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position, it can only form a virtual, upright, and smaller (diminished) image.

34. White light separates into a spectrum of colors when passing through a triangular glass prism because different colors have different:

- A. Velocities inside the glass medium
- B. Frequencies while traveling in a vacuum
- C. Initial intensities when entering
- D. Wave amplitudes

Answer: A

Detailed Explanation: Optical dispersion happens because a material's refractive index varies with wavelength. Violet light slows down and bends the most, while red light experiences the least speed reduction and bends the least.

35. Calculate the optical power of a converging thin lens that has a focal length of 20 cm.

- A. +5.0 D
- B. +0.05 D
- C. -5.0 D
- D. +2.0 D

Answer: A

Detailed Explanation: Lens power formula is $P = \frac{1}{f(\text{in meters})}$. Converting focal length to

meters: $20\text{ cm} = 0.20\text{ m}$. Therefore, $P = \frac{1}{0.20} = +5.0\text{ Diopters}$.

36. Total internal reflection can take place within an optical interface only when light attempts to travel from:

- A. An optically denser medium to an optically less dense medium
- B. An optically less dense medium to an optically denser medium
- C. Atmospheric air directly into water
- D. A complete vacuum into a glass block

Answer: A

Detailed Explanation: Total internal reflection requires two strict conditions: light must travel from a medium with a higher refractive index toward one with a lower index, and the angle of incidence must exceed the critical angle.

37. A person struggles to see distant objects clearly, but can read a book up close without issue. This eye defect is corrected using a:

- A. Concave lens
- B. Convex lens
- C. Cylindrical lens
- D. Bifocal lens

Answer: A

Detailed Explanation: The person suffers from Myopia (nearsightedness), where light from distant objects

magnifier, producing an enlarged, upright, virtual image on the same side of the lens.

40. Calculate the critical angle for a glass-air interface if the refractive index of the glass is 2.0.

- A. 30°
- B. 45°
- C. 60°
- D. 90°

Answer: A

Detailed Explanation: The critical angle relationship formula is $\sin c = \frac{1}{n}$. Substituting the value: $\sin c = \frac{1}{2.0} = 0.5 \implies c = \sin^{-1}(0.5) = 30^\circ$.

41. Two point charges of $+2\,\mu\text{C}$ and $+3\,\mu\text{C}$ are separated by a distance of 0.3 m in a vacuum. Calculate the electrostatic force between them.

[Take $k = 9.0 \times$

$10^9\,\text{N}\cdot\text{m}^2/\text{C}^2$]

- A. 0.60 N
- B. 0.18 N
- C. 1.80 N
- D. 6.00 N

Answer: A

Detailed Explanation: Use Coulomb's Law: $F = \frac{k q_1 q_2}{r^2}$. Convert microcoulombs to Coulombs:

Detailed Explanation: Energy stored in a capacitor formula is $E = \frac{1}{2}CV^2$. Convert capacitance to Farads: $4\,\mu\text{F} = 4 \times 10^{-6}\text{ F}$. Substituting: $E = \frac{1}{2} \times (4 \times 10^{-6}) \times (100)^2 = (2 \times 10^{-6}) \times 10000 = 0.02\text{ Joules}$.

50. The electrical resistance of a long uniform copper wire is directly proportional to its length and:

- A. Inversely proportional to its cross-sectional area
- B. Directly proportional to its cross-sectional area
- C. Inversely proportional to its total mass volume
- D. Independent of the material's specific resistivity

Answer: A

Detailed Explanation: Conductor resistance formula is $R = \frac{\rho L}{A}$. This means resistance increases with length (L) but drops off as the cross-sectional area (A) expands.

51. A multiplier resistor is connected in series with a moving-coil galvanometer to convert the instrument into a functional:

- A. Voltmeter
- B. Ammeter
- C. Ohmmeter
- D. Galvanometer amplifier

Answer: A

- B. Henry (H)
- C. Farad (F)
- D. Watt (W)

Answer: A

Detailed Explanation: Impedance (Z) represents the total opposition an alternating circuit offers to the flow of current. Like standard electrical resistance, it is measured in Ohms.

62. A circuit component that allows alternating current (a.c.) to pass through easily but completely blocks the flow of direct current (d.c.) is a:

- A. Capacitor
- B. Inductor
- C. Resistor
- D. Diode rectifier

Answer: A

Detailed Explanation: Capacitive reactance is calculated as $X_C = \frac{1}{2\pi fC}$. For direct current, the frequency is zero ($f = 0$), making the reactance infinite (∞), which blocks the current path entirely.

63. The power factor of a purely resistive alternating current circuit loop is equal to:

- A. 1
- B. 0
- C. 0.5

D. Self-excitation

Answer: A

Detailed Explanation: Discovered by Michael Faraday, electromagnetic induction is the production of an electrical potential difference across a conductor situated within a changing magnetic field environment.

68. Lenz's law states that the direction of an induced current is always such that it opposes the change that produces it. This law is a direct consequence of the law of conservation of:

- A. Energy
- B. Linear momentum
- C. Electric charge
- D. Total mass

Answer: A

Detailed Explanation: Lenz's law satisfies energy conservation. The mechanical work done to overcome the magnetic repulsion forces created by the induced current is transformed directly into electrical energy within the circuit loop.

69. A transformer features 300 turns in its primary coil winding and 900 turns in its secondary coil winding. If an alternating primary input voltage of 100 V is applied, calculate the resulting secondary output voltage.

- A. 300 V