(Section B)

Q. No. 2 Part (I) *EXPLANATION :- When a satellite is put into a higher Orbit its Orbital velocity will decrease due to the value of g which decreases

*PROOF :- $v_o = \sqrt{\frac{GM_E}{r}}$

This is because the the Artificial satellites are Orbiting the planet due to attractive forces of Gravitational field strength. When we move further away from the Earth, Our velocity Orbiting the Earth will decrease. Thats why putting the satellites requires specific velocity to move or orbit them about the Globe. If Orbital velocity decreases it will fall on Earth.

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Q. No. 2 Part (II) INTERFERENCE PATTERNS :-

*CONSTRUCTIVE INTERFERENCE :- The Interference in which crests fall on crests & troughs fall on troughs leading to higher wavelength waves is termed as Constructive Interference.

*PATH DIFFERENCE FOR C.I :- $P.D = d\sin\theta$

$d\sin\theta = m\lambda$

*DESTRUCTIVE INTERFERENCE :- Such Interference patterns that cancel out the crests & trough leading to Inferior or decreased wavelength waves is termed as Destructive Interference.

*PATH DIFFERENCE FOR D.I :- $P.D = d\sin\theta$

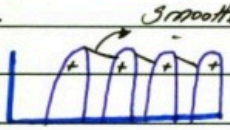
$d\sin\theta = (m + \frac{1}{2})\lambda$

(Section B)

Q. No. 2 Part (iii) **SIGNIFICANCE OF CAPACITOR :-**

* DEFINATION OF CAPACITOR :- "Such an Electronic Circuit Component responsible for the storage of charge is called a Capacitor."
* ROLE IN RECTIFIER BRIDGE :-

As we know that; rectifier bridge converts Alternating AC voltage into DC voltage with the help of Diodes. Capacitors in rectifiers help to stablelize the output DC voltage by suppling Potential Energy when the Rectifier voltage decreases, this makes the Output DC voltage Smooth & Stable.



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Q. No. 2 Part (iv) **SELF INDUCTANCE :-**

* DEFINATION :- "Self Inductance is the phenomenon in which a Changing Current or voltage produces an Emf in the coil itself is called Self Inductance."
* UNIT :- "Self Inductance is measured in Henry". $H = V_3A^-$
* FACTORS DEPENDANCY :- Self Inductance depends upon the magnitude of Changing current & the delevarance of that in coil in Ampere per second. It mainly follows the distance blw the Coil & Changing Electric Current in the Circuit.

(Section B)

Q. No. 2 Part (v) RELATION B/W TEMPERATURE & AVERAGE TRANSLATIONAL KINETIC ENERGY :-

$\langle K.E \rangle = \frac{3}{2} kT$ $K.E \propto T$

★ EXPLANATION :-

Kinetic Energy of the Gas molecules directly depends upon the Absolute temperature of the Gas molecules.

$PV = nRT$

$PV = \frac{N}{N_A} RT$

$\therefore n = \frac{N}{N_A}$

$PV = \frac{NR}{N_A} T$

$\therefore \frac{R}{N_A} = k$ $PV = NkT$

$P = \frac{1}{2} mv^2 kT$

★ RELATION :-

$\frac{1}{2} mv^2 \propto T$

★ If the temperature of the sample will increase; its average K.E will also increase.

$P = \frac{3}{2} NkT$

$\langle \frac{1}{2} mv^2 \rangle = \frac{3}{2} kT$

.....

Q. No. 2 Part (vi) INTERNAL BODY IMAGING :-

★ ROLE OF X-RAYS :-

X-rays are more common type of Imaging diagnostics techniques. In this technique; X-rays are passed from the body and are absorbed by different Organs & Tissues. Bones cast their shadow on the X-ray film as they appear Opaque & are clearly visible on the X-ray film; while Soft Tissue are seen with the help of Contrast in the X-ray Imaging. After passing through body; they are detected by X-ray detectors & forms images with the help of Computer.

(Section B)

Q. No. 2 Part (vii) **CLIMATE INERTIA :-**

* DEFINATION :- Climate Inertia is the property of the Climate System to respond slowly against the Sudden & Late Climate Changes. This property is important to maintain the Climate conditions in an Equilibrium state.
* TYPES :- 1) **SHORT TERM INERTIA :-** Such Climate Inertia adopted for a Short span of time such as weather pattern Changes & Precipitation.
* **LONG TERM INERTIA :-** Such Climate Inertia that is adopted for long time scales & show symptoms progressily. For Example :- Global Warming caused by CO_2 Concentrations are Experienced by the Climate.

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Q. No. 2 Part (viii) * **PIZO - ELECTRIC EFFECT :-**

* DEFINATION :- The property of certain materials to respond by generating Electric Charges in response to the applied mechanical stress is termed as Pizo - Electric Effect. It is done with the help of Pizoelectric material such as PZT & Quartz.
* APPLICATIONS OF PIZO - ELECTRIC EFFECT :-

1) Generation of Electrical Charges in a circuit to produce Current.
2) In Wind Turbines from where we can get Electricity.
3) In dams ; from where water develops mechinical stress to produce Electrical Charges.

(Section B)

Q. No. 2 Part (ix) ROLE OF :-

* **CONTROL RODS :-** Control Rods play an important role in the Core of Reactor ; that helps to normalize or Stop the Ongoing Nucleur fission Chain reaction in nucleur reactor by absorbing Excess of free slow moving neutrons to deaceleroate the reaction. The Control rods are made up of Boron & Cadmium.
* **MODERATOR :-** Moderator is responsible for the Conversion of fast moving neutrons into slow moving neutrons to make them feasible for the fission chain reaction. The Elements are water & Graphite that makeup slow moving neutrons.

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Q. No. 2 Part (x) IDEA EXHIBITED BY RED SHIFT STAR :-

* DEFINATION :- "Such a phenomenon where we Observe Increase in the wavelength but decrease in the frequency as the Source leads away from Observer is termed as Red Shift".
* **Expanding Universe** is the common Idea given by astronomats due to the Red Shift phenomenon, In which the Stars are Exceeding from the Earth by time.

This Idea the Expanding Universe was given by Einstein when he studied the Cosmological Origion & Structure. Red Shift phenomenon provides the basis for the theory of Expanding Universe.

(Section B)

Q. No. 2 Part (xi)

TERMS EXPLANATION :-

* **MASS DEFECT :-** The difference in the mass of nucleus & its constituent particles is termed as "Mass Defect." This is due to the lost of Energy during Combining of proton & neutron. The overall mass of the nucleus is less than the total mass of proton & neutron.

$$MD = ((A-Z)m_n + Zm_p) - m_{nucleus}$$

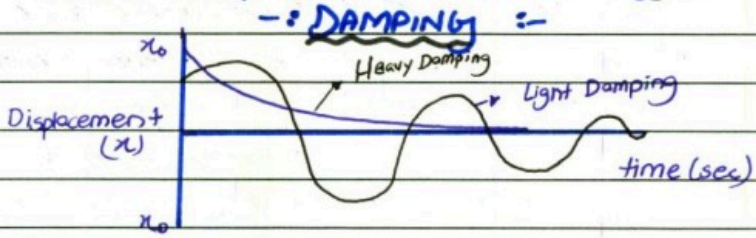
* **BINDING ENERGY :-** The amount of Energy required to break the nucleus in its constituent particles (proton & neutron) is termed as Binding Energy.

* Binding Energy $= \frac{E}{A}$

.....

Q. No. 2 Part (xii)

DISPLACEMENT / TIME GRAPH FOR LIGHT & HEAVY :- DAMPING :-



⇒ In Light Damping, the Oscillator slowly moves to rest position after performing several Oscillations under resistive or damping force.

⇒ In Heavy damping, the Oscillator slowly moves to the rest position without even performing a single Oscillation.

(Section B)

Q. No. 2 Part (xiii)

* **DIFFRACTION GRATING :-** Diffraction Grating is an Optical device usually of transparent material that have several grids & lines etched or ruled over it that act as a secondary source for the Diffraction & Interference of Incident Light.

* **FORMULA :-** Diffraction Grating = Unit length of Grating / Total No of lines ruled over

$$D.G = \frac{1}{N}$$

* Where; the total No of Grids are responsible for the resolving power of the Grating Element.

.....

Q. No. 2 Part (xiv) **RELATION :-**

$$d\sin\theta = n\lambda$$

$$d \propto \lambda L \quad \left(\Delta y \propto \frac{1}{d}\right)$$

This mathematical relation shows the Slit seperation 'd' is indirectly proportional to the λ-wavelength of light or mainly the fringe spacing. $\left(\frac{\lambda L}{d}\right)$. Increasing the distance between the Slits will mainly causes the distance b/w the Consecutive Bright & Dark fringes to Decrease. So; Here in this Scenario. $1/d \propto \Delta L$. Increasing the Slit seperation will defenitly decrease the fringe Seperation.

$$\left[\Delta y \propto \frac{1}{d}\right]$$

(Section C)

Q. No. 3 (Page 1)

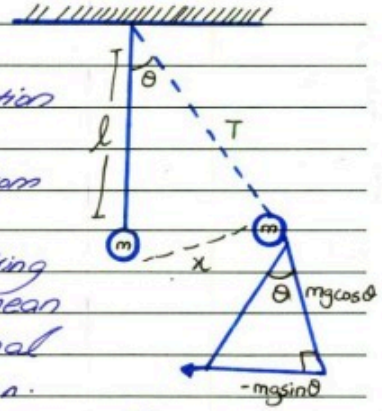
SIMPLE HARMONIC MOTION

DEFINATION :-

"Such Oscillatory motion in which the direction of the displacement / acceleration of the motion is always towards the displacement from the mean position."

"To & Fro" motion of the String attached mass about its mean position is known as Vibrational or Simple Harmonic Motion.

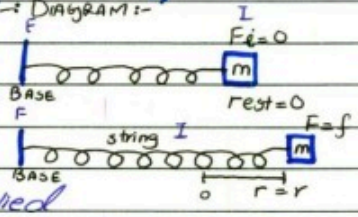
DIAGRAM :-



EXPLANATION OF MASS SPRING SYSTEM :-

The mass attached to a Spring possesses S.H.M as in the presence of Applied force it stretches & then Oscillates to & fro about its mean position with the help of Restoring Force.

DIAGRAM :-



DERIVATION :- $F_x = ma$

According to the Spring Constant :-

$$F = -kx$$

Thus;

$$F_x = F$$

$$ma = -kx$$

$$a = -k/m\,x$$

(Section C)

Q. No. 3 (Page 2)

As we know that; $\omega = \sqrt{k/m}$; $\omega^2 = k/m$

So;

$$a = -\omega^2 x$$

a ∝ -constant x

$$a \propto -x$$

→ This relation proves that; the direction of acceleration is always towards the displacement from the mean position.

-: EQUATIONS FOR TIME PERIOD & FREQUENCY :-

As we know;

$$\omega = 2\pi f \quad \text{or} \quad \omega = 2\pi \, 1/T$$

So;

FOR TIME PERIOD :-

*According to this relation :-

$$T = \frac{2\pi}{\omega}$$

$$T = \frac{2\pi}{\sqrt{k/m}}$$

$$T = 2\pi\sqrt{m/k} \Rightarrow T = 2\pi\sqrt{m/k}$$

This is the Equation for time period.

Now;

FOR FREQUENCY :-

$$f = \frac{\omega}{2\pi}$$

$$f = \frac{\sqrt{k/m}}{2\pi}$$

$$f = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$$

*This is the Equation for frequency.

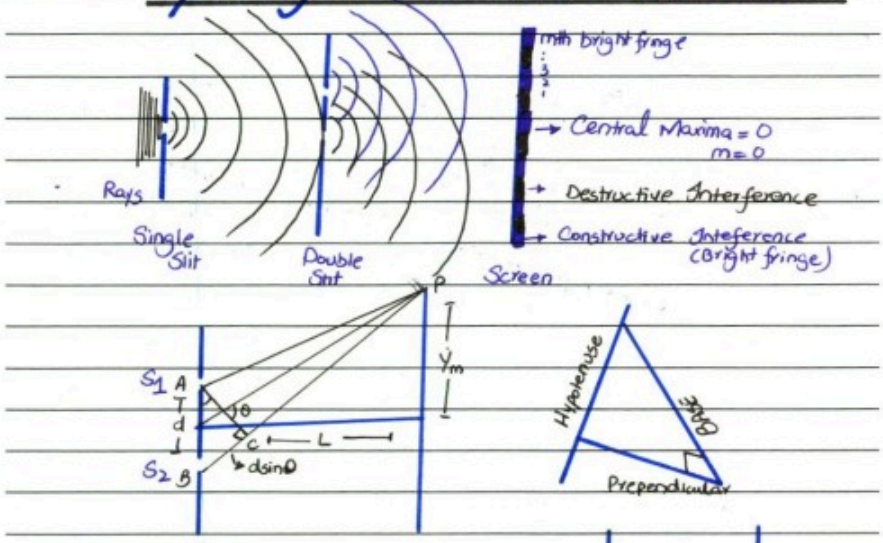
(Section C)

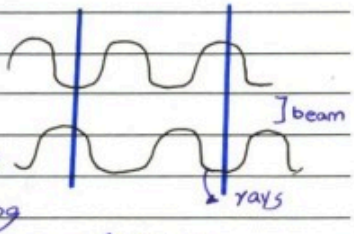
Q. No. 3 (Page 3)

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Q. No. 4 (Page 1)

YOUNG'S DOUBLE SLIT EXPERIMENT





DISCOVERY :-

Thomas Young first performed this Experiment in 1801, mainly focussing to describe the wave nature of light.

EXPLANATION :- He conducted an Experiment from which, he passed the polychromatic Sunrays through a single slit to make it a single monochromatic light source & then passed this monochromatic light source through a double slit. Instead of seeing just two bright spots. He derived several bright & dark spots. known as interference fringes.

(Section C)

Q. No. 4 (Page 2)

INTERFERANCE PATTERNS :-

→ CONSTRUCTIVE INTERFERENCE :- Such spots where light appear brighter were the areas of Constructive Interference known as **Bright fringes.**

→ DESTRUCTIVE INTERFERENCE :- Such spots where light appear fainter or darker was termed as Dark fringes.

DERIVATION :- As we know that;

$$AP \approx CP$$

$$P.D = BP - AP$$

$$P.D = BP - CP$$

$$P.D = BC$$

$$\therefore BC \approx d\sin\theta$$

Thus; $\boxed{P.D = d\sin\theta}$

OR $S_2P - S_1P = P.D$

$S_2P - S_1P \approx d\sin\theta$

So; $\boxed{P.D = d\sin\theta}$

As we know; that

$$\sin\theta = \frac{P}{H}$$

$$\sin\theta = \frac{P}{d}$$

$$P = d\sin\theta$$

$\boxed{BC = d\sin\theta}$

(Section C)

Q. No. 4 (Page 3)

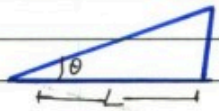
*// FOR CONSTRUCTIVE INTERFERENCE :- $P.D = m\lambda$

$d\sin\theta = m\lambda$

*// FOR DESTRUCTIVE INTERFERENCE :-

$P.D = (m+\frac{1}{2})\lambda$

$d\sin\theta = (m+\frac{1}{2})\lambda$



$\tan\theta = \frac{Y_m}{L}$ $\tan\theta \approx \sin\theta$

$\sin\theta = Y_m/L$

So;

$d\sin\theta = m\lambda$ $\frac{dY_m}{L} = m\lambda$

FOR C.I :- $Y_m = \frac{m\lambda L}{d}$

FOR D.I :- $Y_{m+1} = \frac{(m+1)\lambda L}{d}$

*// **FRINGE SPACING :-** The distance b/w consecutive bright & dark fringe is known as fringe spacing.

FOR CONSTRUCTIVE :- $\Delta y = Y_{m+1} - Y_m$

$\Delta y = \frac{(m+1)\lambda L}{d} - \frac{m\lambda L}{d}$

*// THUS; Fringe spacing is same.

$\Delta y = \frac{m\lambda L}{d} + \frac{\lambda L}{d} - \frac{m\lambda L}{d}$

$\Delta y = \frac{\lambda L}{d}$

FOR DESTRUCTIVE :-

$\Delta y = Y_{m+1} - Y_m$

$\Delta y = (m+\frac{1}{2}+1)\frac{\lambda L}{d} - (m+\frac{1}{2})\frac{\lambda L}{d}$

$\Delta y = (m+1)\frac{\lambda L}{d} + \frac{\lambda L}{d} - (m+1)\frac{\lambda L}{d} \Rightarrow \frac{\lambda L}{d}$

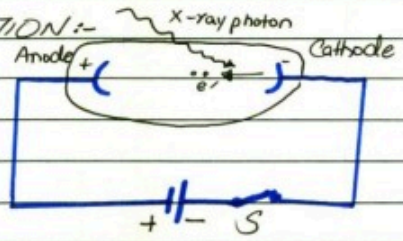
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Q. No. 5 (Page 1)

DEFINATION OF PHOTO ELECTRIC EFFECT :-

Photo electric effect is described as the Emission of Electrons from the metal surface when a high frequency light beam falls over it."

EXPLANATION :-



* When the light beam strikes the metal surface it pulls out the Electron & due to potential difference across the plates the Electrons moves towards the (+) anode

Threshold frequency (φ) :-

The minimum amount of energy required to pull out the electrons from the metal surface is termed as threshold frequency.

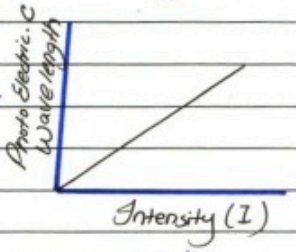
* Without achieving the threshold frequency it will not be possible to excite the Electrons from the metal surface or photoelectrons cannot be emitted.

Thus; threshold frequency is required to excite the photoelectrons.

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Q. No. 5 (Page 2)

-: **RELATION WITH INTENSITY:-**



→ In the Classical Physics Laws; Intensity determines the No of total Electrons emitted from the metal surface.

If the light is Intensive means higher Intensity it will eject more photo electrons. or if it has low Intensity it will eject few photo electrons.

It donot describe the frequency or brightness of e⁻ ejected..

Work function will define intial work to remove the Electrons providing threshold frequency.

(Section C)

Q. No. 5 (Page 3)

(Section C)

Q. No. 6 (Page 1)

* **RADIANT FLUX INTENSITY :-**

* DEFINATION :- "The Luminosity per unit area measured on the surface of the Earth is termed as "Radiant Flux Intensity"

* UNIT :- Watt pe meter square (W/m^2)

* FORMULA :- $I = \frac{L}{A}$

$$F = \frac{L}{4\pi d^2}$$

* **EXPLANATION :-** Luminosity is the total power output of radiation while, radiant flux intensity is what that is measured on Earth. By covering distance (d) the the Luminosity decreases over distance.

* RELATION WITH INVERSE SQUARE LAW :-
If the distance b/w the star & Earth increases by a factor of 2 ; the Radiant flux intensity will decrease by a factor of 4 ; This describes Inverse square law

$$I \propto \frac{1}{d^2}$$

(b) DATA :-

Luminosity = $9.7 \times 10^{27} W$

Radiant flux Intensity (F) = $114n\ Wm^{-2}$
$= 114 \times 10^{-9} Wm^{-2}$

$d = ?$

(Section C)

Q. No. 6 (Page 2)

Solution:- Now;

$$F = \frac{L}{4\pi d^2}$$

$$4\pi d^2 = \frac{L}{F}$$

$$d^2 = \frac{L}{F 4\pi}$$

$$d = \sqrt{\frac{L}{4\pi F}}$$

Thus;

$$d = \sqrt{\frac{9.7 \times 10^{27}}{4(3.14)(114 \times 10^{-9})}}$$

$$d = 8.23 \times 10^{16}\ m$$

Thus; the star is 8.23×10^{6} m away from the planet Earth with following Luminosity & Radiant Flux Intensity.

(Section C)

Q. No. 6 (Page 3)