**ASSIGNMENT QUESTIONS FOR BTECH PHYSICS LAB**

Every student is required to answer two questions according to the following table.

Make sure you write your Name and Roll No. on the answer sheet before you scan and submit as pdf.

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| --- | --- | --- |
| **Name of Student** | **Question Nos. to be Answered** | |
| Aadarsh Pratik | 1 | 2 |
| Aditya mukund | 3 | 4 |
| AMARDEEP KUMAR | 5 | 6 |
| Amir Ashish Kujur | 7 | 8 |
| Animesh Mishra | 9 | 10 |
| Ankit singh | 11 | 12 |
| Ankur Jain | 13 | 14 |
| Anshuman Deep | 15 | 16 |
| Ashish Mandal | 17 | 18 |
| Badal Raj | 19 | 20 |
| Chaitanya prasad | 21 | 22 |
| Chinmay Chougaonkar | 23 | 24 |
| Dipit sehgal | 25 | 26 |
| Elham Faizy | 27 | 28 |
| Harsh Anand | 29 | 30 |
| Harsh Choudhary | 31 | 32 |
| Kumar Mritunjay | 33 | 34 |
| Ladi Rahul | 35 | 36 |
| Lakshmi Sai Manideep Vutukuri | 37 | 38 |
| Lakshya Gupta | 39 | 40 |
| Mandar Mandar | 41 | 42 |
| Manish Kumar | 43 | 44 |
| Mayank Upadhyaya | 45 | 46 |
| Palash Asati | 47 | 48 |
| PIYUSH ANAND | 49 | 50 |
| prahanjal adhikari | 51 | 52 |
| Prakhar Gupta | 53 | 54 |
| Pranav Sharma | 55 | 56 |
| PRANJAL SINGH | 57 | 58 |
| Pranjwal Singh | 59 | 60 |
| Pratyush Dev | 61 | 62 |
| Pulkit Kejriwal | 63 | 64 |
| Raghavendra Bushetty | 65 | 66 |
| Ravi Raj | 67 | 68 |
| Rishav Kumar | 69 | 70 |
| Rohan | 71 | 72 |
| Rohit N | 73 | 74 |
| Sahil Raj | 75 | 76 |
| Sakshat Jain | 77 | 78 |
| Sanchit gupta | 79 | 80 |
| Shashank Gautam | 81 | 82 |
| Shashwat Sinha | 83 | 84 |
| Shikhar Agrawal | 85 | 86 |
| Shishir singh | 87 | 88 |
| Somaditya Singh | 89 | 90 |
| SUBHODIP KUNDU | 91 | 92 |
| swetank singh | 93 | 94 |
| Trayambkesh Kumar | 95 | 96 |
| Ujjwal Sotra | 97 | 98 |
| Utkrisht Sharma | 99 | 100 |
| vaibhav falod | 101 | 102 |
| Vaibhav Kumar | 103 | 104 |
| Yashwanth raj lakumarapu | 105 | 106 |

**ASSIGNMENT QUESTIONS FOR BTECH PHYSICS LAB**

* 1. The focal length of a concave mirror obtained using a spherometer in repeated experiments are 25.4, 25.2, 25.6, 25.1, 25.3, 25.2, 25.5, 25.4, 25.3, 25.7 in cm. Find the error in the measurement.
  2. Two wires of steel of the same length are stretched on a sonometer. The tension of the first and second are 8 kgwt and 2 kgwt, respectively. Find the ratio of the fundamental notes emitted by the two wires when the diameter of cross-section of the first wire is half that of the second.
  3. A string AB of length 100 cm is kept under uniform tension. A bridge kept at C such that BC = 60 cm. When the string is subjected to vibration BC part vibrates with frequency 252 Hz. Find the frequency of both parts of the string when the bridge is moved through 10 cm towards A.
  4. A stretched string is observed to vibrate with a frequency 30 c.p.s. In the fundamental note when the length of the string is 60 cm. The string has a mass of 0.5 gm/cm. Find the velocity of propagation of the transverse wave and compute the tension of the string.
  5. A wire of linear density 0.01 gm/cm is stretched with a tension of 10 N. It resonates at a frequency of 200 Hz. The next higher frequency at which it resonates is 240 Hz. Find the length of the wire.
  6. (a). What is the natural frequency of sonometer wire? (b). How does the wire begin to vibrate in this case? (c). When will the wire resonate? (d). For securing resonance, where do you put the magnet and why?
  7. Illustrate and explain the working principle of each component of a spectrometer?
  8. In the Newton’s rings experiment, the radius of the 10th dark ring is found to be 4 mm when there is air between the convex lens and the glass plate. However, when air is replaced by a liquid, the radius of the ring shrinks from 4 mm to 3.3 mm. Find the refractive index of the liquid.
  9. Newton’s rings are formed with reflected light of wavelength 5.895E-7 m with a liquid between the plate and the curved surface. The diameter of the 5th ring is 0.3 cm and the radius of curvature of the curved surface is 1 m. Calculate the refractive index of the liquid.
  10. What will happen in Newton’s rings experiment if the glass plate is replaced by a plane mirror?
  11. Why do we prefer a convex lens of large radius of curvature for producing Newton’s rings?
  12. Explain what will happen if white light is used instead of monochromatic light in Newton’s rings experiment.
  13. Lenses coated with non-reflecting thin film appear purple in colour when seen in reflected light. Why?
  14. If the diameters of 10th and 15th dark rings of a Newton’s ring pattern are found to be 6.0 mm and 8.0 mm respectively, find the diameter of the 5th dark ring. Plane glass plate and plano convex lens combination is used to produce interference patterns due to reflected beams.
  15. Newton’s rings are formed in the air film enclosed between a plano-convex lens (of radius of curvature = 50cm) and a plane glass plate by reflection. Diameters of 4th and 20th bright rings are respectively 0.203cm and 0.484cm. Show that the lens and the plate ate not exactly in contact. Also, find the wavelength of the light used.
  16. What will happen in Newton’s ring experiment when air in the inter-space is replaced by a transparent liquid of refracting index (μ)?
  17. In a Newton’s rings experiment if in the place of air film, a transparent liquid film be used, the diameter of the nth dark ring changes from 0.3cm to 0.25cm. Find the refractive index of the liquid.
  18. Newton’s rings by reflected light of wavelength 5000Å are formed between two biconvex lens of equal radii of curvature. If the distance between the 5th and 15th dark rings are 0.085cm, calculate the radius of either lens.
  19. A source of light emits two wavelengths 5896Å and 5890Å. Interference fringes are observed with a certain arrangement when the paths of two interfering beams are equal. How much will the path difference be increased so that a bright fringe for first wavelength coincides with a dark fringe of second wavelength.
  20. Describe the newtons ring apparatus. Find an expression for the radius of the nth dark ring. How to find the wavelength of a given monochromatic source of light using this expression?
  21. To determine the resistance per unit length of a Carey Foster’s bridge wire and then to find the resistivity of the material of a given wire.

1. What are called end corrections?  How are they dealt in the Carey Foster’s experiment?
2. Write the expressions relating the values of the resistances and end corrections.
3. Suppose unknown resistance, X=10 ohm, known resistance, Y =12-ohm, resistance, P=2 ohm, resistance, Q=2.001 ohm. Comment as to if the set up in the lab would do the job.
   1. If peak to peak voltage of sinusoidal signal appears 22 small divisions on Y-axis and voltage knob is kept at 0.2 volt/div, what will be the actual voltage. If the same signal shows 20 small divisions for one complete oscillation on X-axis and time knob is kept at 0.5ms, then find the frequency of that signal. Given 1 div has 5 small divisions on both the axes.
   2. Describe different parts of CRO and explain the procedure for measurement of voltage and frequency of a given electrical pulse.
   3. Two stars emit light of wavelengths 5770 Å and 5790 Å.  How large a diffraction grating is needed to separate the two wavelengths present.?
   4. For resolving D1(5890 A0) and D2 (5896 A0) lines of sodium, the number of lines/rulings in a grating should be atleast …….?
   5. Consider a diffraction grating of width 5 cm with slits of width 0.0001 cm separated by a distance of 0.0002 cm. What is the corresponding grating element? How many orders would be observable at   𝞴  = 5.5 10–5 ?
   6. Ans: The grating element is d = 0.0002 cm. we observe only three orders at 𝞴  = 5.5 10–5 cm?
   7. Consider a diffraction grating with 15,000 lines per inch. Show that if we use a white light source the second and third order spectra overlap.
   8. A plane transmission grating can just resolve two spectral lines of wavelength 5499.5 Å and 5500.5 Å in the first order diffraction pattern. Determine the minimum order the same grating can resolve, while using another pair of wavelengths 6500 Å and 6500.5 Å.
   9. For a single slit diffraction fringe find the percentage intensities of 1st and 2nd order maxima with respect to that of the central maximum.
   10. Prove that for white light (wavelength range 4000 Å to 7000 Å) the second and third order spectrum will partially overlap for any grating.
   11. Yellow light is used in single slit diffraction experiment with slit width 0.6 mm. What will happen If yellow light is replaced by X-rays?
   12. When light is normally incident on the grating, the diffracted light has maxima at angles θm given by …… ………..(write condition for maxima)
   13. Calculate the wavelength of an incident light when it is incident normally on a diffraction grating having 3000 lines per centimeter angular separation is 10°.
   14. Two spectral lines of wavelengths 5890Å and 5896Å are just resolved by a plane transmission grating in the 2nd order. Find the number of rulings in the grating.
   15. A grating is made of 200 lines/cm. The width of each line is 0.025mm. Calculate the angle of diffraction for the third order spectrum and find the absent spectrum. (λ = 6000Å)
   16. A grating of 1000 lines/cm just resolves the D1 and D2 lines of sodium in the second order. What is the effective width of the grating?
   17. Monochromatic light of wavelength falls normally on a grating 2cm wide; the first order spectrum is produced at an angle of 18˚14̕ from the normal. What is the total number of lines on the grating?
   18. In an experiment with Newton’s rings the diameter of the sixth and twentieth bright rings formed by wavelength of light 5000Å are 1.76 and 3.22mm. Calculate the radius of curvature of the convex surface.
   19. In an interference experiment (n+1)th blue bright band coincides with the nth red bright band for the same setting. If the wavelength of blue light is 5200Å and that of red is 7800Å, find the value of n.
   20. Monochromatic light is incident normally on a thin wedge-shaped film of transparent plastic of refractive index 1.42. Interference fringes are observed in reflected light with a separation of 0.26mm between adjacent bright bands. If the wavelength of light is 5893Å, calculate the angle of the wedge.
   21. How to find wavelength by a grating using spectrometer?
   22. Sketch a ray diagram of refraction of a ray through a prism.  Identify the condition for a minimum deviation.  How will you show the condition experimentally?
   23. Consider a plane wave incident obliquely on the face of a prism. Using Huygens’ principle, construct the transmitted wavefront and show that the deviation produced by the prism is given by   𝛿= i + t – A , where A is the angle of the prism, i and t are the angles of incidence and transmittance.
   24. If the angle of a prism is 60° and the angle of minimum deviation is 37.2°, what will be the refractive index of the prism?  (Ans: 1.5)
   25. In an L-C circuit, L=3,3 H and C=840 pF. At t=0 charge on the capacitor is 105C and maximum. Compute the following quantities at t=2 ms.
4. The energy stored in the capacitor.
5. The energy stored in the inductor.
6. The total energy ihe circuit.
   1. Compute the oscillation frequency of the LCR circuit having L = 0.1 mH, C = 20 μF, R = 0.1 Ω. What will happen if R is made zero?
   2. Consider an LC circuit in which L = 500 mH and C = 0.10 μF. Calculate the resonance frequency. If a resistance of 1.00 kΩ is introduced in series, what will be the frequency of the (damped) oscillations? What should be the value of resistance to make it a critically damped system?
   3. If a bright flashlight has a light intensity of 15.0 candela at a distance 1.00 m from the lens, what is the intensity of the flashlight 100.0 m from the lens?
   4. Suppose in the experiment, the value of the stopping voltages are 1 V, 30 V with the two different frequencies? Comment on this data if it is possible.
   5. Comment as to why for photoelectric experiments alkali earth metal is used.  Is it a necessary requirement?
   6. A coil consists of 200 turns of wire having a total resistance of 2 ohm. Each turn is a square of side 18 cm, and a uniform magnetic field directed perpendicular to the plane of the coil is turned on. If the field changes linearly from 0 to 0.5 T in 0.8 s, what is the magnitude of induced emf and current in the coil while the field is changing?
   7. What is the magnetic flux through one turn of a solenoid of self-inductance 810-5 H when a current 3 A flows through it? Assume that the solenoid has 1000 turns and is wound from wire of diameter 1 mm. What is the cross-sectional area of the solenoid?
   8. Two solenoids A and B spaced close to each other and sharing the same cylindrical axis have 400 and 700 turns respectively. A current of 3.5 A in coil A produced an average flux of 300 T-m2through each turn of A and a flux of 900 T-m2through each turn of B.
7. Calculate the mutual inductance of the two solenoids.
8. What is the self-inductance of coil A?
9. What emf is induced in B and when current in A increases at the rate of 0.5A/s ?
   1. A sensitive electronic device of resistance 175 ohm is to be connected to a source of emf by a switch. The device is designed to operate with a current of 36 mA, but to avoid damage to the device, the current can rise to no more than 4.9 mA in the first 58-- after the switch is closed. To protect the device, it is connected in a series with an inductor.
10. What emf must the source have?
11. What inductance is required?
12. What is the time of constant?
    1. Calculate the emf when the electric flux is given by 3sin t + 5cos t.
    2. To determine the emf of an unknown cell using a potentiometer.
    3. Suppose the balance point is reached at length, l for the unknown emf,  E. Potentiometer is maintained at V, with the rheostat resistance R. The total length of the wire is L and its cross section is A.  Write the equation relating the resistivity of the potentiometer-wire, A, R, l, L, V and E.
    4. Write five factors on which the sensitivity of the potentiometer-experiment depends.
    5. The resistivity of a potentiometer wire is given as 5  × 10-6 Ωm. The area of cross section of the wire is given as 6  × 10-4 m2. Find the potential gradient if a current of 1 A is flowing through the wire.
    6. A potentiometer has a wire of length 8 m and the resistance of the wire is 20 Ω. It is connected in series with a cell of emf 2 V and an internal resistance 2 Ω and a rheostat. Find the value of the resistance in rheostat when the potential drop along the wire is 20 µv/mm.
    7. A potentiometer of length 1 m has a resistance of 20 Ω. It is then connected with a battery of 8 V and resistor of 5 Ω in series with the wire. Calculate the emf of the primary cell when it gives a balance point at 60 cm.
    8. A straight wire carries a current into the page. Explain what is the direction of the magnetic field at a point east of the wire?
    9. Find the force due to a current element of length 2cm and flux density of 12 tesla. The current through the element will be 5A.
    10. A positive charge q exerts a force of magnitude -0.20 N on another charge - 2q. Find the magnitude of each charge if the distance separating them is equal to 50 cm.
    11. In a certain region of space, electric field is along z direction throughout. The magnitude of electric field is however, not constant but increases uniformly along the positive z direction, at the rate of 105NC-1 per metre. What are the force and torque experienced by a system having a total dipole moment equal to 10-7 Cm in the negative z direction.
    12. Write the condition of the formation of standing waves, relating the wavelength and the total length of the string, in the case of (i) transverse (ii) longitudinal movement of the fork wrt the orientation of the string.
    13. Two cars, one behind the other, are traveling in the same direction at the same speed. Does either driver hear the other’s horn at a frequency that is different from that heard when both cars are at rest?
    14. A person lying on an air mattress in the ocean rises and falls through one complete cycle every five seconds. The crests of the wave causing the motion are 20.0 m apart. Determine (a) the frequency and (b) the speed of the wave
    15. The linear density of the A string on a violin is 7.8 × 10-4 kg/m. A wave on the string has a frequency of 440 Hz and a wavelength of 65 cm. What is the tension in the string?
    16. The middle C string on a piano is under a tension of 944 N. The period and wavelength of a wave on this string are 3.82 ms and 1.26 m, respectively. Find the linear density of the string.
    17. Two submarines are underwater and approaching each other head-on. Sub A has a speed of 12 m/s and sub B has a speed of 8 m/s. Sub A sends out a 1550 Hz sonar wave that travels at a speed of 1522 m/s. (a) What is the frequency detected by sub B? (b) Part of the sonar wave is reflected from B and returns to A. What frequency does A detect for this reflected wave?
    18. The security alarm on a parked car goes off and produces a frequency of 960 Hz. The speed of sound is 343 m/s. As you drive toward this parked car, pass it, and drive away, you observe the frequency to change by 95 Hz. At what speed are you driving?
    19. A string of length 0.28 m is fixed at both ends. The string is plucked, and a standing wave is set up that is vibrating at its second harmonic. The traveling waves that make up the standing waves have a speed of 140 m/s. What is the frequency of vibration?
    20. How to measure the Mechanical equivalent of heat? Discuss its physical significance.
    21. In the electrical equivalent of heat experiment, is there any limit on time for which experiment be conducted?
    22. Describe the working principle of a voltmeter. Explain with a suitable circuit diagram.
    23. Describe the working principle of an ammeter. Explain with a suitable circuit diagram.
    24. Explain how an ammeter can be changed to a voltmeter and vice versa, Explain with suitable circuit diagrams.
    25. An AC circuit is composed of a serial connection of a resistor with resistance 50 Ω, a coil with inductance 0.3 H and a capacitor with capacitance 15 μF. The circuit is connected to an AC voltage source with amplitude 25 V and frequency 50 Hz. Determine the amplitude of electric current in the circuit.
    26. A positive lens with a radius of curvature of 20 cm rests on an optical flat and is illuminated normally with sodium D light, = 589.29 nm. The gap between the two surfaces is then filled with carbon tetrachloride (n = 1.461). What is the ratio of the radius of the 23rd dark band before introducing the liquid to the radius after introducing the liquid?
    27. Two coherent sources of intensity 10 W/m2 and 25 W/m2 interfere to from fringes. Find the ratio of maximum intensity to minimum intensity.
    28. The refractive index of the material of a prism is 1.5. When the prism is placed in minimum deviation position, the angle of incidence is 51º. Calculate the angle of prism.
    29. The intensities of a monochromatic light are in the ratio 16:1. Calculate the second distance if the first distance is 6m?
    30. A 500-tum rectangular loop of wire has an area per tum of . At , a magnetic field is tumed on" and its magnitude increases to 0.50 T when t = 0.75 s. The field is directed at an angle of with respect to the normal of the loop. Find the magnitude of the average emf induced in the loop.
    31. A long straight wire carries a 15.0 A current to the left. At a particular instant, a point charge q = +5.0 μC moving at 1.8 × 106 m/s in the negative y direction is 25 cm from the wire. What is the magnitude and direction of the force on the charge at this instant?
    32. In a Newton’s rings experiment the diameter of the 15th ring was found to be 0.59 cm and that of the 5th ring is 0.336 cm. If the radius of curvature of the lens is 100 cm, find the wave length of the light.
    33. In a Young’s double slit experiment, suppose the separation between the two slits is d = 0.320 mm. If a beam of 500-nm light strikes the slits and produces an interference pattern. How many maxima will there be in the angular range -450 to +450.
    34. In a double-slit interference experiment, suppose the slits are separated by d = 1.00 cm and the viewing screen is located at a distance L = 1.20 m from the slits. Let the incident light be monochromatic with a wavelength λ = 500 nm.
        1. Calculate the spacing between the adjacent bright fringes.
        2. What is the distance between the third order fringe and the center line.
    35. In a double slit Fraunhofer interference-diffraction experiment, if the slits of width 0.010 mm are separated by a distance 0.20 mm, and the incident light is monochromatic with a wavelength λ = 600 nm. How many bright fringes are there in the central maximum.
    36. If a student has taken 20 readings for the diameter of a wire using a screw gauge and the average is 0.53 mm. If he drops the first one then the average is 0.51 mm. Estimate what was the percentage error in his first reading.
    37. Write the expression for standard deviation and standard error of a data set. Explain and justify which one gives a better picture of the associated error in measurement.
    38. In the expression , what is the justification of ?
    39. In practice Newton’s rings appear distorted sometimes. What might be the possible reasons? Explain.
    40. What is the prime advantage that the Carey Foster bridge arrangement offers over the meter bridge arrangement and how? Explain.
    41. Is there a minimum voltage requirement for the Carey Foster bridge to work? Explain your answer.
    42. What is the peak-to-peak voltage for a 220 V rms ac domestic supply? What would you do if you were to view the same on a CRO that usually allows only a maximum of 200 V? Explain your answer with the aid of a suitable diagram.
    43. What would be your specifications for a plane diffraction grating to view the mercury spectral line 577nm of the third order? Explain your answer.
    44. What would be the effect of enhancing or reducing the number of rulings per inch on a diffraction grating? Give a detailed explanation.
    45. Sketch the schematic structure of the collimator of a spectrometer and explain its functionality.
    46. What is backlash error? Explain the reason for it with the help of a suitable diagram.
    47. There is composite signal 200 mVpk-pk ac riding over 1 V dc. Explain with the help of suitable diagrams how would the signal appear on the CRO screen when (a) DC button (b) AC button (c) GND button; is pressed on the CRO front panel.
    48. What would be its effect of breaking a plane diffraction grating into multiple small pieces? Discuss.
    49. Sketch the schematic diagram for a 3rd order diffracted line of wavelength 577nm using a 15000 lines/inch plane transmission grating
    50. The coil of the inductor L used in an LCR experiment is stretched to 2 times its original length, by how much would the resonant frequency change?
    51. Newton’s rings are an example of “fringes of equal thickness” although they appear wider, close to the center and thinner away from it. Explain the statement with the help of a suitable diagram.
    52. Sketch the circuit diagram that you use in the “Verification of Faraday’s Law of EM Induction Experiment” and explain the role of each component in the circuit.
    53. Discuss in how many different ways could you enhance the sensitivity of a stretched wire potentiometer? Explain.
    54. What are the differences between a standard cell and usual primary cell?
    55. The brass weights on the aluminum D frame for the verification of Faraday’s law are meant to balance the frame and make it horizontal. The frame may be balanced while keeping the brass weights close to each other as well as keeping them as far as possible from each other. Which position would you choose and why? How would the other positions affect its motion?
    56. In the LCR experiment, R affects the quality factor of the circuit adversely. Suppose we do not connect any R whatsoever externally and want to boost the quality factor, further. What would you do to accomplish the task? Put forth any design that you may think of.
    57. In the Melde’s experiment with transverse and longitudinal vibrations of the tuning fork, a factor of two creeps into one of the expressions relating frequency and length? Justify the factor with the help of suitable diagrams.
    58. Why is there a hole in the sonometer box? Explain its role. Does it have any relevance in the experiment for the determination of frequency of ac mains?
    59. Is the plot if δ vs i symmetrical about δm ? Explain your answer.
    60. Explain the focusing mechanism of the cathode ray spot on the CRO screen with the help of a suitable circuit diagram.
    61. In the experimental setup for the determination of Planck’s constant, if a spectrometer is placed in place of the photocell and a spectrum of light is obtained through a green filter, what would the spectrum look like. Discuss both the ideally and practically expected results.
    62. Explain in detail with the help of a suitable diagram the reason behind grinding the base of prism and making it dull.
    63. While determining the electrical equivalent of heat, time is a quantity that may go on increasing while there may be no increase in temperature of water beyond a certain time. Explain and justify, how do you decide upon the start and the end of time for one particular data set.
    64. Explain why a capacitor offers higher impedance to low frequency alternating currents while an inductor offers higher impedance to high frequency alternating currents.
    65. A cylindrical inductor L in an LCR circuit has an iron core. If this iron core is removed without disturbing the coil explain what would happen to its resonant frequency and quality factor.
    66. It is usual to use a resistance box as R in an LCR circuit experiment. The resistances inside a resistance box are in the form of coils of thin resistive wires. Explain why do you not take their inductances into account while computing the resonant frequency of the LCR circuit.
    67. Draw the structure of a “one-ohm standard resistor” that you generally use for performing the Carey-Foster bridge experiment. Explain the efficacy of its peculiar design.
    68. Finding standard deviation of *N* measurements of a quantity *x* requires that you calculate . Show that this sum can be written as

.

Is there any advantage of using the form given on RHS?

* 1. The measured values of diameter and thickness of a circular disc are as given below.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diameter (cm) | 7.64 | 7.42 | 7.57 | 7.55 | 7.38 | 7.45 | 7.59 | 7.54 | 7.51 | 7.65 |
| Thickness (mm) | 8.23 | 8.29 | 8.20 | 8.25 | 8.18 | 8.22 | 8.31 | 8.27 | 8.19 | 8.26 |

Determine the volume of the disc and standard error in the result by following methods:

1. Find the volume for each pair of measured values and then compute the average volume and standard error in volume.
2. Compute average diameter and average thickness, and their respective standard errors. Obtain the volume and standard error in volume from these by method of propagation of errors.

Which one of these two methods provides a better estimate of the volume.

* 1. The current flowing in sonometer wire produces heating and it can raise the temperature of the wire. Does this have any effect on accuracy of the measurements? Justify your answer.
  2. Resonance is achieved in a sonometer at some unknown length . If tension in the wire is increased by 20%, the resonating length changes by 4.0 cm. Determine the initial resonating length .
  3. In a Newton’s ring set-up, the planoconvex lens is attached to a movable arrangement that facilitates its raising (or lowering) above the glass plate with an arbitrary precision. Initially the lens is in contact with the glass plate and Newton’s rings are obtained. Explain what will be observed when the lens is gradually raised through some distance. From the final pattern is it possible to determine by what amount the lens has been raised?
  4. Explain the procedure of determining the value of an unknown resistance using Carey-Foster bridge without knowing (or measuring) the resistance per unit length of the bridge wire.
  5. Is it possible that interchanging known resistance and unknown resistance does not change the position of null point in a Carey-Foster bridge experiment, explain? If possible, will the null point necessarily lie at middle of the wire?
  6. A signal generator provides a waveform given by

where and (say ). Sketch how this waveform will appear on a CRO. Describe the procedure to measure the unknown quantities as accurately as possible.

* 1. A high frequency signal has a low frequency signal of relatively small amplitude superimposed on it. Sketch how this waveform will appear on a CRO and describe the procedure to measure the amplitudes and frequencies of both the signals.
  2. Compare the angles of minimum deviation of the prisms having , where A is the angle of prism, and discuss the limiting cases. (Assume refractive index of prism material to be 1.5)
  3. Find the angle of minimum deviation of a prism having if the entire setup is immersed in a medium of refractive index .
  4. Compare the angles of incidence for the prisms having , where A is the angle of prism, when the prisms are set in minimum deviation position.
  5. A series LCR circuit consists of an inductor of, a capacitor of and a variable resistor *R*. It is connected to a sinusoidal supply voltage that has constant amplitude at all frequencies. The maximum current in the circuit is obtained at resonance by setting variable resistor and is found to be 1.8 A. The maximum current reduces to when variable resistor. Find the resistance (*not reactance*) of the inductor coil and quality factor (Q) of the circuit in both cases ( and ).
  6. A series LCR circuit consists of, and . It is connected to a sinusoidal supply having at all frequencies. Calculate, the resonant frequency, rms current at resonance, and *peak-to-peak* voltage across the inductor at resonance.
  7. A series LCR circuit consisting of, and is connected to a sinusoidal power supply. Compare the *peak-to-peak* voltages across the inductor, capacitor and resistor at resonance.
  8. A rectangular loop is rotating about Z-axis with uniform angular velocity. A magnetic exists in the region and is given by

Plot the induced emf in the loop.

* 1. Normally a dark fringe forms at the centre of Newton’s rings. Is it possible to get a bright fringe at the centre. If no, why and if yes, how?
  2. For a copper surface irradiated by light of wavelength 1849 Å stopping potential is 2.72 V. Calculate the work function and threshold frequency.
  3. Light of wavelength 2000 Å falls on a photosensitive material having work function 4.2 eV. What is the kinetic energy of the fastest and slowest photoelectron? Also calculate the stopping potential.
  4. What is Planck’s constant? Find the dimensions of Planck’s constant. Name a physical quantity with similar dimensions.
  5. What kind of lens combinations are inside the collimator and telescope of a spectrometer? Are they of same type or different in the two arms of the spectrometer? Give reasons to support your answer. What is the advantage of using such lens combinations?
  6. Why do we use a potentiometer to measure the emf of the unknown cell? Can the emf of a cell be determined using a voltmeter? Give reasons to support your answer.
  7. What is a spherometer? How does it measure the curvature of a lens?
  8. Newton’s rings arrangement is used with a source emitting two wavelengths λ1 and λ2. It is found that the nth dark ring due to wavelength λ1 coincides with (n+1)th dark ring due to λ2. Find the diameter of the nth dark ring of wavelength λ1.Given, λ1 = 6000 Å and λ2 = 5900 Å and radius of curvature of the lens is 0.9 m.
  9. In the Faraday’s law experiment, what changes in the output plot will be observed if, in place of one bar magnet, two bar magnets are placed in the aluminum rail
     1. side-by-side (parallel combination)
     2. one after other (series combination)
  10. In Melde’s experiment, explain how we set vibrations in prongs of the tuning fork.
  11. In Melde’s experiment, why the frequency is different in longitudinal mode when compared with the transverse mode? Which mode is greater and why?
  12. What is a CRO? On what principle it works. Why the screen of a CRO glows green when cathode ray strikes on it? How the screen gets discharged from excessive negative charges due to incoming electrons?