CONTENTS

General Wave Properties

Multiple Choice Questions (MCQs)

i. A girl throws a small stone into a lake. Waves spread out from where the stone hits the water and travel to the bank of the lake. She notices that ten waves reach the side of the pond in a time of 5.0s. What is the frequency of the waves?
* 0.50Hz * 15Hz *** 2.0Hz** * 50Hz

ii. Water waves can be used to shoe reflection, refraction, and diffraction. For each of these, which row shows whether or not the speed of the water waves changes?

	Reflection	Refraction	Diffraction
a)	**Yes**	**Yes**	**Yes**
b)	Yes	No	Yes
c)	No	Yes	no
d)	No	No	no

iii. The wave reaches point P. What is the name of effect that causes the wave to reach point P?
*** Diffraction** * Dispersion * reflection * Refraction

iv. Water waves pass from deep into the shallow region then refracted. The characteristics of wave which remains constant is:
* Direction *** Frequency** * Speed * Wavelength

v. When an oscillating object is in simple harmonic motion, its maximum speed occurs when the object is at its.
* Higher point * Lowest point *** Equilibrium point** * Extreme point

vi. In an oscillating pendulum, the accelerates from its extreme position due to.
* The earth * Floor of the bowl * Centre of bowl *** Extreme position**

vii. Oscillations are damped due to the presence of;
* Linear motion * Restoring force *** Frictional force** * Mechanical force

viii. A disturbance from an equilibrium condition that propagates from one region of space to another is called:
*** Wave** * Sound * Motion * Period

ix. The waves which require a medium for propagation is called:
* Electromagnetic wave *** Mechanical wave**
* Long waves * None of them

x. The waves do not require medium for propagation is called:
* Longitudinal waves * Mechanical waves
* Electromagnetic waves * None of them

xi. An oscillatory (vibratory) motion is always under:
* A negative force * A periodic table * An applied force ***An elastic restoring force**

xii. When a body attached with the spring has no displacement from its mean position of the body is known as:
* Extreme position * Equilibrium position
*** Zero position** * Initial position

xiii. The distance between mean position and extreme position is known as:
* Displacement * **Amplitude**
* Equilibrium * Maximum distance

xiv. When a body attached with a spring has maximum displacement from its:
* Equilibrium position * Mean position
* Extreme position * **Initial position**

xv. When a string is stretched and then released it moves toward the mean position due to:
* Applied force * External force * **Elastic restoring force** * All of there

xvi. The number of vibrations executed by an oscillating body in one second is called:
* **Frequency** * Time period * Amplitude * All of these

xvii. The time required to complete one vibration is called:
* Frequency * **Time period** * Amplitude * All of these

xviii. The S.I unit of frequency is:
* Meter * Newton * Kilogram * **Hertz**

xix. Frequency and time period are:
* Equal to each other * Equal to each other but in opposite direction
* **Reciprocal to each other** * None of these

xx. A generator produces 30 pulses in 5 seconds its frequency is:
* 30 hertz * 150 hertz * **6 hertz** * 5 hertz

xxi. Which of the following does not exhibit S.H.M.:
* A plucked violin string * **A train shunting between two terminals**
* A simple pendulum * A mass attached to a spring when released

xxii. At mean position during S.H.M.:
* P.E is max & K.E is min * **P.E is min & K.E is max**
* Both P.E & K.E are max * Both P.E & K.E are min

xxiii. The time period of a simple pendulum depend upon:
* **Length of the pendulum** * Mass of the thread
* Mass of the pendulum * Material of pendulum

xxiv. The time period of a second pendulum is:
* One second * **Two second** * Three second * Four second

xxv. When a simple pendulum swings which of the following quantities does not become zero throughout oscillation:
* Acceleration * Momentum * Speed * **Weight**

xxvi. The frequency of second pendulum is:
* **0.5 hertz** * 1 hertz * 1.5 hertz * 2 hertz

xxvii. For a simple pendulum the graph between l and T is:
* **Parabola** * Circle * Straight line *Ellipse

xxviii. The wave in which the particles of the medium vibrate perpendicular to the direction of wave is called:
* Compression wave * Longitudinal wave
* **Transverse wave** *Electromagnetic wave

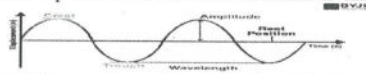
xxix. The wave in which the particles of the medium vibrate parallel to the direction of water is called:
* Compression wave * **Longitudinal wave**
* Transverse wave * Electromagnetic wave

SHORT QUESTION'S & ANSWERS

Q.1. What are waves and formation of waves?

Waves:

"A method transport energy from one point to another point without transfer of matter is called Wave".



Formation of Waves:

Disturbance of medium cause of formation of wave like, we can produce waves by using a rope, slinky spring, and water waves in ripple tanks.

Q2. Explain the procedure of producing wave in Slinky Spring?

A slinky spring is a pre- compressed helical or coiled spring

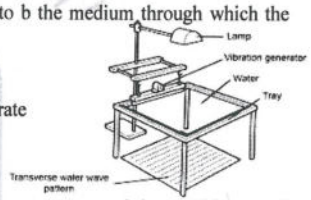
Explanation:

Attach one of the spring with a wall. Now moving the free end of the slinky horizontally left and right continuously on the table will be able to see the coils of the spring moving left and right whereas humps travel to the other end.

Now moving the free end of the attached wall slinky spring continuously back and forth as horizontally shown. You can observe the individual coils moving forwards. Where the coils are compressed are seen traveling form the fixed end to the other end.

In both of the above experiments, the slinky spring is said to b the medium through which the waves travel or propagate.

Q.3. What is ripple tank? Explain its working.



Ripple Tank:

"A ripple tank is a shallow glass tank of water used to demonstrate the basic properties of waves"

Working:

In the ripple tank, a small vibrator moves up and down the water surfaces that are in contact with the dipper being made to move up and down. This up and down motion soon spread to other parts of the water surface in the tank in the form of ripple.

Q.4. Define transvers waves.

Transvers Waves:

"Transvers waves are waves that travel in a direction perpendicular to the direction of wave motion"

Transverse wave motion can also be observed on the surface of the water in a pond or a ripple tank, vibrations in a guitar string. Another essential type of transverse wave is electromagnetic waves, e.g., light waves, microwaves, radio waves.

Q.5. Define the following.

Amplitude:

"Amplitude is the maximum displacement moved by a point on a vibrating body from the rest or mean position".

It is the height of a crest or depth of a trough measured from the rest position. Its SI unit meter (m).

Crest:

"Crest is a point on a surface wave where the displacement of the medium is at a maximum".

OR

"The positive/upper part of wave is called crest".

Through:

"Trough is a point on a surface wave where the displacement of the medium is at a minimum".

Compression:
Compression, in the longitudinal waves this is a region where turns of the coil or particles are closer together than average.

Rarefaction:
Rarefaction, in the longitude waves this is a region where turns of the coil or particles are further apart than average.

Q.6. Define Longitudinal Wave.

Longitudinal Wave:

"Longitudinal waves are waves that travel in a direction parallel to the direction of wave motion". Another common example of a longitudinal wave is sound waves.

Q.7. Write any four differences between Mechanical and Electromagnetic Waves.

Mechanical and Electromagnetic Waves:

Mechanical Waves	Electromagnetic Waves
Mechanical waves are such waves that need a medium for propagation.	Electromagnetic waves are such that do not need a medium for propagation.
Mechanical waves are produced by vibratory motion in the respective medium.	Electromagnetic waves are produced by a changing of electric and magnetic fields.
Sound waves, water waves, and seismic waves are some examples of mechanical waves.	Radio waves, microwaves, light waves, U.V waves and infrared waves are some examples of electromagnetic waves.
Mechanical waves cannot travel through the vacuum.	Electromagnetic waves are only comprised of a transverse wave in nature.

Q8. Write down the name of some wave properties?
There are three properties of waves; which are as under.
1. Reflection:
2. Refraction;
3. Diffraction;

Q.9. Define Reflection of the wave.

Reflection of the waves:
"Bouncing back of waves into same medium by striking other medium surface is called reflection of the waves".
When a vertical straight surface is placed in the path of the incoming waves. The incident waves are reflected from the surface at the same angle. It can be seen that the reflected waves obey the law of reflection. Example the angle of the incident wave along the normal will be equal to the angle of the reflected wave.

Q.10. Define Refraction of the wave.

Refraction of the waves:
"When a wave enters from a region of deep water to a region of shallow water at an angle, the wave will change its direction" and waves travel faster in deep water then in shallow water this effect is called refraction.

Q.11. Define Diffraction of waves.

Detraction of waves:
"The spreading of the waves near an obstacle is called Diffraction"
When an obstruction or a straight surface with a gap in the ripple tank is placed in the path of the incoming water waves, they strike it the waves will bend around the sides of an obstruction o spread out as they pass through a gap. This phenomenon is called diffraction.

Q.12. Write some characteristics of Waves.

Characteristics of Waves:
The following are some terms used to describe wave motion.

i. Time-Period (T):
"Time-Period (T) is the time taken for any one point on the wave to complete one oscillation". The SI unit of the period is second (s).

ii Frequency:
"Frequency (f),is the number of complete waves produced by a source per unit of time".
Frequency is denoted by f and its unit is hertz (Hz)

iii. Relation between f and T
Frequency = Number of complete waves produced/ time taken
If the number of waves produced= is 1
And time is taken = T Then

$$f = 1/T$$

Wavelength:
"Wavelength λ is the linear distance between two successive crests or troughs in a transverse wave and two successive compressions and rarefactions in a longitudinal wave".
Its SI unit is mete (m). and it is denoted by λ.

The Wavefront:
"The Wavefront is an imaginary line on a wave that joins all points that are in the same phase.

Types of Wavefront:
There are two types of the Wavefront
1. Circular Wavefront 2. Plane Wavefront

Q13. Define wave speed and drive its formula

Wave Speed:
it is defined as the distance traveled by a given point on the wave, such as a crest in a given interval of time.

Speed = Distance traveled/time taken or $V = \frac{s}{t}$ ------eqe, 1

Let us consider for a wave,
Distance travelled = λ and time is taken = T, then eq , 1 becomes

$$V = \frac{S}{t} = \frac{\lambda}{T}$$

Here $S = \lambda$
and $t = T$
so $v = \frac{\lambda}{T}$ ⟶ (i) ∴ $\frac{1}{T} = f$

$$v = f\lambda$$

Q.14. Define Periodic or oscillatory motion and give condition for simple harmonic motion.

Periodic Motion:
"A motion repeating itself in an equal time interval is referred to as periodic or oscillatory motion".

Condition For SHM;
Following are the conditions of SHM
1. The body must act upon by some restoring force.
2. The body must have inertia.
3. The acceleration should be directly proportional to displacement.
4. The system should be elastic.
5. The system should obey Hook's Law.
6. The acceleration should be directed to mean position.

Q. 15 Define simple Harmonic Motion. Give some examples of Simple Harmonic Motion?

Simple Harmonic Motion:

Simple harmonic motion is a vibratory motion in which acceleration is directly proportional to the displacement and always directed towards the mean or equilibrium position

$$.a\ \alpha(-x)$$

(-ve) negative sign shows that the direction of displacement (x) is opposite to that of the restoring force.

Example of simple harmonic motion;

Following are the some example of simple harmonic motion

i. Motion of simple pendulum ii. Motion of body attaché to a spring

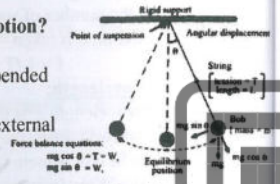
iii. Motion of swing

Q.16 What is a Simple Pendulum prove that it has Simple Harmonic Motion?

Simple pendulum:

"A simple pendulum consists of a small metallic bob of mass 'm' suspended from a light inextensible string of length 'l' fixed at its upper end".

At the mean position, a pendulum is in its equilibrium position. If no external force were applied, the bob of a pendulum would naturally settle here.



Forces Acting on a Displaced Pendulum:

When the bob of the pendulum is displaced at a small angle θ to an extreme position. The forces that act upon it are as given underneath:

i, Tension 'T' along the direction of the string, and

ii, Weight W= mg, acting vertically downwards.

The weight is further resolved into its components mg sinθ and mg cosθ.

Proof of motion of simple pendulum is SHM:

If a point mass is suspended by mean of an ideal and weightless string and is hang by a regid support then the system is called simple pendulum.

Let in the beginning bob of pendulum is at its mean position then it is displaced up to a extreme position.

Then work done Fd = Fx on the bob restore a force -F equal in magnitude and opposite to applied force F and it is gains maximum potential energy at extreme point , when bob release from extreme position it starts periodic motion about mean position it means that potential energy is greater at extreme points. And kinetic energy is minimum at mean position due to maximum velocity. It means its velocity decreases at the time when it is moving mean to maximum positions and velocity decreasing means acceleration is negative at extreme position it is zero. So we can say that acceleration of bob is directly proportional to displacement in opposite direction.

$$a\ \alpha(-x)$$

Hence motion of simple pendulum is SHM.

Q.17 Define Time Period of Simple Pendulum.

Time Period of Simple Pendulum:

"The time required to complete one vibration is called Time Period"

The time period of simple pendulum can be calculate as:

$$T = 2\pi\sqrt{\frac{l}{g}}$$

Depending Factor:

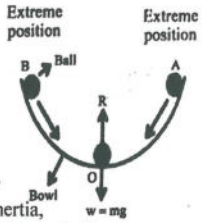
The time period of simple pendulum depends upon:

i. Length = l

ii. Acceleration due to gravity = g

The time period of pendulum is independent of its mass and amplitude.

Q.18 With the help of diagram explain SHM in the ball and bowl system.



Ball and Bowl System and SHM:

The motion of a ball placed in a bowl executes simple harmonic motion. When the ball is placed at the mean position "O", at the centre of the bowl. In this position, the net force acting on the ball is zero. Hence there is no motion. If we displace the ball to an extreme position 'A' and then release it the ball starts moving towards the mean position '0' due to the restoring force caused by its weight component. At position '0' the ball acts maximum speed and due to inertia, it moves towards opposite extreme position 'B' with the restoring force that acts towards the mean position, the speed of the ball starts to decrease. The ball stops for a while at 'B' and then again moves towards the mean position '0'. This ball's to and fro motion continues about the mean position '0'. This result shows that the acceleration of the ball is directed towards `O'. Hence, the ball's to and fro motion about a mean position placed in a bowl is also an example of simple harmonic motion.

Q.19 What are Damped System and Oscillations?

Damped System:

"An oscillating system in which friction has an effect is a Damped System"

Damped Oscillations:

"The oscillations of a system in the presence of some resistive forces are Damped Oscillation".

Q.20 A boy is swinging in the swing. Explain why its amplitude reduces progressively with time.

During the flight boy experience force of friction of air due to which reduce the amplitude of the swing because of damp oscillation.

Sound

(MULTIPLE CHOICE QUESTIONS)

i. Sound is form of;
* Electrical energy * **Mechanical energy**
* Thermal energy * Chemical energy

ii. Audible frequencies range that a normal human ear can detect is;
* 10 HZ and 10KHz * **20 HZ and 20 KHz**
* 25 Hz and 25 kHz * 30 Hz and 30 kHz

iii. The approximate value of the speed of sound in air at 0°C temperature is;
* **332 m/s** * 34m/s * 17 m/s * 680 m/s

iv. Sound travel faster in solid as compare toe gases because of;
* Gas molecules are packed loosely
* Sound does not travel faster though a solid than a gas
* **Solid molecules are packed tightly**
* Gas molecules move faster

v. The two factors that affect the speed of sound in air are;
* Humidity and volume of the air * Temperature and mass of the air
* Volume and mass of the air * **Temperature and humidity of the air**

vi. The separation between two consecutive compressions of the sound wave is called;
* Time period * Amplitude * Frequency * **Wavelength**

vii. The order of speed of the sound in the different mediums from faster to slowest is;
* Gas → Liquid → Solid * Liquid → Solid → Gas
* **Solid → Liquid → Gas** * Gas → Solid → Liquid

viii. Ultrasound has several uses in medicine and industry. Which one has use of ultrasound?
* Absorption * **Pre-natal scanning**
* Dispersion * Measuring humidity of air

ix. The causes of the echo is;
* Absorption * Dispersion * **Reflection** * Refraction

x. Which type of wave cannot travel through a vacuum?
* **Sound waves** * Infra-red radiation * Microwaves * X-rays

SHORT QUESTION'S & ANSWERS

Q.1 Define sound and how sound is produced.

Sound is a form of energy related to the vibrating motion of molecules.

This energy travels from one point to another as a wave for example, a guitar produces a musical note when a string vibrates.

Production of Sound;

Sound is produced by vibrating sources placed in a medium.

A vibrating object in the medium cause of alternating compressions and rarefaction that carry the sound further away through the medium.

Q2. Define the nature of sound

A sound is a mechanical longitudinal wave. The direction of vibration of air molecules is parallel to wave motion , similar to the longitudinal waves produced when a slinky spring is vibrated parallel to Its direction of motion. Now we can consider that the compressions and rarefaction of sound wave are due to a slight change in the air pressure.

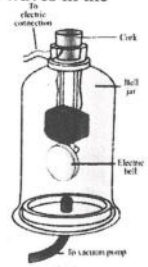
The comparisons and rarefaction of sound waves are due to a slight change in the air pressure.

Compression are regions where are pressure is slightly higher than surrounding air pressure and **Rarefaction** are regions where are pressure is slightly lower than the surrounding air pressure.

The rising and falling of air pressure take place continuously as long as a vibrating body produces the sound.

Q.3 By an experiment prove that sound waves need material medium in travel?

Sound is a mechanical wave that needs a material medium such as gases, liquids, solid to propagate due to the vibratory motion of particles of the medium that transport sound waves in the form of energy from one point to another sound cannot travel through a vacuum.



Take an electric bell and an airtight glass bell jar and then suspend the electric bell inside the jar. Connect the Bell jar to a vacuum pump, when you switch on the electric bell, you can hear the sound of the bell coming from inside ear and glass material. Now start the vacuum pump. As the air in the jar is gradually pumped out, the sound becomes fainter, although the same current is passing through the bell and hammer that strike the gong. After a while, you will hear the faintest sound, when there is less air.

Q4. Describe the experiment to determine the speed of sound?

Experiment to determine the speed of Sound;

- There are several experiments that can be carried out. To determine the speed of sound.
- One of the methods is described below.
- The apparatus for each experiment is given in bold. Measuring the speed of sound directly between two points.

1. Two people stand a distance of around 100 m apart
2. The distance between them is measured using a trundle wheel
3. One person has two wooden blocks, which they bang together above their head
4. A second person with a stopwatch starts watch when he hears one of the claps and ends timing after 20 claps.
5. This is then repeated several times and an average value is taken for the time.
6. The speed of sound can then be calculated using he equation;

$$\text{Speed od sound} = \frac{\textit{Distance travel by sound}}{\textit{Time taken}}$$

Q.5 Define the speed of Sound Establish relation between speed (V) wavelength (λ) and frequency (f)

The speed of sound is defined as the distance which a point on a wave, such as a compression or a rarefaction, travels per unit of time.

We know.

Speed v = distance / time

$$v = \frac{\lambda}{T}$$

Where λ is the wavelength of the sound wave. It is the distance traveled by the sound wave in one time period (T) of the wave. Thus,

$$V = \lambda f \quad (\because 1/T = f)$$

Or $V = \lambda f$

Q.6 Describe the factor that effect the speed of sound?

The speed of sound is affected by a variety of factors.

Effect of Temperature

Temperature is also a condition that affects the speed of sound. Heat is a form of energy that depends upon the kinetic energy of molecules. Molecules of the medium at higher temperatures have more energy. Thus, they can vibrate at a higher rate. As the molecules vibrate faster, sound waves can travel more quickly. The formula to find the speed of sound at temperature Tin the air is given as follows:

$$v = 331x\sqrt{\frac{T}{273K}}$$

This formula shows that the speed of sound in air is directly proportional to the square root of the absolute temperature.

Effect of Humidity:

Humidity also affects the speed of sound in the air. The effect of water vapor on the speed of sound is minimum than that of dry air. The presence of moisture in air replaces oxygen and nitrogen gases that reduce the density of air because the molecular mass of water vapors (Molecular Mass =18) is less than that of oxygen the speed of sound in gases are inversely related to the square root of its density

$$v \propto \frac{1}{\sqrt{\rho}}$$

Thus, humidity increases, the density of the air decreases and sound travels faster.

Q:7 Write the Characteristics of sound.

Quality:

It is defined as the characteristic of sound by which we can distinguish between two sounds of the same loudness and pitch.

Loudness:

It refers to the ability to distinguish between a loud and a quiet sound.

Pitch:

It is the quality of sound that distinguishes between a shrill and a flat sound.

Q.8 What is Sound intensity?

Sound intensity or acoustic intensity: It is defined as the power carried by sound waves per unit area in a direction perpendicular to that area. The SI unit of intensity, which includes sound intensity, is the watt per square meter (W/m^2).

Q.9 Write the harmful effect of noise?

The excessive noise level has harmful effects of human health as they can cause conditions such as stress and disturb concentration. Over time, hearing loss, sleeping disorder, aggression, hypertension, high stress levels.

Q:10 Define Echo.

Echo:

The repetition of the sound after reflection is known as an echo. If we take the speed of sound 340 m/s at a temperature of 26 °C in air, the sound travels to the obstruction and reaches back to the listener on reflection after 0.1s. Hence, the total distance covered by the sound from the point of production to the reflecting surface and back should be at least

distance = speed x time d=

340 m/s × 0.1 s

d= 34 m.

For hearing clear echoes, the minimum distance of the obstruction from the source of sound should be half of this distance, that is, 17 m.

The sound with frequencies above the upper limit of the human range of audibility is known as Ultrasound.

The range of frequencies of sound that a person can hear is called the range of audibility or the audible frequency range.

Sound with frequencies below the lower limit of the human range of audibility is known as infrasonic.

Q:11 Write some uses of Ultrasound.

Ultrasounds are used extensively in industries and for medical diagnostic purposes. Cleansing Ultrasound is commonly used to clean many objects even in hard-to-reach places, including jewellery, dental and surgical instruments, musical instruments, objects be cleaned are placed in a cleaning solution, and ultrasonic waves are sent into the solution. Due to its high frequency dust, grease, and contamination particles detached and dropped. The objects thus get thoroughly cleansed.

Quality control

Ultrasounds are also used to detect cracks cavities, and flaws in metal and concrete blocks. Ultrasonic waves pass through the metal block, and detectors are used to detect the transmitted waves.

Sound navigation and ranging (SONAR)

SONAR is extensively used in marine applications. Due the transmitter sends out ultrasound pulses, and measures the time it takes for the pulses to reflect off a distant object and return to the source or transducer. The position of that object can be identified, and its movement can be tracked. Locate and track submarines at sea, and locate explosive mines below the surface of the water.

Echocardiography

Echocardiography is a painless and non-invasive medical imaging procedure. A transmitter sends out pulses of very high frequency. The transducer is positioned on the chest at specific locations and angles, the pulses move across the skin and other body tissues to the heart tissues, where the pulses bounce or echo of the heart structure. These pulses are then transmitted to a computer to create moving images of the heart walls and valves. The image produced is called an echocardiogram.

Q12: Write a note on Ultrasonography?

Ultrasonography

It is a technique that uses an instrument ultrasound scanner. This scanner uses high-frequency sound waves to obtain images of the internal organs of the human body and to examine the foetus during pregnancy. A sinologist visualize the organs of the patient, such as the liver, gall bladder, uterus. kidney, It helps the doctor identify abnormalities, such as stones in the gall bladder and kidney or tumors and abnormalities in different organs. In this technique, the sound waves penetrate the body and hit boundary between tissues, e.g., between fluid and soft tissue, bone and soft tissue, and get reflected from an area where their tissue density changes. The instrument calculates the distance from the probe to the tissue or organ boundaries using the speed of sound in tissue and the time of the return of each echo. These pulses are then converted into electrical signals used to create two-dimensional images of the organ.

Electromagnetic Spectrum

Multiple Choice Questions;(MCQs)

i. The wave that have maximum penetrating power to treat tumors are;

* Ultraviolet radiation * Microwaves * **Gamma-rays** * Radio waves

ii. The electromagnetic rays used in radiotherapy to destroy cancer cells are;

* Infrared rays * Visible rays * **X-rays** * Ultraviolet rays

iii. The velocity of light in a diamond is;

(Whereas the refractive index of a diamond with respect to vacuum is 2.5)

* **1.2×10^8 m/s** * 5×10^8 m/s * 1.2×10^{10} m/s * 2.5×10^8

iv. The group containing only electromagnetic waves is;

* **Light waves, Radio waves, Microwaves** * Light waves, Radio waves Sound waves

* Light waves, Sound waves, Microwaves * Radio waves, Sound waves, Microwaves

v. The list that shows electromagnetic waves in order of an increasing wavelength is;

* Microwaves, X-rays, Gamma – rays * Microwaves, Gamma-rays, X-rays

* X-rays, gamma-rays, Microwaves * **Gamma-rays, X-rays, Microwaves**

vi. The type of electromagnetic wave used in security scanners at night is;

* **Infra-red** * Microwaves * Radio waves * X-rays

vii. A narrow beam of white light passes from air into the glass and is refracted. The wave characteristic remains unchanged in its;

* Direction * **Frequency** * Speed * Wavelength

viii. The type of waves that are used in the television remote controllers;

* Radio waves * **Infra-red waves** * Ultra-violet waves * Visible light

ix. The color that is least deviated by a prism;

* Violet ray * Green ray * **Red ray** * Yellow ray

x. The optical phenomenon in which the splitting of white light into seven distinct colors occurs is called;

* Refraction * Reflection * **Dispersion** * Diffraction

SHORT QUESTION'S & ANSWERS

Q.1 What is dispersion of light?

Dispersion of light:

Splitting white light into its constituent colors when it passes through a glass prism is called dispersion of white light.

Explanation:

A narrow beam of white light entering from the air is passed through a prism of the denser medium. A prism refracts the light at both the refracting surfaces as, and it produces a range of colors calleda spectrum.

White light is not a single color but a mixture of all the spectrum colors. The prism refracts each individual color differently depending on their refractive index.

The color pattern produced in the dispersion is called a spectrum of light.

Q.2 Define rainbow

The rainbow is one of nature's most beautiful creations. When a rainbow appears, it serves as an excellent sunlight demonstration of light dispersion. Every droplet of water acts as a tiny prism, dispersing and reflecting light droplets emit wavelengths of light associated with a color. Several ways sun rays can enter through a drop. The bending toward and away from the normal is a defining characteristic of each and every path.

Q.3 Define electromagnetic waves also write its formula for speed.

Electromagnetic Waves

Electromagneticwaves are transverse waves. It is electric and magnetic fields that are oscillating, not material. Thusthey can travel Through a vacuum or space.

Electromagnetic waves are radiated out when charged particles oscillate. For example, vibrating atoms in a hot glowing bulb filament emit infrared and visible light in the house.

The formula for speed is

Speed = frequency x wavelength $C = f \times \lambda$

All electromagnetic waves travel through the space vacuum at the same speed of 300000 kilometers per second 3×10^8 m.s^{-1}

Q.4 Write any four characteristics of electromagnetic waves?

Characteristics of Electromagnetic Waves:

i. Electromagnetic waves are transvers waves in nature.
ii. It cannot carry electric charge.
iii. It can travel through space, traveling at the speed of $c=3 \times 10^8$ m.s^{-1}
iv. It obeys the laws of reflection, refraction, and diffraction.

Q.5 What are main components of the electromagnetic spectrum?

Main Components of the Electromagnetic Spectrum:

The electromagnetic spectrum has a wide range of frequencies, wavelengths, and energies. The spectrum covers the range of all electromagnetic radiation and consists of many sub-ranges that are generally referred to as components, such as visible light or ultraviolet radiation.

The electromagnetic spectrum is the entire distribution of electromagnetic waves according to their frequencies or wavelengths.

Q.6 Write some uses of electromagnetic waves?

Uses of Electromagnetic waves

Electromagnetic waves have many advanced technological uses in our day-to-day life.

i. **Radio Waves**

Radio waves have the longest wavelengths in the electromagnetic spectrum. Radio waves canbe artificially generated by oscillating the current in a transmitting antenna. Radio waves are also used in television communication.

ii. **Microwaves:**

Microwaves have a shorter wavelength in the micrometer range and a higher frequency than all radio waves. Satellite phones use microwaves for communication, and satellite television uses microwaves to receive satellite. Television programs.

iii. **Infra-red:**

Infrared (IR), or infrared light, is electromagnetic radiation (EMR) with wavelengths longerthan visible light. Infra-red wireless remote controllers control various household electrical appliances that send invisible signals to an infrared receiver on a device such as televisions, video recorders, or hi-fi (High fidelity) systems.

The human body also gives out infrared radiations because of the rotational-vibrational motion of its atoms or molecules.

iv. **Light = optical fibers in medical uses and telephone:**

The high flexibility of optical fibers makes them also ideal- for use in the medical industry.

v. **Ultra Violet – Sunbeds fluorescent tubes Sterilization:**

Very hot objects, such as the Sun, emit radiations beyond the violet end of the visible spectrum, known as ultraviolet radiations. The ultraviolet is also produced by passing an electric current through the mercury vapors in the tube. Ultraviolet radiation is further divided into threebands in order of increasing energy UV-A type, UV-B type, and UV-C type.

Q.7 Define sunbeds, fluorescent tubes sterilization?

Sunbeds:

Under medically controlled supervision, sunbeds beautify, provide the body with vitamin D, and treat certain skin conditions.

Fluorescent:

When absorbed in ultraviolet, some materials convert their energy into light and glow. This phenomenon is called fluorescence.

Sterilization:

As ultraviolet kills harmful bacteria, strong UVB and UVC radiations are used to sterilize food and medical equipment in hospitals.

Q.8 Write some usages of radio waves in medical field?

Applications of X-rays

X-rays are produced when fast-moving electrons lose their energy quickly. The long-wavelength or low-frequency -rays are highly penetrating that can pass through flesh but not bones. In the medical imaging field, radiologists use low-frequency X-rays to produce the x-ray images to diagnose the fracture in the bones or even tooth decay, tumors, and abnormal masses inside the body.

Computed Tomography (CT):

Computed Tomography (CT) scan is a computational diagnostic tool for detecting diseases and injuries. It uses a series of low-frequency X-rays and a computer to produce a 3D image of soft tissues and bones.

Radiation Therapy:

Radiation therapy is a cancer treatment that uses controlled doses of high-frequency x-rays to kill cancerous cells and shrink tumors.

Stable nucleus or lose energy. They tend to have high energy than x-rays.

Gama Rays are used to treat cancer. These high-energy rays are directed at the cancerous tumour tokill cancer cells in oncology.

Q.9 Write Gamma Knife Radiosurgery?

The Gamma Knife Radiosurgery

Is a medical procedure that uses gamma rays to destroysmall tumors in the brain with less damage to surrounding cells.

Positron Emission Tomography (PET)

Is a functional medical imaging method. In a PETscan, a short-lived positron-emitting radioactive sampling taken suitable for a particular function is injected into the body. Radiated positrons quickly fuse with nearby electrons and lead to two gamma rays of 511-keV traveling in opposite directions. After detecting the gamma rays, a computer generates an image that highlights the location of the biological process being examined.

Gamma rays are highly penetrating and can pass through metals; because of their extreme power, gamma rays used to radiograph holes and defects in metal castings and other structural parts.

Geometrical Optics

Multiple Choice Questions (MCQ's)

i. In a concave mirror , the image size depends upon;
* Size of the object
* **Position of the object**
* Area covered by the object
* The shape of the object

ii. In the normal human eye, the image is formed;
* In from of the retina
* Behind the retina
* **On the retina**
* In between lens and retina

iii. When a light ray enters from a denser medium to a rare medium, it bends;
* Perpendicular to normal
* Parallel to normal
* Toward normal
* **Away from normal**

iv. In a compound microscope as compared to an objective the eyepiece lens has a focal length;
* Zero
* Negative
* Small
* **Large**

v. When the angle of refraction is 90° and there refractive index for water is1.33the critical angle is;
* **48.8°**
* 49.1°
* 50.0°
* 51.0°

vi. To view dim stars, we use;
* Compound microscope
* Simple microscope
* Endoscope
* **Telescope**

vii. The human eye acts like a;
* **Camera**
* Projector
* Telescope
* Microscope

viii. A magnifying glass forms an enlarged;
* Real and upright image
* Real and inverted
* **Virtual and upright image**
* Virtual and inverted image

ix. The entire light is reflected into the same denser medium. Which is called total;
* External reflection
* **Internal reflection**
* External refraction
* Internal refraction

x. In the optic fiber the core is made of glass or plastic of relatively;
* Zero refractive index
* **High refractive index**
* Low refractive index
* No refractive index

xi. A magnifying glass is also called;
* Endoscope
* Compound microscope
* **Simple microscope**
* Telescope

xii. The defect in which the image is formed beyond the retina is called;
* **Long – sightedness**
* Short – sightedness
* Blind spotting
* Image defect

xiii. The short-sightedness can be corrected by using;
* Convex glasses
* Convex mirror
* concave mirror
* **Convex glasses**

xiv. Lenses from images through;
* Dispersion
* **Refraction**
* Diffraction
* Reflection

xv. To illuminate the inaccessible places in the tooth, dentists use;
* Concave mirror
* **Convex mirror**
* Convex lens
* Concave lens

SHORT QUESTIONS & ANSWERS;

Q. 1 What is meant by reflection of light and define the following?

i. Incidentray. ii. Angle Of Incident iii. Reflected Ray iv. Angle Of Reflection

REFLECTION OF LIGHT:

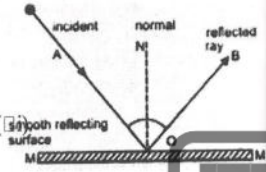
If a light is traveling through a medium and it strikes the surface of an opaque body a part of it is sent back in the same medium this phenomenon is known as reflection of light.

i. INCIDENT RAY:

The ray coming out from a source is called incident ray.

ii. ANGLE OF INCIDENCE:

The angle between incident ray and normal is called angle of incidence (□i).



iii. REFLECTED RAY:

The ray formed after striking of incident ray on the mirror is called reflected ray.

iv. ANGLE OF REFLECTION:

The angle formed between normal and reflected ray is called angle of reflection (□r).

Q.2 Describe Laws of reflection of light?

LAWS OF REFLECTION

There are two Laws of reflection of light:

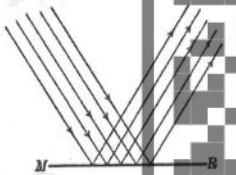
1. The angle of incidence is equal to the angle of reflection.

MATHEMATICALLY:

We can express this law as follow:

$\angle i = \angle r$

2. The incident ray, the reflected ray and the normal all lie in the same plane.



Q.3 What is spherical mirror?

Spherical Mirror;

A spherical is a mirror with curved reflecting surface. Most curved mirror have surfaces that are shaped like part of sphere.

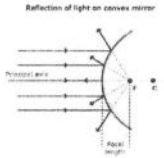
Types of Mirror:

There are two types of mirror;

i. Convex Mirror ii. Concave Mirror

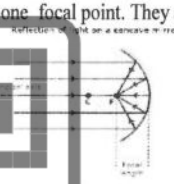
Convex Mirror:

A convex mirror is a spherical mirror in which the reflective surface bulges to words the light shows. Convex mirror reflect light outward and are therefore not use to focus light.



Concave Mirror;

A concave mirror has a reflecting surface that is recessed in word away from the light source. Concave mirror reflect light inward to one focal point. They are use to focus light.



Q4. Define the following terms;

i. Centre of curvature. ii. Optical Centre. iii. The focal point or Principal focus
iv. The focal length v. Object distance vi. Image distance

i. **OPTICAL CENTRE:**
The centre of mirror is called the optical mirror. It is denoted by O.

ii. **ENTRE OF CURVATURE:**
"The centre of the sphere by which the mirror is made up of is called centre of curvature. It is denotedby C.

iii. **PRINCIPAL AXIS:**
"A line which join the optical centre and principal focus is called principal axis.

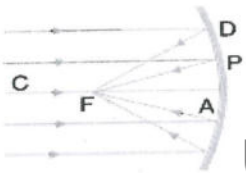
iv. **RADIUS OF CURVATURE:**
"The distance between optical centre and centre of curvature is called radius of curvature. It isdenoted by R.

v. **PRINCIPAL FOCUS:**
"All the rays which are parallel to the principal axis after passing through the convex mirror converge at a point. This point is called principal focus. It is denoted by F.

vi. **FOCAL LENGTH:**
"The distance between optical centre and principal focus is called focal length.It is denoted by 'f'.

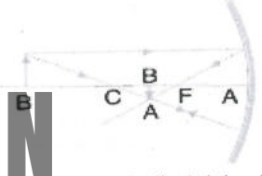
Q.5 Find the position, nature and the size of image with the help of a ray diagram when an object is placed onthe following positions?

(1) At infinity (2) Beyond centre of curvature (3) At centre of curvature
(4) Between F and C (5) At principle focus (6) Between F and P



Real, inverted, highly diminished image at focus

(a) When the object is situated at ∞



Real, inverted, diminished between C and F

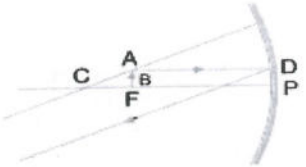
(b) Object beyond C

Real, inverted image of the same size as object at C

(c) Object at C

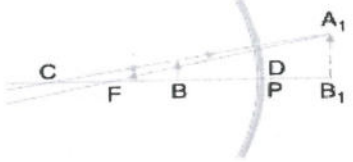
Real, inverted, enlarged image beyond C

(d) Object between C and F



Real, inverted, highly enlarged image at infinity

(e) Object at F



Virtual, erect, enlarged mage behind the mirror

(f) Object between F and P

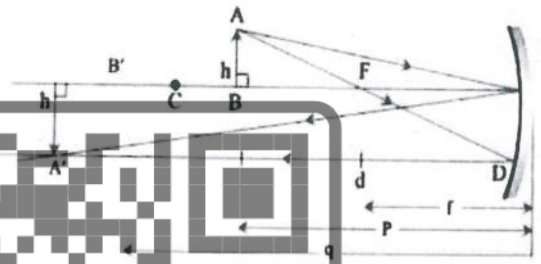
Q6. Establish mirror Equation;

Mirror Equation:

Suppose and object pcm in front of spherical mirror of focal length f cm. The image q cm from the mirror , p ,and q are related by the equation

$$\frac{1}{f}=\frac{1}{p}+\frac{1}{q}$$

This is known as mirror equation. This equation applies to both concave and convex mirror



Concave mirror

Q7. Describe the uses of spherical mirror?

Uses Of Spherical Mirror;

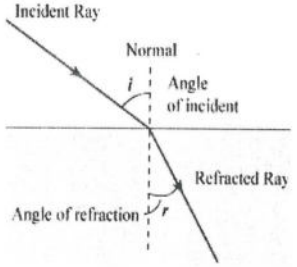
Spherical mirror have various applications in our every day life.

i. Convex Mirror are often used as rear view mirrors.
ii. Convex Mirror are also use for traffic safety purposes to see the blind turns on the road.
iii. Concave Mirror are used by dentist in see the tooth clearly and diagnosed any infection of germ attack.

Q.8 Define refraction of light:

REFRACTION OF LIGHT:

When a ray of light enters from one medium to another medium, it undergoes a change in direction as wellas in velocity. This phenomenon of light is called refraction of light.



Q.9 Define the following?

i. **INCIDENT RAY:**
The ray coming from a source which passes through first medium and strike the boundary of secondmedium is called incident ray.
In figure OA is an incident ray.

ii. **REFRACTED RAY:**
The ray which enters into the second medium is called refracted ray.In figure, refracted ray is OB.

iii, **ANGLE OF INCIDENCE:**
The angle between incident ray and normal is called angle of incidence. It is denoted by □i.

iv. **ANGLE OF REFRACTION:**
The angle between refracted ray and normal is called angle of refraction. It is denoted by □r.

Q.10 Write laws of refraction:

LAWS OF REFRACTION:

There are two laws of refraction:

FIRST LAW OF RERACTION:
The incident ray, the normal and the refracted ray at the point of incidence all lie on the sameplane.

SECOND LAW OF REFRACTION OR SNELL'S LAW OR REFRACTIVEINDEX:
The ratio of the sine of angle of incidence (Sin □i) to the sine of angle of refraction (Sin □r) is always constant. This constant is called refractive index. It is denoted by *n* and has no unit. This is also called Snell's Law.

$$\text{Refractive Index} = \frac{\text{Sin Of Angle of Incidence}}{\text{Sin of angle of Refraction}}$$

Q.11 Write a formula of refractive index of a material?

REFRACTIVE INDEX OF A MATERIAL:

The refractive index of a medium does not depend only on the angle of incidence but it also depends uponthe nature of medium. So the refractive index of medium can be defined as follow:
"The ratio of the speed of light in vacuum (or air) to thespeed of light in that medium is called refractive index of the medium.
For example, the refractive index of water can be calculated as follow:

$$\text{Refractive Index of Material} = \frac{\textit{Speed of light in air}}{\textit{Speed of light in Material}}$$

$$n = \frac{3 \times 10^8\ m/s}{2.26 \times 10^8\ m/s}$$

$$= 1.33$$

Q.12 Describe the phenomena of telecommunication through optical fiber?

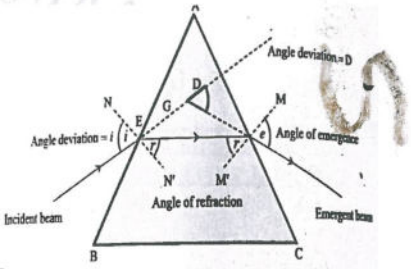
Telecommunication through optical fibers;

Optical fibers consist of hair-size threads made of flexible plastic or glass fibers that transmit light over long distance. An optical fiber comprises two parts, an inner part "core" with a high refractive index, coated with another material "cladding" When a light ray enters the fiber and hits the cladding, it is reflected internally in the core as the incidence angle is larger than the critical angle, even if the fiber is bent. Light rays entering the fiber are continuously reflected at the interface between two refractive materials and cover long distances without energy loss.

Q. 13(a) What is Prism describe the activity to illustrate passage of light (Refraction through a Prism)

(b) Write the point of observation through prism

(c) Write the conclusion



Refraction through a Prism;

Activity;

i. Fix a paper sheet on a drawing board using drawing pins.
ii. Places the triangular prism resting on its base. Using a pencil outline the prism.
iii. Draw " NEN" normal to one facet of the prism AB. Suppose an angle between 30° and 60°
iv. Fix two pins slightly apart on the line PE and label them as P and Q.
v. Look for the images for the pins at P and Q through the other facet of the prism AC
vi. Fix two pins at R and S to appear in a straight line as those of the P and Q when viewed from AC face of the prism.
vii. Remove the pins and also the prism.
viii. At point F, produce the points R and S meet by extending them.
ix. At point F, produce the points R and S meet by extending them
x. PQE is the incident ray that is extended till it meets backward to meet at point G
xi. Now measure the angle of incident $\angle i$, angle of refraction $\angle r$, and the angle of emergence $\angle e$, and $\angle D$,

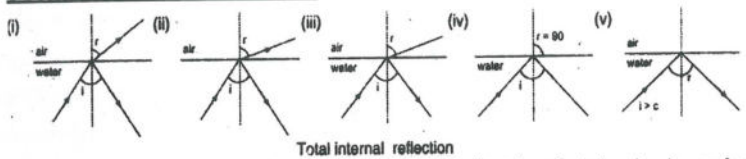
(b) Write the point of observation through prism;

i. At surface AB, the ray of light enters and bends towards the normal on refraction.
ii. At surface AC, the ray of light bends away from the normal as it travels from one medium to the other medium.

(c) Write the conclusion;
The incident ray bends towards the normal when enters the prism and bends away from the normal while leaving the prism.

Q.14 What is critical angle? Describe total internal reflection.

TOTAL INTERNAL REFLECTION:



Total internal reflection

When a ray of light passes through denser medium to a rarer medium the refracted ray bends away from the normal, angle of refraction (∠r) is always greater than angle of incidence (∠i)

As the angle of incidence increases the angle of refraction also increases till for a certain value of angle ofincidence the angle of refraction becomes 90 and the refracted ray pass through the surface. The angle of incidence for which angle of refraction is 90, is **called critical angle.** When the value of angle of incidence become greater than critical angle then there is no refracted ray but the whole ray is internally reflected back into a denser medium. such reflection of light is called total internal reflection.

CONDITIONS FOR TOTAL INTERNAL REFLECTIONS:

- Light ray must travels from denser medium to rare medium
- Angle of incidence must be greater than critical angle

Q.15 What is lens? How many types of lenses are there, define them.

LENSES:

"A lens is a transparent refracting medium bounded by one or two spherical surfaces".

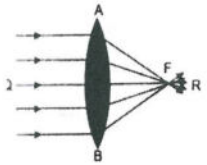
TYPES OF LENSES:

There are two type of lenses:

1. Convex lenses or converging lenses
2. Concave lens or diverging lens

CONVEX LENS:

A convex lens is a thick at the centre and thin at the edges. It converges parallel beam of light at a point andhence is called converging lens.



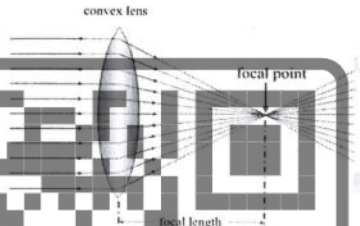
CONCAVE LENS:

A concave lens is thin at the centre and thick at the edges. It diverges parallel beam of light at a point andhence it is called diverging lens.

Q.16 Describe how a lens refract light?

Refraction of light through a lens;

Consider a monochromatic ray of light traveling parallel to the principle axis of the double convex lens. When a ray enters a lens, Lenses surface of the light at each interface, i.e air to glass and glass to air boundaries. The net effect of the refraction the light ray has changed its directions. Because of its special geometric shape , it converges the ray to the focal point;



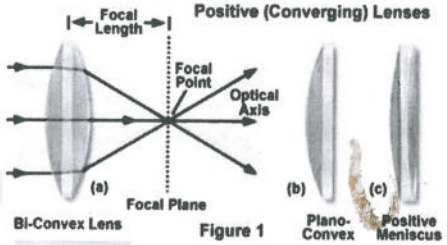


Figure 1

Q.17 Define Magnification.

MAGNIFICATION

"The ratio between height (hi) of the image to the height of the objet (ho) is called magnification".

Mathematically:

$$\text{Magnification} = \frac{\text{Height of image}}{\text{Height of object}}$$

$$M = \frac{h_i}{h_o}$$

Magnification can also be defined as follow:

"The ratio between image distance to the object distance is called magnification.

$$\text{Magnification} = \frac{\text{Image distance}}{\text{Object distance}}$$

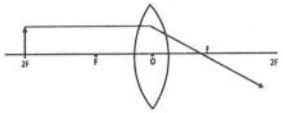
$$M = \frac{q}{p}$$

$$\frac{h_i}{h_o} = \frac{q}{p}$$

Q.18 Describe the rays for graphical construction of images in convex lenses.

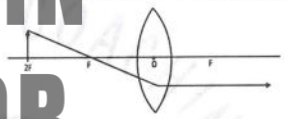
The following three rays are use for the graphical construction of images in convex lenses.

i. A ray parallel to the principal axis after refraction passes, through the principal focus F.



ii.

iii. A ray that passes through the principal focus F at the side of the object is refracted parallel tothe principal axis.



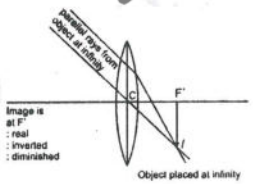
iv. A ray that passes through the optical centre O, goes straight without bending.

Q.19 Describe briefly the change in position, nature and size of image formed by a convex lens whenthe object is brought from infinity towards the lens

(A)OBJECT AT INFINITY

Characteristics of image

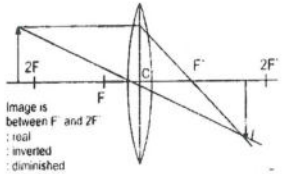
1. Image formed at principal focus
2. Real and inverted
3. Highly diminished
4. Formed at the Opposite side of lens



(b) OBJECT BEYOND CENTRE OF CURVATURE (2F)

Characteristics of image

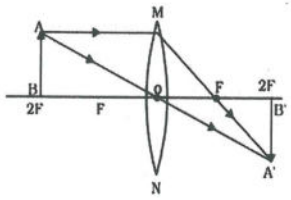
1. Image is formed between F and 2F
2. Real and inverted
3. Diminished
4. Formed at the opposite side of lens



(c) OBJECT AT 2F

Characteristics of image

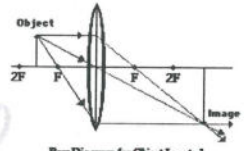
1. Image is formed at 2F
2. Real and inverted
3. Same in size
4. Formed at the opposite side of lens



(d) OBJECT IN BETWEEN F AND 2F

Characteristics of image

1. Image is formed beyond 2F
2. Real and inverted
3. Magnified (greater)
4. Formed at opposite side of lens

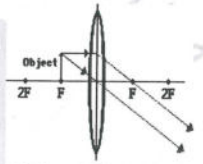


Ray Diagram for Object Located Between F and 2F

(e) OBJECT AT F

Characteristics of image

1. Image formed at infinity
2. Real and inverted
3. Changes magnified.
4. Formed at opposite side of lens

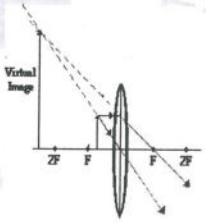


Ray Diagram for Object Located at F (an image is not formed)

(f) OBJECT BETWEEN F AND OPTICAL CENTRE

Characteristics of image

1. Image is formed behind object
2. Virtual and erect
3. Magnified
4. Formed at the same side of the lens



What do you understand by thin lens formula?

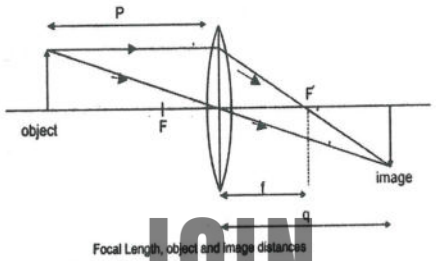
THIN LENS FORMULA

As we know that image is formed by a lens. Then its quantitative analysis made by a formula known aslens formula.

It is simply a relation between distance of object, distance of image and focal length of the object.By mean of a lens formula we can find nature and position of an image

If the distance of object = p The distance of image = q and the focal length = f

Then $\frac{1}{f}=\frac{1}{p}+\frac{1}{q}$



Focal Length, object and image distances

Equation (1) is called lens formula

i. All distance are measured from optical center of lens.
ii. Distance of image in case of concave lens is negative.
iii. Focal length of concave lens is negative.

What do you understand by accommodation?

Q. 20 ACCOMODATION:

This is the ability of the eye to change the focal length of its lens so as to form a clear image of an objecton its retina and is called its power of accommodation.

Q.21 What are the main defects of the eye?

MAIN DEFECTS OF THE EYE:

(i) Short sightedness or myopia:
If a person can see objects placed near, but cannot see distant object, this defect is called as shortsightedness.

(ii) Long sightedness or hypermyopia:
If a person can see the distant object and cannot see the near object. Then this defect is called longsightedness or hyper myopia.

(iii) Astigmatism:
It is the defect in which the clear image of an object does not form on retina.

(iv) Presbyopia:
The accommodation power of an eye of a person loses by which he/she stuffers long sightedness. It iscalled presbyopia or lack of accommodation.

Q.22 What are the causes of defects?

CAUSES OF DEFECT:

(i) Causes of short sightedness or myopia:
This defect appears due to increase in thickness of eyeball or when the focal length of the lens becomes toshort so that image forms before retina. This defect is corrected by using a concave lens.

(ii) Causes of long sightedness or hypermyopia:
This defect appears due to decreases in thickness of eyeball or when the focal length of the lens becomestoo long so the image forms beyond the retina. This defect is corrected by using the convex lens.

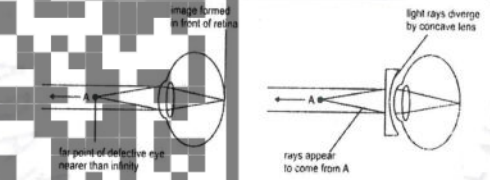
(iii) Causes of astigmatism:
The defect appears due to non spherical shape of the cornea. It is corrected by using lenses of differentfocal lengths.

(iv) Causing of presbyopia:
This defect appears due to loss of accommodative power of the lens of eye. This defect is corrected byusing the convex lens.

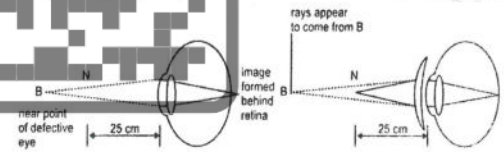
Q.23 How are the defects of eye removed? Show by diagram

REMOVAL OF DEFECT OF EYE:

(i) Short Sightedness: is removed by using a concave lens of suitable focal length as shown in figure:



(ii) Long Sightedness: is removed by using a concave lens of a suitable focal length as shown in figure



ASTIMGMATISM:
This defect can be removed by using lenses with cylindrical surfaces.

PRESBYOPIA:
This defect can be removed by using a convex lens. However, for looking distant objects concave lenses are used. For this reason, mostly old people use spectacles with bifocal lenses i.e. convex part in the lowerside and concave part in the upper side.

Q.24 What is power of the lens? Describe its unit.

POWER OF THE LENS
"The reciprocal of the focal length is called the power of the lens".

Mathematically:
If the focal length of the lens is (f) then the power of lens (P) can be calculated as follow:

Power of the lens =

$$P = \frac{1}{focal\ length}$$

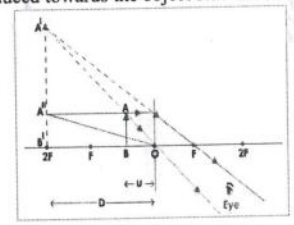
$$P = \frac{1}{f}$$

UNIT OF POWER OF LENS:
If the focal length is measured in metre(m) then, the unit of power of lens is called dioptre.

Q.25 What is simple microscope or magnifying glass, describe its working and write down the formulafor the magnification of magnifying glass?

SIMPLE MICROSCOPE OR MAGNIFYING GLASS
"A magnifying glass is simply a convex lens of very short focal length".

WORKING:
When the object is placed within the focal length of the magnifying glass then enlarge, virtual and erectimage is produced towards the object side as shown in figure.



MAGNIFICATION OF MAGNIFYING GLASS:

If "f" is the focal length of the magnifying glass and "d" is the least distance of distinct vision, thenmagnifying power of magnifying glass can be determined as follow:

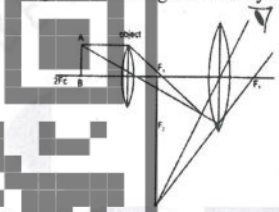
$$M = 1 + \frac{d}{f}$$

Q.26 What is compound microscope, describe its construction and working.

COMPOUND MICROSCOPE
"An optical instrument which is used to see the very small object such as germs, cells, unicellular animalsand biological slides is called compound microscope".

CONSTRUCTION:
Compound microscope consists of two convex lens of short focal length. The lens closed to the object is called the objective and its focal length is short. The lens close to the eye is called the eye-piece; its focal length is greater than the focal length of the objective.

WORKING:
The object to be viewed is placed between F and 2F of the objective lens. The objective lens produced an inverted, enlarged and real image I_2. This image I_1, acts as the object for the eye piece. This image is focused within the focal length of the eye-piece resulting in an erect, highly magnified and virtual image I_2. This image can finally be seen by the eye.

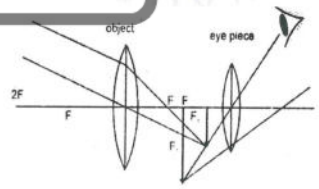


Formation of image in a compound microscope

Q.27 What is astronomical telescope, describe the construction and working of astronomicaltelescope.

ASTRONOMICAL TELESCOPE
"An optical instrument which is used to see the distant object on the sky such as moon, stars and planets, is called astronomical telescope".

CONSTRUCTION:
An astronomical telescope consist of two convex lenses. The lens towards the object is called objective, ithas long focal length. The lens near to the eye is called eye-piece, it has very short focal length.



WORKING:

Formation of images with an astronomical telescope.
When parallel beam of light from a distant object such as moon or star passes through the objective, with the help of objective a real, inverted and diminish image I_1, is formed at the principal focus of the objective. The eye-piece is so adjusted that the image formed by the objective lies within the focal length of the eye-

Piece Finally with the help of the eye-piece a virtual and highly magnified image I_2 is obtained with thehelp of eye piece.

Electrostatics

Multiple Choice Questions (MCQs)

i. Branch of physics which deals with the charges at rest is called;
* Electricity * **Electrostatic** * Quantum * Magnetism

ii. The magnitude of force between two unit positive charges when the distance between them is 1m would be;
* 0N * 1N * 2 N * **Coulombs Constant**

iii. Coulombs law most closely resembles with;
* Law of conservation of Energy * **Newton's Law of gravity**
* Newton's 2nd law of Motion * Faraday's law

iv. If the electrostatic force between two electrons is F Newton, then the electrostatic force between two point charge at the same distance is;
* 0N * 2F * 2/3F * **F**

v. The direction of electric force and electric field intensity is;
* **Parallel to each other** * Perpendicular to each other
* Opposite to each other * In any direction

vi. The work done on a unit charge against electric field intensity is called;
* Electric field * Electric current * **Electric potential** * Electric field

vii. The capacitance of capacitors increases when they connected in;
* **Parallel** * Series * Both * None of them

viii. Two capacitors of $8\mu F$ are connected in series then the equivalent capacitance is;
* ¼ μF * $2\mu F$ * $3\mu F$ * $6\mu F$

ix. The presence of a dielectric between the plates of capacitors, the capacitance of capacitor;
* Increases * **Decreases**
* Remain constant * Remain uncharged

x. If the area of the parallel plate capacitor is doubled then the capacitance will be;
* Remain uncharged * Half
* **Double** * Increased two times

SHORT QUESTION'S & ANSWERS

Q.1 Define electric charge.

Charge is a basic characteristic of matter that cause electrical processes. Electric charge is a fundamental feature of mater that is carried by some elementary particles and governs how the particles react to an electric or magnetic field. The charge is scalar quantity with the coulombs as its SI unit.

A static electric charge can be generated by rubbing together two neutral bodies. Positive charge and negative charge are the traditional names given to different types of electrical charge. The act of rubbing causes a transfer of negative charge from one object to another as it moves from surface to surface.

Q2. Write five properties of charges.

1. Charges are a fundamental property of a material body that determines whether or not it attracts or repels another object.
2. Two distinct types of charge are produced by friction on two distinct types of materials (such as glass and plastic)
3. Charges that are identical to one another always repel one another.
4. Charges that are not similar to one another always attract one another.
5. The only reliable indicator of charge on a body is repulsion.

Q3. Define types of charges or Describe electrical nature of matter.

Matter is composed of three elementary particles called neutron proton and electron. Proton is positively charged particle and is found in the nucleus of an atom. It is considered to be a heavy particle because it is about 18 times more massive than electron.

Neutron is a neutral particle i.e it has no charge on it. Neutron is confined in the nucleus. It's mass is approximately equal to that of a proton.

Electron is a negatively charged particle. The amount of charge on it is equal to that on a proton. An atom may contain one or more than one electrons. Since an atom in normal state is a neutral particle, the number of protons in a nucleus is equal to the number of electrons revolving around it.

Q4. Write the methods of charges formation.

There are three methods of formation of charges on a body as given below;

1. Induction 2. Conduction 3. Friction

Induction:- It is a charging method in which a neutral object is charged without actually touching another charged object.

Conduction:- It is charging by conduct where charge is transferred to the object.

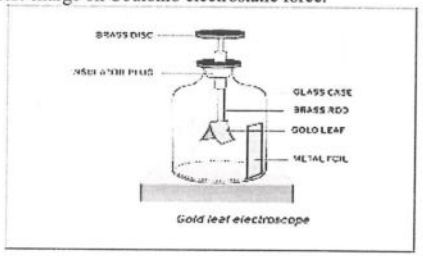
Friction: The imbalance of electrons and protons can be easily created by fraction when two objects rubbing over one another. This process of charging is called charging by friction.

Q5. What is electrostatic Induction?

The formation of a charge through the influence of a nearby charged object rather than the actual object, called electrostatic induction (Here induction means to influence without contact.)

Q6. Write a note on Electroscope.

An electroscope is a scientific instrument for detecting the presence of an electric charge on a body Electroscope detects test charge on Coulomb electrostatic force.



Construction of Electroscope:-

It consist,

i. A glass bottle ii. Insulator plug iii. Brass disc iv. Brass rod
v. Gold leaves vi. Metal foil

Brass rod has brass disc at one end and at the other end gold leaves are fixed. The brass suspended in glass bottle passing through the insulating plug.

Working:-

In the absence of a charge gold leaves allowed to hang. When a charge brought near the electroscope positive charge attract electrons which migrate upward out of the leave , which causes the leave have a transient positive charge and since similar charge repel the leaves split.

When the charge is negative electrons in the electroscope metal reject and migrate toward the leave leaves will again spill due negatively charge.

When the charges are removed the electrons return to then original location and the leaves relax.

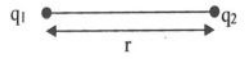
Q7. State and explain coulombs law.

Statement:

This law state that;

"The magnitude of electrostatic force of attraction or repulsion between two point charges is directly proportional to the product of magnitudes of charges and inversely proportional to the square of the distance between them"

Explanation:-



Consider two point charges q_1 and q_2 which are (r) distance a part, than according to coulombs law,

$$F \propto q_1 q_2 \quad ----(i)$$

$$F \propto \frac{1}{r^2} \quad ----(ii)$$

Unit of Electric Potential:

The SI unit of electrical potential is volt and it is equal to Joule / Coulomb

1 Volt = 1 Joule / 1 Coulomb

Q11. Write some application of electrostatic?

There are many applications of electrostatics which are given below;

i. The Van de Graaff Generator
ii. Xerography
iii. Laser Printer
iv. Ink Jet Printers and Electrostatic Painting
v. Smoke Precipitators and Electrostatic Air Cleaning.

Q.12 What is capacitor and define capacity of capacitor and give the unit of capacity of a capacitor?

CAPACITOR:

An electrical device which is used to store electric charge is called capacitor

Construction:-

A capacitor consist of two parallel metal placed at some distance from each other. One plate is connected with positive terminal of battery so it becomes positively charge and second plate is connected with negative terminal of battery so it becomes negatively charge.

Capacity of Capacitor (Capacitance)

The charge q which is stored on the plates of a capacitor is directly proportional to the potential difference between them i.e. $Q \propto V$

$Q=CV$

Where C is a constant called the capacity of a capacitor and it is expressed as follow. $C=Q/V$

Factor on which capacity of capacitor depend;

Capacitance depends on these factors;

- Area of the plate : Capacitance increases if area of the plate increases.
  Hence $C \propto A$
- Distance between the plates: Capacitance increases if the distance between the plate decreases.
  Hence $C \propto \frac{1}{d}$
- Dielectric Constant (ϵ_r) capacitance increases if insulating medium of high dielectric constant is used Hence $C \propto \epsilon_r$

Unit Of Capacity of Capacitor :-

The unit of capacity of a capacitor is Farad and is denoted by F.

$$1F=\frac{1Coulumb}{1Volt}$$

Farad is defined as the capacity of that capacitor which stores a charge of 1 Coulomb if the potential difference between the plates is 1 volt.

Q.13 Define parallel and series combination of capacitor?

Combination of Capacitor:-

For a circuit the capacitance of a desired value can be obtained by different combination of capacitors and that combination may be;

Parallel combination , Series combination , Series parallel combination

I. Parallel combination of capacitors;

Let suppose capacitor consists on such a combination that positive terminal of each capacitor is connected with the positive terminal of the other capacitor and negative terminal of each capacitor is connected with the negative terminal of the other capacitor. Then the combination is said to be parallel combination.

If three capacitor C_1, C_2 and C_3 are connected parallel and further connects them with a battery of V volts then;

C_1 draws charge Q_1 , C_2 draws charge Q_2 and C_3 draws charge Q_3. Then;

$Q = Q_1 + Q_2 + Q_3$

By applying capacitor equation , We get;

$Q_1 = C_1V$, $Q_2 = C_2V$ $Q = C_3V$,

$Q = C_eV$

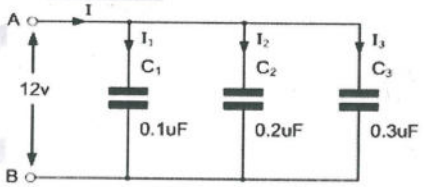
So capacitance becomes;

$C_eV = C_1V + C_2V + C_3V$

$C_eV = (C_1 + C_2 + C_3)V$

$C_e = C_1 + C_2 + C_3$

So now according to the equation the equivalent capacitance of overall capacitance is equal to the sum of individual capacitors.



Series combination of capacitors;

Capacitors are consists on such a combination that positive terminal of one capacitor connected with the negative terminal of the other capacitor and the negative terminal of first capacitor is connected with the positive terminal of the other capacitor. Then the combination is said to be Series combination.

If three capacitor C_1 , C_2 and C_3 are connected in Series and further connects them with a battery of V volts.

If voltage acquired by each capacitor is V_1 , V_2 , V_3 by applying capacitor equation on C_1,C_2 and C_3. We get;

$Q_1 = C_1V_1$, $Q_2 = C_2V_2$, $Q_3 = C_3V_3$, $Q = C_eV$

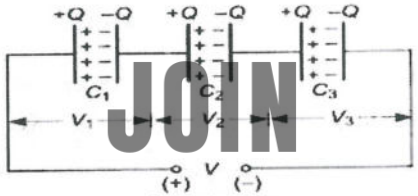
$V_1 = \frac{Q}{C_1}$, $V_2 = \frac{Q}{C_2}$, $V_3 = \frac{Q}{C_3}$

$$\frac{Q}{C_e} = Q\left[\frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}\right]$$

$$\frac{1}{C_e} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$$

So now according to the equation:

The reciprocal of equivalent capacitance the sum of reciprocals of individual capacitance.



Capacitors in series combination

Q14. Write some uses of capacitors?

Uses of Capacitors:

1. They are utilize for instance in the process of tuning transmitters, receivers and transistor radios.
2. It is also common to find capacitors in the electronic circuitry of computers and other products like smartphones.
3. It is possible to utilize capacitors to distinguish between high and low frequency signals.

Current Electricity

Multiple Choice Questions (MCQs)

i. In an electric circuit when Electrons move from Low to high potential they will;

* **Gain energy** * Lose their identity * Lose energy * Gain Potential

ii. In an electric circuit an ammeter is always connected in;

* **Series** * Parallel * Mixed * None of above

iii. Resistance of a conductor does not depend on;

* Length of the conductor * Area of cross section
* **Density** * Resistivity

iv. Ohm' law states that;

* Resistance increases are current * Resistance decreases as current increases
* Resistance increases as voltage increase * **Current increases as voltage increases**

v. The condition when the resistance of a circuit is zero is known as;

* Closed – Circuit * Open unit * **Short Circuit** * Zero circuit

vi. The condition for the validity of Ohm's law is that the;

* **Temperature should remain constant** * Current should be proportional to voltage
* Resistance must be wire would type * All of the above

vii. Ohm's law is not applicable to;

* **Semiconductors** * D.C circuits * Small resistance * High current

viii. Two resistance of 6Ω and 12Ω are connected in parallel. Their net resistance is _____;

* 7Ω * 6Ω * 4Ω * 5Ω

ix. The property of a body to oppose the flow of electric charge through it is called electric _____;

* Capacitance * Potential * **Resistance** * Conductance

x. Which of the following is the purpose of connecting a battery in an electric circuit?

* To maintain resistance across the conductor
* To vary resistance across the conductors
* **To maintain constant potential difference across the conductor**
* To maintain varying potential difference across the conductor

SHORT QUESTION'S & ANSWERS

Q.1 Define electric current and its types

Ans:- Electric Current:

A current is motion of any charge moving from one point to another point. An electric current is always considered flow of negative charges of the conductor. An electric current is symbolized by I.

Electronic Current:

When current flow from the negative terminate to the positive terminal of battery.

Conventional Current:

When current flows from the positive terminal to the negative terminal of battery.

Equation:-

$$I = \frac{q}{t} \quad \therefore [q = ne]$$

There are two types of electric current;

i. Direct current (DC)
ii. Alternating current (AC)

i. Direct Current (DC)

A current that always flows in one direction only is called direct current. The current we get from a battery is a direct current.

ii. Alternating Current (AC)

A current that reverses its direction periodically is called alternating current. Most power stations in our country produce alternating current. AC changes direction every 1/50 second and its frequency is 50 Hertz (Hz).

Q2. Define potential difference

Potential Difference

The amount of energy or work done required to move a unit charge from 1 To another point is called potential difference;

Mathematical expression;

$$\Delta V = \frac{W}{q_o}$$

If W the amount of work done to move a unit positive charge q_0 from point A to point B then

$$\Delta V = V_B - V_A$$

$$V_B - V_A = \frac{W}{q_o}$$

Potential difference is measured in volt. Volts is denoted by V.

$$Volt = \frac{Joule}{Columb}$$

$$1Volt = \frac{1Joule}{1Columb}$$

Q3. Define electro motive force (EMF)

The amount of energy required to move the charge from lower potential to higher potential of the battery is called EME.

$$EMF \quad (\varepsilon) = \frac{energy \ (W)}{Unit\ charge\ (q)}$$

$$(\varepsilon) = \frac{(W)}{(q)}$$

SI unit of EMF is volt.

Q.4 State and Explain Ohm's Law?

Statements;

Ohm's Law states that;

The current passing through a conductor is directly proportional to the potential difference applied across its ends provided that the temperature and other physical condition of the conductor are kept constant.

Mathematical Expression:

If V is the potential difference across the conductor and I is the current passing through the conductor then mathematically Ohm's Law can be expressed as follow.

$$V \propto I$$

$$V = IR$$

Where R is the constant of proportionality and is known as the resistance of the conductor.

Q5. Write limitation of Ohm's Law?

Following are the some limitation of the Ohm's Law.

i. Ohm's Law is an empirical law which is found true for maximum experiments but not for all.
ii. Some materials are non-ohmic under a weak electric field.
iii. Ohm's Law holds true only for a conductor at a constant temperature because resistivity changes with temperature.
iv. As long as the current flows, greater will be the temperature of the conductor.

Q6. What is resistance?

The electrical resistance of a circuit is the ratio between the voltage applied to the current flowing through it. It is given by,

$$R = \frac{V}{I}$$

The unit of electrical resistance is ohms, and it is denoted by Ω

$$R = \frac{V}{I}$$

Since;

$$1Ohm = \frac{1volt}{1ampere}$$

Q7. Define the resistance connected in series?

Combinations of resistance;

In electrical circuits the resistors are interconnected in two ways;

1. Series
2. Parallel

Resistance in Series;

In such combination, the resistors provide a single path to the passage of current and the same current passes through each of the resistors.

Characteristic;

1. Consider three resistors, R_1, R_2 and R_3 are joined together in series across a battery of potential difference V. The same current I pass through each resistor.
2. In series combination, the potential difference across each resistor is different. If V_1, V_2 are potential difference across the resistance R_1, R_2 and R_3 respectively then some of the potential difference across reach resistor is equal to the total voltage of the battery.

$$V = V_1 = V_2 = V_3$$

3. If some of the individual resistance is replaced by a single equivalent resistance Re, then mathematically it can be expressed as follow.

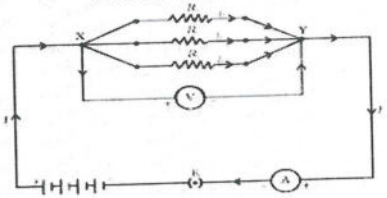
$$I\,\mathrm{Re} = IR_1 + IR_2 + IR_3$$
$$I\,\mathrm{Re} = I(R_1 + R_2 + R_3)$$
$$\mathrm{Re} = R_1 + R_2 + R_3$$

Q8. Define the resistance connected in Parallel?

Resistance in Parallel;

When two or more resistance are joined in such a way that one end of each resistor is connected to one terminal of the battery while the other ends are connected to the second terminal of the battery the resultant combination is known as a parallel combination of resistors.

Resistors in Parallel



1. Consider three resistance R_1,R_2 and R_3 are joined together in parallel across a battery of potential difference V in parallel combination different current pass through each resistance. The current I_2 passes through R_1 the current I_2 passes through R_2 and the current I_3 passes through R_3 ($I=I_2+I_2+I_3$)
2. In parallel combination the potential difference across each resistance remain same

$$V_1 + V_2 = V_3 = V$$

3. In parallel combination there is more than one path for the flow of current. The current passes through R_1 is I_2 through R_1 is I_1 through R_2 is I_2 and through R_3 is I_3. The total current I is equal to sum of individual current.

$$I = I_2 + I_2 + I_3$$
$$\frac{V}{R} = \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3}$$
$$\frac{V}{R} = V\left[\frac{I}{R_1} + \frac{I}{R_2} + \frac{I}{R_3}\right]$$
$$\frac{I}{R} = \frac{I}{R_1} + \frac{I}{R_2} + \frac{I}{R_3}$$

Q9. Write some advantages and disadvantages for series combination?

Advantages;

i. Each appliance can be turned on or off independently
ii. The voltage of each electrical appliance is the same as the power supply line.
iii. If one electrical appliance stops working due to problem the other appliances will continue to function.

Disadvantages;

i. Because the circuit can carry higher current, it is less safe.
ii. If hundreds of appliances or lamps need to be turned on or off at the same time this method is difficult to apply.

Q.10 Define power gives its mathematical relation and units?

Power;

Power can be defined as follows;

Mathematical expression;

If W amount of work is done in total time t then power p can be express as follow;

Power = Work / time

$$P = \frac{W}{t}$$

We know that works can be express as follow;

$$W = I_2R_t$$

Putting the value of W in equation

$$P = \frac{I_2R_t}{t}$$
$$P = I^2R$$

According to Ohm's law

$$V = IR$$

$$R=\frac{V}{t}$$

Putting the value of R in equation

$$P= I^2\frac{V}{I}$$

$$P= IV$$

Unit of Power:

Since unit of work is joule and unit of time is second therefore unit power become joule/sec and it is equal to watt. Therefore unit of power is called watt.

Watt: $$1\ \text{Watt} = \frac{1\,Joule}{1\,Sec}$$

If 1 joule of work is done in 1 second than power will be 1 watt;

Q11. State Joule's Law and given its mathematical relation?

In an electric circuit, I^2 Rt the amount of electrical energy dissipated as heat energy. This relationship is knows as Joule's Law.

Or

When a current passing through a conductor heat is produce which is directly proportional to the resistance R of the conductor the time T and the square of the current $H= I^2 Rt$

Mathematical proof;

We know that voltage can be expressed as follows;

$$Voltage = \frac{work\ done}{Electric\ charge}$$

$$V = \frac{w}{q}$$

$$W=qv$$

Since current is given as;

$$I = \frac{q}{t}$$

$$Q = I \times t$$

Putting value of q in equation

$$W= Ix\ t=v$$

From Ohm's Law

$$V = IR$$

Putting value of V in equation

$$W = (Ixt)x(IxR)$$

$$W = I^2Rt$$

Hence Joule's Law verified.

Q12. What is moving coil galvanometer? What is the working principle of a moving coil galvanometer? Write the construction of moving coil galvanometer.

Moving coil galvanometer;

It is a sensitive device used to detect measure and compare the magnitude and direction of very small amount of current usually of few mili amperes.

Working Principle;

The working principle of a moving coil galvanometer is that of an electric motor i.e when a coil is suspended in a magnetic field and a current passes through it a couple of forces acts on it causing the coil to rotate or turn or simply move.

Construction of a Moving Galvanometer;

Main parts of a galvanometer and their functions are as follows;

U – shaped magnet with concave pole;

It produces tidal magnetic field

Rectangular copper coil;

A copper coil is wounded on a frame of nonmagnetic material.

Soft Iron core;

It makes radial field stronger in inner coil.

Spiral Spring;

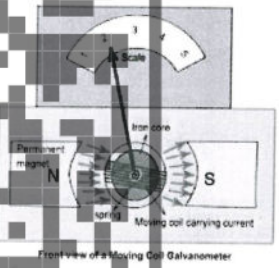
They provide counter force against continuous rotation of coil. They also serve as a current lead.

Scale with pointer;

Deflection produced by torque in the coil is measured on a scale with pointer.

Pivots;

For pivoting the coils and the soft iron core on their axis;



Front view of a Moving Coil Galvanometer

Q13. How and why an ammeter is connected in a circuit?

Ammeter is a device which measures large amount amount of current it is a modified form of a galvanometer.

Conversion of Galvanometer into ammeter;

To convert a galvanometer into an ammeter a wire of suitable low resistance is joined in parallel to the galvanometer as shown in figure' this resistance is called Shunt, Shunt

Increase the value of full scale deflection. It takes most of the current away from the galvanometer.

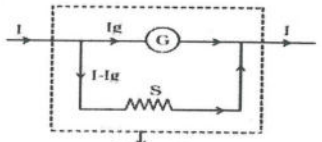


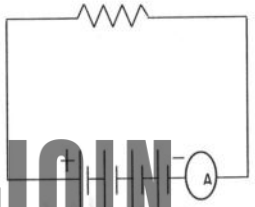
Fig 3.30 Conversion of galvanometer into an ammeter

Method for connecting and ammeter;

An ammeter is always connected in series in a circuit.

Reason;

As we know that it is used to measure the amount of current so that the total current passing through the circuit should pass through it as it has low resistance with shunts.



If it is connected in parallel of part of current will parts through it so it will not measure the total current.

Q14. Define electrical component its different types and their uses?

The devices that make up electronic circuit or known as electronic components. They are made to be joined together usually by welding inform a circuit on a circuit system.

Types of Component;

Electrical component are of the following types;

i. **Switches or key**: It is one of the most fundamental electrical component, it is used to turn electrical circuits on an off.

ii. **Resisters**: It is a two terminal electrical component that implements electrical resistance as a circuit element.

iii. **Battery**: It is a electrical source that store the chemical energy and converts the chemical energy into electrical energy.

iv. **Transducer**: It is an electrical component that converts one from of energy in to another form of energy.

v. **L.D.R** (Light , Dependent , Resistors) A photo resistor or light dependent resistor is an electronic component that is sensitive to light.

vi. **Thermistors**: It is thermally sensitive resistors whose resistance is strongly dependent all temperature. It is used to measure the temperature very accurately.

vii. **Relay;** It switches which aim at OFF and ON the circuits electronically as well as electromechanically.

Q15. Describe house circuits, which type of circuit is in house? Describe different components use in house circuits?

House Circuit;

Electricity usually comes to our homes by two wires or lines the live (L) and neutral (N) . The potential difference between these wires is 220V. the neutral wire is connected to the earth about every 100m. The potential on the live wire is alternatively positive and negative with respect to the neutral wire.

Types of circuit:

Every circuit is connected in parallel with the supply i.e. across the live wire and neutral wire and receivers the full mains p.d of 220V.

Components of House Circuit;

The following are the components of house circuit.

i. **Switches and fuse:**

These are always in the live wire side of the circuit. It they were in the neutral side then lamp and power sockets would be "live" even. When switches are "Off" or fuse remains blown a shock (fatal)

Could then the obtained by a person who touches the element of an electric wire when it was switched.

ii. **Ring main circuit:**

The live and neutral wires are thick (called heavy duty wire) and each run in a complete ring round the house and the power sockets each rated as 13A are tapped off from them. Thinner wire can be used for each socket since the current to each socket is less than 13A in the whole ring the ring has a 30A fuse and if it has ten sockets all can be used so long as the total current does not exceed.

iii. **Fused Plug:**

Only one type of plug is used in a ring main circuit it is wired and has the own caruidge fuse 3A (blue) for applications with power up to 660W and 13A (brown) for powers between 720 W and 286W.

Electromagnetism

Multiple Choice Questions(MCQ)s

i. Which statement is true about the magnetic poles?
* Unlike poles repel * Like poles attract
* Magnetic poles do not effect each other * **A single magnetic pole does not exist**

ii. What is the direction of the magnetic field lines inside a bar magnet?
* **From north pole to south pole** * From south pole to north pole
* From side to side * There are not magnetic field lines

iii. The presence of a magnetic field can be detected by a;
* Small mass * Stationary positive charge
* Stationary negative charge * **Magnetic compass**

iv. If the current in a wire which is placed perpendicular to a magnetic field increases, the force on the wire;
* **Increases** * Decreases * Remains the same * Will be zero

v. A.D.C motor converts;
* Mechanical energy into electrical energy * Mechanical energy into chemical energy
* **Electrical energy into mechanical energy** * Electrical energy into chemical energy

vi. Which part of a D.S motor reverses the direction of current through the coil every half – cycle;
* The armature * The commutator * The brushes * **The slip rings**

vii. The direction of induce e.m.f in a circuit is in accordance with conservation of;
* Mass * Charge * Momentum * **Energy**

viii. The step-up transformer;
* Increases the input current * **Increases the input voltage**
* Has more turns in the primary * Has less turns in the secondary coil

ix. The turn ratios of a transformers is 10. It means;
* $I_s = 10I_p$ * $N_p = 10N_s$ * $N_s = 10N_p$ * $V_s = 10V_p$

SHORT QUESTION'S & ANSWERS

Q.1 Name the four fundamental forces of nature.

Following are the four fundamental forces act upon us every day.

1. Gravity **2.** Electromagnetic force **3.** Weak nuclear force **4.** Strong nuclear force

Q.2 Define electromagnetic force.

The electromagnetic force is a type of physical interaction that occurs between electrically charged particles. It acts between charged particles and is the combination of all magnetic and electrical forces. The electromagnetic force can be attractive or repulsive.

Q.3 Define Magnetic force.

Magnetic Force;

The attractive force between the poles of the magnet is called Magnetic Force. Magnetic force between two magnets or a magnet and a magnetic substance is directly proportional to the strength of two poles and inversely proportional to the square of the distance between them. A powerful magnet has a greater magnetic force.

Q4. Drive expression of force on a charged moving in a magnetic field.

Now suppose a particle carrying charge q is projected with speed v into a magnetic field of magnetic induction B such that the angle between B and V is θ. The magnetic field of the charged particle interacts with the magnetic field of the magnet in which it is sent due to which a force is produced which acts upon the particle. It is found that.

- The force F acting on the particle in directly proportional to the charge q.

$$F \propto q \quad ---1$$

- The force F acting on the particle is directly proportional to the velocity V.

$$F \propto v \quad ---2$$

- The force F is directed perpendicular to the plane containing V and B.

$$F \propto B \quad ---3$$

Combining 1, 2 & 3

$$F = qv \times B$$

If θ is the angle between V and B then force on charge article is given by

$$F = qvB \sin \theta$$

Q5. Define magnetic field and what are magnetic line of force write its properties.

Magnetic field;

The magnetic field is the region or space around the magnet in which the influence of magnetism may be felt in the region of a magnet.

Magnetic Lines Of Forces;

The imaginary lines around a magnet are called magnetic lines of forces. The magnetic lines of a magnetic can be drawn by the help of a compass-needle and the magnet.

Characteristics Of Magnetic lines of force;

i. The magnetic lines of force start from North Pole and end at South Pole.
ii. The lines of forces are infinite in number.
iii. The lines are imaginary and field is real.
iv. They never intersect each other.
v. They can pass easily into the glass, iron , air , wood , paper etc.

Q6. Describe force on current carrying conductor in a magnetic field

When a conductor of length L carrying current I and placed in a magnetic field B at an angle θ It experiences a force which is ;

i. Directly proportional to current I $F \propto I$ 1
ii. Directly proportional to length L $F \propto L$.....2
iii. Directly proportional to magnetic field B $F \propto B$.....3
By combining eq 1, 2, and 3 $F = I (L \times B)$
If θ angle between L and B then force on the conductor can the express as follow;

$$F = BIL \sin \theta$$

The strength of magnetic field can be express as follow;

$$B = \frac{F}{IL \sin \theta}$$

Q7. Define the strength of magnetic field.

We know that isolated moving charges produce both electric and magnetic field but an electric current through a conductor produces a magnetic field because the electric field of moving electrons is neutralized by the field of the fixed protons in the conductor. This magnetic field symbolized by B.

We know that force on a charged q in a magnetic field is given by

$$F = qvB \sin \theta$$

Therefore strength of magnetic field B can be express as follow

$$B = \frac{F}{qv \sin \theta}$$

Unit of B

Since unit of force is Newton, unit of charges is coulomb and unit of velocity is m/sec. therefore unit of B become $\frac{Newton}{Coulomb \times m/\sec}$ and it is equal to Tesla.

Q8. Explain the turning effect on a current carrying coil in a magnetic field.

When an electric current is passed through a coil, placed in a magnetic fields with its plane parallel to the field, it experience a torque, thus with it plane to the field, it experiences a torque. This rectangular coil tends to rotate in the magnetic field and it suffers torque. This torque is;

$\tau = BIAN \cos \alpha$

Consider a rectangular coil placed in the magnetic field of strength B and the plane of the coil is parallel to the field and is free to rotate about an axis.

When current I passed through the coil, a force is experienced on the perpendicularly placed conductor. The magnitude of the force is F = BIL. Hence pair of two equal but opposite forces (couple) acts on the coil, that causes he coil to rotate.

So, Torque = $\tau = BIA$

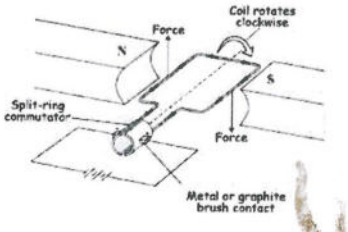
If the plane of the coil makes an angle α with the field B then the perpendicular distance $\cos \alpha$ can be added. $\tau = BIA \cos \alpha$

If the coil has N turns then;

$\tau = BIAN \cos \alpha$

Q9. What is D.C motor?

D.C motor is an Electromechanical device that converts electrical energy into mechanical energy. D.C Motor is similarto D.C Generator in construction but the output device act as input and input as output.



Construction;

There are two main parts of the DC motor.

- Armature
- Stator

The rotating part is the armature and the Stator is their stationary part. The armature coil is connected to the DC supply.

Working Principle of DC Motor

A DC motor is an electrical machine which converts electrical energy into mechanical energy. The basic working principle of the DC motor is that whenever a current carrying conductor places in the magnetic field, it experiences a mechanical force.

When armature winding is connected to a DC supply, an electric current sets up in the winding. Permanent magnets or field winding (electromagnetism) provides the magnetic field. In this case, current carrying armature conductors experience a force due to the magnetic field, according to the principle stated above.

The Commutator is made segmented to achieve unidirectional torque. Otherwise, the direction of force would have reversed every time when the direction of movement of the conductor is reversed in the magnetic field. This is how a DC motor works!

Q10. Define electromagnetic induction;

Electromagnetic or magnetic induction is the production of an electro motive force a cross an electrical conductor by changing magnetic field.

Q11. State and Explain Fraday's Law of Induction?

Micheal Fraradya's Law of electromagnetic induction states as follow;

"A voltage is induced in a circuit whenever relative motion exists between a conductor and a magnetic field and that the magnitude of this voltage is proportional to the rate of change of the flux"

Q12. State and explain Lenz's Law of electromagnetic induction;

Statement;

"The magnetic field produced by induced current opposes the original magnetic field that produce the current".

Explanation;

Magnetic field produced by induced current generate an additional magnetic field which always opposing the magnetic field that form it

$$\mathcal{E} \propto \frac{-d\phi_B}{dt}$$

$$\mathcal{E} = -N\frac{d\phi_B}{dt}$$

ε = Induced emf

Where $d\Phi$ = Change in magnetic flux

N = No of turns in coil

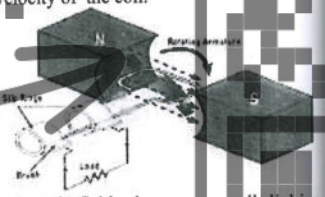
Q13. Write down factors effecting the magnitude of an induced e.m.f

The factors involved in the induced e.m.f of a coil or

i. That the induce e.m.f is directly proportional N, the total number of turn in the coil.
ii. The induce e.m.f is directly proportional to A, the area of cross – section of the coil.
iii. The induced e.m.f is directly proportional to B, the strength of the magnetic field in which coil is rotating.
iv. The induced e.m.f is directly proportional to 'ω' the angular velocity of the coil.

Q14. Write a note on An AC Generator;

An AC generator is an electric generator that converts mechanical energy into electrical energy in the form of alternative emf or alternating current An AC generator works on the principle of "Electromagnetic Induction.



Q15. What is mutual induction?

When the electric current in the Primary Coil changes, the magnetic field changes as well, linking the secondary coil to the primary Coil.

The Secondary coil's e.m.f is proportional to the primary coil's rate of change of current. Thus;

$$\varepsilon_s \propto \frac{\Delta I_p}{\Delta_t}$$

$$\varepsilon_s = \frac{-M\Delta Ip}{\Delta t}$$

Where M is a constant, called Mutual Inductance of the two coils.

Hence;

$$M = \frac{\varepsilon_s}{\Delta I_p / \Delta t}$$

Q16. Write note on transformer.

Transformer is a static machine used for transforming power from one circuit to another without changing the frequency. Transformers operate based on the principle of mutual inductions. It operates on an AC supply.

It consists of two coil which are magnetically linked to each other but electrically isolated from one another The primary coil is the first or two coils in the system which is connected to AC input power. The secondary coil is the other coil to the output circuit. Np and Ns stand for the number of turns on the primary and secondary coils respectively. When current passing through the primary coil generates magnetic field which is transmitted to the secondary coil through the core. The change in the field causes an alternating e.m.f to be generated in the secondary coil. The secondary voltage Vs is proportional to the primary voltage Vp. The ratio of the number of turns on the secondary coil to the number of turns on the main coil also affects the secondary voltage, as illustrated by the following expression;

$$\frac{Vs}{Vp} = \frac{Ns}{Np}$$

Q17. Name the types of Transformer and define them.

There are two types of transformer;

i. Step – up transformer ii. Step – down transformer

Step - up transformer;

The transformer is referred to as a step-up transformer if the secondary voltage exceeds the primary voltage

Step – down transformer;

A step- down transformers is one in which the secondary voltage is lower than the primary voltage

Q18. What is ideal transformer. Write its mathematical expression;

An ideal transformer dissipates no power, and we may write the following mathematical expression for such a transformer;

Mathematically Pp = Ps

VpIp = VsIs

Q19. Write some daily life applications of transformers?

There are several ways a transformer can be used in homes.

In Stabilizer;

A stabilize is made up of transformers that help to give out a voltage or manage voltage in such a way that it ok with the voltage circuits. It helps to step down and step up the level of current in a building.

In Battery Charger;

Batteries can also be charged with the help of transformers. The voltage needs to be conublled properly so that it doesn't damage the parts inside the battery. This can only be done with the help of a stop down transformer.

In circuit breakers;

Circuit breakers with integrated transformers can prevent damage from high voltage current by allowing users to manually switch on and of power.

In air conditioner (A.C)

This is another modern uses of a transformer in our homes. Because of its high inductance and low resistance levels it aids in the proper functioning of the AC. Without this there would be no long- lasting AC (Air condition) in our home.

Introductory Electronics

Multiple Choice Questions (MCQ)'s

i. Metals are good conductors of electricity because they have free;
* **Electrons** * Protons * Neutrons * Photons

ii. The continuous flow of electrons is made possible by a device called;
* Cathode * **Electro gun** * Anode * Filament

iii. The electric field can be detect;
* Photon * Neutron * Proton * **Electron**

iv. If the direction of magnetic field is reversed the direction of force is;
* **Reversed** * Not reversed * May or may not reversed * None of these

v. The process of emission of electron form the hot metal surfaces is called;
* Plastic emission * **Thermionic emission** * Static emission * Current emission

vi. If input of a NOT gate is "I" then its output is;
* 1 * 0 * May be1 or may be 0 * None of these

vii. The Boolean expression of an AND gate;
* **A , B** * A+B * A x B * None of these

viii. Electronics comprises the;
* physics * Engineering * Technology * **All of these**

ix. The Boolean expression of an OR gate is;
* A. B * **A + B** * A x B * None of these

x. The cathode ray carry;
* Positive charge * Neutral * **Negative charge** * Positron

SHORT QUESTION'S & ANSWERS

Q.1 What is electronics?

The invention of vacuum tube opens up a new field of a technology called "ELECTRONICS". Electronics comparison the physics engineering and technology. Electronic also has applications that deal with the emission flow and control of electrons in vacuum and matter using different devices.

Q.2 Write the ways or which progress in science and technology departs?

The progress in the field of science of science and technology depends upon the ability to measure calculate and finally estimate the unknown. There are three ways in which this could be done.

i, Mechanical (Measurement of gas pressure by pressure gauge.
ii, Electrical (Measurement of current with electrical ammeter).
iii. Electronics (Measurement of potential difference by cathode – ray oscilloscope.

Among above three ways the electronics is far better. Since, in electronics we get higher sensitivity faster response and greater flexibility in indicating, controlling the measured quantity.

Electronics may have two fields.

1. Analogue
2. Digital

Q.3 Write the importance of digital electronics?

Digital electronic technology is a revolution in the field of information. Data of any sort can be instantly and accurately retrieved from any art of the world. Internet is just the start of this global sharing of information.

The conversion of signals from analogue to digital has been the key to this digital revolution, their processing and transmission in digital form and their conversation back into analogue form.

Q.4 Write some advantages of digital information?

Digital information has several advantages over analogue information. Some of these advantages are;

i. Easy storage
ii. Easy transmission
iii. Large amplification
iv. Less noisy signal (Clear signal)
v. Negligible power

Q.5 What are advantages of digital electronics devices?

Digital electronics devices have many advantages over analogue electronic devices. Some of these advantages are;

i, They have greater speed
ii, They are very sensitive
iii, Their displays are easily readable
iv. They are very accurate
v. There size are very small
vi. They have better revolution

Q.6 Write 4 differences b/w analog and digitals electronics.

Ans; S.#	Analogue Electronics	Digital Electronics
01	Data can not be stored closely (compactly)	Data can be sorted more closely (compactly) like in CD
02	Analogue signals are very much affected by noise (the unwanted voltage fluctuations	Digital signals are almost not affected by noise (the unwanted voltage fluctuations)
03	Amplified analogue signal does have noise	Amplified digital signal almost do not have noise
04	Analogue devices have high precession	Digital devices have very high precession

Q7. Write a note on "Computer" the forefront of electronic technology.

Electronic Technology is improving day by day electronics devices are proving more efficient , accurate , fast less costly flexible , portable and smaller in size with time.

There are advancement in electronic technology in every field but computer can be regarded as forefront. Because computers are the most simple and accurate device, process this data and produced the result in desire format. They can also store data.

Computers are used almost everywhere for various purpose.

Q.8 Write note on the THERMIONIC EMISSION?

Thermionic emission is the emission of electrons from a hot metal surface.

The vacuum tube is called a thermionic diode. This vacuum tube consists of two electrodes called the anode and he cathode

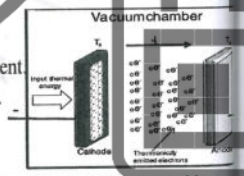
The anode is positively charged so attracts negative charges (Electrons)

The cathode is negatively charged so repels negative charges.

Q9. Give and experiment to demonstrate Thermionic Emission.

Ans; <u>Demonstration of Thermionic Emission;</u>

The thermionic emission effect can be demonstrated by the following experiment.



i. Vacuum tube: This vacuum consist of two electrodes called the anode & cathode.

ii The Anode is positively charged so attracts negative charges (Electrodes)

iii.The cathode is charged negatively so repels negative charges (Electrons)

The cathode is made up of tungsten filament normally the gap between cathode and anode cannot be crossed by the electrons when the climate is switched OFF. As the filament is switched ON the electrons from hot tungsten surface. These electron are attracted across to the anode. Hence thermionic occurs.

Q10. What are Cathode rays also write some characteristics of cathode rays?

An electron gun made the electrons to travel in straight lines like a beam called Cathode rays. These invisible rays were coming to found from the cathode.

These rays have following characteristics;

1. They transfer negative charge (electrons)
2. They transfer energy
3. They transfer momentum

Q11.Write the structure electron gun?

Electro gun is placed inside a sealed glass tube called vacuum tube. The fast moving e beams produced by electron gun electron are used in TV monitors, cathode ray oscilloscopes, electron microscopes and in some other devices.

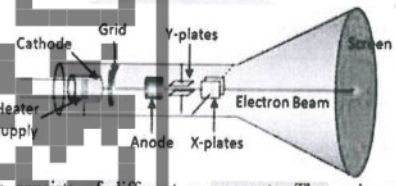
Q12. Write some effects on deflection of electron beam by a electric field.

the effects of deflection of electron beam by an electric field are;

i. The beam bends and changes direction.
ii. The beam follows a parabolic (curved) path in the electric field.
iii. The beam of electron changes direction millions of times each second.
iv. The energy and speed of electron beam increases.
v. The beam continues to move in a straight line after passing through the electric field.
vi. Electron can be deflected by magnetic field.
vii. This field is generated by passing a current through a pair of plates (coils).

Q13. Write a note on cathode ray oscilloscope.

A cathode-ray oscilloscope (CRO) is generally referred to as oscilloscope or scope. It is called a cathode ray oscilloscope because it traces a required wave-form with a beam of electrons called cathode rays.



A cathode ray oscilloscope consists of different components. The main component of a cathode ray oscilloscope (CRO) is a cathode – ray tube.

<u>Working:</u>

The electro gun emits a beam of electrons (i.e cathode – ray) which is produce by the cathode.

When this electron beam strikes the fluorescent screen a bright spot is created on the screen.

The electron gun consists of a grid which is connected to (-ve) potential. It repels the electrons and therefore controls the number of electrons reaching to anode and screen. Thus it controls the brightness of the spot on the screen.

The deflecting system consists of X- plates and Y-plates to move the move the spot on the screen. If it Moves fast enough it appears as a line.

Y – plates cause deflection in vertical direction (up and down) when voltage is applied across them.

The vertical deflection of the electron beam can be changed by varying the voltage across the Y- plates.

X – plates cause deflection in horizontal direction (left and right) when voltage is applied across them. The horizontal deflection of the electron beam can be changed by varying the voltage across the X- plates.

The following are the four important controls on an oscilloscope.

1- X – Shift 2- Y – Shift 3- Time base 4- Y – gain

Q.14 Define Logic Gates;

The logic gate is the basic unit of digital logic circuits, there are mainly three basic gates AND, OR and NOT and these logical gates perform AND, OR and NOT operations in the digital system.

AND Gate:

An AND gate is a digital circuit that has two or more inputs and a single output AND gate operates on logical multiplication rules. AND operation using variables A and B is represented "A.B" here(•) dot is Logical multiplication sign. Boolean Expression of AND gate Y = A.B

Truth table of AND gate using three input variables A,B,C and output is if any input is 0, then output Y becomes 0. If all output are 1 then output Y becomes 1.

Boolean expression of AND gate is Y = A.B.C


AND

Q15. Write is OR gate writes its logical symbol and rule also baleen Expression?

An OR gate is a digital circuit that has two or more inputs and products a single output. Which is the logical OR of all those inputs. The logical OR is represented with the symbol " + " An OR gate operates on logical addition rules.


OR

Boolean Expression of OR gate; Y = A+B

Truth Table of OR gate using three input variables A,B,C and output is Y. If any input is Y. If any input is I then output Y becomes I and if all inputs are 0 then output Y becomes 0.

Boolean expression of OR gate is Y= A+B+ C and output is Y. if any input is I then output Y becomes I and if all input are 0 then output y becomes Boolean expression of OR gate is Y=A+B+C

NOT Gate:

Note gate is a digital circuit circuit has as single input and single output and a single output it is Known as INVERTER. The operators complement or invert of any input it symbolized by complement sign (*) right side on top of the input variable or bar (-) sign on top of the variable.


NOT

Boolean express in is NOT gate; Y = A or Y = A

Truth table of NOT gate is A is input and Y = A is output.

NAND Gate;

A NAND gate could construct by connecting a NOT gate at the output terminal of the AND Gate


NAND

Boolean expression of NAND gate is Y (A.B) or Y= AB.

The Truth table of the NAND gate shows. A.B are the input and Y is the output. When both input are "I" The output. Y is "0" if any one of the inputs is "0" then the output Y is "1"

NOR Gate:

A NOR Gate could constructed by connecting a NOT Gate at the output terminal of the OR Gate. The Boolean expression of NOR gate is y = Y = (A+B) or Y = A+B


NOR

The truth table of the NOR gate shows. A .B are h inputs and Y is the output. If both inputs are"0" then the output Y is "I" . If any one of the inputs is "I" then the output Y as "0"

Q16. Write some use of Logic Gate;

an AND gate is used in a simple automobile seat belt alarm system

Intrusion detection and alarm system;

A simplified portion of an intrusion detection and alarm system could be used for one room in a home a room with two windows and a door.

Information & Communication Technology

Multiple Choice Questions(MCQ)'s

i. Another name for a supercomputer is a;
* **High- performance computer** * Maxi computer
* Main frame computer * None

ii. Input processing, output and storage are collectively referred to as;
* **Information processing cycle** * Software life cycle
* Hardware life cycle * Information Technology

iii. Is the output from a computer that ranks from processing input data;
* Data * **Information** * Computer * Mouse

iv. Which of the following is not considered as a such software?
* Assembler * Interoperate * Compiler * **Tally**

v. Which of the following is suitable for connecting different computers in an organize manner within an office building?
* MAN * WAN * ANN * **LAN**

vi. A computer program that translates one program instruction at a time into machine language is called;
* **Interpreter** * CPU * Compiler * Simulator

vii. The name given to a sequence of instructions in a computer language, to get the desired result is?
* **Program** * Decision table * Pseudo code * Algorithm

viii. USB stands for;
* Ultra serial bus * Unlimited Structured Bit
* **Universal Serial Bus** * Unified Status Bus

ix. Which is the extension not suitable to an ms-word file;
* .doc * **.docx** * .rtf * .jpeg

x. JCT stands for;
* Information and Communication Technology
* Integrated Circular Technology
* Intensive Computer Techniques
* Interfacing Computer Theories

SHORT QUESTION'S & ANSWERS

Q1. What is information technology.

An electronic – based system for transmitting, receiving , processing , and retrieving information is known as information and communication Technology (ICT). Telecommunication and Information Technology have been merged to become (ICT). The above term can be defined separately as

Information Technology:

Information technology is the scientific approach for storing information organizing it for optimal use, and communication it to others.

Telecommunication:

The process of transmitting information over long distances is known as telecommunication. ICT refers to the scientific techniques and tools to store process and transport large volumes of information in a matter of seconds using electronic devices.

Q2. How many components must come together to creat a CBIS?

Five components must come together to create a CBIS Now we will briefly discuss them;

i. **Hardware is machinery:**

This comprises the CPU and its supporting hardware. Input/output, storage and communication devices are examples of essential equipment.

ii, **Software:**

Software includes computer applications. They tell the CBIS,s hardware how to process data and turn it into meaningful information . Programs are usually saved on a chips or tape.

iii, **Data:**

Programs utilize be a phrase , picture or figure that has special significance. Data like programmes, are usually saved on chips or tape until needed by the computer.

iv, **Procedures:**

The guidelines for creating and using information systems. These are in user manuals and papers. From time to time these rules or technique may be revised. In order to accommodate these adjustments the information system must be adaptable.

v, **People:**

A CBIS is useless without individuals who can impact the success or failure of information systems. People develop and maintain the software, enter data, and construct the hardware that makes a CBIS work people write the processes and ultimately decide the CBIS's effectiveness.

Q3. How many information flow from one place to another?

Flow of Information:

Electronic and optical equipment can be use to transfer information from one place to another place, which is called flow of information, When we use a phone, electrical impulses are used to transmit data via cables Radio, television , and mobile phones provide information by electromagnetic waves or light via optical fibres.

Q4. Write the working of Telephone?

An electric coil is attached to a vibrating diaphragm which is made of metal. Diaphragms are used in modem telephones to convert voice into electrical signals for transmission. The mouthpiece and the earpiece are two elements of the telephone system.

A thin metal diaphragm and carbon granules are found in the mouthpiece and receiver respectively. The diaphragm vibrates as we speak through the mouth piece. An electrical current may travel through the wire because the diaphragm vibrates slightly compressing the carbon.

At the opposite end of the line, the receiver reverses this procedure procedure. An electromagnet in the receiver generates a changing magnetic field as a result of electrical current as a result of the receivers thin metal diaphragm vibrating due to the magnetic field, sound is produced.

Q5. Write some uses of radio waves transmission?

Transmission;

Radio waves may be used o transmit electrical signals representing data from a microphone, TV camera, or computer,

Microphones;

The microphones convert the radio station's sound wave into electrical impulses. The transmission aerial consist of two metal rods, and these signals are subsequently fed into the antenna. Electromagnetic radio waves are produced when the charges on the transmission antenna vibrate in response to electrical signals. are produced when the charges on the transmission antenna vibrate in response to electrical signals.

The modulated signal is selected and amplified by the receiver at the other end.

Fax Machine:

A fax machine is s need for many enterprises across the globe. There are two essential functions in the use of fax machines; scanning the page and transmitting the resulting electronic signals over telephone line.

An internal printer on the receiving system is used to print out a copy of the transmitted message one it has been converted by the software;

Cell Phones;

In mobile phones, radio technology is used it's a sort of radio that allows for two-way communication between users. These are radio transmitters and receivers built inside the mobile phone's internal components. To communicate, it uses radio waves to transmit and receive.

Q6. Write a note on computer?

A computer processes, stores, and display data. Hardware and software are software are two components that are fundamental to the operation of a computer "Hardware" is a physical component of computer. CPU, Monitor, Keyboard, and mouse are a few examples CPU a microprocessor is the most important component hardware. It is the brain of computer the unit that processes instructions and calculated results. System (OS) is the software that governs the functioning of your computer and any other connected devices. Window and Linux are well- known operating systems.

Today computers are employed in almost every field, including medicine, engineering, weather , forecasting, transportation, and shopping malls.

Q7. What are storage devices?

Storage devices is a device that can be used to store information in a computer. Storage devices use electronics magnetism and laser technology in different ways to store information.

Primary Memory;

Primary memory is made up of integrated circuits Random Access memory (RAM) is a region in the memory where running programmers and services may be accessed by the CPU.

The second part of memory is called read-only memory (ROM). Which is a type of storage medium that storage data on personal computers (PCs) and other electronic devices in a way that doesn't change it.

Secondary stage devices;

They are usually the secondary storage memory it can also be used to store other types of data. It is use to keep the data in the computer for a long time. When we open a software data is transferred from secondary to main storage. Audio- Video cassettes, hard discs, USBs memory cards are the few examples of secondary storage devices.

Q8. Write a short note on hard disk?

A hard disk is a rigid, magnetically sensitive disk that spins rapidly and continuously inside the computer chassis or in a separate box connected to the computer housing. This type of hard disk is never moved by the user. A typical hard disk consists of several letters, each accessed via a read/ write head on a movable arm.

Compact Disk(CDs);

It's a moulded plastic disk with tiny "pits" and "lands" that store digital data. pits are CD's spiral tracks and lands lie between them; a laser beam scans the disc to read data. CD its and lands reflect laser light differently this pattern of pit and land light reflection is transformed a binary data. Pits signify 1 and 0 CDs can contain 680 MB of data A DVD can contain 17GB of data the same as CD.

Flash Drive;

It is an electronics device and has integrated circuits (ICs) that store data. A flash drive may transfer data between computers. Many of these little devices can hold year's load of schoolwork.

Q9. State and explain internet its services and uses?

Internet is a network of network which spreads all across the globe. Initially today internet comprises of several million computers.

Internet is a basically a large computer network, which extends all across the globe. In internet millions of computers remain connected together through well- laid communication system.

Internet Services;

The main services used on the internet include;

Web browsing – this function allows users to view webpages.

E-mail - Allows people to send and receive text messaged.

Browsers;

A browser in an application which provides a window to the Web. All browsers are designed to display the pages of information located at Web sites around the world. The most popular browsers on the market today include internet Explore. The World Opera, Safari, Mozilla Firefox Chrome, etc;

List of use of internet;

i, Faster Communication
ii, Big Source of Information
iii, Source of Entertainment
iv, Access to social media
v, Access to Online Services
vi, E – Commerce
vii, E - Learning

Atomic Structure

Multiple Choice Questions(MCQ)'s

i. $^{2}_{1}H$ and $^{3}_{1}$ are;

* **Isotopes** * Isobars * Isotones * Isochrones

ii. The neutral atoms all of the isotopes of the same element have;

* Difference numbers of protons * Exact numbers of neutrons
* **An exact number of protons** * An exact number of nucleons

iii. Consider the species $_{17}Cl^{35}$ and $_{17}Cl^{37}$. These species have;

* The exact number of nucleons * **The exact number of protons**
* The exact number of neutrons * The exact mass number

iv. Atomic mass of an element is equal to;

* **Mass of protons and neutrons** * Mass of protons and electrons
* Mass of electrons and neutrons * Mass of protons only

v. The maximum mass of an atom is concentrated in;

* **Nucleus** * Neutrons * protons * Electrons

vi. Consider isotope $_{92}U^{237}$ of uranium. The number of neutrons in it is.

* 92 * 237 * **145** * 329

vii. The symbol denotes the proton number is;

* P * A * N * **Z**

viii. The number of neutron(s) in Protium is;

* No * One * Two * Three

ix. In an atom, the nucleus when compared to the extra- nuclear part, is;

* More significant is volume and heavier in mass
* **Smaller in volume but heavier in mass**
* More significant in volume but lighter in mass
* Smaller in volume and lighter in mass

x. If an element B has five protons and neutron what will be the symbol of element B

(a) 11_6B (b) 11B (c) 11_5B (d) $A_{11}B$

SHORT QUESTION'S & ANSWERS

Q1. What is an atom give complete structure of an atom?

Atom

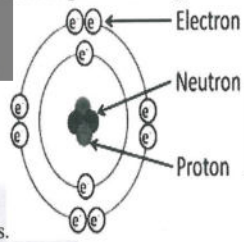
Is the smallest unit into which mater can be divided without releasing electrically charged particles. This is to small to be seen with any ordinary microscope.

An atom consist of three fundamental particle.

i. Electron ii. Proton iii. Neutron

Nucleus;

The central hard core of an atom is called Nucleus it is small dense region consisting of close or pack proton and neutron. Most of the atom is empty space.



Protons:

It is positively charge particle found in the nucleus.

Having equal number as the number of Electron.

Nuetron;

It is also found in the nucleus have no charge.

Electron;

It is negatively charged particle and move around the nucleus.

Q2. Describe Rutherford Atomic model to explain the basic structure of an atom.

The simple Rutherford Atomic model is often used to explain the basic structure of an atom.

Every atom is composed of two parts.

1. The Central hard core of an atom is cord nucleus which is the small, dens region consisting of closely pack proton and neutrons.
2. Around the nucleus electron revolved at high speed.

Most of the atom is empty space. The rest comprise a positively charge nucleus surrounded by the negatively charged orbiting electrons. The nucleus is tiny and dense compared with the electrons. Electrons are rounded by a positively charged nucleus it the electrostatic force.

Q3. Explain Geiger and marsden often experiment and its result?

Geiger and Marsden $\alpha-$ scattering Experiment.

In this experiment Geiger and Marsden use a bean of positively charged α - particle to bombard on a thin gold foil place in a vacuum surrounded by a ring shaped fluorescent screen. After bombarding the foil, the scattered $\alpha-$ particle were detected using a rotating detector. When $\alpha-$ particles hit the screen of light was observed through the detector.

Results:

i, Most of the $\alpha-$ particles were not deflected or only a few deflected through small angles.

ii, A small number of the $\alpha-$ particles were deflected through considerable large angles of more than 90°, and a few of the $\alpha-$ particles were even deflected back through nearly 180°.

iii, Few of the $\alpha-$ particles were even deflected back through nearly 180°.

Q4. Write Rutherford atomic model postulate?

Following are the main postulate of Rutherford atomic model

Rutherford introduce an atomic model with the following postulate

i, The nucleus carries all the positive charge of atom and nearly all its mass .

ii, There exit large empty spaces in an atom.

The number of protons in the nucleus of an atom in an element is called atomic number (Z)

The number of protons and neutrons is collectively known as nucleon number (A) or atomic mass (A)

The total number of nucleons is the atomic mass - A nucleus is represented symbolically by;

${}_{z}X^{A}$

Q5. What the centre of an atom is called?

Centre of an atom is called Nucleus it consist two particles neutron and proton

Q6. Where are the electrons found inside an atom?

The outer most region of the nucleus is called electron shell. It contains electrons have a negative charge

Q7. Define Nuclear Physics?

The branch of Physics concerned with the study an understanding of the atomic nucleus including is composition and the force which kind it together is called nuclear physics.

Q8. Define the following;

i. Atomic Number ii. Atomic Mass or Nucleon Number

Atomic Number:

The number of protons in the nucleus of an atom in an element is called atomic number it represents by Z

ii. Atomic Mass or Nucleon Number

The number of Protons and Neutron is collectively known as Nucleon number (A) or Atomic Mass(A)

Q9. How a Nucleon represented symbolically?

A Nucleus represented symbolically by ${}_{z}X^{A}$

Where X represent Nuclide A is the Nucleon number and Z is the Atomic number

Q10. What are Isotopes give the Isotopes of Hydrogen?

Isotopes;

The atoms of an element are not exactly alike. Some may have more neutron than others. These different variants of the element are called isotopes.

Two or more species of atoms of an element with the same atomic number, (Z) have different atomic mass, (A) is called Isotopes.

Isotopes the Hydrogen;

i. Protiun ${}_{1}H^{1}$

ii. Deuterion ${}_{1}H^{2}$

iii. Tritium ${}_{1}H^{3}$

Nuclear Structure

Multiple Choice Questions(MCQ)'s

i. α – radiation is;
* A structure of fast- moving electrons
* A forms of electromagnetic radiation
* **Highly ionizing than γ – radiation**
* More penetrating than β – radiation

ii. A radioactivity nuclide emits a β – particles. The atomic number (proton number) of the nucleus
* **Stays the same**
* Increase by 1
* Decreases by 2
* Decreases by 1

iii. A radioactive element emits a particle from the nucleus of one of its atoms. The particle comprises two protons and two neutrons. The name of this process is called;
* **α – emission**
* β – emission
* γ – emission
* Nuclear fission

iv. A radioactive decay can be represented as shown. ${}_{91}Pa^{233} \rightarrow {}_{92}U^{233} + ...$ the emitted particle is a/an;
* Gamma – ray
* Proton
* α – particle
* **β – particle**

v. The type of radiation that travels in a straight line across an electric field is a/an;
* Proton
* Electron
* Alpha particle
* **Gamma – ray**

vi. A powder contains 100mg of a radioactive material that emits α – particles. The half-life of the isotope is five days. The mass of isotope that remains after ten days will be;
* 0mg
* **25mg**
* 50mg
* 75mg

vii. The main source of energy in the stars is;
* Chemical reaction
* Nuclear fission
* **Nuclear fusion**
* Gamma decay

viii. The splitting of a heavy nucleus into smaller nuclei is called;
* Fusion
* **Fission**
* Half-life
* Gamma decay

ix. A process in which two light nuclei combine to form a heavier nucleus is called;
* **Nuclear fusion**
* Nuclear fission
* Half-life
* Gamma decay

x. Which now shows the nature and the penetrating ability of β – particles?

	Nature	Most are stopped by
a)	Helium nucleus	A few mm of aluminum
b)	Helium nucleus	A thin sheet of paper
c)	**Electron**	**A few mm of aluminum**
d)	Electron	A thin sheet of paper

xi. Compared with α – particles and β – particles, γ – rays;
* Are a type of radiation to carry a charge
* Have the most significant ionizing effect
* **Have the most significant penetrating effect**
* Have the most negligible mass

xii. The severe health hazards caused by radioactive emission is/are;
* Cancer
* Genetic change
* Deep – sited burns
* **All of these**

xiii. Radioactive material should be handled carefully. Which safety measure does not reduce the risk of using radioactive material?
* Keeping the material at a long distance
* **Keeping the material at a low temperature**
* Using lead screening
* Using the material ton a short time

xiv. A scientist experiments using a sealed source that emits β – particles. The range of the β – particles in the air is about 30cm, The precaution that is the most effective to protect the scientist from the radiation is;
* **Handling the source with long tongs**
* Keeping the temperature of the source low
* Opening all windows in the laboratory
* Washing his hands before leaving the laboratory

xv. The safest way to dispose of a large quantity of radioactive waste is;
* **Burying it in a dry rock deep underground**
* Washing it in the drain
* Burning it on a fire
* Draining it into the sea

SHORT QUESTION'S & ANSWERS

Q1. Define radio-isotops and radioactivity?

The isotopes of radioactive element are called radio isotopes.

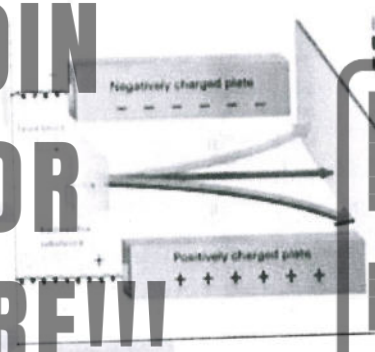
Radio Activity;

The emission of $\alpha, \beta \& \gamma$ radiation with the release of energy is known as radioactivity.

Q2. Describe the nature of Radio active emission

Nature of radioactive emission;

To describe the nature of three types of Radiation $\alpha, \beta,$ *and* γ the radio active Source is placed inside the electric field. The radiation emitted from the source break down in to three components. α *and* β radiation bend in the opposite direction in the electric field while γ Gamma radiation does not change its direction.



Result;

This result describes that;

- α - Reflected towards a negatively charged while the plate is positively charged
- β - Reflected towards a positive plate that is negatively charged. It is reflected more in the field thus, much lighter than α Particles.
- γ - Rays are not reflected by the field and carry no electric charge.

Q3. Define i. ions ii. ionization?

Ions;

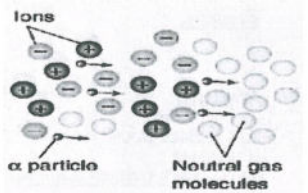
Ions are charged atoms or charged molecules. Atoms become ions when they lose or gain electrons.

Ionization;

i, The phenomenon by which radiations split matter into positive and negative ions is called ionization.

Q4. Describe relative ionizing effects of radio active emission?

Nuclear radiations i.e alpha, beta, and gamma can knock out electrons form atoms in their paths, resulting in an ionizing effect However alpha particles have the most significant ionization power then beta particles and gamma rays. It is due to the large positive charge and large mass of alpha particles. Beta particles ionize a gas much less than alpha particles. The ionization power of gamma rays is even less than that of beta particles. The ionization of alpha particles in a gas.



(a) Alpha particles cause intense ionisation in a gas.

Q5. Define parent Nucleus and daughter Nucleus Radioactive Disintegration?

Parent Nucleus;

The original nucleus before decay is called the parent nucleus.

Daughter Nucleus;

The nucleus formed after decay is called the daughter nucleus.

Radioactive Disintegration;

Radioactive disintegration cause nuclear transmutation and converts one chemical element or isotope into another chemical element or isotope.

Alpha (α) - decay;

In alpha decay the proton number or atomic number, Z of the parent nuclide reduces by 2, while its atomic mass or nucleon number, A, decreases by 4.

Its general equation $_{Z}X^{A} \longrightarrow {}_{Z-2}Y^{A-4} + \alpha +$ energy

Parent nuclide — Daughter nuclide — alpha particle

Example;

$$_{88}Ra^{226} \longrightarrow {}_{86}Rn^{222} + \alpha + \text{energy}$$

Beta (β)- decay;

In beta decay, the atomic number Z of the parent nuclide increases by one, and its atomic mass or nucleon number its general equation is;

$$_{Z}X^{A} \longrightarrow {}_{z+11} + {}_{-1}e + \text{energy}$$

Parent nuclide — Daughter nuclide — beta Particle

Example;

$$_6C^{14} \longrightarrow {}_7N^{14} + {}_{-1}e^{0} + \text{energy}$$

Q6. What are;

i, Back ground radiation ii, Spontaneous decay iii, Random decay

i, Back Ground Radiation;

These natural radiations that comes from the surroundings are called back ground radiations.

Our planet Earth is also exposed to radiation from outer space called colonic radiations, consisting, of electrons, protons, alpha particles, and larger nuclei. The cosmic radiation interacts with atoms in the atmosphere to create a shower of radiation including X- rays, muons, protons, alpha particles, electrons and neutrons.

ii Spontaneous decay

The half-life of a radioactive isotope is the time taken for half of the nuclei present in any given sample to decay Iodine-131 is a radioactive isotope is the time taken for half of the nuclei in any given sample to decay.

iii. Random decay;

a. The radioactive decay process is random, and the rate of radioactive decay is proportional to the number of unstable nuclei present. In the decay process a constant fraction of many unstable radioactive nuclei disintegrates at a certain time.

b. A random decay is a process in which the exact time of decay of a nucleus cannot be predicted. Every radioactive element has its characteristic half – life.

Q7. Define radioactive dating?

Radioactive dating is a process by which the approximate age of an object is determined by using certain radioactive nuclides.

For example radioisotope carbon – 14 is found in a small amount in the atmosphere and is used to measure the age of organic material.

Q8. What are radio isotopes explain with example?

Radio- isotopes;

The radioisotope is also a radioactive isotope, radionuclide or radioactive a nuclide. Kind of the same element with different masses. It undergoes decay spontaneously and emits radiation to dissipate excess energy.

Examples;

$$_2He^{4} + {}_{13}Al^{27} \longrightarrow {}_{15}P^{30} + {}_0n^{1}$$

Alpha particle — Stable aluminum Nuclide — Unstable Phosphorus Nuclide — Neutron

Q9. Define half life of a radio active element?

The half life of a radioactive isotope is the time taken for half of the nuclei present in any given sample to decay.

Example;

Iodine 131 is a radioactive isotope of iodine 131 has an 8 days half line, which means that half of an iodine 131 sample will be converted to other elements within 8 days.

Every radioactive element as its characteristic half line.

Q10. Describe uses of radio isotopes in medicine, industry and agriculture?

Radioisotope are used as tracers in medicine, industry, and agriculture.

Medicine;

In medicine a patient drinks a liquid containing radio iodine-131, a gamma emitter, to check thyroid function. For the diagnosis of brain tumors, the phosphorous-32 isotope is used.

Industry;

In industry manufactures use tracers to monitor flow and filtration to detect leaks in the equipment.

Radiotracers are also used in the oil and gas industry to detect and estimate the extent of oil field.

Agriculture;

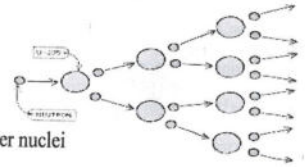
In agriculture, fertilizer uptake in the plant from root to leaves is traced by adding tracer phosphorus-32 to the soil water.

Nuclear Medicines;

Radioisotopes are used for curing various diseases. for example cobalt-60 is a strong gamma emitter.

Kill the malignant tumor cells in the patient. Treatment like this is called radio energy.

Q11. Define nuclear fission and chain reader with example?



Nuclear Fission;

Nuclear fission occurs when a heavy nucleus, such as U-235 absorbing a slow-moving neutron, splits or fissions into two smaller nuclei with the release of energy.

For example;

When U-235 captures a neutron an intermediate, highly unstable nucleus, U-236 is formed that disintegrates only for a fraction of a second into two smaller nuclei of nearly equal fragments, Kr–144 and Barium -89 called fission fragments accompanied by two or three neutrons.

$$_0n^1 + {}_{92}U^{235} \longrightarrow {}_{92}U^{236} \longrightarrow {}_{56}Kr^{144} + {}_{36}Ba^{89} + 3\,{}_0n^1$$

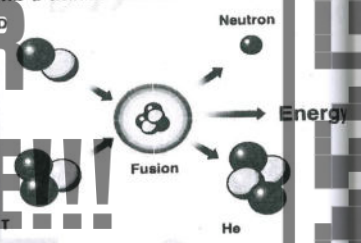
Chain Reaction;

In each nuclear fission, a few neutrons are emitted. Fission with the possibility of a chain reaction. If the chain reaction is not controlled it will explode, releasing massive energy.

This is fission chain reaction is controlled in nuclear reactors. A nuclear reactor provides an enormous amount of energy for our valuable purposes.

Q12. What is Nuclear Fusion?

Nuclear fusion occurs when two light nuclei combine to form a heavier nucleus with the release of energy.



For example;

When a nucleus of Deuterium (H^2), is fused with a nucleus of Tritium (H^3) then a Helium nucleus or alpha particle is formed as represented by the equation.

$$_1H^2 + {}_1H^3 \longrightarrow {}_2He^4 + 0n1 + \text{energy}$$

The total mass of the final nuclei is always less than the mass of the original nuclei. This loss of mass produces nuclear energy.

Q13. Write the Hazard of radioactive material?

i, The danger from α particle because of their lower penetration power is minimal.
ii, The β particles are more penetrating and can damage the body surface tissues.
iii, The γ rays are lightly penetrating and the most dangerous of all other radioactive radiations.
iv, The prolonged exposure to radioactive radiation can produce deep-sited burns.

Q14. Write five Safety Measures of radioactivity?

Following safety measures to avoid an risk of radiation hazards;

i. Keep all radioactive sources at a safe distance from the body.
ii. Minimize the time spent near radioactive materials.
iii. Lapel the dosimeter badge always and monitor regularly.
iv. Use tongs to handle radioactive sources.
v. All radioactive sources should be kept in thick lead containers.

An electric current through a conductor produces a magnetic field because the electric field of moving electrons is neutralized by the field of the fixed protons in the conductor. This magnetic field symbolized by B.