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XII-B
39
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St. Mary's School, Dwarka
First Term Examination
Class XII
Subject: Physics

Reading Time : 15 min
Writing Time: 3 Hrs. **M.M: 70**
No. of questions: 26
General instructions:

1. **All questions are compulsory.**
2. **Question no 1 to 5 are very short answer type questions of 1 mark each.**
3. **Question no 6 to 10 are short answer type questions of 2 marks each.**
4. **Question no 11 to 22 are short answer type questions of 3 marks each.**
5. **Question no 23 is a value based question of 4 marks .**
6. **Question no 24 to 26 are long answer type questions of 5 marks each**

Q1. What is the power dissipated in an a.c. circuit if voltage and current are given by $V=230 \sin(\omega t + \pi/2)$ and $I=10 \sin \omega t$? (1)

Q2. A long wire is first bent into a circular coil of one turn and then into a circular coil of smaller radius having n turns. If the same current passes in both the cases find the ratio of the magnetic field produced at the centers in the two cases. (1)

Q3. Draw a graph to show the variation of electric field intensity with increase in distance from the center of a charged hollow sphere. (1)

Q4. What is the work done in moving a 100nc charge between two points 5cm apart on an equipotential surface? Explain. (1)

Q5. If a toroid uses bismuth for its core, will the field in the core be (slightly) greater or (slightly) less than when the core is empty? Why? (1)

Q6. (a) A 600 pF capacitor is charged by 200V battery. How much electrostatic energy is stored by the capacitor? (b) The capacitor is disconnected from the battery & is connected to another 600pF capacitor. What is the electrostatic energy stored by the system? (2)

Q7. A particle of mass m and charge q moves at right angles to a uniform magnetic field. Plot a graph showing the variation of the radius of the circular path described by it with the increase in its (i) charge,(ii) kinetic energy, where ,in each case other factors remain constant .Justify your answer. (2)

Q8. A galvanometer with a coil resistance of 5 ohm can tolerate a maximum current of 10mA. Explain how this can be converted into an ammeter of range 1A. (2)

Q9. Define magnetic meridian. A freely suspended bar magnet of magnetic moment 0.8 J/T is to be held normal to the magnetic meridian at a place where the horizontal component of earth's magnetic field is 0.4 Gauss. How much external torque must be applied on the bar magnet in this orientation? (2)

Q10. Two current carrying concentric circular coils, one of small radius R_1 and other of large radius R_2 such that $R_1 < R_2$ are placed co- axially with centers coinciding. Obtain the mutual inductance of the arrangement. (2)

Q11. A monochromatic source of light of wavelength λ illuminates a narrow slit of width d to produce a diffraction pattern on the screen. (i) Obtain the conditions when secondary wavelets originating from the slit interfere to produce maxima and minima on the screen.(ii) How would the diffraction pattern be affected when the monochromatic source of light is replaced by white light? (2+1=3)

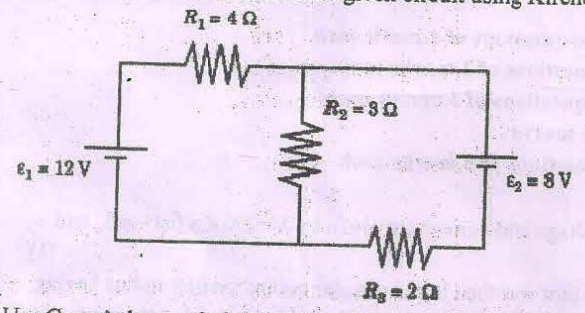
Q12. Suppose while sitting in a parked car, you notice a jogger approaching towards you in the side mirror of R= 2m. If the jogger is running at a speed of 5 ms^{-1} how fast does the image of the jogger appear to move when the jogger is (a) 39m (b) 29m. (1.5+1.5=3)

Q13 (i) Draw a labeled ray diagram of a refraction type telescope in normal adjustment.(ii) Give its two shortcomings over reflection type telescope. Why is eyepiece of a telescope of short focal length, while objective is of large focal length? (1.5+1.5=3)

OR

Q13. Draw a labeled diagram to explain the working of a compound microscope. Write an expression for the magnifying power of a compound microscope. (3)

Q14. Find current in all branches of the given circuit using Kirchoff's law. (3)



Q15. Use Gauss's law to derive the expression for the electric field between two uniformly charged large parallel sheets with surface charge densities σ and -σ respectively. Draw a labeled diagram also. (3)

Q16.Explain the principle of cyclotron. Draw a labeled diagram and explain its working. (3)

Q17. A 100 μF capacitor in series with a 40 Ω resistance is connected to a 110 V, 60 Hz supply. (i) What is the maximum current in the circuit? (ii) What is the time lag between the current maximum and the voltage maximum? (1+2=3)

Q18.1 MW power is to be delivered from a power station to a town 10 km away. One uses a pair of Cu wires of radius 0.5 cm for this purpose. Calculate the fraction of ohmic losses to power transmitted if (i) power is transmitted at 220 V. Comment on the feasibility of this plan. (ii) A step-up transformer is used to boost the voltage to11000V,power transmitted, then a step down transformer is used to bring voltage to 220 V. (ρ_{cu}=1.7 x 10^{-8}ohm-m) (3)

Q19. Define relaxation time of the free electrons drifting in a conductor. How is it related to the drift velocity of free electrons? Use this relation to deduce the expression for the electrical resistivity of the material. (3)

Q20. (i) Define temperature coefficient of resistivity of a material. Write its mathematical expression and its SI unit. (ii) A set of *n* identical resistor, each of resistor R ohm, when connected in series have an effective resistance of X ohm and when the resistor are connected in parallel, the effective resistance is Y ohm. Find the relation between R, X and Y. (3)

Q21 (i) A wire of resistance 20 ohm is stretched to double its original length. Calculate its new resistance & resistivity. (ii) Draw a graph showing variation of resistivity with temperature for Copper & Nichrome. (2+1=3)

Q22. Four point charges are placed at four corners of a square in two ways as shown in figure a and figure b. Find the (i) electric field and (ii) electric potential at the center of both the squares and give reason for your answer. (3)

Fig a

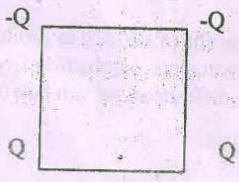
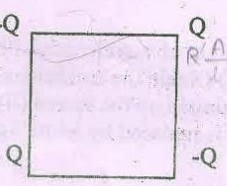


fig b



Q23. Rakesh purchased cells for his transistor. He felt that cells are not working properly. He wanted to check their e.m.f. So, he took the cell to the physics lab and with the help of potentiometer found their e.m.f. To his surprise e.m.f. was less than the value claimed by the manufacturer. He lodged the complaint with consumer forum and received the deserving response. (i) Write two values displayed by Rakesh. (ii) What do you think why Rakesh used potentiometer instead of voltmeter to find out e.m.f. of the cell? For more precise measurement the potential gradient of the potentiometer should be high or low? (1+3=4)

Q24 (i) In Young's double-slit experiment, derive the condition for (i) constructive interference and (ii) destructive interference at a point on the screen. Draw a labeled diagram as well.(ii) A beam of light consisting of two wavelengths, 800 nm and 600 nm is used to obtain the interference fringes in a Young's double-slit experiment on a screen placed 1.4 m away. If the two slits are separated by 0.28 mm, calculate the least distance from the central bright maximum where the bright fringes of the two wavelength coincide. (3+2=5)

OR

Q24.(i) What is a wavefront? Explain with labelled diagram how Huygen's principle can be used to prove laws of reflection of light. (ii) List two advantages of reflecting type telescope over a refracting type telescope. (3+2=5)

Q25(i) Derive an expression for impedance and hence the average power consumed in a series LCR circuit connected to a.c. source in which the phase difference between the voltage and the current in the circuit is ϕ. (ii) Define the quality factor in an a.c. circuit. Why should the quality factor have high value in receiving circuits? Name the factors on which it depends. (3+2=5)

OR

Q25 (i)Derive the relationship between the peak and the r.m.s value of current in an a.c. circuit.(ii)Describe briefly, with the help of a labeled diagram, working of a step-up transformer. Why such devices cannot be used to step up d.c. voltage? (iii) A step-up transformer converts a low voltage into high voltage. Does it not violate the principle of conservation of energy? Explain. (2+2+1=5)

Q26. Draw a labeled diagram and explain the working of a moving coil galvanometer. Define its current and voltage sensitivity and explain how they can be increased.

OR

Q26. Explain the working of an A.C generator and draw neat and labeled diagram. Derive the mathematical expression for emf induced in the coil of the generator. (2+2+1=5)