LR DAV PUBLIC SCHOOL, CUTTACK

SAMPLE QUESTION PAPER

CLASS- XII

SUB- PHYSICS

Time: 3 Hours **Maximum Marks: 70**

General Instructions:

(i) All questions are compulsory.

(ii) The question paper consists of **27** questions.

(iii) Question number **1** to **5** carry **1** mark each. Question number **6** to **12** carry 2 marks each. Question number **13** to **24** carry 3 marks each .Question number **25** to **27** carry **5 m**arks each.

(iv) There is no overall choice. However, an internal choice has been provided in **one** question of **two** marks, **one** question of **three** marks and all **three** questions of **five** marks each. You have to attempt only **one** of the given choices in such questions.

(v) Use of calculators is not permitted.

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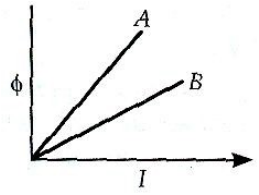
1. A 500 μC charge is at the centre of a square of side 10 cm. Find the work done in moving a charge of 10 μC between two diagonally opposite points on the square.
2. Two wires of equal cross sectional area, one of iron and the other of manganin, have the same resistance. Which one will be longer?
3. A plot of magnetic flux (ϕ) versus current (I) is shown in the figure for two inductors A and B . Which of the two has larger value of self-inductance?



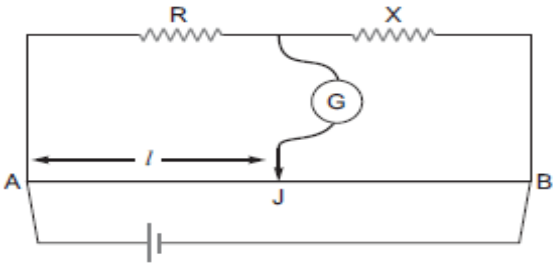
4. A lens when immersed in a transparent liquid becomes invisible. Under what condition does it happen?
5. Does the voltage sensitivity of galvanometer increase by increasing no. of turns in the coil of galvanometer. Answer with reason.
6. A capacitor of unknown capacitance is connected across a battery of V volts. The charge stored in it is 360 μC. When potential across the capacitor is reduced by 120 V, the charge stored in it becomes 120 μC.

   Calculate: (*i*) The potential V and the unknown capacitance C.
   (*ii*) What will be the charge stored in the capacitor, if the voltage applied had increased by 120 V.

OR

Net capacitance of three identical capacitors in series is 2 μF. What will be their net capacitance if connected in parallel? Find the ratio of energy stored in the two configurations if they are both connected to the same source.

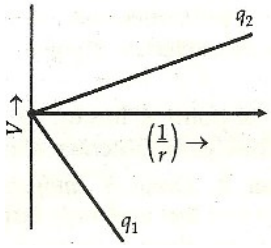
7. In the meter bridge experiment, balance point was observed at J with $AJ = l$.



(i) The values of R and X were doubled and then interchanged. What would be the new position of balance point?

(ii) If the galvanometer and battery are interchanged at the balance position, how will the balance point get affected?

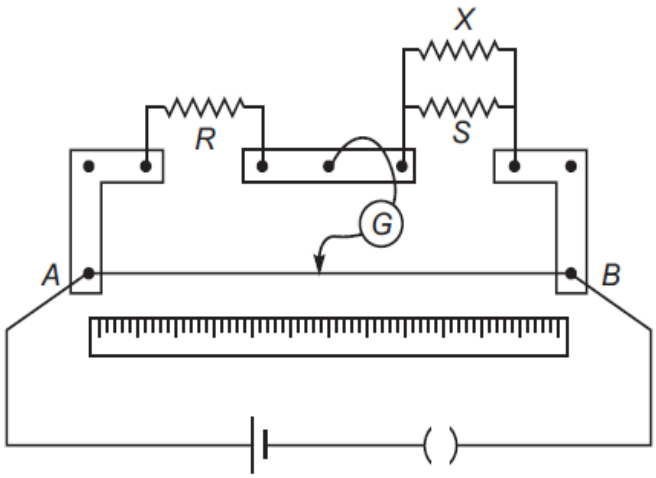
8. The two graphs drawn here, show the variation of electrostatic potential (V) with 1/r (r being distance of the field point from the point charge) for two point charges q_1 and q_2.
(i) What are the signs of the two charges?
(ii) Which of the two charges has a large magnitude and why?



9. Define angle of dip. Deduce the relation connecting the angle of dip and horizontal component of earth's magnetic field at a place.
10. An ideal capacitor having a charge $q = q_0 \cos \omega t$ is connected across an ideal inductor 'L' through a switch 'S'. On closing the switch, show that the sum of the energies in the capacitor and inductor is constant in time in the free oscillations of the LC circuits.
11. For a glass prism ($\mu = \sqrt{3}$) the angle of minimum deviation is equal to the angle of the prism. Find the angle of the prism.
12. Three immiscible liquids of densities $d_1 > d_2 > d_3$ and refractive indices $\mu_1 > \mu_2 > \mu_3$ are put in a beaker. The height of each liquid column is $\frac{h}{3}$. A dot is made at the bottom of the beaker. For near normal vision, find the apparent depth of the dot.
13. A particle of mass m and charge $(-q)$ enters the region between the two charged plates initially moving along x-axis with speed v_x .The length of

plate is L and an uniform electric field E is maintained between the plates. Find out the vertical deflection of the particle at the far edge of the plate.

14. In a metre bridge, the null point is found at a distance of l_1 cm from A. If now a resistance of X is connected in parallel with S, the null point occurs at l_2 cm. Obtain a formula for X in terms of l_1, l_2 and S.



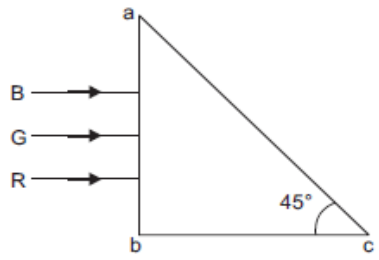
15. Write the expression for Lorentz magnetic force on the particle of charge 'q' moving with velocity $\vec{v}$ in a magnetic field $\vec{B}$. Show that no work is done by this force on the charged particle

16. (a) A magnetic dipole is placed in a uniform magnetic field with its axis tilted with respect to its position of stable equilibrium. Deduce an expression for the time period of (small amplitude) oscillation of this magnetic dipole about an axis, passing through its centre and perpendicular to its plane.

17. The current flowing through an inductor of self inductance L is continuously increasing ,Plot a graph showing the variation of :
    (a) Magnetic flux versus the current
    (b) Induced emf versus dI/dt
    (c) Magnetic potential energy stored versus the current

18. Identify the type of electromagnetic waves, whose methods of production , is associated with (a) a klystron valve (b) vibrations of atoms and molecules (c) decay of atomic nuclei
    Also give the approximate range of wavelength of each of these e.m. waves.

19. Three light rays red *(R)*, green (*G*) and blue (*B*) are incident on a right angled prism '*abc*' at face '*ab*'.



The refractive indices of the material of the prism for red, green and blue wavelengths are 1.39, 1.44 and 1.47 respectively. Out of the three which colour ray will emerge out of face '*ac*'? Justify your answer. Trace the path of these rays after passing through face '*ab*'.

OR

One face of a prism with a refracting angle of 30° is coated with silver. A ray incident on another face at an angle of 45° is refracted and reflected from the silver coated face and retraces its path. Find the refractive index of the material of the prism. Explain why diamond sparkles.

20. Use the mirror equation to show that
(*a*) an object placed between *f* and 2*f* of a concave mirror produces a real image beyond 2*f*.
(*b*) a convex mirror always produces a virtual image independent of the location of the object.
(*c*) an object placed between the pole and focus of a concave mirror produces a virtual and enlarged image.
21. Two heating elements of resistance R_1 and R_2 when operated at a constant supply of voltage, *V*, consume powers P_1 and P_2 respectively. Deduce the expressions for the power of their combination when they are, in turn, connected in (*i*) series and (*ii*) parallel across the same voltage supply.
22. (*a*) How is the electric field due to a charged parallel plate capacitor affected when a dielectric slab is inserted between the plates fully occupying the intervening region?
(*b*) A slab of material of dielectric constant *K* has the same area as the plates of a parallel plate capacitor but has thickness $\frac{1}{2}\ d$, where *d* is the separation between the plates. Find the expression for the capacitance when the slab is inserted between the plates.
23. A parallel plate capacitor is being charged by a time varying current. Explain briefly how Ampere's circuital law is generalized to incorporate the effect due to the displacement current.

24. Deduce the expression for the torque experienced by a rectangular loop carrying a steady current 'I' and placed in a uniform magnetic field $\vec{B}$. Indicate the direction of the torque acting on the loop.

25. (a) Define electric dipole moment. Is it a scalar or a vector? Derive the expression for the electric field of a dipole at a point on the equatorial plane of the dipole.

(b) Draw the equipotential surfaces due to an electric dipole. Locate the points where the potential due to the dipole is zero.

OR

Using Gauss' law deduce the expression for the electric field due to a uniformly charged spherical conducting shell of radius R at a point

(i) outside and (ii) inside the shell.

Plot a graph showing variation of electric field as a function of distance r,

(i) r > R and (ii) r < R. (r being the distance from the centre of the shell)

Two charges of magnitudes + 4Q and – Q are located at points (a, 0) and (– 3a, 0) respectively. What is the electric flux due to these charges through a sphere of radius '2a' with its centre at the origin?

26. Trace the rays of light showing the formation of an image due to a point object placed on the axis of a spherical surface separating the two media of refractive indices n_1 and n_2 . Establish the relation between the distances of the object, the image and the radius of curvature from the central point of the spherical surface. Hence, derive the expression of the lens maker's formula.

OR

Draw the labelled ray diagram for the formation of image by a compound microscope. Derive the expression for the total magnification of a compound microscope. Explain why both the objective and the eye piece of a compound microscope must have short focal lengths.

27. State Biot-Savart law, giving the mathematical expression for it. Use this law to derive the expression for the magnetic field due to a circular coil carrying current at a point along its axis. How does a circular loop carrying current behave as a magnet?

OR

With the help of a labelled diagram, state the underlying principle of a cyclotron. Explain clearly how it works to accelerate the charged particles.

Show that cyclotron frequency is independent of energy of the particle. Is there an upper limit on the energy acquired by the particle? Give reason.

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