



# SUMMER FELLOWSHIP REPORT 2022

## GRAPHICS & ANIMATION

**Submitted by**  
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**Under the Guidance of**  
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**From 25th April 2022 to 25th June 2022**

# ACKNOWLEDGMENT

I, the summer intern of the FOSSEE, am overwhelmed in all humbleness and gratefulness to acknowledge my sincere gratitude to all those who have helped me put my ideas to perfection and have assigned tasks well above the level of simplicity and into something concrete and unique. I wholeheartedly would like to thank and express my gratitude to **Prof. Kannan M. Moudgalya**, IIT Bombay, for making it possible for me to work on this project.

I would like to express my deep and sincere gratitude to my senior project advisor and mentor, **Mr. Khushalsingh K. Rajput**, Project lead (FOCAL) & Sr. Software Engineer (FOSSEE), IIT Bombay, for the enthusiasm and continuous support, in helping me complete the project successfully. I am extremely thankful and deeply moved by his round-the-clock support and patience in sharing his immense knowledge without any limits or boundaries. His fatherly approach toward students combined with outstanding problem-solving and management skills is a euphoric treasure worth experiencing firsthand.

I am feeling blessed that I got an opportunity to work for this fellowship. It is always fruitful to work on such a project full of brainstorming ideas.

I am extending my thanks to my colleague from this fellowship for providing quick support and critical analysis at different stages and out of the project.

I would like to thank my parents and friends for supporting me in this fellowship. Lastly, I would also like to thank all the people who supported and wished for the success of my internship directly or indirectly.

Last but not the least, I thank the management of IIT Bombay and the FOSSEE team for conducting this Fellowship. I thank Professor Kannan M. Moudgalya yet again for his eagle-eyed supervision which made this fellowship a grand success.

**With Regards,**  
**Syankita**

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# INTRODUCTION

## About the Fellowship

The FOSSEE project (Free/Libre and Open Source Software in Education) promotes the use of FLOSS (Free/Libre and Open Source Software) tools in academia and research. This project is part of the National Mission on Education through Information and Communication Technology (ICT), the Ministry of Human Resource Development (MHRD), and the Government of India.

The FOSSEE Summer Fellowship is a grand opportunity for students from any stream to be a part of the FOSSEE project, with the ultimate aim being the promotion and development of Free/Libre and Open Source Software in education.

I was selected as a 2D Graphic Designer in the Graphics and Animation category of the fellowship and was placed under the mentorship of Mr. Khushalsingh K. Rajput, Project lead (FOCAL) & Sr. Software Engineering (FOSSEE), IIT Bombay.

## Duration of the Fellowship

I chose the part-time FOSSEE Summer Fellowship 2021 which spanned from 25th April 2022 to 25th June 2022.

## Aim & Objectives

### AIM:

- **Make artworks for FOCAL (Free and Open-source Creative Art Library).**
- **To create XIIth Std. science syllabus chapter's infographics that can help the students to summarize the concepts through that graphics.**

## OBJECTIVES:

- Make 20 different artworks/templates using various open-source software, which can easily clarify the 12th standard concepts on various topics of the science syllabus.
- To make it obvious that using FOSS tools is easy, economic, and reliable.
- Promote FOSS tools among the general public.

## Software

- Inkscape - a professional quality vector graphics open source software.
- Scribus - It is designed for layout, typesetting, and preparation of files for professional-quality image-setting equipment.

## Project Plan

Make 20 artworks from but not limited to the following using FLOSS tools:

- XIIth Std. science syllabus chapter's Infographics
- Icon
- Social media post
- Brochure

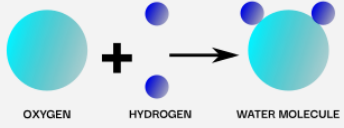
# Project Outcome

## Artwork 1 - Atom History

# ATOMS

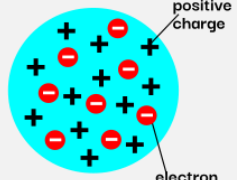
### Dalton's atomic theory

All matter was made up of small, indivisible particles known as 'atoms'.



OXYGEN + HYDROGEN → WATER MOLECULE

### The plum pudding model



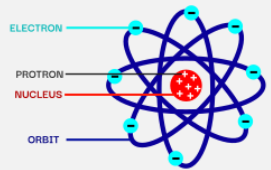
positive charge  
electron

### Thomson's atomic theory

All atoms contain tiny negatively charged subatomic particles or electrons which is embedded in positively charged cloud.

### Rutherford atomic theory

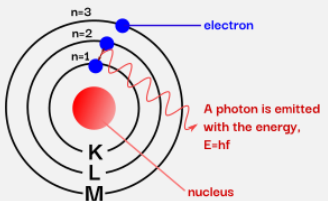
Negatively charged electrons surround the nucleus (a collection of protons) of an atom.



ELECTRON  
PROTON  
NUCLEUS  
ORBIT

### Bohr's atomic theory

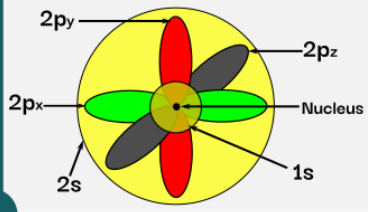
Electrons move in spherical orbits at fix distance and each orbit with fix energy.



n=3  
n=2  
n=1  
electron  
A photon is emitted with the energy,  $E=hf$   
nucleus  
K  
L  
M

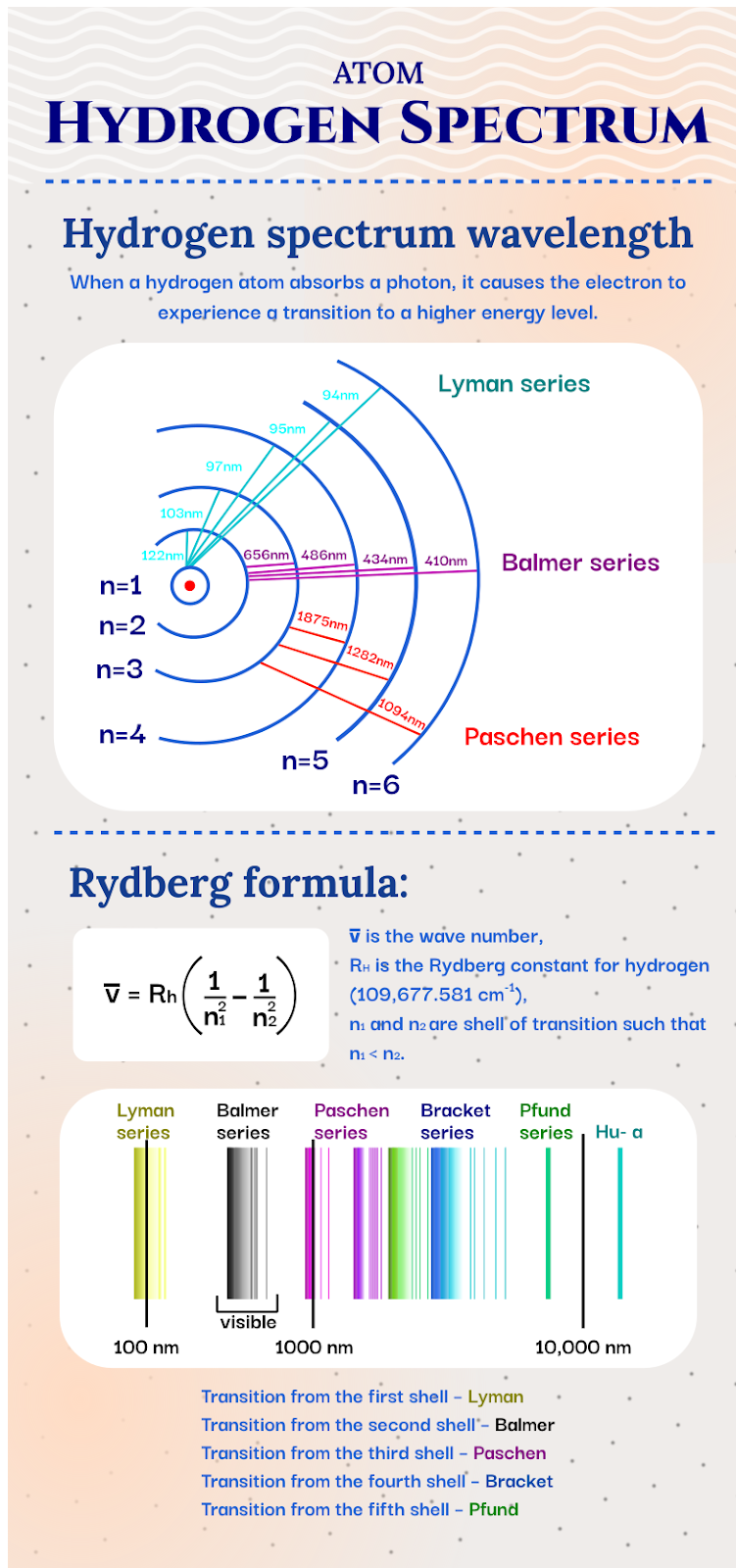
### Schrodinger atomic theory

Electrons doesn't inhabit precise orbit, but rather exist as probability cloud.

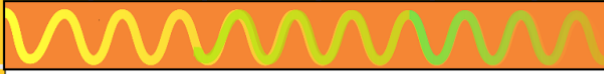


2py  
2pz  
2px  
Nucleus  
1s  
2s

## Artwork 2 - Hydrogen Spectrum Explanation

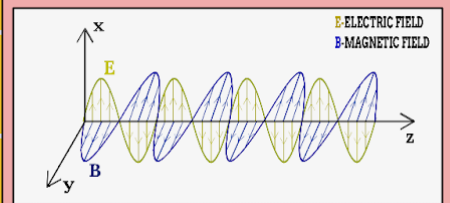


# Artwork 3 - Electromagnetic Waves



## ELECTROMAGNETIC WAVES

**Definition:**  
Electromagnetic waves or EM waves are waves that are created as a result of vibrations between an electric field and a magnetic field.



A linearly polarised EM waves, propagating in the z-direction, with the electric field E along the x-direction and the magnetic field B along the y-direction.


### Electromagnetic Spectrum

Electromagnetic Spectrum is a range of electromagnetic radiations, which can move in form of waves and can travel in medium like air, water and space.

#### TYPE OF RADIATIONS


**RADIO WAVES**

Radio waves are produced by the accelerated motion of charges in conducting wires. They are used in radio and television communication systems.




**MICROWAVES**

Due to their short wavelengths, they are suitable for the radar systems used in aircraft navigation. Radar also provides the basis for the speed guns used to time fast balls, tennis serves and automobiles.




**INFRARED WAVES**

Infrared waves are produced by hot bodies and molecules. This band lies adjacent to the low-frequency or long-wave length end of the visible spectrum. Infrared waves are sometimes referred to as heat waves.




**VISIBLE RAYS**

It is the most familiar form of electromagnetic waves. It is the part of the spectrum that is detected by the human eye.




**ULTRAVIOLET RAYS**

Ultraviolet (UV) radiation is produced by special lamps and very hot bodies. The sun is an important source of ultraviolet light.




**X-RAYS**

One common way to generate X-rays is to bombard a metal target by high energy electrons. X-rays are used as a diagnostic tool in medicine and as a treatment for certain forms of cancer.



**GAMMA RAYS**

This high frequency radiation is produced in nuclear reactions and also emitted by radioactive nuclei. They are used in medicine to destroy cancer cells.



**WAVELENGTH (nm)**

> 0.1 mm

0.1 mm

1 mm

700 nm

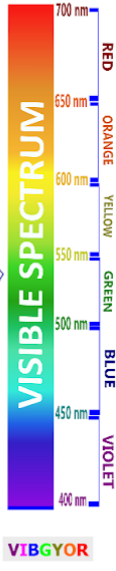
400 nm

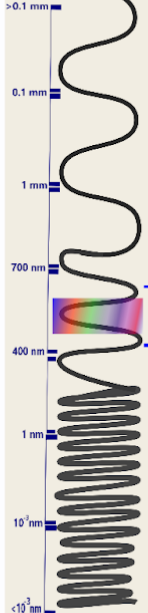
1 nm

10<sup>-3</sup> nm

< 10<sup>-3</sup> nm

**COLORED WAVELENGTH (nm)**



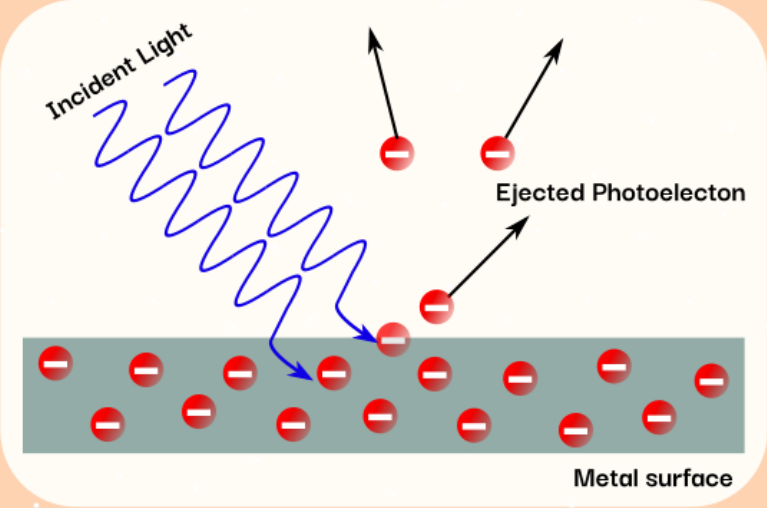




## Artwork 4 - Photoelectric effect

# Photoelectric Effect

Phenomenon in which electrons are ejected from the surface of a metal when light is incident on it.



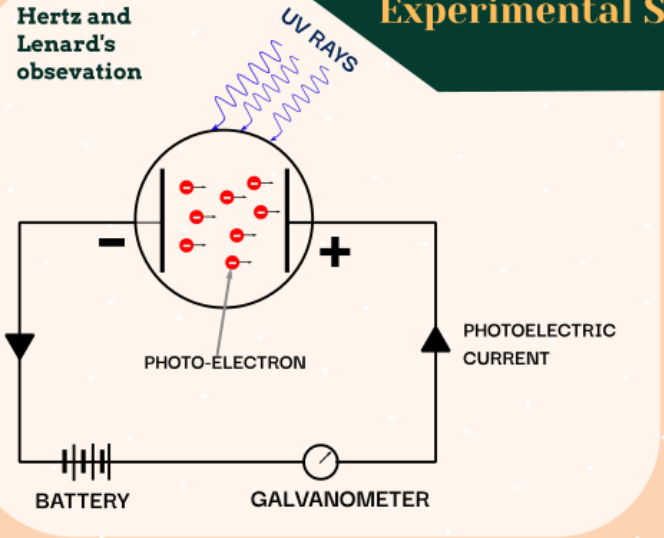
Incident Light

Ejected Photoelectron

Metal surface

### Experimental Study of Photoelectric Effect

Hertz and Lenard's observation



UV RAYS

PHOTO-ELECTRON

PHOTOELECTRIC CURRENT

BATTERY

GALVANOMETER

#### Factors affecting Photoelectric Effect

- Intensity
- A potential difference between metal plate .
- Frequency

## Artwork 5 - Dual Nature of Radiation and Matter

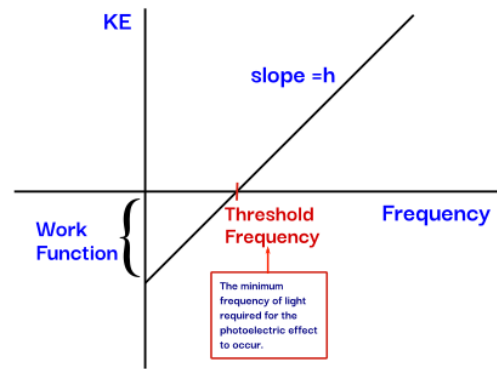
# Photoelectric Effect

### RELATIONSHIP BETWEEN THE FREQUENCY AND THE KINETIC ENERGY

$$E_{\text{photon}} = \Phi + \text{KE}$$

$$hf = hf_{\text{th}} + \frac{1}{2}m_e v^2$$

- $E_{\text{photon}}$  - energy of the incident photon, ( $= hf$ ),
- $\Phi$  - threshold energy, ( $= hf_{\text{th}}$ ),
- KE - kinetic energy of  $e$ , ( $= \frac{1}{2}m_e v^2$  ( $m_e = \text{mass of electron} = 9.1 \times 10^{-31} \text{ kg}$ )),
- $h$  - Planck's constant.



Potassium needs 2eV for electron ejection

The photoelectric effect does not occur when the red light strikes metallic surface because the frequency of red light is lower than the threshold frequency of the metal.

The photoelectric effect occurs when green light strikes metallic surface and photoelectrons are emitted.

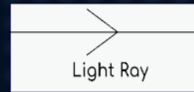
The photoelectric effect occurs for blue light. However, KE for blue light is greater than green light. Because blue light has greater frequency than green light.

# Artwork 6 - Reflection

## RAY OPTICS AND OPTICAL INSTRUMENTS

### Ray :

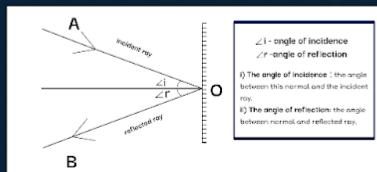
The straight line path along which light travels in a homogeneous medium is called ray.



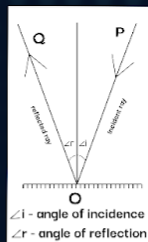
### LAW OF REFLECTION

The law of reflection states that when a ray of light reflects off a surface, the angle of incidence is equal to the angle of reflection.

$$\angle i = \angle r$$

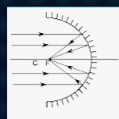


### REFLECTION BY PLAN MIRROR



### REFLECTION BY SPHERICAL MIRRORS

#### CONCAVE MIRROR



F - FOCUS  
C - CENTER OF CURVATURE

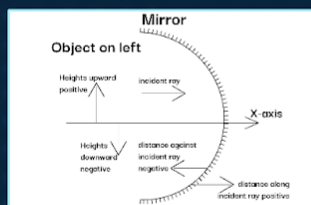
#### CONVEX MIRROR



F - FOCUS  
C - CENTER OF CURVATURE

### SIGN CONVENTION FOR SPHERICAL MIRRORS

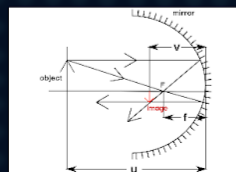
- i) All the distances are to be measured from the pole.
- ii) Distances measured along the direction of the incident ray are positive. The distance measured opposite the direction of the incident ray are negative.
- iii) Height of object and height of image are positive if measured upward from the axis and negative if measured downward.



### MIRROR FORMULA :

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f} \quad \& \quad f = \frac{R}{2}$$

where,  $f$  = focal length,  
 $u$  = distance of object from mirror,  
 $v$  = distance of image from mirror,  
 $R$  = radius of curvature.



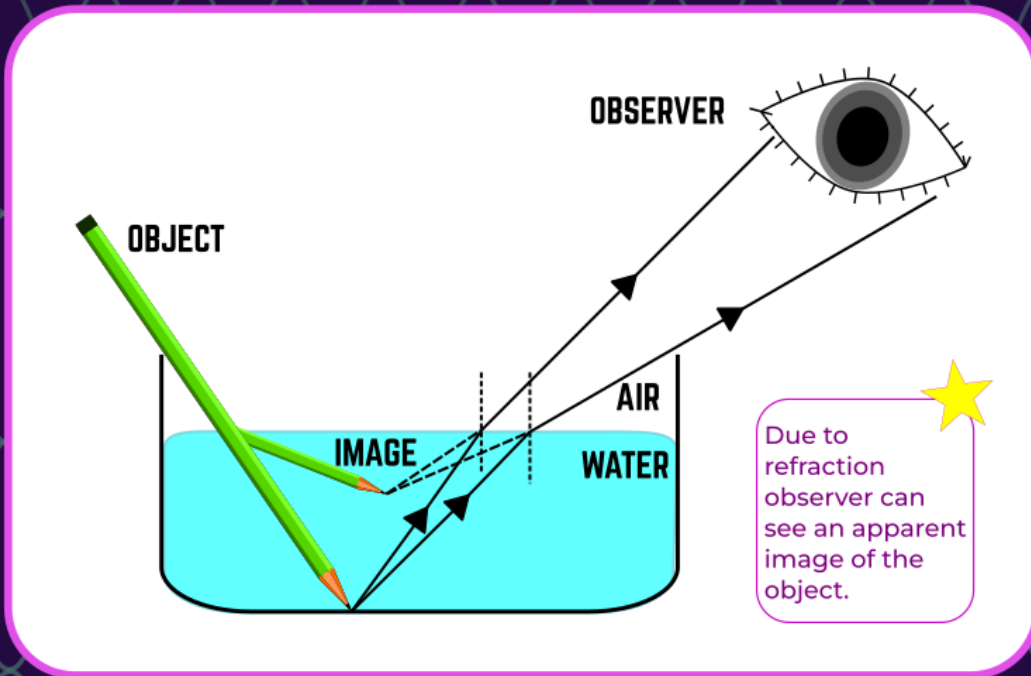
# RAY OPTICS AND OPTICAL INSTRUMENTS

## REFRACTION OF LIGHT

Refraction is the bending of a light when it passes from one medium to another.

## CAUSE OF REFRACTION

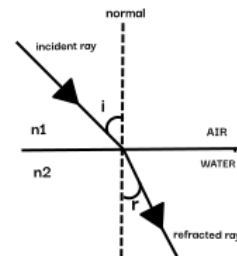
It is caused due to the differences in density between the two substances.



## SNELL'S LAW

The ratio of the sines of the angles of incidence and refraction of a wave are constant when it passes between two given media.

$$\frac{\sin i}{\sin r} = \frac{n_2}{n_1}$$

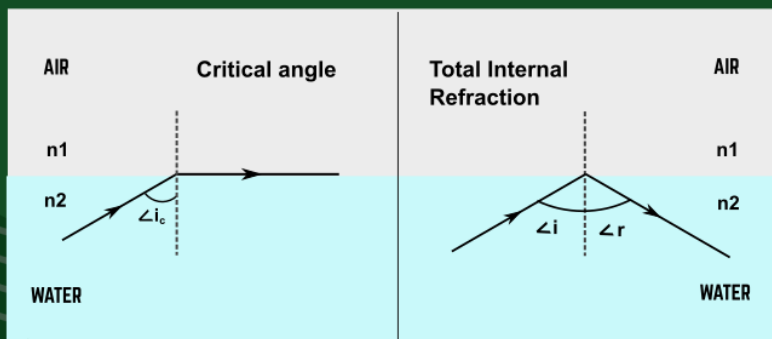
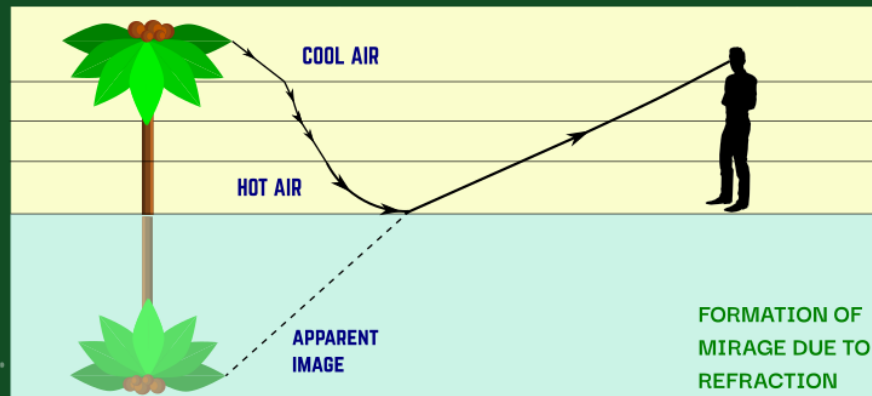


## Artwork 8 - Total Internal Reflection

# RAY OPTICS AND OPTICAL INSTRUMENTS

## TOTAL INTERNAL REFLECTION

The phenomenon which occurs when the light rays travel from a optically denser medium to a optically rarer medium.  
Example- Diamond, Mirage, Optical fiber.



FORMULA

**TOTAL INTERNAL REFLECTION**

$$\frac{\sin i}{\sin r} = \frac{n_2}{n_1}$$

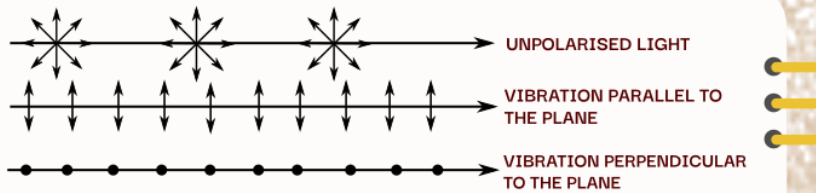
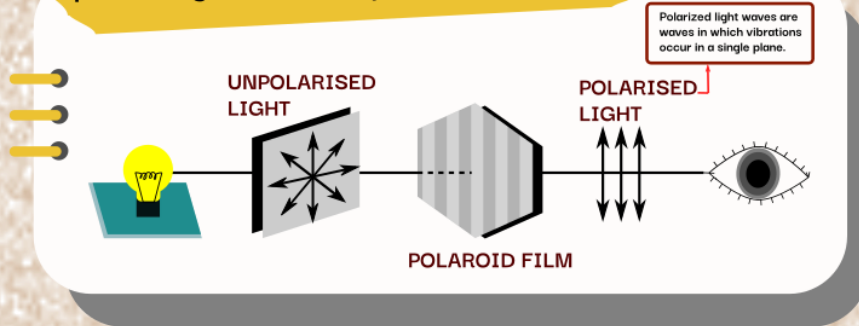
**CRITICAL ANGLE,  $\theta$**

$$\sin \theta = \frac{n_2}{n_1}$$

# WAVE OPTICS

## Polarization

The process of transforming unpolarized light into polarized light is known as polarization.

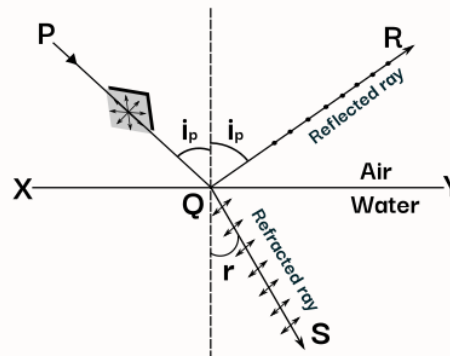


Polarisation of light by REFLECTION and REFRACTION

### Brewster's law :

When light is incident on transparent surface at polarising angle, the reflected and the refracted rays are perpendicular to each other.

$$QR \perp QS$$





# Artwork 10 - Huygen's Principle

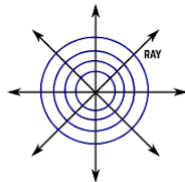
## WAVE OPTICS

### Wavefront

Locus of all points having same phase at a given instant of time.

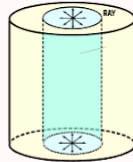
#### Spherical Wavefront

Disturbances propagated outward in all directions from the source of waves.



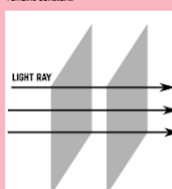
#### Cylindrical Wavefront

When the source of light is linear, all the points equidistant from the linear source lie on the surface of a cylinder.



#### Plane Wavefront

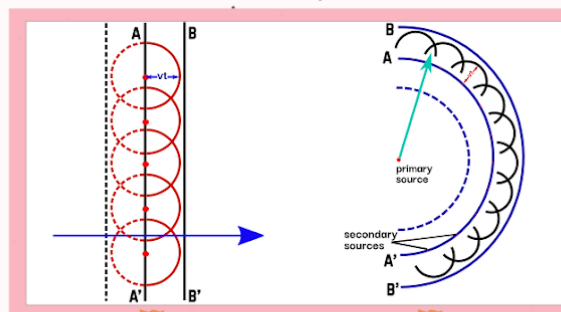
When the light is coming from a very far-off source, the wavefronts are planar. Amplitude remains constant.



### The Huygens' Principle

Every point on a wave front may be considered as a source of secondary waves.

v- velocity of light  
t- time



Plane wavefront

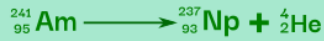
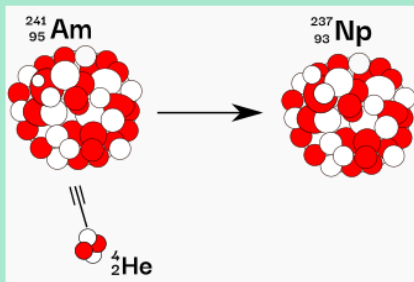
Spherical wavefront

## Artwork 11 - Radioactivity

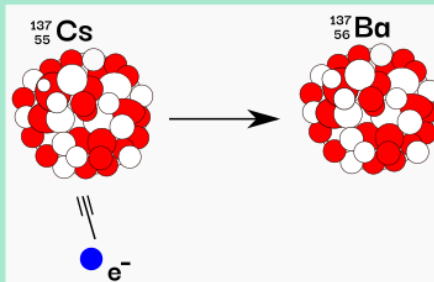
# RADIOACTIVITY

The emission of ionizing radiation or particles caused by the spontaneous disintegration of atomic nuclei.

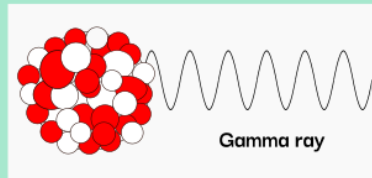
### ALPHA DECAY



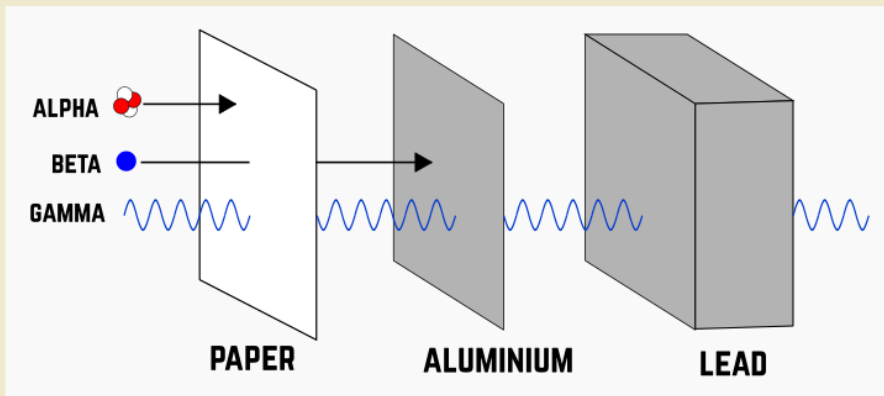
### BETA DECAY



### GAMMA DECAY



### PENETRATION EFFECT ON ALPHA, BETA AND GAMMA





## Artwork 12 - Semiconductor

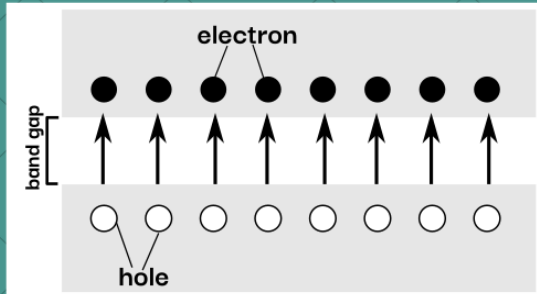
# Semiconductors

Semiconductors are the materials which have a conductivity between conductors and non-conductors or insulators.

### Holes and Electrons

**Holes** are the absence of an electron in a particular place. And are the positively charged.

**Electrons** are the negatively charged electric charge carrier.

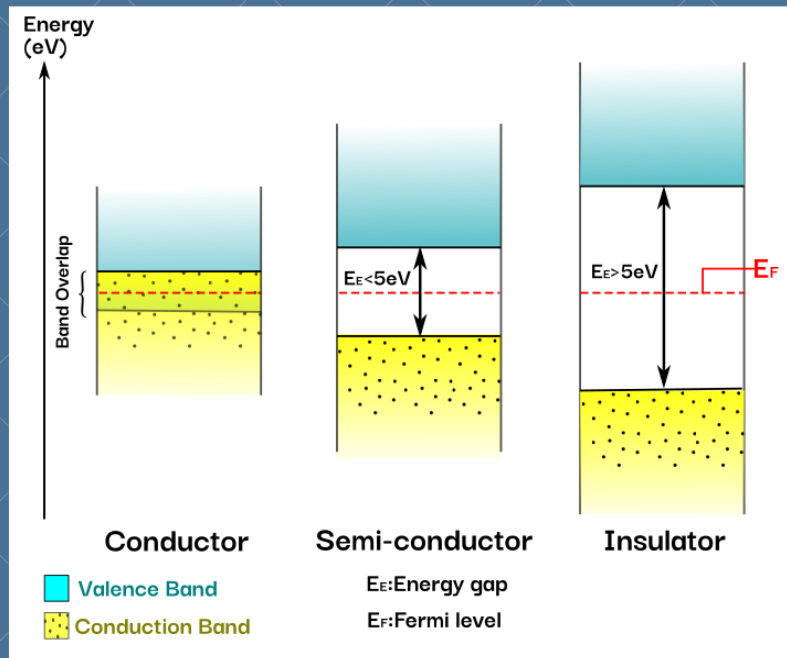


### Energy Band Gap

**Valence Band**-The energy band involving the energy levels of valence electrons.

**Conduction Band**-It is the lowest unoccupied band that includes the energy levels of holes or free electrons.

**Energy Band Gap**- Energy required for electron/hole to transition from valence band to conduction band.



# Artwork 13 - Type of semiconductor

## TYPE OF SEMICONDUCTOR

**Intrinsic Semiconductor**

**Extrinsic Semiconductor**

### Intrinsic Semiconductor

An intrinsic semiconductor is made to be **pure** and **single** type of element.

#### CONDUCTION MECHANISM

#### ENERGY BAND DIAGRAM

*Number of holes = Number of electrons*

$n_h = n_e$

⊕ NUCLEUS + INNER ELECTRONS

○ HOLE    ● VALENCE ELECTRON    ● FREE ELECTRON

---

### Extrinsic Semiconductor

An extrinsic semiconductor is made by **doping** some **impurities** in pure semiconductors.

#### n-type

##### CONDUCTION MECHANISM

##### ENERGY BAND DIAGRAM

$n_h \ll n_e$

#### p-type

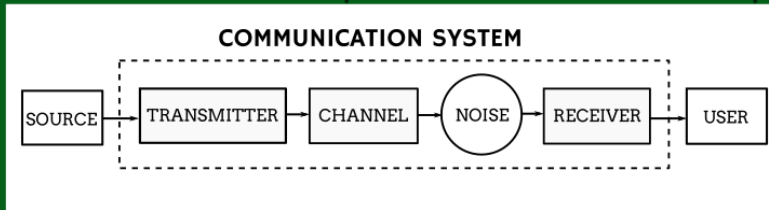
##### CONDUCTION MECHANISM

##### ENERGY BAND DIAGRAM

$n_h \gg n_e$

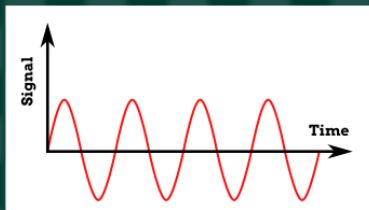
# COMMUNICATION SYSTEMS

Transmission of information from source to user.



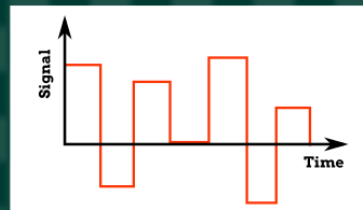
## Type of signals

### Analog signal



- ◆ Continuous signals
- ◆ Represented by sine waves
- ◆ Continuous range of values

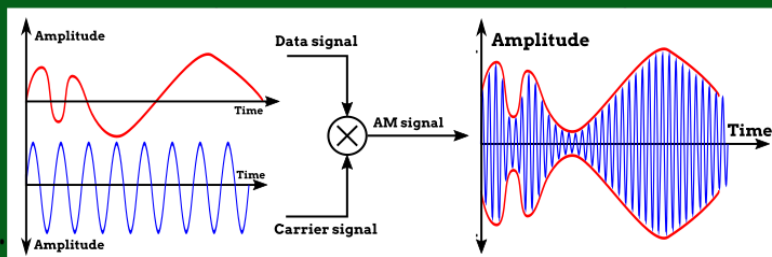
### Digital signal



- ◆ Discrete signals
- ◆ Represented by square waves
- ◆ Discontinuous values

## Amplitude Modulation

When the carrier amplitude is varied in accordance with the modulating waves.



## Artwork 15 - NFT sale post



**NEW NFT**  
3D ART GALLERY  
★★★★★

Design by  
**SYANKITA**

**2057+** Items Sold    **24K+** Followers

**Buy it now**  
opensea.com

**3D GRAPHIC DESIGNER**

**\$50.00 USD**  
Item Price

The artwork features a dark blue background with a circular graphic on the right containing a 3D character on a green platform. The character is a stylized figure with a bald head, wearing an orange shirt with the Chinese character '敗' (defeat) on it, and blue pants. The background of the circle is orange with blue clouds. The overall design is modern and digital.

## Artwork 16 - Social media post



**BIG SALE**

**Best  
Wrap  
Around**

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The artwork shows a woman with blonde hair wearing a dark blue wrap-around top with a white and green floral pattern. She is standing outdoors with trees in the background. The text is in white and yellow on a dark grey background.

## Artwork 17 - Poster



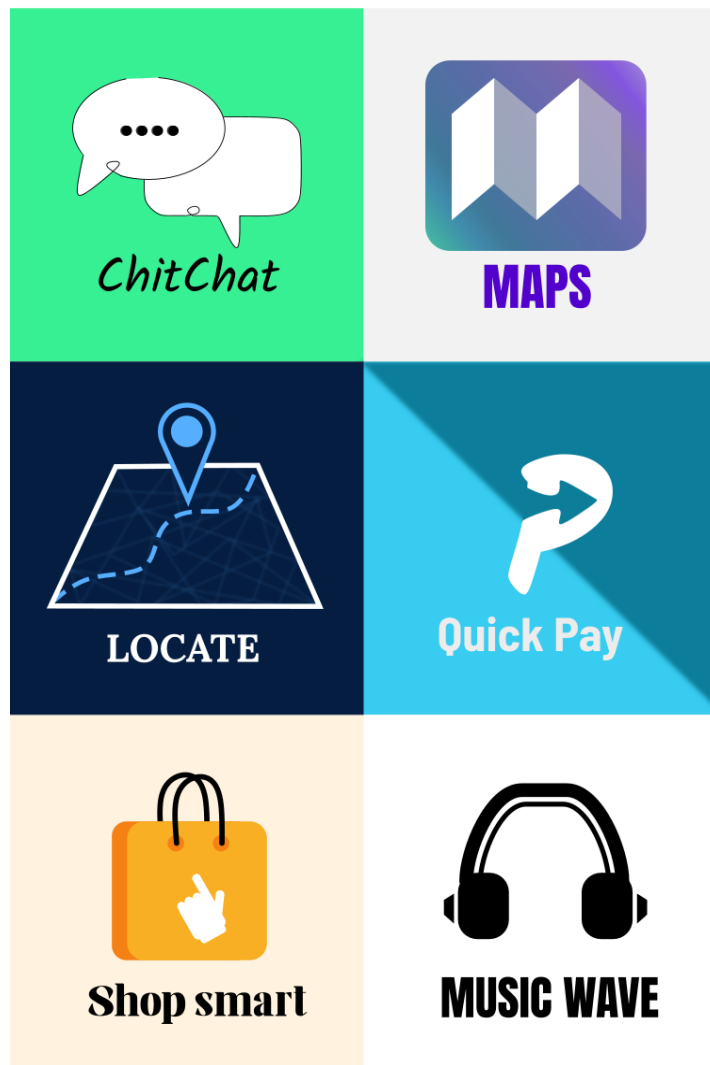
## Artwork 18 - Gender equality poster



## Artwork 19 - Travel Brochure



## Artwork 20 - Different App Icons



## Personal Impact

This fellowship has helped me achieve diverse skills in graphic designing as well as gave me very useful insight into the capabilities of open source software alternatives, especially in graphic design. I also acquired talented designers from colleges across the country from whom I gained immense knowledge from their unique outlooks on design, art, and life. I came to know about the FOSSEE project in detail and working with them opened many career options.

## References

Apart from the insights provided by my mentor and acquaintances, I took references from:

- Pinterest
- Wikipedia
- Google
- Other online sources like Khan Academy, etc.
- Books like NCERT XIIth Std. Physics, Nootan ISC XIIth Std. Physics.

Thank  
you