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Name: _____ R. No.___ Class/ Sec:_____ Date:_____ Invig. Sign_____

ATOMIC ENERGY CENTRAL SCHOOL, NARORA

CLASS XII PHYSICS HALF YEARLY EXAMINATION 2018-19

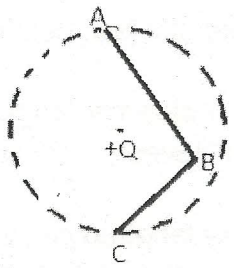
MM: 70 TIME: 3 Hr.

General Instructions:

- All questions are compulsory and marks are mentioned in front of each question.
- Electronic devices are prohibited to use in the examination.
- Use Blue or Black Pen only.
- 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 ,
  $\mu o = 4\pi \times 10^{-7}$ T m A^{-1} ,
  $\varepsilon_0 = 8.854 \times 10^{-12}$ F/m ,
  $1/4\pi\varepsilon_0 = 9 \times 10^9$ N m^2 C^{-2} ,
  $m_e = 9.1 \times 10^{-31}$ kg

SECTION - A

Q1. In the given figure, charge +Q is placed at the centre of a dotted circle. Work done in taking another charge +q from A to B is W1 and from B to C is W2. Which one of the following is correct: W1 > W2, W1=W2 and W1 < W2?



Q2. Give an example of a material each for which temperature coefficient of resistivity is (i) positive, (ii) negative

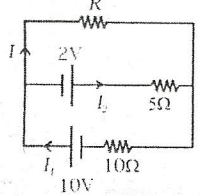
Q 3. Plot a graph showing the variation of current 'I' versus resistance 'R', connected to a cell of emf E and internal resistance 'r

Q 4. What physical quantity is the same for X-rays of wavelength 10^{-10} m, red light of wavelength 6800 Å and radio waves of wavelength 500 m?

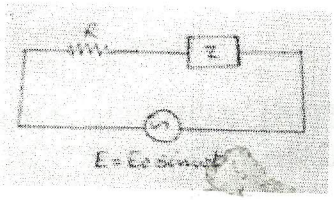
Q 5. An electric dipole of dipole moment 20×10^{-6} C-m is enclosed by a closed surface. What is the net flux coming out of the surface? [1x5=5]

SECTION – B

Q 6. Two cells of E.M.F. 10 V and 2 V and internal resistances 10 Ω and 5 Ω respectively, are connected in parallel as shown. Find the effective voltage across R.



Q 7 An alternating voltage E = Eo sinωt is applied to a circuit containing a resistor R connected in series with a black box. The current in the circuit is found to be I = Iosin (ωt +π/4).



(i) State whether the element in the black box is a capacitor or inductor.
(ii) Draw the corresponding phasor diagram and find the impedance in terms of R.

Q 8. The magnetic field in a plane electromagnetic wave is given by:
$B_y = 12 \times 10^{-8} \sin (1.20 \times 10^{7} \; z + 3.60 \times 10^{15} \; t)$ T.
Calculate the
(i) Energy density associated with the Electromagnetic wave
(ii) Speed of the wave

Q9 Write two properties of a material suitable for making (a) a permanent magnet, and (b) an Electromagnet

Q10. You are given 'n' resistors, each of resistance 'r'. These are first connected to get minimum possible resistance. In the second case, these are again connected differently to get maximum possible resistance. Compute the ratio between the minimum and maximum values of resistance so obtained.

Q 11.Using Ampere's circuital law, derive and expression for the magnetic field along the axis of a solenoid.

OR

Using Ampere's circuital law, derive and expression for the magnetic field inside core of a toroid

Q 12 Write the order of frequency range and one use of each of the following electromagnetic radiations:(i) Microwaves (ii) Ultra-violet rays [2x7=14]

SECTION - C

Q 13 An electric dipole of length 8 cm, when placed with its axis making an angle of 60° with a uniform electric field experiences a torque of 81 Nm. Calculate the (i) magnitude of the electric field, (ii) potential energy of the dipole, if the dipole has charges of ± 4n C.

Q 14 State Gauss' theorem in electrostatics. Using this theorem, derive an expression for the electric field intensity due to an infinite plane charged sheet.

Q 15 A cyclotron's oscillator frequency is 10 MHz. What should be the operating magnetic field for accelerating protons? If the radius of its 'dees' is 60 cm, what is the kinetic energy (in MeV) of the proton beam produced by the accelerator.

Q 16. A jet plane is travelling towards west at a speed of 1800 km/h. What is the voltage difference developed between the ends of the wing having a span of 25 m, if the Earth's magnetic field at the location has a magnitude of 5×10^{-4} T and the dip angle is 30°.

Q 17 A sinusoidal voltage of peak value 283 V and frequency 50 Hz is applied to a series *LCR* circuit in which R = 3 W, *L* = 25.48 mH, and C = 796 μF.
Find (a) the impedance of the circuit;
(b) the phase difference between the voltage across the source and the current;
(c) the power dissipated in the circuit; and
(d) the power factor.

Q 18 With the help of a diagram, explain the principle of a device which changes a low voltage into a high voltage but does not violate the law of conservation of energy. Give any one reason why the device may not be 100% efficient.

Q19 Define mutual inductance between a pair of coils. Derive an expression for the mutual inductance of two long coaxial solenoids of same length wound one over the other.

OR

Define self-inductance of a coil. Obtain the expression for the energy stored in an inductor L connected across a source of emf.

Q 20. State the principle of a cyclotron. Show that the time period of revolution of particles in a cyclotron is independent of their speeds. Why is this property necessary for the operation of a cyclotron ?

Q 21. Deduce an expression magnetic dipole moment for a revolving electron around nucleus.

Q 22. Deduce an expression for the electric potential due to an electric dipole at a point any where.

Q 23. Establish relation between Electric Current and drift velocity

Q 24. Distinguish Dia, Para and Ferro Magnetic substances [3x12=36]

SECTION-D

Q 25 (a) Deduce the expression for the electric field due to a uniformly infinitely long straight charged wire at a point by using Gauss' law.

(b) How can you charge a metal sphere negatively without touching it? Explain with the help of diagram.

OR

(a) Deduce the expression for the torque acting on an magnetic dipole of dipole moment M in the presence of a uniform magnetic field B.

(b) Consider two hollow concentric spheres, S_1 and S_2, enclosing charges 3Q and 6 respectively

(i) Find out the ratio of the electric flux through them.

(ii) How will electric flux through the sphere S1 change if a medium of dielectric constant 'ε_r is introduced in the space inside S_1 in the place of air ? Deduce the necessary expression.

Q 26. (a) A transformer has an efficiency of 80%. It works at a 4 kilowatt and 100V. If the secondary voltage is 240V, calculate the primary and secondary currents.

(b) Prove that in an ideal inductor, Alternate Current does not dissipate power.

OR

(a) When a voltage of 120 v is impressed across the primary of a transformer, the current in the primary is 1.85 A .Find the voltage across the secondary, when it delivers 150 mA. The efficiency of transformer is 95%.

(b) Prove that in an ideal Capacitor, Alternate Current does not dissipate power.

Q 27. With the help of suitable diagram, explain the principle and construction of Potentiometer. Explain how you will use it to compare the e.m.f. of two primary cells.

OR

(a) Explain how you will use Potentiometer to measure the internal resistance of a cell.

(b)How does the resistively of (i) a conductor and (ii) a semiconductor vary with temperature? Give reason for each case. [5x3=15]

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