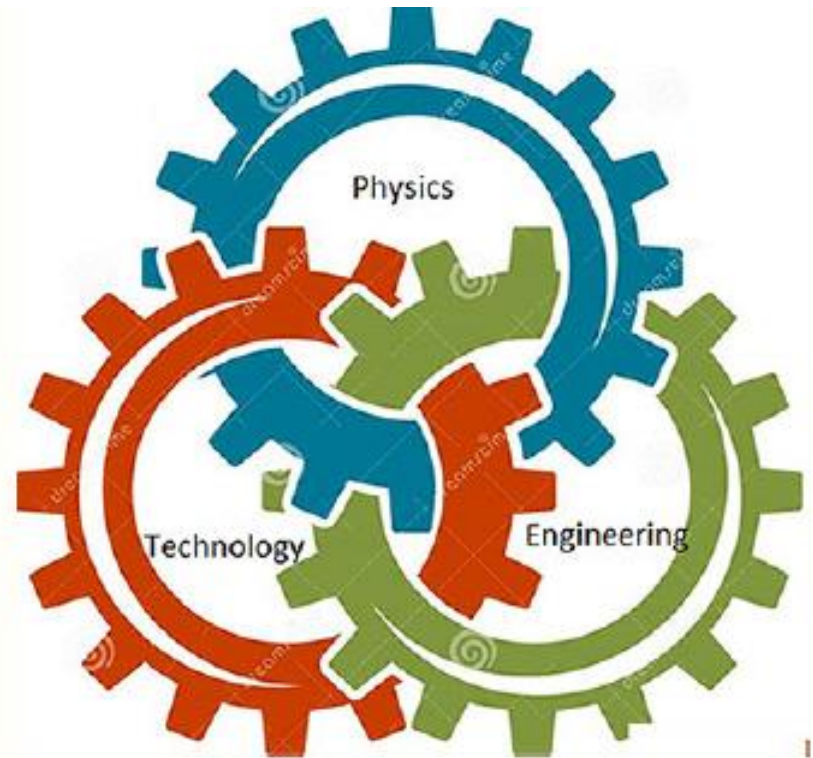
Student Textbook Grade 12



**FEDERAL DEMOCRATIC
REPUBLIC OF ETHIOPIA
MINISTRY OF EDUCATION**

9/24/2023

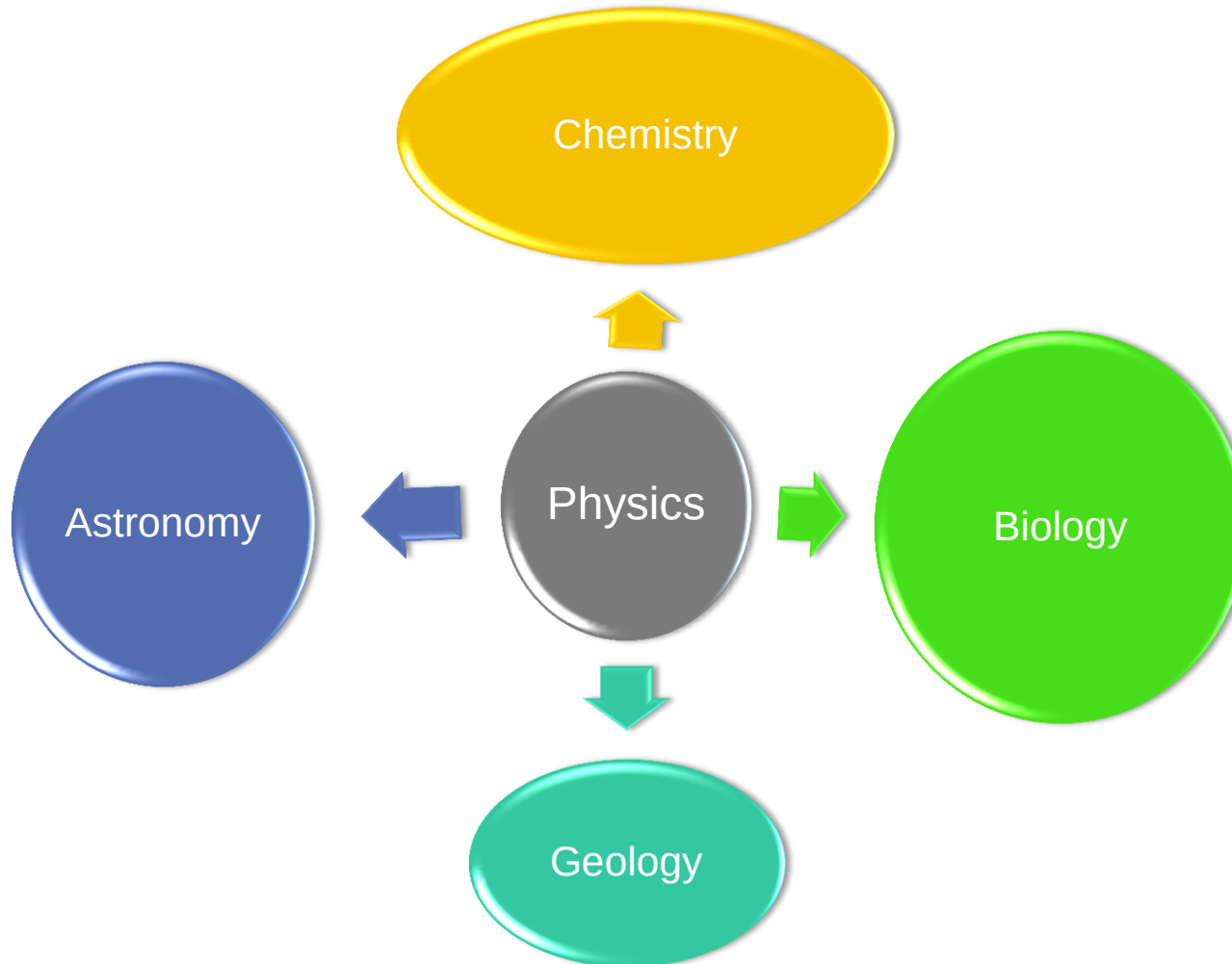
Mengesha W.



Unit 1

Application of physics in other fields

1.1. PHYSICS AND OTHER SCIENCES



PHYSICS AND CHEMISTRY

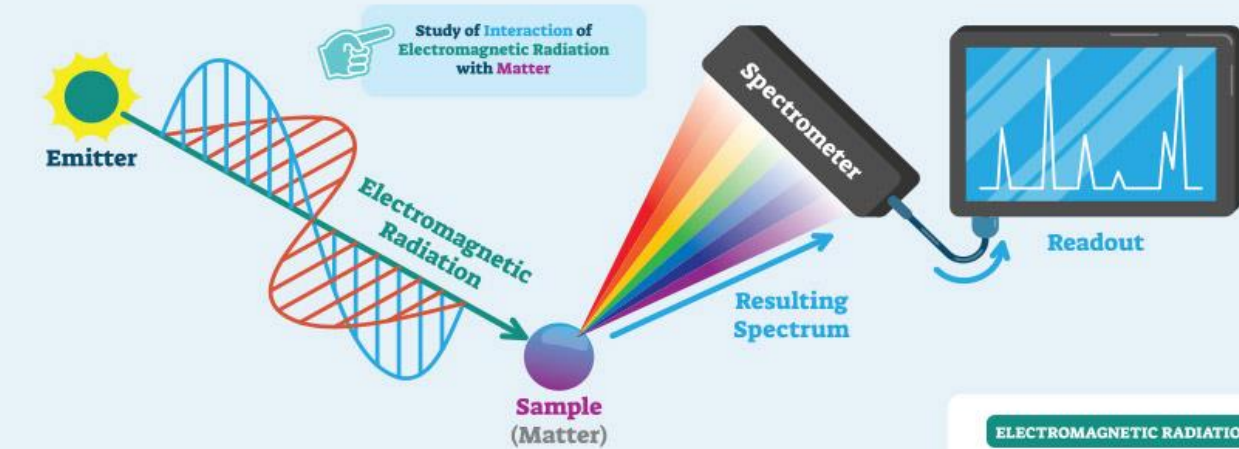
- Physics and chemistry may overlap when the system under study involves matter composed of electrons and nuclei.
- Fundamental laws that govern the behavior of matter apply to both chemistry and physics.
- Both physics and chemistry are concerned with matter and its interaction with energy.

- ❑ The concepts of thermochemistry to an exploration of *thermodynamics*.
- ❑ Thermochemistry is the branch of chemistry which describes the changes occurring in the *chemical reaction* due to the presence of heat.

Thermodynamics explains:

- ✓ why graphite can be converted to diamond;
- ✓ how chemical energy stored in molecules can be used to perform work; and
- ✓ why certain processes, such as iron rusting and organisms aging and dying, proceed spontaneously in only one direction, requiring no net input of energy to occur.

WHAT IS SPECTROSCOPY?



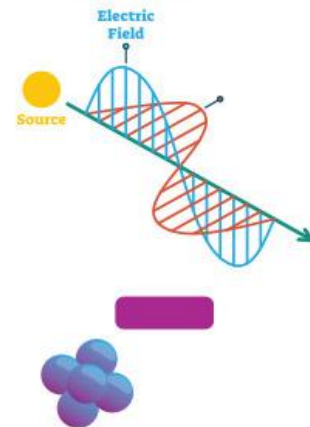
SPECTROSCOPY

ABSORPTION:
Ground State to Excited State

EMISSION:
Excited State to Ground State



ELECTROMAGNETIC RADIATION



- Spectroscopy is defined as any measurement of a quantity as a function of wavelength or frequency.
- During a spectroscopy experiment, electromagnetic radiation of a specified wavelength range passes from a source through a sample containing compounds of interest, resulting in absorption or emission.
-  During absorption, the sample absorbs energy from the light source.
-  During emission, the sample emits light of a different wavelength than the source's wavelength.

USES OF SPECTROSCOPY

- ❑ Spectroscopy is used in physical and analytical chemistry to detect, determine, or quantify the molecular and/or structural composition of a sample.
- ❑ Each type of molecule and atom will *reflect, absorb, or emit electromagnetic radiation* in its own characteristic way.
- ❑ Spectroscopy uses these characteristics to deduce and analyze the composition of a sample.

Examples of Spectroscopy Applications

- 🌐 Determining the atomic structure of a sample
- 🌐 Determining the metabolic structure of a muscle
- 🌐 Monitoring dissolved oxygen content in freshwater and marine ecosystems
- 🌐 Studying spectral emission lines of distant galaxies
- 🌐 Altering the structure of drugs to improve effectiveness
- 🌐 Characterization of proteins
- 🌐 Space exploration
- 🌐 Respiratory gas analysis in hospitals

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SUMMARY

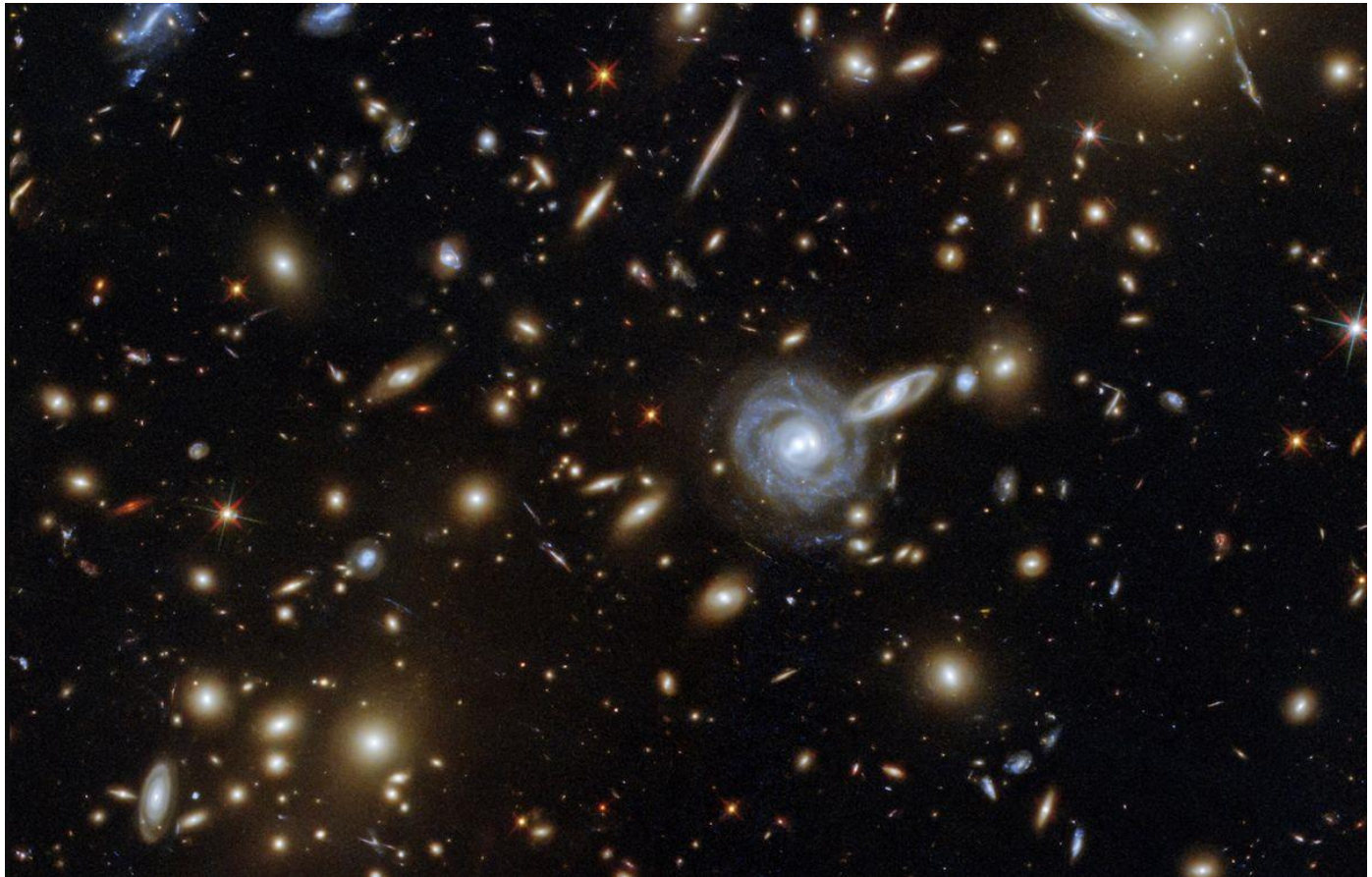
In general, the study of ***matter and electricity*** in physics is fundamental towards the understanding of concepts in chemistry, such as

- *atomic structure,*
- *molecular structure,*
- *X-ray diffractions,*
- *radioactivity,*
- *periodic properties of elements,*
- *nature of valency,*
- *chemical bonds in molecules,*
- *crystal structure of solids and others.*

This shows that ***chemistry*** is rooted in *atomic and molecular physics*.

PHYSICS AND BIOLOGY

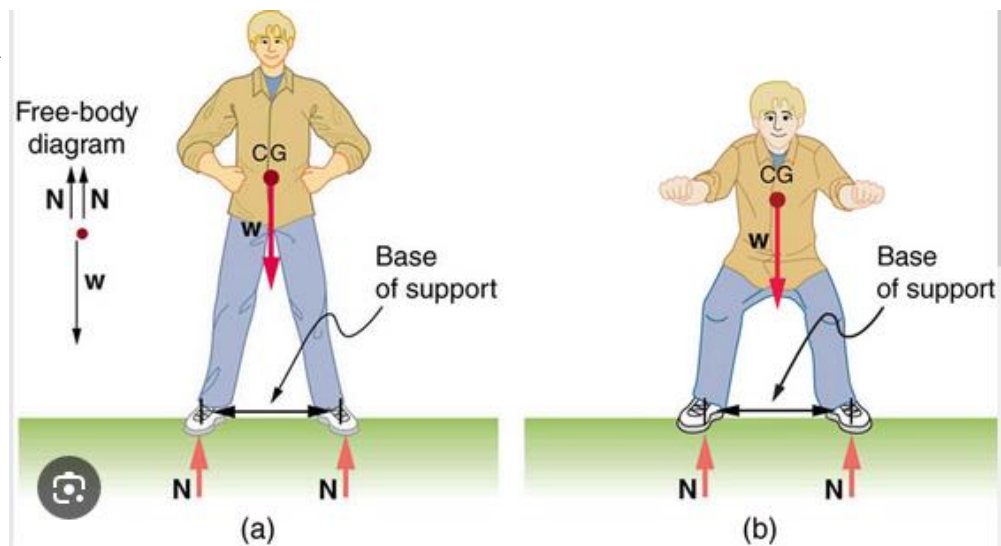
- Physics provides the basis for biology. Without space, matter, energy and time ~ components that make up the universe ~ living organisms would not exist.



PHYSICS OF NEWTONIAN MECHANICS AND BIOLOGY

- The Newtonian mechanics tells us how different animals and their body parts move.
- ✓ Newtonian mechanics tells us that a body is in stable equilibrium under the action of gravity if its center of mass is directly over its base of support. Under this condition, the reaction force at the base of support cancels the force of gravity and the torque produced by it.

If the center of mass is outside the base, the torque produced by the weight tends to fall the body.



PHYSICS OF FLUID FLOW AND BIOLOGY

What is the application of fluid mechanics in biology?

- Bio-fluid mechanics is focused on how biological systems interact with and/or use liquids/gases.
- For humans, this includes obtaining and transporting oxygen, maintaining body temperature, and regulating homeostasis.
- Biofluid mechanics focuses on macro-circulation, microcirculation, and specialty circulation that flows through kidney, lungs, eyes, joints, diarthroses, and splanchnic circulation that are important in human body.
- It is necessary to understand fluid dynamic factors such as velocity distribution, pressure, flow rate ratio, flow behavior, velocity gradients, and stress on the wall and on blood cells to design medical device for recording and diagnosis purpose.

PHYSICS OF SOUND WAVE AND BIOLOGY

How We Hear

1.

Sound waves enter your outer ear and travel through the ear canal to your eardrum.

2.

Your eardrum vibrates with the incoming sound and sends the vibrations to three tiny bones in your middle ear.

3.

The bones in your middle ear amplify the sound vibrations and send them to your inner ear, or cochlea. The sound vibrations activate tiny hair cells in the inner ear, which in turn release neurochemical messengers.

4.

Your auditory nerve carries this electrical signal to the brain, which translates it into a sound you can understand.

