KENDRIYA VIDYALAYA SANGATHAN ERNAKULAM REGION

SECOND PRE-BOARD EXAMINATION 2018-19

CLASS: XII **SUBJECT: PHYSICS**

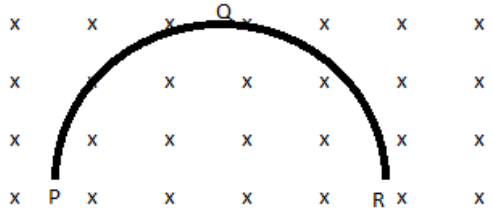
MAX. MARKS: 70 **TIME: 3 HRS**

General Instructions:

i. All questions are compulsory
ii. There are 27 questions in total. Questions **1 to 5** are very short answer type questions and carry **one mark** each.
iii. Questions **6 to 12** are short answer type-I questions and carry **two marks** each.
iv. Questions **13 to 24** are short answer type-II questions and carry **three marks** each.
v. Questions **25 to 27** are long answer type questions and carry **five marks** each.
vi. 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 choices in such questions.
vii. Use of calculator is **not** permitted. However, you may use log tables if necessary.
viii. You may use the following values of physical constants wherever necessary:
$c = 3 \times 10^8$ m/s $h = 6.63 \times 10^{-34}$Js $e = 1.6 \times 10^{-19}$C
$\mu_0 = 4\pi \times 10^{-7}$ TmA^{-1} $m_e = 9.1 \times 10^{-31}$Kg.

Section A

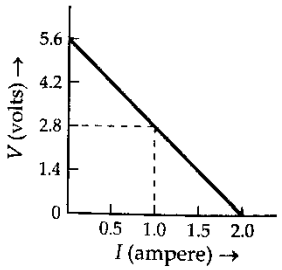
1. An electron is moving from east to west direction in a uniform magnetic field which acts vertically downwards. What will be the direction of the force acting on the electron?
2. A thin semicircular conducting ring (PQR) of radius 'r' is falling with its plane vertical in a horizontal magnetic field 'B' as shown in figure.



What is the potential difference developed across the ring when its speed is 'v'?
3. What is the phase difference between voltages across an inductor and that across a capacitor in an LCR series circuit?
4. What is the nuclear radius of ^{125}Fe, if that of ^{27}Al is 3.6 fermi?
5. Which mode of propagation is used by short wave broadcast services?

Section B

6. What are polar and non-polar dielectrics? Give one example each.
7. 4 cells of identical e.m.f 'E', internal resistance 'r', are connected in series to a variable resistor. The following graph shows the variation of terminal voltage of the combination with the current output.
   a. What is the e.m.f of each cell used?
   b. For what current from the cells, does maximum power dissipation occur in the circuit?
   c. Calculate the internal resistance of each cell.



8. What are Focault currents? Explain any two uses of it?

OR

Derive an expression for the self-inductance of a long solenoid. What are the factors on which self-inductance depends on?

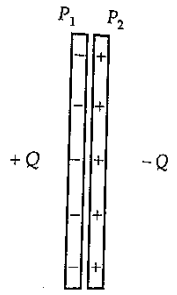
9. A metallic rod of length 'l' and resistance 'R' is rotated with a frequency 'ν', with one end hinged at the centre and the other end at the circumference of a circular metallic ring of radius 'l' about an axis passing through the centre and perpendicular to the plane of the ring. A constant and uniform magnetic field 'B' parallel to the axis of the ring is present everywhere.
    a. Derive the expression for the induced e.m.f in the rod.
    b. Hence obtain the expression for the power required to rotate the rod.
10. The magnetic field in a plane electromagnetic wave is given by:
    $B_y = 12 \times 10^{-8} \sin (1.2 \times 10^7 z + 3.6 \times 10^{15} t)$ T. calculate:
    a. Energy density associated with the electromagnetic wave
    b. Speed of the wave.
11. Calculate the speed of light in a medium whose critical angle is 45^0. Does critical angle for a given pair of media depend on the wavelength of incident light? Give reason.
12. Define the term 'resolving power' of an astronomical telescope. How does it get affected on:
    a. Increasing the aperture of the objective lens?
    b. Increasing the focal length of the object lens? Justify your answer in each case.

Section C

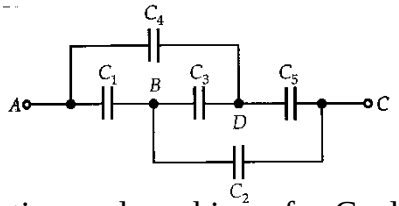
13. Find the electric field intensity due to a uniformly charged spherical shell at a point (i) outside the shell and (ii) inside the shell. Plot the graph of electric field with distance from the centre of the shell.

OR

    a. Obtain Coulomb's law from Gauss' theorem.
    b. Figure shows two large metal plates P_1 and P_2, tightly held against each other and placed between two equal and unlike point charges perpendicular to the line joining them. Draw the pattern of electric field lines for the system.



14. Five capacitors of capacitance 10 μF each are connected with each other as shown in figure. When the points A and C are connected to 6 V battery, find:
    a. Effective capacitance between points A and C
    b. Total charge stored in the network
    c. Total energy stored.

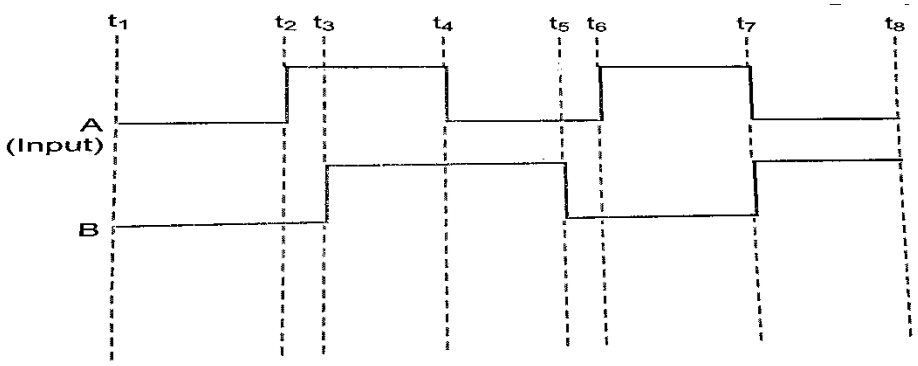


15. With a neat labeled diagram, explain the principle, construction and working of a Cyclotron. What are its limitations?
16. Explain with the help of a diagram (i) magnetic declination and (ii) magnetic dip at a place. In what direction will a compass needle point when kept at (i) poles and (ii) equator?
17. An inductor 200 mH, a capacitor 100 μF and a resistor 10 Ω are connected in series to an a.c source of 100 V, having variable frequency.
    a. At what frequency of the applied voltage will the power factor of the circuit be 1?
    b. What will be the current amplitude at this frequency?
    c. Calculate the Q-factor of the circuit.

18. Draw the ray diagram for the image formation in a compound microscope when final image is formed at near point. Also write the expression for magnifying power. How the magnification can be increased in a compound microscope?
19. Trace the path of a monochromatic ray of light through a prism of refracting angle 'A'. Draw a graph to show the variation of angle of deviation 'δ' with the variation of angle of incidence 'i'. Deduce the relation $\mu = \frac{\sin(\frac{A+\delta_m}{2})}{sin\frac{A}{2}}$ where terms μ, δ_m have their usual meaning.
20. (i) A proton and a deuteron are accelerated through the same accelerating potential. Which one of the two has:
    a. Greater value of de-Broglie wavelength associated with it, and
    b. Less momentum?
    Give reasons to justify your answer.

    (ii) Draw a plot showing the variation of photoelectric current versus the intensity of incident radiation on a photosensitive surface.
21. (i) A 12.3 eV electron beam is used to bombard gaseous hydrogen at room temperature. Up to which energy level the hydrogen atoms would be excited?

    (ii) Calculate the wavelengths of second member of Lyman series and first member of Balmer series. Given, Rydberg constant R = 1.097 x 10^7 m^{-1}.
22. (i) Explain the process of nuclear fission and nuclear fusion by using the plot of binding energy per nucleon (BE/A) versus the mass number A.
23. The figure shows input waveforms A and B to a logic gate. Draw the output waveform for a NAND gate. Write the truth table for this logic gates and draw its logic symbol.



Section D

24. Suppose you wish to transmit an electronic signal in the audio frequency range over a long distance directly. Write briefly the three important factors which prevent you from doing so and explain how you overcome these factors?
25. (i) In Young's double slit experiment, deduce the conditions for obtaining constructive and destructive interference fringes. Hence deduce the expression for the fringe width.

    (ii) What would be the width of each slit to obtain 10 maxima of the double slit pattern within the central maximum of the single slit pattern, for green light of wavelength 500 nm, if the separation between two slits is 1 mm?

OR

(i) "Two independent monochromatic sources of light cannot produce a sustained interference pattern". Give reason.

(ii) Light waves each of amplitude 'a' and frequency 'ω', emanating from two coherent light sources superpose at a point. If the displacements due to these waves is given by

$y_1 = a \cos \omega t$, $y_2 = a \cos (\omega t + \phi)$ where ϕ is the phase difference between the two, obtain the expression for the resultant intensity at the point.

26. (i) Differentiate between three segments of a transistor on the basis of their size and level of doping.

(ii) How is a transistor biased to be in active state?

(iii) With the help of necessary circuit diagram, describe briefly how *n-p-n* transistor in CE configuration amplifies a small sinusoidal input voltage. Write the expression for the ac current gain.

OR

(i) How is Zener diode fabricated? What causes the setting up of high electric field even for small reverse bias voltage across the diode?

Describe with the help of a circuit diagram, the working of Zener diode as a voltage regulator.

(ii) Draw a circuit diagram to study the input and output characteristics of an *n-p-n* transistor in its common emitter configuration. Draw the typical input and output characteristics.

27. (i) State the principle of working of a potentiometer

(ii) Draw a circuit diagram to compare the e.m.f. of two primary cells. Write the formula used. How can the sensitivity of a potentiometer be increased?

(iii) Write two possible causes for one sided deflection in the potentiometer experiments.

OR

(i) With proper circuit diagram, explain how a potentiometer can be used to measure the internal resistance of a primary cell.

(ii) A 10 m long wire of uniform cross section of 20 Ω resistance is fitted in a potentiometer. The wire is connected in series with a battery of 5 volt, along with an external resistance of 480 Ω. If an unknown e.m.f 'E' is balanced at 6.0 cm length of this wire, calculate (a) the potential gradient of the potentiometer wire, (b) the value of the unknown e.m.f 'E'.