UDAAN

2026

PYQ -2025

Practice Session-

Previous Year Paper

PHYSICS Lecture-06

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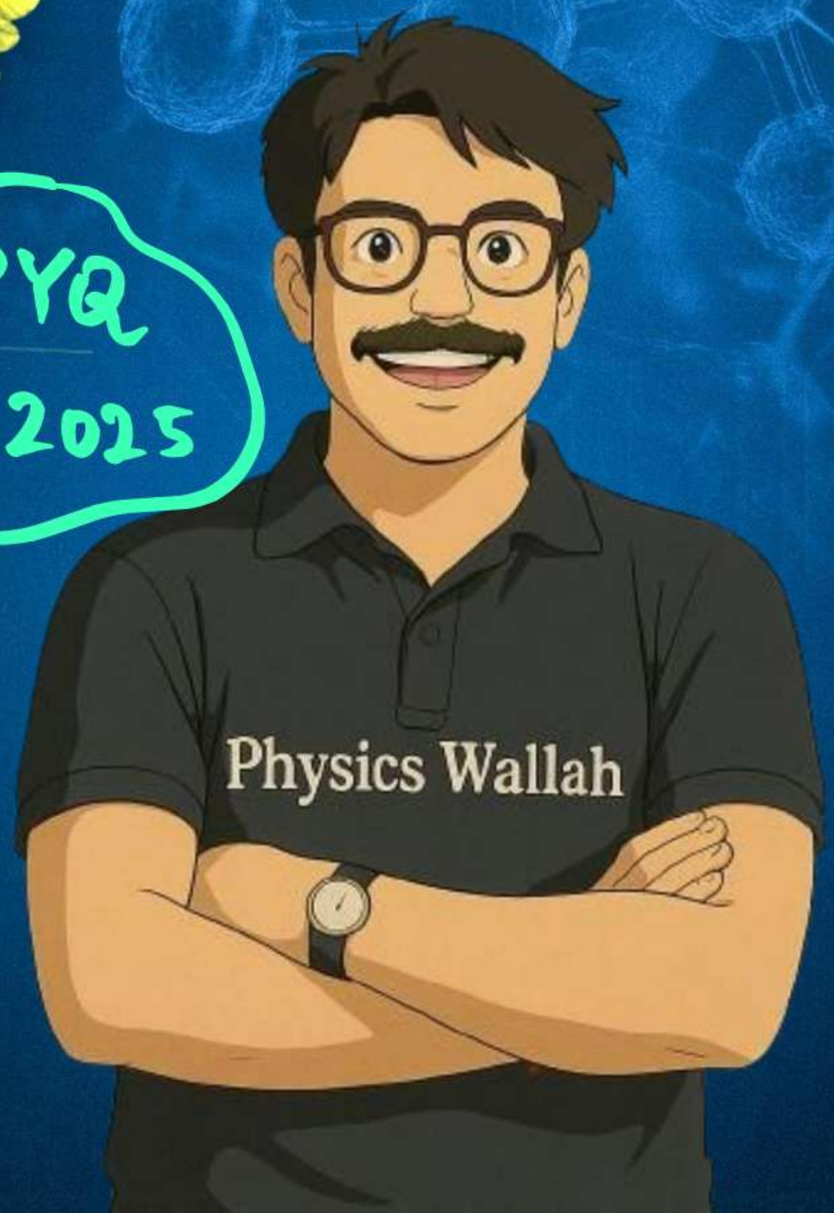


Topics *to be covered*

PY Previous Year Paper

A [redacted] Paper – 2025

QUESTION

Concave : Converging

Convex (VED)

Mirror 'X' is used to concentrate sunlight in solar furnace and Mirror 'Y' is fitted on the side of the vehicle to see the traffic behind the driver.

Which of the following statements are true for the two mirrors ?

(i) The image formed by mirror 'X' is real, diminished and at its focus. = T

(ii) The image formed by mirror 'Y' is virtual, diminished and erect. = T

(iii) The image formed by mirror 'X' is virtual, diminished and erect. X

(iv) The image formed by mirror 'Y' is real, diminished and at its focus. X

A (i) and (ii)

B (ii) and (iii)

C (iii) and (iv)

D (i) and (iv)

Solution: (A)

To analyze the statements regarding the two mirrors, we need to understand their types and the nature of the images they form. Mirror 'X' is a concave mirror, which is used to concentrate sunlight. A concave mirror can form a real, inverted, and diminished image when the object is placed between the focus and the mirror. Therefore, statement (i) is true. Mirror 'Y' is a convex mirror, which is used for rear view in vehicles. Convex mirrors always form virtual, erect, and diminished images regardless of the object distance. Hence, statement (ii) is also true. Statements (iii) and (iv) are false because they incorrectly describe the images formed by the mirrors.

QUESTION

An old person is suffering from an eye defect caused by weakening of ciliary muscles and diminishing flexibility of the eye lens. If the defect of vision is 'a' which can be corrected by lens 'b', then 'a' and 'b' respectively are:

A hypermetropia and convex lens

B presbyopia and bifocal lens

C myopia and concave lens

D myopia and bifocal lens

Presbyopia

Solution: (B)

“An old person is suffering from an eye defect caused by weakening of ciliary muscles and diminishing flexibility of the eye lens.

”As people age, their ciliary muscles weaken and the lens loses flexibility, reducing their ability to focus on nearby objects.

This condition is known as presbyopia.

- The inability to see nearby objects clearly (while distant objects remain clear) → similar to hypermetropia, but caused by aging.
- Therefore, defect ‘a’ = presbyopia.
- Presbyopia is corrected using bifocal lenses, which have:
- Upper part → for distant vision (concave lens)
- Lower part → for near vision (convex lens)So, lens ‘b’ = bifocal lens

QUESTION

Assertion (A): No two magnetic field lines are found to cross each other.

Reason (R): The compass needle cannot point towards two directions at the point of intersection of two magnetic field lines.

A. Both A and R are true, and R is the correct explanation of A.

B. Both A and R are true, and R is not the correct explanation of A .

C. A is true but R is false.

D. A is false but R is true.

Solution: (A)

A — Both A and R are true, and R is the correct explanation of A.

QUESTION

An object is placed at a distance of 60 cm from a concave lens of focal length 30 cm. Use lens formula to find the position of the image formed in this case.

$u = -60\ cm$

$f = -30\ cm$

$v = ?$

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$\frac{1}{-30} = \frac{1}{v} - \left(\frac{1}{-60}\right)$$

$$-\frac{1}{30} = \frac{1}{v} + \frac{1}{60}$$

$$\frac{1}{v} = -\frac{1}{30} - \frac{1}{60}$$

$$\frac{1}{v} = \frac{-2-1}{60} = -\frac{3}{60}$$

$$v = -20\ cm$$

Solution:

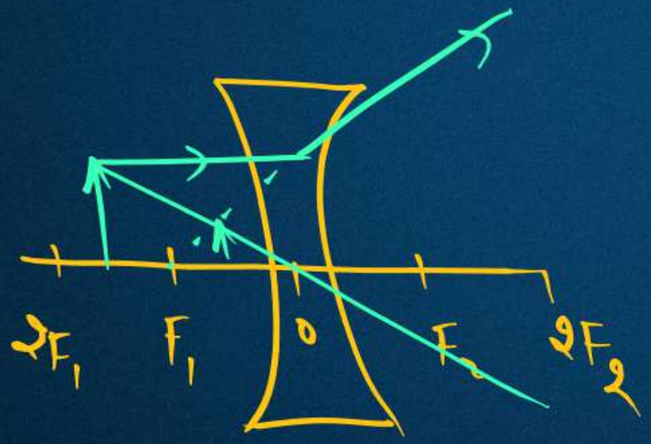
An object is placed at a distance of 60 cm from a concave lens of focal length 30 cm.

(i) Use the lens formula to find the distance of the image from the lens.

(ii) List four characteristics of the image (nature, position, size, erect/inverted) formed by the lens in this case.

Virtual, Erect, diminish, on the same side of object

(iii) Draw a ray diagram to justify your answer of the part (ii).



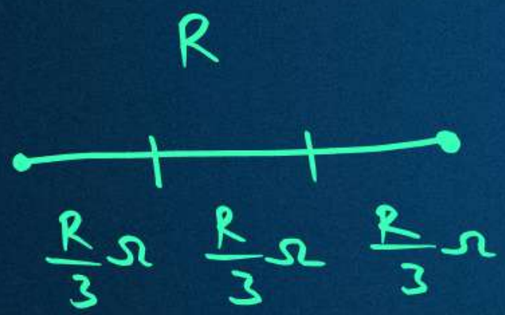
QUESTION

(a) A wire of resistance R is cut into three equal parts. If these three parts are then joined in parallel, calculate the total resistance of the combination so formed.

OR

(b) Define electric power. When do we say that the power consumed in an electric circuit is 1 watt?

a)



$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$\frac{1}{R_p} = \frac{1}{R/3} + \frac{1}{R/3} + \frac{1}{R/3}$$

$$\frac{1}{R_p} = \frac{3}{R} + \frac{3}{R} + \frac{3}{R}$$

$$\frac{1}{R_p} = 3 \cdot \frac{3}{R}$$

$$\frac{1}{R_p} = \frac{9}{R}$$

$$R_p = \frac{R}{9}$$

b) $P = \frac{E}{t}$

$1\,\text{Watt} = \frac{1\,\text{Joule}}{1\,\text{sec}}$

Solution:

(a) Calculate resistance of each part

- When a wire is cut into n equal parts, the resistance of each part becomes $\frac{R}{n}$.
- Here, $n = 3$, so resistance of each part:

  $R_{part} = \frac{R}{3}$

  Find total resistance when three parts are connected in parallel
- For resistors connected in parallel, total resistance R_{total} is given by:

$$\frac{1}{R_{total}} = \frac{1}{R_{part}} + \frac{1}{R_{part}} + \frac{1}{R_{part}} = 3 \times \frac{1}{R_{part}} = \frac{3}{R_{part}}$$

Substitute $R_{part} = \frac{R}{3}$:

$$\frac{1}{R_{total}} = \frac{3}{\frac{R}{3}} = \frac{3}{1} \times \frac{3}{R} = \frac{9}{R}$$

Calculate $R_{total} = \frac{R}{9}$

Solution:

(b) Definition of Electric Power and Condition for 1 Watt

Electric Power is defined as the rate at which electrical energy is transferred by an electric circuit.

Mathematically,

$$P = VI$$

where:

- P is the power in watts (W),
- V is the potential difference in volts (V),

I is the current in amperes (A).

Solution:

Alternatively, power can also be expressed as:

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

where R is the resistance.

When is power consumed 1 watt?

- Power consumed is 1 watt when 1 joule of energy is converted or used up per second.
- In terms of current and voltage, power is 1 watt if:

$$P = VI = 1\text{watt}$$

For example, if $V = 1$ volt and $I = 1$ ampere, then power consumed is 1 watt.

QUESTION

$\frac{1}{R_p} = \frac{1}{10} + \frac{1}{15} = \frac{3+2}{30} = \frac{5}{30} = \frac{1}{6}$ $R_p = 6\Omega$

$\frac{1}{R_p} = \frac{1}{60} + \frac{1}{40} = \frac{2+3}{120} = \frac{5}{120} = \frac{1}{24}$ $R_p = 24\Omega$

Consider the following electric circuit:

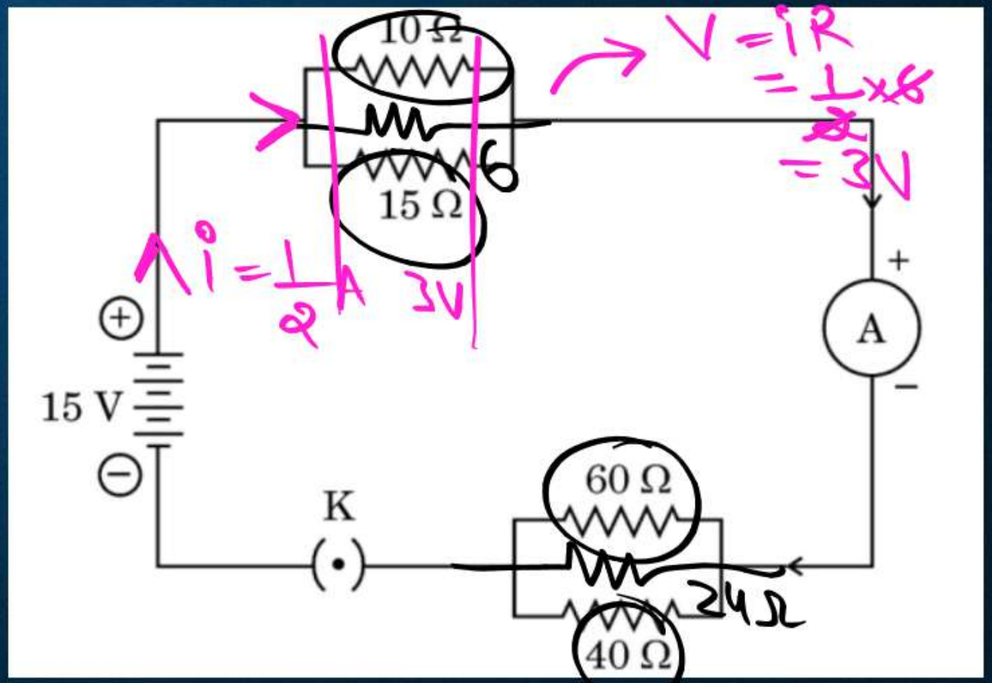
Calculate the values of the following : 3

(a) The total resistance of the circuit $R_t = 6 + 24 = 30\Omega$ ✓

(b) The total current drawn from the source $V = iR \Rightarrow 15 = i \times 30 \Rightarrow i = \frac{1}{2} = 0.5A$

(c) Potential difference across the parallel combination of 10 Ω and 15 Ω resistors

↳ 3V



Solution:

(a) $R_1 = 10, R_2 = 15, R_3 = 60, R_4 = 40$

$$\Rightarrow \frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$= \frac{1}{10} = \frac{1}{15} = 6\Omega$$

$$\Rightarrow \frac{1}{R_p} = \frac{1}{R_3} + \frac{1}{R_4} = \frac{1}{60} + \frac{1}{40} = 24\Omega$$

$\Rightarrow R_5 = 6 + 24 = 30\Omega$

$\therefore$ The total resistance of the circuit is 30Ω.

(b) $V = IR$

$15 = I \times 30$

$I = 0.5$ A

(c) $R = 6\Omega$

$V = IR$

$V = 6 \times 0.5$

$V = 3$ volts

QUESTION

ρ R

(a) Write the relationship between resistivity and resistance of a cylindrical conductor of length l and area of cross-section A. Hence derive the SI unit of resistivity.

(b) Why are alloys used in electrical heating devices?

a) $R = \rho \frac{l}{A}$

$\Omega = \rho' \frac{m}{m^2}$

$\Omega m = \rho'$

→ $\rho \uparrow$ $R \uparrow$ $H \uparrow$

→ Corrosion resistive

Solution:

(a) The resistance R of a cylindrical conductor is given by the formula:

$$R = \frac{\rho l}{A}$$

where ρ is the resistivity of the material, l is the length of the conductor, and A is the cross-sectional area.

Rearranging the formula to solve for resistivity ρ: $\rho = R\frac{A}{l}$

To derive the SI unit of resistivity, we need to consider the SI units of resistance, length, and area. The SI unit of resistance R is ohms (Ω), the SI unit of length l is meters (m), and the SI unit of area A is square meters (m^2).

Substituting the SI units into the formula for resistivity:

$$\rho = R\frac{A}{l} = \Omega\frac{m^2}{m} = \Omega \cdot m$$

Therefore, the SI unit of resistivity is ohm-meter ($\Omega \cdot m$).

Solution:

(b) Alloys are commonly used in electrical heating devices because

- They have a higher resistivity as compared to pure metals and has high melting point.
- They do not burn in oxygen i.e. they don't get oxidized readily at a higher temperature.

QUESTION

The phenomenon responsible for making the smoke particles visible when a beam of sunlight enters a smoke filled room through a narrow hole is:

A scattering of light → Tyndall effect

B dispersion of light

C reflection of light

D internal reflection of light

Solution: (A)

The phenomenon responsible for making the smoke particles visible when a beam of sunlight enters a smoke filled room through a narrow hole is scattering of light.

Smoke particles scatter the sunlight, making the beam visible (Tyndall Effect). Other options like dispersion, reflection, and internal reflection do not apply in this case.

QUESTION

An object is placed at a distance of 10 cm in front of a concave mirror of focal length 15 cm. Use mirror formula to determine the position of the image formed by this mirror.

$u = -10\,cm$

$f = -15\,cm$

$v = ?$

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

$$\frac{1}{-15} = \frac{1}{v} - \frac{1}{10}$$

$$\frac{1}{10} - \frac{1}{15} = \frac{1}{v}$$

$$\frac{3-2}{30} = \frac{1}{v}$$

$$\frac{1}{30} = \frac{1}{v}$$

$v = 30\,cm$

Solution:

Focal length (f) $= -15$ cm

Image distance (v) = ?

Using the mirror formula, we get

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

$$\frac{1}{-15} = \frac{1}{v} + \frac{1}{-10}$$

$$\frac{1}{v} = \frac{1}{-15} - \frac{1}{-10}$$

$$\frac{1}{v} = \frac{1}{-15} + \frac{1}{10} \ \ldots$$ [Taking LCM of 15 and 10, is Which 30]

$$\frac{1}{v} = \frac{-2}{30} + \frac{3}{30}$$

$$\frac{1}{v} = \frac{-2+3}{30}$$

$$\frac{1}{v} = \frac{1}{30}$$

$\therefore v = 30$ cm

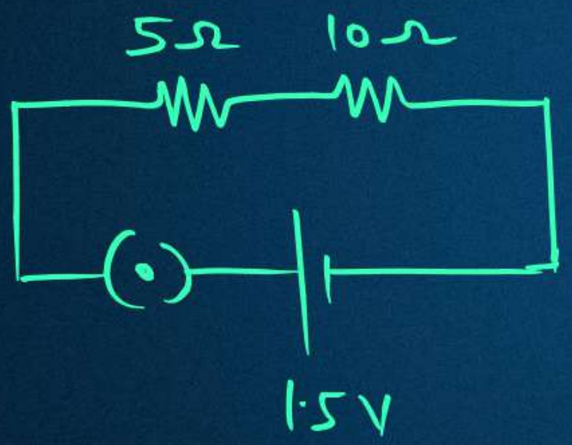
The image is formed at a distance of 30 cm behind the mirror. The positive value of v indicates that the image is formed on the same side as the object, meaning it is a virtual and erect image.

QUESTION

$V = \frac{W}{Q}$ $\quad 1V = \frac{1J}{1C}$

(a) Define one volt potential difference between two points in an electric field.

(b) Draw a schematic diagram of an electric circuit of a cell of 1·5 V, 5 Ω and 10 Ω resistor and a plug key, all connected in series. Calculate the current drawn from the cell when the key is closed.



$R_t = 5 + 10 = 15\Omega$

$i = ?$

$V = 1.5V$

$i = \frac{V}{R} = \frac{1.5}{15}$

$i = 0.1A$

Solution:

(a) Define one volt potential difference between two points in an electric field.

One volt potential difference between two points in an electric field is defined as the amount of work done to move a charge of one coulomb from one point to the other. Mathematically, it is given by:

$$V = \frac{W}{Q}$$

where V is the potential difference, W is the work done, and Q is the charge.

Solution:

(b) Draw a schematic diagram of an electric circuit of a cell of 1.5 V, 5Ω and 10Ω resistor and a plug key, all connected in series.

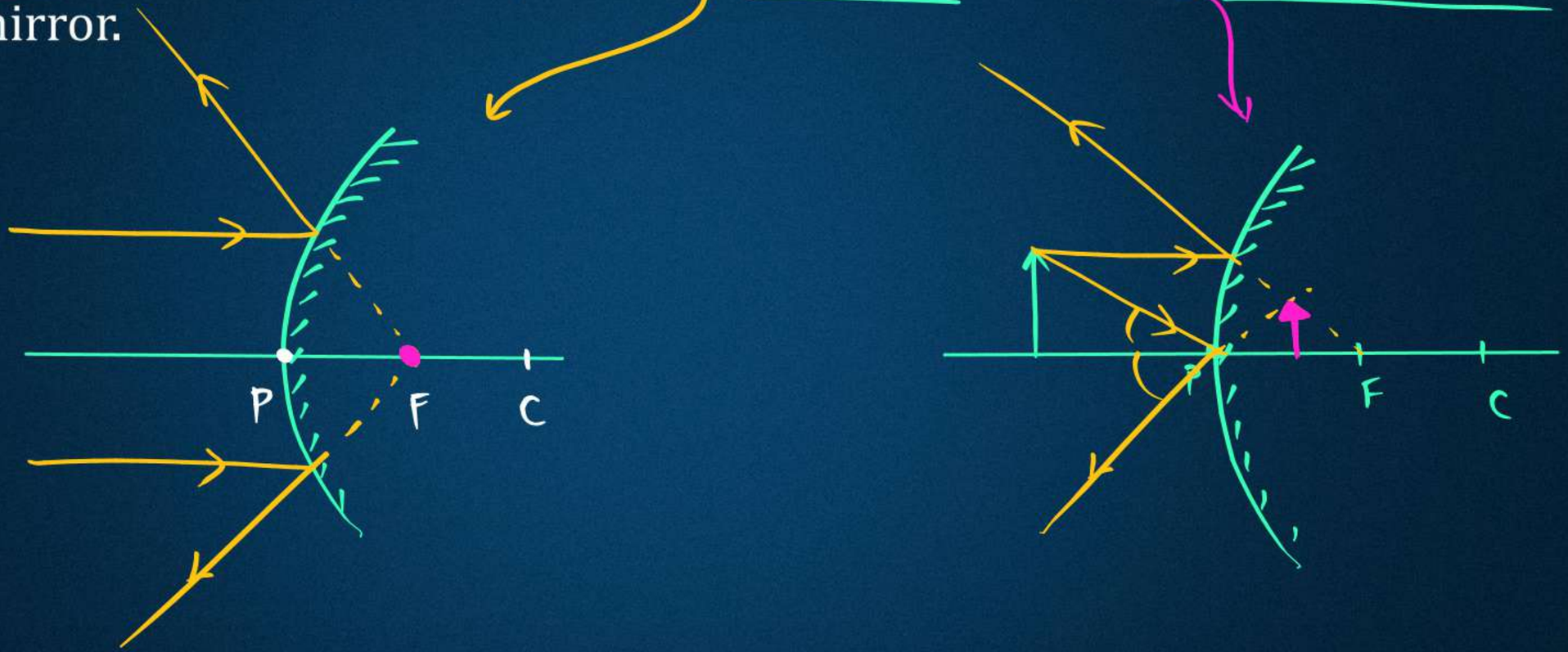
The schematic diagram is as follows:

Calculate the current drawn from the cell when the key is closed. Using Ohm's Law, $I = \frac{V}{R_{total}}$, where R_{total} is the total resistance in the series circuit.

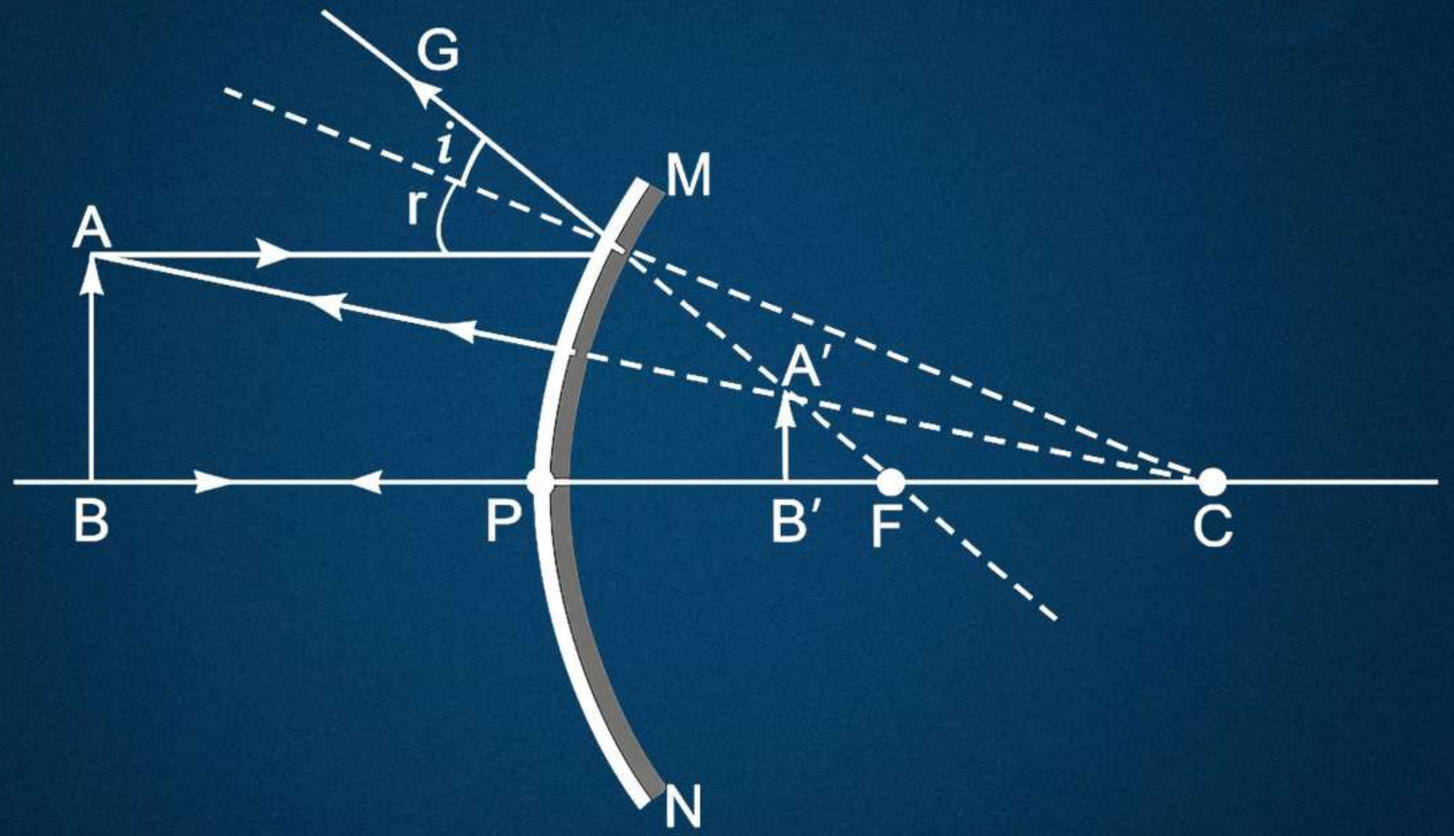
Here, $R_{total} = 5\Omega + 10\Omega = 15\Omega$. Therefore, $I = \frac{1.5\ V}{15\Omega} = 0.1\ A$.

QUESTION

Draw ray diagrams to show the nature, position and relative size of the image formed by a convex mirror when the object is placed (i) at infinity and (ii) between infinity and pole P of the mirror.



Solution:



QUESTION

Concave lens

$P = \frac{100}{f(cm)}$

(a) (i) The power of a lens 'X' is – 2.5 D. Name the lens and determine its focal length in cm. For which eye defect of vision will an optician prescribe this type of lens as a corrective lens?

'Myopia'

R + I

Enlarged ✓

(ii) "The value of magnification 'm' for a lens is – 2." Using new Cartesian Sign Convention and considering that an object is placed at a distance of 20 cm from the optical centre of this lens, state:

$m = -2$

$m = \frac{V}{u}$

(I) the nature of the image formed; R + I + Enl

$u = -20cm$

Double ← (II) size of the image compared to the size of the object;

$-2 = \frac{V}{-20}$

(III) position of the image, and $V = +40cm$

$V = 40cm$

-Ve ← (IV) sign of the height of the image.

(iii) The numerical values of the focal lengths of two lenses A and B are 10 cm and 20 cm respectively. Which one of the two will show higher degree of convergence/divergence? Give reason to justify your answer.

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

higher degree $\uparrow$ $f \downarrow$

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

Solution:

(a) (i)

Determine the focal length,

The power P of a lens is related to its focal length f (in meters) by the equation:

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

$$\therefore f = \frac{1}{2.5}$$

$$= -0.4 \text{ m}$$

$$= -40 \text{ cm (or 40 cm in magnitude)}$$

The negative sign of the power indicates that the lens is a diverging (concave) lens. A concave lens is typically prescribed to correct myopia (nearsightedness). In myopia, the eye focuses images in front of the retina. A concave lens diverges the incoming light rays, moving the focal point back onto the retina for clear vision.

(ii) Using the new Cartesian sign convention, we take distances measured from the optical centre in the direction of the incident light (from left to right) as positive. Thus, the object placed on the left of the lens is at:

$$u = +20 \text{ cm}$$

For a thin lens under this convention, the linear magnification is given by

$$m = \frac{v}{u}$$

so the image distance is

$$v = m \cdot u = (-2)(20 \text{ cm}) = -40 \text{ cm}$$

1. The nature of the image formed:
   The negative value of v (i.e. $v = -40$ cm) indicates that the image is formed on the side opposite to the incident light direction.
   In this convention, that means the image is real.

In this convention, that means the image is real.

The magnification $m = -2$ is negative, which tells us that the image is inverted relative to the object.

2. Size of the image compared to the size of the object:

   The magnitude of the magnification is $|m| = 2$.

   Therefore, the image is twice as large as the object.

3. Position of the Image:

   The image is located 40 cm from the optical centre, on the opposite side to the object (to the right of the lens).

4. Sign of the Height of the Image:

   Since $m = \frac{h_i}{h_o} = -2$, if we take the object's height h_o as positive (by convention), then the image height h_1 must be negative. A negative image height indicates that the image is inverted relative to the object.

(iii) The degree of convergence or divergence of a lens is determined by its optical power P , which is given by the formula:

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

where f is the focal length (in meters). A lens with a shorter focal length has a higher power and thus bends light rays more strongly.

Lens A: $P_A = \frac{1}{f_A} = \frac{1}{0.1} = 10$ diopters

Lens B: $P_B = \frac{1}{f_B} = \frac{1}{0.2}$

= 5 diopters

Since Lens A has a higher power (10 diopters) than Lens B (5 diopters), Lens A shows a higher degree of convergence or divergence.

Reason: The focal length is inversely proportional to the lens's power. A shorter focal length means that the lens can bend light more sharply, resulting in a stronger converging or diverging effect.

QUESTION **OR**

(b) (i) Draw a ray diagram to show the refraction of a ray of light through a rectangular glass slab when it falls obliquely from air into glass.

(ii) State Snell's law of refraction of light.

(iii) Differentiate between the virtual images formed by a convex lens and a concave lens on the basis of :

All Cases

(I) object distance, and

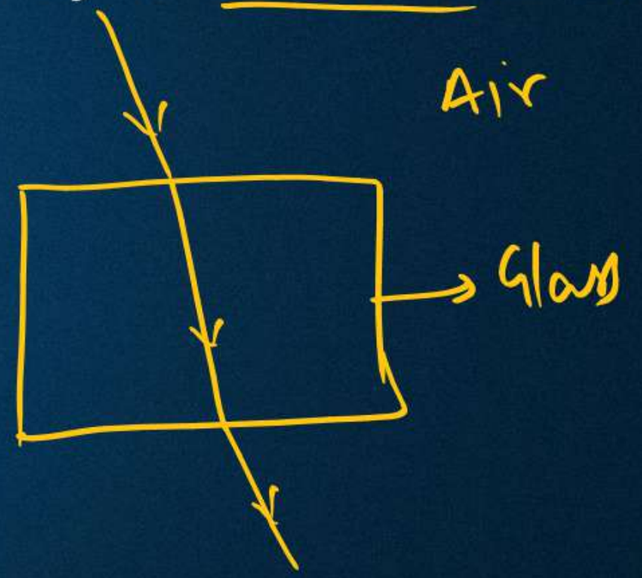
B/w F_1 & O

B/w ∞ and O

(II) magnification.

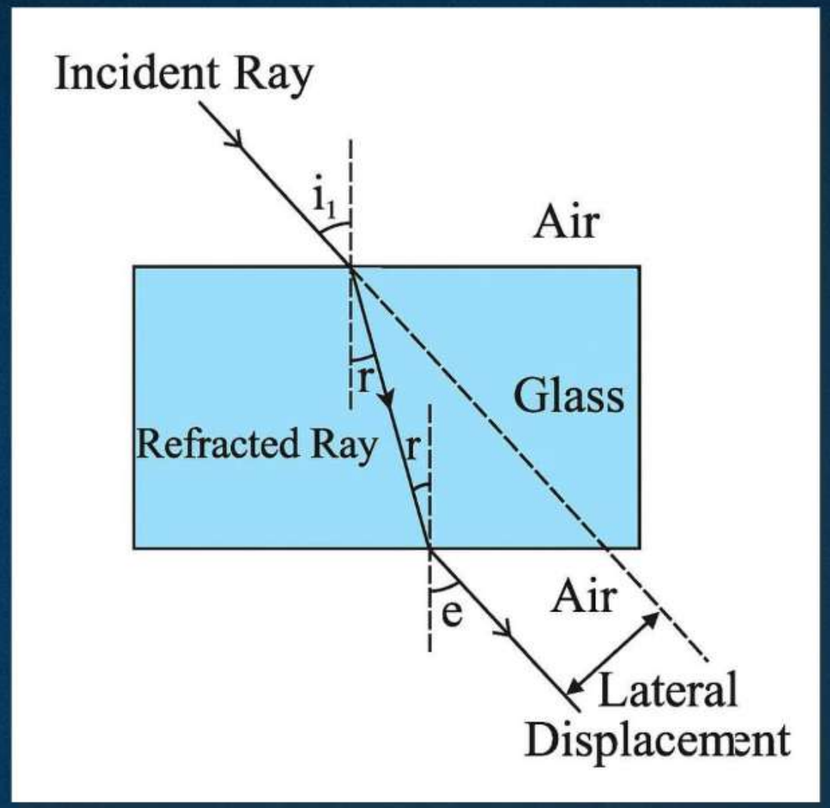
Enlarged, V+E

diminish, V+E



Solution:

(b) (i)


Incident Ray
i_1
Air
r
Glass
Refracted Ray
r
e
Air
Lateral
Displacement

Solution:

(ii) Snell's law states that:

$n_1 \sin \theta_1 = n_2 \sin \theta_2$

where:

- n_1 and n_2 are the refractive indices of the first and second medium respectively,
- θ_1 is the angle of incidence,
- θ_2 is the angle of refraction.

This law relates the angles of incidence and refraction when light passes from one medium to another.

Solution:

(iii) Differentiation between Virtual Images Formed by Convex and Concave Lenses

Aspect	Convex Lens (Converging Lens)	Concave Lens (Diverging Lens)
Object Distance	Virtual image is formed only when the object is placed between the lens and its focal point (F) (i.e., object distance < focal length).	Virtual images are formed for all object distances, as concave lenses always form virtual images regardless of where the object is placed.
Image Position	Virtual image is formed on the same side as the object (i.e., on the left side for objects placed on the left).	Virtual image is also formed on the same side as the object.
Magnification (Size)	The virtual image is magnified (magnification > 1) because the image appears larger than the object.	The virtual image is diminished (magnification < 1) because the image appears smaller than the object.
Nature of Image	Virtual, erect, and magnified	Virtual, erect, and diminished

Case-based questions

$P = Vi$
$1000 = 220 \times i$
$i = \frac{1000}{220} =$

b) $P = 1000\ W$, $V = 220\ V$, $i = ?$

In our homes, we receive the supply of electric power through a main supply also called mains, either supported through overhead electric poles or by underground cables. In our country the potential difference between the two wires (live wire and neutral wire) of this supply is 220 V.

(a) Write the colours of the insulation covers of the line wires through which supply comes to our homes. 1

Red – Live, Green – Earth, Black – Neutral

(b) What should be the current rating of the electric circuit (220 V) so that an electric iron of 1 kW power rating can be operated?

(c) (i) What is the function of the earth wire ? State the advantage of the earth wire in domestic electric appliances such as electric iron. 2

OR

(c) (ii) List two precautions to be taken to avoid electrical accidents. State how these precautions prevent possible damage to the circuit/appliance.

Solution:

(a) Colours of the Insulation Covers:

- Live (Line) Wire: Red (in older standards) or Brown (in updated IEC standards)
- Neutral Wire: Black (older standards) or Blue (in updated IEC standards)

(b) Current Rating of the Circuit:

An electric iron rated at 1 kW(1000 W) operating on 220 V draws a current given by

$$I = \frac{P}{V} = \frac{1000\ W}{220\ V} \approx 4.55\ A$$

Thus, the circuit should be rated at approximately 5 A to safely operate the iron.

Solution:

(c) (i)

- Function: There is a low-resistance path to the ground for any leakage or fault current through the earth line.
- Advantages: When a live part of a device, like an electric iron, touches the metal case by mistake, the earth wire safely sends the fault current to the ground. This helps keep the case from going live, which lowers the user's risk of getting an electric shock.

Solution:

(ii) Precautions to Avoid Electrical Accidents:

- Ensure Proper Insulation:
- Precaution: Make sure to check and fix the insulation of your appliances and lines on a regular basis.
- Benefit: It keeps live wires from being accidentally touched and lowers the risk of short circuits and electric shocks.
- Use of Protective Devices:
- Precaution: In home circuits, put in fuses, circuit breakers, or earth leakage circuit breakers (ELCBs).
- Benefit: These gadgets cut the circuit off immediately if there is an overload or a problem. This keeps appliances from getting damaged and lowers the risk of fire and electrocution.

SUMMARY

Majo Bandh Deyo ke Na ??

Thank You