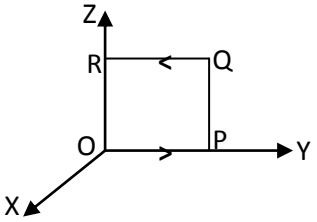
Class XII

Time: 3hrs. **PHYSICS** **M.M. 70**

1. A capacitor, of capacitance C, is being charged up by connecting it across a direct current voltage source of voltage V. How does the conduction & displacement currents, in this set up compare with each other (a) during the charging up process? (b) after the capacitor gets fully charged? (1)
2. Two identical cells of negligible internal resistance are connected in (i) series & (ii0 parallel with each other. Find the ratio of currents through a load resistance R in the two cases. (1)
3. A square coil OPQR of side 'a', carrying a current 'I', is placed in Y-Z plane as shown here. Find the magnetic moment associated with this coil.

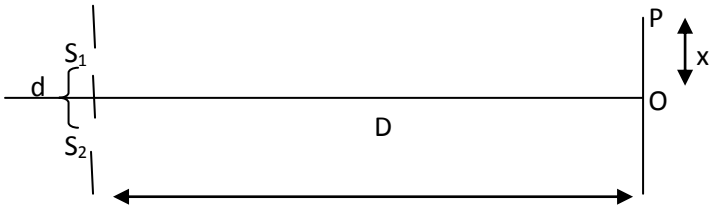


(1)

4. How does the angle of minimum deviation of a glass prism vary if the incident violet light is replaced by orange light? (1)
5. What happens to neutron to proton ratio after the emission of α-particle? (1)
6. An athlete peddles a stationary tricycle whose pedals are attached to coil having 100 turns each of area $0.1m^2$. The coil, lying in the X-Y plane, is rotated, in this plane, at the rate of 50 rpm, about Y-axis, in a region where a uniform magnetic field, $\vec{B} = (0.01)\hat{k}$ tesla, is present. Find the (i) maximum emf (ii) average emf generated in the coil over one complete revolution. (2)
7. Derive the expression for the electric potential at any point along the equatorial line of an electric dipole.

   OR

   Define intensity of electric field at a point. At what points is the electric field intensity parallel to the line joining the charges? (2)
8. The intensity, at the central maxima (O) in a Young's double slit set up is I_0. If the distance OP equals to one-third of the fringe width of the pattern, show that the intensity, at point P, would be equal to $\frac{I_0}{4}$. (2)



9. Write two advantages of frequency modulation over amplitude modulation. (2)
10. Write two characteristic features to distinguish between n-type and p-type semiconductors. (2)
11. What would be the modulation index for amplitude modulated wave for which the maximum amplitude is 'a' while the minimum amplitude is 'b'? (3)
12. Define half life of a radioactive substance and derive an expression for it. (3)

    OR

    (a) Define the terms (i) mass defect (ii) binding energy for a nucleus.

    (b) Identify the nature of the 'radioactive radiations', emitted in each step of the 'decay chain' as given:
    $^{A}_{Z}X \rightarrow {}^{A-4}_{Z-2}Y \rightarrow {}^{A-4}_{Z-1}W$
13. If the frequency of the light falling on a metal is doubled, what will be the effect on photo current and the maximum kinetic energy of emitted photoelectrons? Explain. (3)
14. State de-Broglie dualistic hypothesis. Derive an expression for the de-Broglie wavelength of an electron. (3)
15. State Huygens Principle. Using it, show that the angle of incidence is equal to the angle of reflection. (3)

16. Draw a neat & labeled ray diagram showing the image formation by a compound microscope. Also write an expression for its magnifying power. (3)

17. The oscillating magnetic filed in a plane electromagnetic wave is given by :

$$B_y = (8X10^{-6}) \sin [2X10^{11} t + 300 \pi x] \mathbf{T}$$

(i) Calculate the wavelength of the electromagnetic wave.

(ii) Write down the expression for the oscillating electric field. (3)

18. The primary of a transformer has 200 turns and secondary has 1000 turns. If the power output from the secondary at 1000 V is 9kW, calculate: (3)

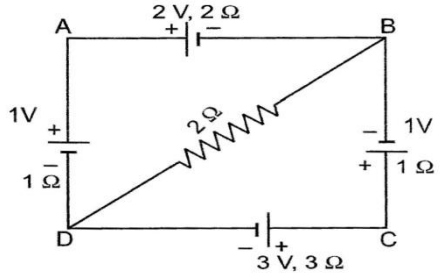
(i) The primary voltage.

(ii) The heat loss in the primary coil if the resistance of primary is 0.2 Ω and the efficiency oof the transformer is 90%.

19. Write Faraday's laws of electromagnetic induction. Also, state Lenz's law. (3)

20. State Ampere's circuital law. Using it derive an expression for the magnetic field at a point due a straight long conductor. (3)

21. For the circuit shown here, calculate the potential difference between B and D. (3)



22. Define resistivity (specific resistance) of a conductor and state its SI unit. State and explain the variation of conductivity of metallic conductor with temperature. (3)

23. Suhasini's uncle was advised by his doctor to have an MRI scan of his chest. Her uncle did not know much about the details & significance of this test. He also felt that it was too expensive and thought of postponing it. When Suhasini learnt about her uncle's problems, she immediately decided to do something about it. She took help of her family, friends and neighbours and arranged for the cost of the test. She also told her uncle that MRI (Magnetic Resonance Imaging) scan of his chest would enable the doctors to know the condition of his heart & lungs without causing any (test related) harm to him. This test was expensive because of its set up that needed strong magnetic fields (0.5 T to 3T) and pulses of radio wave energy.

Her uncle was convinced and had the required MRI scan of his chest done. The resulting information greatly helped his doctors to treat him well.

(i) What according to you, are the values displayed by Suhasini and her family, friends and neighbours to help her uncle?

(ii) Assuming that MRI scan of her uncle's chest was done by using a magnetic field of 1.0T, find the maximum & minimum values of force that this magnetic field could exert on a proton (charge = $1.6X10^{-19}C$) that was moving with a speed of 104 m/s. State the condition under which the force has its minimum value. (4)

24. Define the terms 'depletion layer' and 'potential barrier' foe a p-n junction diode. How does an increase in the doping concentration affect the width of the depletion region? Draw the circuit of a full wave rectifier. Explain its working. (5)

OR

Why the base region of a transistor is kept thin and lightly doped.

Draw a labeled circuit diagram of a common emitter amplifier using a n-p-n transistor. Explain how the input and output voltages are out of phase by 180° for this configuration?

25. With the help of a ray diagram, show the image formation of a point object by refraction of light at a convex spherical surface separating two media of refractive indices μ_1 & μ_2 ($\mu_2 > \mu_1$) respectively. Using this diagram, derive the relation:

$$\frac{\mu_2}{v} - \frac{\mu_1}{u} = \frac{\mu_2 - \mu_1}{R}$$

Write the sign convention used. What happens to the focal length of convex lens when it is immersed in water? (5)

OR

What are coherent sources? Also define interference. Derive the conditions for the constructive and destructive interference and hence find the ratio of maximum and minimum intensity of light.

26. Define an electric dipole. Find the expression for the electric field intensity due to an electric dipole at a point on equatorial line. Would the electric field be necessarily zero at a point where the electric potential is zero? Give an example to illustrate your answer. (5)

OR

Find the expression for the capacitance of a parallel plate capacitor of area 'A' and plate separation 'd' if (i) a dielectric slab of thickness 't' and (ii) a metallic slab of thickness 't', where (t<d) are introduced one by one between the plates of the capacitor. In which case would the capacitance be more and why?

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