Federal Board SSC-II Examination
SLOs Based Model Question Paper
PHYSICS (SSC-II) 10th
(2023-24 and Onwards)

SECTION – A (Marks 12)

Q1. Fill the relevant bubble for each part. All parts carry one mark.

(1) In vacuum, all electromagnetic waves have the same:

A. Speed ○ B. Amplitude ○
C. Frequency ○ D. Wavelength ○

(2) The relationship between speed, frequency and wavelength of a wave is known as:

A. Wave equation ○ B. Frequency equation ○
C. SHM equation ○ D. Wavelength equation ○

(3) Which of the following forms of wave is "sound"?

A. Electrical ○ B. Longitudinal ○
C. Transverse ○ D. Magnetic ○

(4) If a ray of light in a glass is incident on an air surface at an angle greater than the critical angle, the ray will:

A. Refract only ○ B. Reflect only ○
C. Partially reflect & refract ○ D. Diffract only ○

(5) According to Coulomb's law, if distance between charges increases, the force of attraction:

A. Will be increased ○ B. Will be decreased ○
C. Will be unchanged ○ D. Will become repulsion ○

(6) When we apply more voltage to an ohmic conductor, we get:

A. More resistance ○ B. More flow of current ○
C. Decrease in power ○ D. Less flow of current ○

(7) Electromagnetism is the study of:

A. Magnetic effect of current ○ B. Flow of protons ○
C. Flow of electrons ○ D. Flow of neutrons ○

(8) Logic gates are used in:

A. LDRs ○ B. DC circuits ○
C. Analogue circuits ○ D. House safety ○

(9) Which one of the following is the most suitable means of reliable continuous communication between an orbiting satellite and Earth?

A. Microwaves ○ B. Radio waves ○
C. Sound waves ○ D. Any light wave ○

(10) Which one of the following particles has the greatest penetrating power?

A. α-Particle ○ B. β-Particle ○
C. γ-Particle ○ D. Proton ○

(11) What is the voltage across a 6 Ω resistor when 3 A of current passes through it?

A. 2 V ○ B. 9 V ○
C. 18 V ○ D. 36 V ○

(12) If the turn ratio of a step-up transformer is 10. It means:

A. $I_s = 10\ I_p$ ○ B. $N_s = \frac{N_p}{10}$ ○
C. $N_s = 10\ N_p$ ○ D. $V_p = 10\ V_s$ ○

SECTION – B (Marks 33)

Q2. Attempt all parts from the following. All parts carry equal marks. (11 × 3 = 33)

i. A pendulum of length 1 m and period 2.01 s is placed at the top of Mount Everest having an altitude of 8849 m. Calculate the value of 'g' at that point.

Ans: $l = 1m$; $T = 2.01\ s$; $g = ?$

$$T = 2\pi\sqrt{\frac{l}{g}} \qquad \ldots\ldots\ldots\ldots (i)$$

Squaring and arranging the equation for "g" we get: $T^2 = 4\pi^2 \frac{L}{g}$

$$\Rightarrow \quad g = 4\pi^2 \frac{L}{T^2} \quad \Rightarrow \quad g = 4 \times (3.14)^2 \times \frac{1}{2.01^2} = 4 \times (9.86) \times \frac{1}{4.0401}$$

$$\Rightarrow \quad g = 39.5 \times \frac{1}{4.0401} = 39.5 \times 0.2475 = 9.77\ \text{ms}^{-2}$$

OR

Define Coulomb's law. Also write its formula.

Ans: **Coulomb's Law:**

Charles Coulomb in 1785 provided an experimental law to explain the nature and magnitude of electrostatic force between the charges. It states that:

The force of attraction or repulsion between two point charges is directly proportional to the product of the quantity of charges and inversely proportional to the square of the distance between them.

Mathematically:

The electrostatic force of attraction or repulsion between two point charges is:

- Directly proportional to the product of charges.

$$F_E \propto q_1 q_2 \qquad \ldots\ldots\ldots\ldots (1)$$

- Inversely proportional to the square of the separation between the charges.

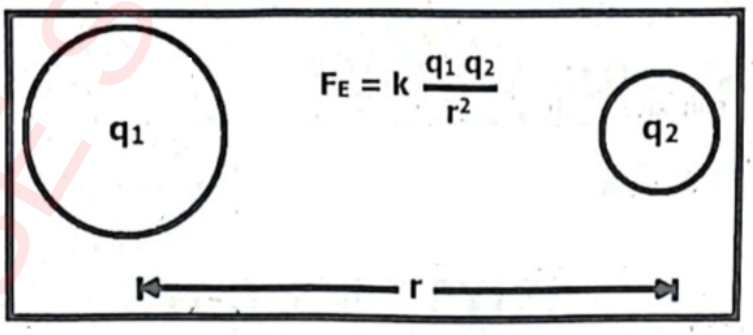
$$F_E \propto \frac{1}{r^2} \qquad \ldots\ldots\ldots\ldots (2)$$

Combining proportionalities 1 and 2: $F_E \propto \frac{q_1 q_2}{r^2}$

Replacing proportionality sign with equality and putting a constant (a generalized rule):

$$F_E = k\frac{q_1 q_2}{r^2} \qquad \ldots\ldots\ldots\ldots (3)$$

Whereas "k" is proportionality constant and is called Coulomb's constant. Its value depends upon the choice of media in between the charges. For air or vacuum its values is $9 \times 10^9\ \text{Nm}^2\ \text{C}^{-2}$. It depends upon the permittivity of medium (ε) used. Coulomb's law is true only for point charges whose sizes are very small as compared to the distance between them.



COULOMB'S LAW

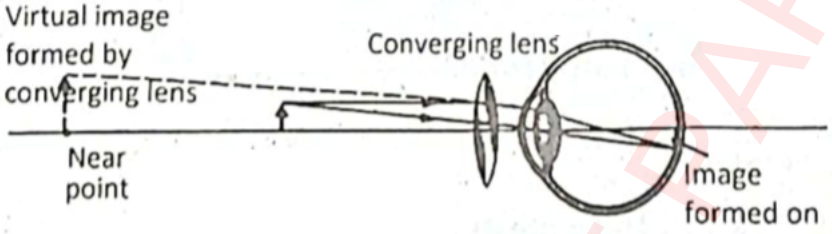
ii. If the concave mirror produces a real image of an object, will the image be necessarily inverted?

Ans: Concave mirror always produces real and inverted images of those objects, which are placed beyond principal focus. But if an object lies within principal focus of mirror, its image will be virtual and erect. So real image will necessarily be inverted.

OR

What spectacles will be used by a person suffering from far sightedness? Draw diagram to show correction of this problem.

Ans: The disability of the eye to form distinct images of nearby objects on its retina is known as farsightedness. This defect can be corrected with the aid of a suitable converging lens. The lens refracts the light rays which converges and form image on the retina.



iii. How can a body be negatively charged by electrostatic induction?

Ans: Fix the object to be charged on insulated stand. Bring a positively charged rod near the insulated object. Rod will attract negative charge towards it and repel positive charge away from it. Now earth the object by a conducting wire, while the rod is still near it. Now if we first break the earth connection and then remove the rod, negative charges are uniformly distributed over the surfaces of the object. By using this process of electrostatic induction, we get a negatively charged object.

OR

Describe three uses of capacitors in various electric appliances.

Ans:

(a) Capacitors are used for tuning transmitters, receivers and transistor radios.

(b) They are also used for fans, fan motors in air conditioners, coolers, motors washing machines, air conditioners and many other appliances for their smooth working.

(c) Capacitors are also used in electronic circuits of computers etc.

iv. Plane waves in ripple tank undergo refraction when they move from deep to shallow water. What changes occur in:

a. Speed of waves **b. Frequency of waves** **c. Wavelength of waves**

Ans:

a. The speed of a wave in water depends on the depth of water. So in shallow water, speed of water wave decreases.

b. The frequency of the water waves remains the same in both parts of water because it is equal to the frequency of the vibrator.

c. When water waves enter the region of shallow water their wavelength decreases, because speed of waves decreases as $V = f\lambda$.

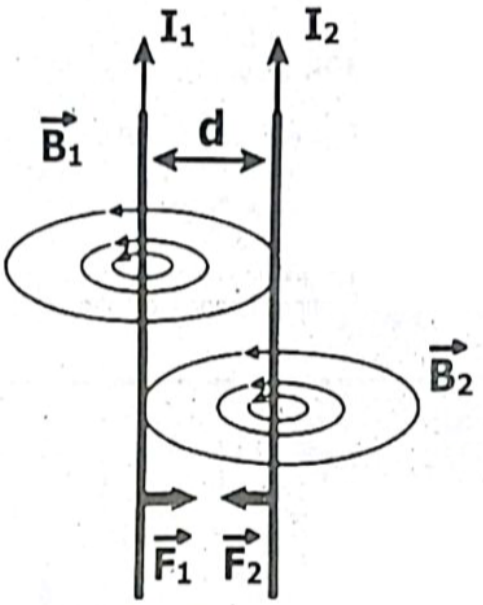
OR

Sound produced on sun is not heard on earth, why?

Ans: Sound waves are mechanical waves; require some material medium for their propagation. Vacuum exists between sun and earth, which does not provide medium for sound waves to propagate; hence we cannot hear sound produced on sun.

v. Will two wires carrying current in the same direction repel or attract each other? Give reason. Show it by a diagram.

Ans: Two wires carrying current in same direction attract each other. The current in each wire generates magnetic field around each wire. In the center, the magnetic fields tend to cancel each other as they are oppositely oriented, therefore creating a weak field region. On the other sides of the wire the field is strong. So, force is exerted towards the weaker region, hence they attract each other.



OR

Define capacitance and its unit.

Ans: Capacitance of a capacitor:

The ability or capacity of a capacitor to store charge per unit applied voltage is called capacitance of a capacitor.

The charge stored on the plates of a capacitor depends upon the applied voltage, greater the applied voltage greater will be the stored charge.

Mathematically,

Replacing proportionality by equality and putting a constant:

$$Q = C\,V \quad \Rightarrow \quad C = \frac{Q}{V} \qquad \ldots\ldots\ldots\ldots (1)$$

Whereas "C" is proportionality constant and is called capacitance of a capacitor.

Unit of capacitance:

The S.I unit of capacitance is farad (F), which is defined as "the capacitance of a capacitor will be 1 F if 1 C of charge is stored on the plates when the applied voltage is 1 V."

Since farad is large unit, we usually use other small units for capacitance given as:

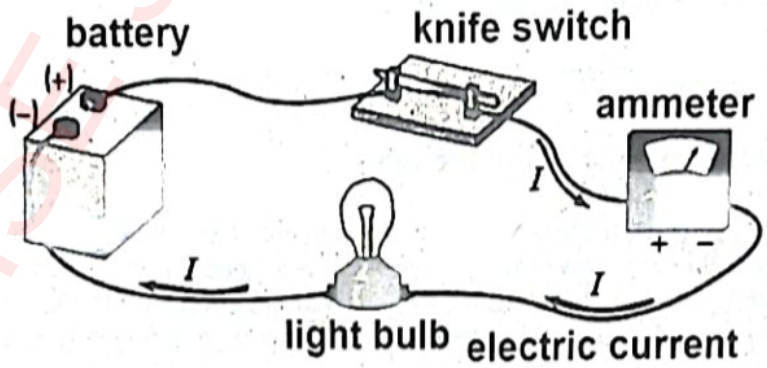
$1\ microfarad = 1\mu F = 10^{-6}\,F$

$1\ nanofarad = 1nF = 10^{-9}\,F$

$1\ picofarad = 1pF = 10^{-12}\,F$

vi. How is an ammeter connected with a device to measure current? Support your answer with reason.

Ans: A large current of the range such as 1 A or 10 A can be measured by means of ammeter. Ammeter is connected in series, so the current flowing in the circuit also passes through the Ammeter.



OR

Draw the symbols truth table of NOR gate.

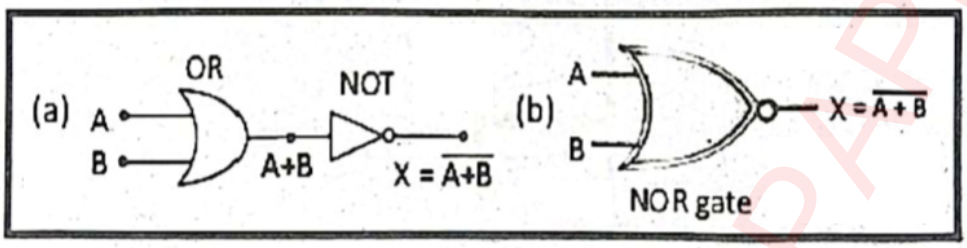
Ans: **NOR GATE:**

The combination of **OR** gate with **NOT** gate is called **NOR** gate.

A **NOR** gate is an **OR** gate with a **NOT** gate at its output. The symbol for a **NOR** gate is made from an **OR** gate with the inversion circle (bubble) at its output as shown in figure below.

The logic equation for the **NOR** gate is written as $X = \overline{A + B}$ (Read as **X** equals not **A** or **B**). From truth table we can see that the output is high **(1)** when both inputs **A** and **B** are low **(0)** otherwise output is high **(1)**.

➢ **Symbol of NOR Gate:**



➢ **Truth table for NOR Gate:**

A	B	A + B	Out put = X = $\overline{A+B}$
0	0	0 + 0 = 0	$\overline{0} = 1$
0	1	0 + 1 = 0	$\overline{0} = 0$
1	0	1 + 0 = 0	$\overline{0} = 0$
1	1	1 + 1 = 1	$\overline{1} = 0$

vii. **What do you understand by digital and analogue quantities?**

Ans: **Digital quantities:**

The quantities whose values vary in non-continuous manner are called digital quantities. Digital quantities are expressed in the form of digits or numbers. The branch of electronics which deals with digital quantities is called digital electronics. Digital electronics uses only two digits 0 and 1.

Analogue quantities:

The quantities whose values vary continuously or remain constant are known as analogue quantities. For example, the temperature of air varies in a continuous fashion during 24 hours of a day. If we plot a graph between time and temperature recorded at different times, we find that temperature varies continuously with time. Therefore, we say that temperature is an analogue quantity. Similarly, time, pressure, distance, etc. are analogue quantities.

OR

Which one is more reliable to store data: floppy disc or hard disc? Briefly explain.

Ans: **Floppy Disc:**

It is a flexible plastic coated with a ferromagnetic material that stores data. The storage medium is flexible. It can store data up to 1.44 MB, it is not reliable medium and data can be lost. It is removable storage device.

Hard disc:

Storage medium is the aluminium plates coated with particular material. These aluminium plates are not flexible. Its capacity is very large, reliable and compact storage media. It is installed inside the system unit.

viii. **An electric kettle is rated as 2.5 kW, 230 V. Determine a suitable current rating of the fuse to put in the three-pin plug. Choose from 1 A, 5 A, 13 A, 30 A and briefly explain.**

Ans:

- **Given data:**

  $\text{Power} = 2.5\ \text{Kw} \quad \Rightarrow \quad \text{Voltage} = 230\ \text{V}$

- **Required:**

  $\text{Current} = I = ?$

- **Solution:**

  $P = VI \quad \Rightarrow \quad I = 2.5 \times 10^3 = 230\, I \quad \Rightarrow$ We get, $I = 10.8\ \text{A}$

  So, fuse of **13 A** will be suitable for this device.

OR

What is CRO? Write its working principle and one use.

Ans: **Cathode Ray Oscilloscope (CRO):**

The cathode ray oscilloscope (CRO) is a type of electrical instrument which converts electric signal to visual signal and is used for showing the measurement and analysis of waveforms and other electronic and electrical phenomenon.

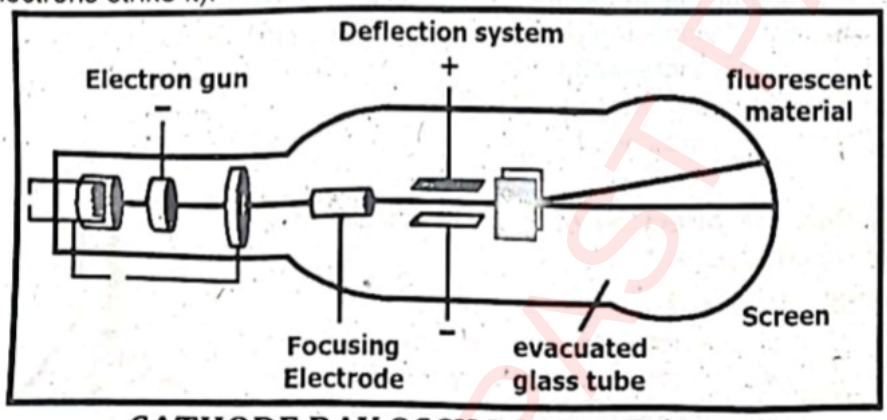
Components of Cathode-Ray Oscilloscope (CRO):

The cathode-ray oscilloscope (CRO) consists of the following components:

(i) The electron gun
(ii) The deflecting plats
(iii) A fluorescent screen

Construction of Cathode Ray Oscilloscope (CRO):

The block diagram of CRO is shown in the figure below, in which the accelerated electron beam from the electron gun is brought to the focal point on a fluorescent screen, with the help of focusing electrode. Thus, the screen produces a visible spot at center where the electron beam strikes it. The visible spot on the screen is observed because it is coated with a thin layer of phosphor (a material that gives light when electrons strike it).



CATHODE RAY OSCILLOSCOPE (CRO)

The horizontal and vertical plates are placed between the focusing electrode and the screen, thus it can detect the beam according to the input signal.

The deflector has two mechanisms, one to change the vertical direction and one to change the horizontal direction of the beam. This allows the electron beam to sweep over the entire screen.

Working Principle:

Working principle of CRO depends on the electron ray movement because of the electrostatic force.

Once an electron ray hits a phosphor face, then it makes a bright spot on it. A Cathode Ray Oscilloscope applies the electrostatic energy on the electron ray from two vertical ways.

The spot on the phosphor monitor turns due to the effect of these two electrostatic forces which are mutually perpendicular. It moves to make the necessary waveform of the input signal.

Uses of Cathode Ray Oscilloscope (CRO):

Measurements of electrical quantities can be done by using CRO. For example,

- Measurement of Amplitude
- Measurement of Time Period
- Measurement of Frequency

It is used in laboratories for the purpose of research. Once researchers design a new circuit, they use CRO to verify the waveforms of voltage and current of every element of the circuit.

It is used in TV, Radar, and analysis of engine pressure. It can also be used to check the reactions of nerves and heartbeat.

ix. Explain whether the atomic number can increase during nuclear decay. Support your answer with an example.

Ans: In beta **β-decay**, the parent nuclide has its proton number Z increased by 1 but its mass number or nucleon number A remains unchanged.

$$A_{Z_Z} \longrightarrow A_{Y_{Z+1}} + 0_{e_{-1}} + \text{Energy}$$

Example:

$$14_{C_6} \longrightarrow 14_{Y_7} + 0_{e_{-1}} + \text{Energy}$$

OR

What is the function of fax machine?

Ans: **Fax Machine:**

The term Fax (short for facsimile), sometimes called telefax is the telephonic transmission of scanned printed material (both text and images) Fax machines or Telefacsimile's machine are must for many businesses around the world. A fax machine basically scans a page to convert its text and graphic into electronic signals and transmits it to another fax machine through telephone line. The receiving machine converts the signals and uses a printer (usually built in) to create the copy of the message sent.

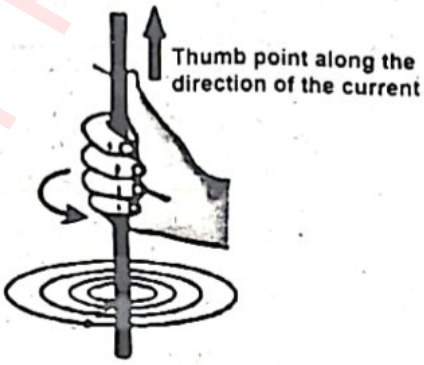
x. Why is an electron beam deflected when passes through a magnetic field?

Ans: When we apply magnetic field at right angle to the beam of electrons. We will notice that the electrons beam is getting deflected from its original direction. Now if we change the direction of the magnetic field. We will see that electrons are getting deflected in the opposite direction. It is due to magnetic force, which magnetic field is applying on moving electrons. The magnetic force is increased if:

(a) The number of electrons is increased.
(b) Strength of magnetic field is increased.
(c) The velocity of electrons is increased.

OR

How can we find the direction of magnetic field of a current carrying conductor?



Ans: **Direction of magnetic field:**

The direction of the magnetic field is governed by the direction of the current flowing through the conductor. A simple method of finding the direction of magnetic field around the conductor is the Right-Hand Grip Rule.

Grasp a wire with your right hand such that your thumb is pointed in the direction of current. Then curling fingers of your hand will point in the direction of the magnetic field.

xi. Lead-210 has half-life of 22.3 years. How much of the 80 mg of lead will be left after 66.9 years?

Ans: Half-life of Lead $T_{1/2} = 22.3$ years

Total time $= 66.9$ years

Original mass $= 80$ mg

Remaining mass $=$?

No. of Half-life $= 66.9/22.3 = 3$

Mass left after 1st half life $= 80/2 = 40$ mg

Mass left after 2nd half-life $= 40/2 = 20$ mg

Mass left after 3rd half-life $= 20/2 = 10$ mg

OR

Write the names of any six information storage devices.

Ans: Information storage devices are the devices that store the information for later use and benefits. These include:

- Audio - Video cassettes
- Floppy disk
- Pen drive
- CD
- RAM
- Hard disk
- SSD
- DVD
- ROM
- Magnetic disk
- Memory card

SECTION – C (Marks 20)

Note: Attempt all questions. Marks of each question are given within brackets. (4 × 5 = 20)

Q3. What is compound microscope? Describe it by drawing Ray Diagram and write formula for its magnification. (1 + 2 + 2)

Ans: **Compound Microscope:**

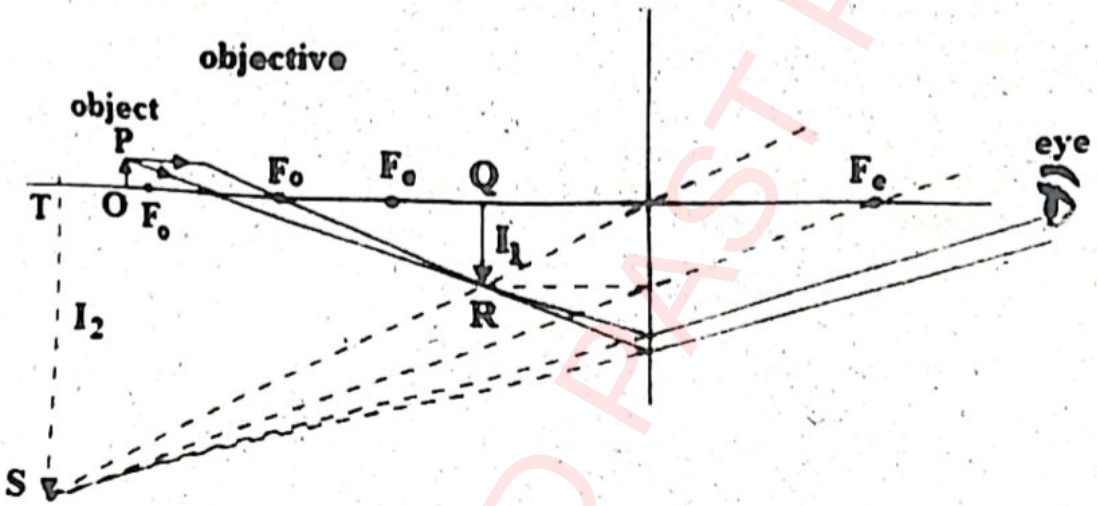
Compound microscope is used to investigate structure of small objects. It gives greater magnification than a single lens.

➢ **Parts:**

It has two converging lenses, the objective and the eyepiece.
The objective lens has a short focal length, $f_o < 1\ cm$.
The eyepiece has a long focal length, f_e of a few cm.

➢ **Ray Diagram:**

Magnification can be determined through the ray diagram as shown in Fig. Objective forms a small image I_1 inside the focal point of eyepiece. This image acts as an object for the eyepiece and the final larger image I_2 is formed outside the focal point of the objective.



➢ **Magnification:**

The magnification of a compound microscope is given by: $M = L/f_o\ (1 + d/f_e)$

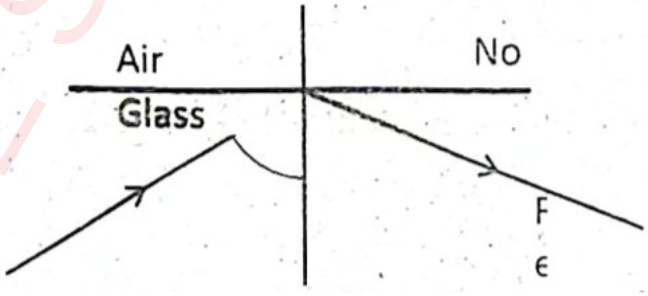
OR

What is total internal reflection? Describe the use of this phenomenon in optical fibers and endoscopy. (1 + 2 + 2)

Ans:

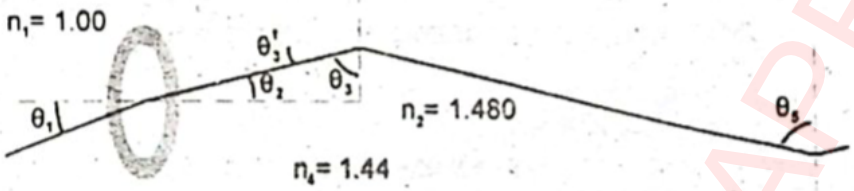
- **Total internal reflection:**

When a ray of light travelling in denser medium enters into a rarer medium, it bends away from the normal. When the angle of incidence becomes larger than the critical angle, no refraction occurs. The entire light is reflected back into the denser medium. This is known as total internal reflection of light.



- **Fibre optics:**

Fibre optics consists of hair size threads of glass or plastic through which light can be travelled. The inner part of the fibre optics is called core that carries the light and an outer concentric shell is called cladding. The core is made from glass or plastic of relatively high index of refraction. The cladding is made of glass or plastic, but of relatively low refractive index. Light entering from one end of the core strikes the core-cladding boundary at an angle of incidence greater than critical angle and is reflected back into the core. In this way light travels many kilometres with small loss of energy.



- **Endoscope:**

An endoscope is used to explore the interior organs of the body. Due to its small size, it can be inserted through the mouth and thus eliminates the invasive surgery. The light shines on the organ of patient to be examined by entering through one of the fibre tubes of the endoscope. Then light is transmitted back to the physician's viewing lens through the other fibre tube by total internal reflection. Flexible endoscopes have a tiny camera attached to the end. Doctor can see the view recorded by the camera on a computer screen.

Q4. An electric bulb is marked with 220 V, 50 W. Find the resistance of the filament of the bulb. If the bulb is used 5 hours daily, find the energy in kilowatt-hour consumed by the bulb in one month (30 days). (2 + 3)

Ans:

- **Given data:**

$\text{Power} = P = 100\ W$; $\text{Voltage} = V = 220\ V$

$\text{time} = t = 5\ \text{hours for } 30\ \text{days}$

- **Required:**

$\text{Resistance} = R = ?$; $\text{The amount of energy in kilowatt hour} = ?$

- **Solution:**

The amount of energy in kilowatt-hour = watt × time of use in hours / 1000

$= 100 \times 5 \times 30 / 1000 = 15\ \text{KWh}$

$P = V^2 / R \implies R = V^2 / P = 220^2 / 10 = 484\ \Omega$

OR

A transformer is used to produce an output of 6 V from 220 V main supply. Primary coil of the transformer has 2000 turns. Calculate the number of turns in the secondary coil. (5)

Ans:

- **Given data:**

$\text{Secondary voltage} = V_s = 6\ V$; $\text{Primary voltage} = V_p = 220\ V$

- **Required:**

$N_p = 2000\ N_s = ?$

- **Solution:**

$N_s / N_p = V_s / V_p \implies N_s / 2000 = 6 / 220 \implies N_s = 54\ \text{approx}$

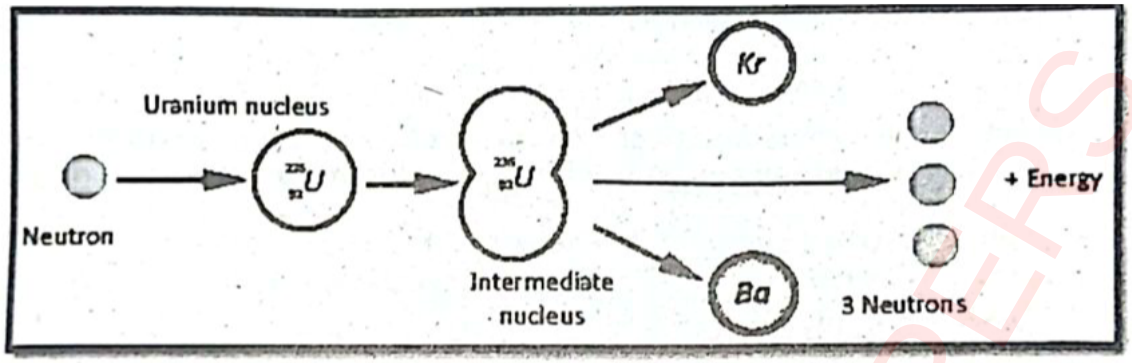
Q5. Explain nuclear fission reaction in detail along with diagram and nuclear equation. (1 + 1 + 3)

Ans: **Fission Chain Reaction:**

A process in which a heavy nucleus breaks into two nearly equal parts with the release of large energy is called nuclear fission chain reaction.

Nuclear fission takes place when a heavy nucleus, such as U-235, splits, or fissions, into two smaller nuclei by absorbing a slow moving (low-energy) neutron as represented by the equation:

$$^{1}_{0}n + {}^{235}_{92}U \longrightarrow {}^{236}_{92}U^{*} \longrightarrow X + Y + \text{neutron}$$



Nuclear fission reaction

Fission Fragments:

Where U^*-236 is an intermediate state that lasts only for a fraction of second before splitting into nuclei X and Y, called **fission fragments**. Nuclear fission was first observed in 1939 by Otto Hahn and Fritz Stresemann.

Fission Chain Reaction:

When a neutron reacts with a uranium nucleus, two or three neutrons are released. Every one of these reacts with next nuclei producing two or three more neutrons and hence, the number of available neutrons and the fission goes on increasing. Such a reaction is called the **chain reaction**.

On the average, 2.47 neutrons are released per event as represented by the expression.

$$^{1}_{0}n + {}^{235}_{92}U \longrightarrow {}^{141}_{56}Ba \longrightarrow {}^{92}_{36}Kr + 3{}^{1}_{0}n$$

In nuclear fission, the total mass of the products is less than the original mass of the heavy nucleus.

Controlled Fission chain reaction:

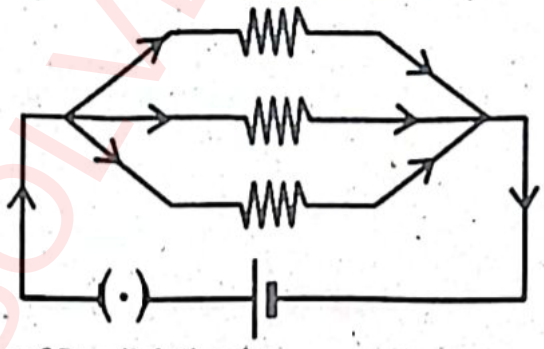
This fission chain reaction is controlled in nuclear reactors by using cadmium rods. In this sort of self sustained reaction, extra neutrons liberated in fission reactions are absorbed to slowdown the chain reaction.

OR

Discuss the main features of parallel combination of resistors. **(1 + 2 + 2)**

Ans: **Parallel Combination:**

In parallel combination one end of each resistor is connected with positive terminal of the battery while the other end of each resistor is connected with the negative terminal of the battery (Fig.). Therefore, the voltage is same across each resistor which is equal to the voltage of the battery i.e. $V_1 = V_2 = V_3 = V$



- **Equivalent Resistance of Parallel Circuit:**

In parallel circuit, the total current is equal the sum of the currents in various resistances i.e. $I = I_1 + I_2 + I_3$. Since the voltage across each resistance is V, so by Ohm's law

$$I = V/R_1 + V/R_2 + V/R_3$$
$$1/R = 1/R_1 + 1/R_2 + 1/R_3$$
$$1/R = 1/R_1 + 1/R_2 + 1/R_3$$

Thus, we can replace the combination of resistors with a single resistor called the equivalent resistance R such that the same current passes through the circuit. ***Thus, the reciprocal of equivalent resistance of a parallel combination is sum of the reciprocals of the individual resistances, which is less than the smallest resistance of the combination.*** If resistances R_1, R_2, R_3 ....., R_n are connected in parallel, then the equivalent resistance of the combination will be given by

$$1/R = 1/R_1 + 1/R_2 + 1/R_3 + \ldots\ldots 1/R_n$$

Q6. **An object of size 3 cm is placed at a distance of 15 cm from a convex lens. Focal length of lens is 10 cm. Find the position, nature and size of image.** **(2 + 1 + 2)**

Ans: **TYPE:** Convex lens

$\text{Size of object} = O = 3\ \text{cm} \Rightarrow \text{Distance of object} = p = 15\ \text{cm}$

$\text{Focal length} = 10\ \text{cm} \Rightarrow \text{Distance of image} = q = ?$

$\text{Size of image} = I = ? \Rightarrow \text{Nature of image} = ?$

Solution: $1/f = 1/p + 1/q$

Rearranging and substituting values of 'f' and 'p', we get: $q = 30\ \text{cm}$

Using magnification formula, $q/p = I/O \Rightarrow I = 6\ \text{cm}$

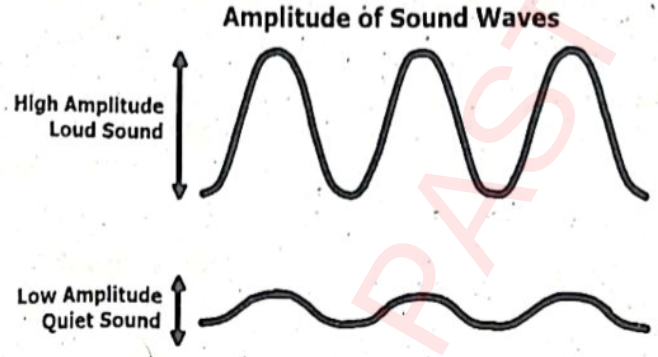
As object is between 'f' and '2f' so real, inverted and large size image will be formed.

OR

Define the term 'Loudness of Sound'. Also state the factors on which loudness of sound depends. **(1 + 4)**

Ans: **Loudness:**

It is that characteristic of sound wave by which we can differentiate between loud and faint sound. It is also not a physical quantity that's why it cannot be measured directly. Loudness can be measured on the basis of "Amplitude of sound wave".



$$\text{Loudness of sound wave} \propto (\text{Amplitude of sound wave})^2$$

The loudness of sound is directly proportional to the square of the amplitude of vibration, and it is expressed in decibel (dB).

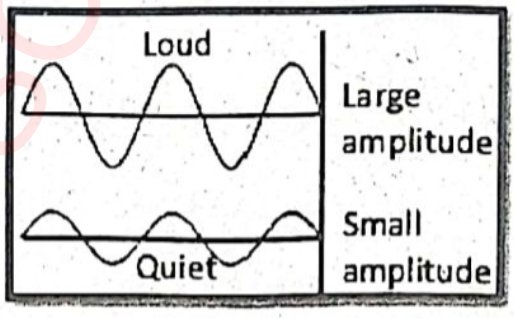
➢ **Factors on which loudness depend:**

Loudness of a sound depends upon a number of factors.

(a) Amplitude of the vibrating body:

The loudness of the sound varies directly with the amplitude of the vibrating body. The sound produced by a sitar will be loud if we pluck its wires more violently. Similarly, when we beat a drum forcefully, the amplitude of its membrane increases and we hear a loud sound.

$$\text{Loudness} \propto \text{Amplitude of the vibrating body}$$



Variation of loudness with amplitude

(b) Area of the vibrating body:

The loudness of sound also depends upon the area of the vibrating body. For example, sound produced by a large drum is louder than that by small one because of its large vibrating area. If we strike a tuning fork on a rubber pad, a feeble sound will be heard. But if the vibrating tuning fork is placed vertically on the surface of a bench, we will hear a louder sound. From this we can conclude that the loudness increases with the area of the vibrating body and vice versa.

$$\text{Loudness} \propto \text{Area of the vibrating body}$$

(c) Distance from the vibrating body:

Loudness of sound also depends upon the distance of the vibrating body from the listener. It is caused by the decrease in amplitude due to increase in distance.

$$\text{Loudness} \propto \frac{1}{\text{Distance from the vibrating body}}$$

(d) The sensitivity of ears of listener:

More sensitive ears can feel more effect of loudness. In other words sensitivity level of ears has direct relation with loudness of sound wave.