



PHYSICS

BOOKS - NAVBODH PHYSICS (HINGLISH)

DERIVATIONS-II

Wave Theory Of Light

1. When light passes from a denser medium to a rarer medium



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Interference And Diffraction

1. Monochromatic light waves of constant phase difference ϕ and amplitudes A_1 and A_2 produce an interference pattern. State an expression for the resultant amplitude at a point in the pattern. Hence deduce the conditions for (i) constructive interference with maximum intensity (ii) destructive interference with minimum intensity. Also

show that the ratio of the maximum and minimum intensities

$$\frac{I_{\max}}{I_{\min}} = \left(\frac{A_1 + A_2}{A_1 - A_2} \right)^2.$$



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2. Monochromatic light waves of intensities I_1 and I_2 , and a constant phase difference ϕ produce an interference pattern. State an expression for the resultant intensity at a point in the pattern. Hence deduce the expressions for the resultant intensity,

maximum intensity and minimum intensity if

$$I_1 = I_2 = I_0.$$



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3. Obtain an expression for path difference and fringe width of interference pattern in Young's double slit experiment. Show that the fringe width is same for consecutive bright and dark bands.

The refractive indices of glass and water w.r.t.

air are $\frac{3}{2}$ and $\frac{4}{3}$ respectively. Determine the refractive index of glass w.r.t. water.



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4. The angular width of the central maximum of the diffraction pattern in a single slit (of width a) experiment, with λ as the wavelength of light, is



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1. State and prove Gauss's law in electrostatics.



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2. Derive an expression for the electric field intensity at a point outside a charged conducting sphere.



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3. Derive an expression for the electric field intensity at a point outside an infinitely long charged cylindrical conductor.



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4. The mechanical force acting on a unit area of a charged conductor is



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5. Which of the following factors does not affect the mechanical force per unit area of charged conductor ?



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6. Derive an expression for the capacitance of a parallel-plate capacitor filled with a dielectric.



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7. A dielectric of relative permittivity (dielectric constant) k completely fills the space between the plates of a parallel-plate capacitor with a surface charge density σ . Show that (i) the induced density of surface charge on the dielectric is $\sigma_p = \sigma \left(1 - \frac{1}{k} \right)$ (ii) the capacitance of the capacitor is increased by a factor equal to the ratio of the electric field without the dielectric to that with the dielectric.



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8. What is the effect of presence of a dielectric medium on

(i) capacitance of a parallel plate capacitor

(ii) electrostatic force between two charges ?

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9. Show that the energy of a charged capacitor

is $\frac{1}{2}CV^2$. Also express this in other forms.

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10. Write different expression for the energy stored in a capacitor.



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11. Derive an expression for the effective capacitance of three capacitors connected in series.



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12. Derive an expression for the effective capacitance of three capacitors connected in series.



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Current Electricity

1. Describe Wheatstone's network with a neat circuit diagram. Obtain the expression for its balance condition.



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2. Using Ampere's circuital law, obtain an expression for the magnetic induction at a point near an infinitely long straight conductor carrying an electric current.



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3. Using Ampere's circuital law, obtain an expression for the magnetic induction at a

point near an infinitely long straight conductor carrying an electric current.



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4. Explain sensitivity of moving coil galvanometer. Show with the help of a circuit diagram that how a moving coil galvanometer can be converted into an ammeter of given range. Write necessary mathematical relation. What is the resistance of ideal ammeter?



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5. What is a voltmeter? How can a galvanometer be converted into a voltmeter?

Explain.



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6. For given positive ions in a cyclotron, obtain an expression for the cyclotron frequency.



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Magnetism

1. Show that the orbital magnetic dipole moment of a revolving electron is $evr/2$.



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Electromagnetic Induction

1. prove that the charge induced does not depend on the rate of change of magnetic flux.



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2. Prove theoretically $E = - \frac{d\Phi}{dt}$.



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3. Derive the expression for motional emf induced in a conductor moving in a uniform magnetic field.



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4. What is meant by self-inductance of a coil?

Obtain an expression for the self-inductance of a long solenoid.



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5. What is a capacitor ? Define its capacitance.

Explain the units of capacitance.



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6. The average power in LCR series circuit is



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Atoms Molecules And Nuclei

1. The radii of Bohr's orbit are directly proportional to



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2. The expression for Bohr radius of n th orbit of an atom is



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3. Angular speed of an electron in a Bohr's orbit is given by



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4. Frequency of revolution of electron in the n^{th} Bohr's orbit of hydrogen is given by



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5. Total energy of electron in n^{th} stationary orbit of hydrogen atom is



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6. The energy of an electron in the n th Bohr orbit of hydrogen atom is



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7. On the basis of the de Broglie hypothesis, obtain the expression for the de Broglie wavelength associated with an electron accelerated from rest through a p.d. V .



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Semiconductors

1. The relation between α and β of a transistor is



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Assignments

1. Describe biprism experiment to calculate the wavelength of a monochromatic light. Draw the necessary ray diagram.

If the critical angle of a medium is $\sin^{-1}\left(\frac{3}{5}\right)$,
find the polarising angle.



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2. Derive an expression for the electric field intensity at a point outside a charged conducting sphere.



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3. A dipole of electric dipole moment p is placed in a uniform electric field of strength E . If θ is the angle between positive direction of p and E , then the potential energy of the electric dipole is largest when θ is



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4. An inductor and a resistor are connected in series with an ac source. In this circuit.



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5. In series resonant circuit, at resonance,



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6. When an electron is excited to n^{th} energy state in hydrogen, the possible number of spectral lines emitted are



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7. State the law of radioactive decay. Hence derive the relation $N = N_0 e^{-\lambda t}$. Represent it graphically.



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8. The relation between half life period and decay constant is



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9. State de-Broglie hypothesis.



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