Central Board of Secondary Education

Test I – June 2019

SUBJECT - PHYSICS

Degree Program: PHYSICS
Date of Examination: 27.06.2019
Teacher's name: ABDUL AZIZ
Course Title: EM THEORY

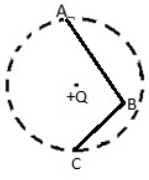
Class: XII
Time duration: 1.5 hour
Total Marks: 37
Student's name: Sangbed Pal
Roll No:

Instructions:
1. **All** questions are compulsory. There are **16** questions in all.
2. It contains **Six** questions of **one** mark each, **three** questions of **two** marks each, **five** questions of **three** marks each and **two** questions of **five** marks each.
4. There is no overall choice. However, an internal choice has been provided in some questions. You have to attempt only one of the choices in such questions.

Q.1) An electron is accelerated through a potential difference V. Write the expression for its final speed, if it was initially at rest. 1 mark

Q.2) Two long straight parallel conductors carrying steady currents I_a and I_b along the same direction are separated by a distance d. How does one explain the force of attraction between them? 1 mark

Q.3) 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 W_1 and from B to C is W_2. Which one of the following is correct: $W_1 > W_2$, $W_1 = W_2$ and $W_1 < W_2$?



1 mark

Q.4) Plot a graph showing the variation of current I versus resistance R, connected to a cell of emf E and internal resistance r. 1 mark

Q.5) Represent graphically the variation of electric field with distance, for a uniformly charged plane sheet. 1 mark

Q.6) Define SI unit of current in terms of the force between two parallel current carrying conductors. 1 mark

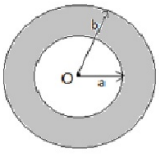
Q.7) Two wires A and B of the same material and having same length, have their cross sectional areas in the ratio 1:6. What would be the ratio of heat produced in these wires when same voltage is applied across each? 2 marks

Q.8) An α-particle and a proton are accelerated through the same potential difference. Calculate the ratio of linear momenta acquired by the two. 2 marks

Q.9) Two cells of emfs ϵ_1 & ϵ_2 and internal resistances r_1 & r_2 respectively are connected in parallel. Obtain expressions for the equivalent. (i) resistance and (ii) emf of the combination. 2 marks

Q.10) (a) How many electrons must be added to one plate and removed from the other so as to store 25.0 J of energy in a 5.0 nF parallel plate capacitor? (b) How would you modify this capacitor so that it can store 50.0 J of energy without changing the charge on its plates? 3 marks

Q.11) A point charge +Q is placed at the centre O of an uncharged hollow spherical conductor of inner radius a and outer radius b. Find the following: (a) The magnitude and sign of the charge induced on the inner and outer surface of the conducting shell. (b) The magnitude of electric field vector at a distance (i) r = a/2 , and (ii) r = 2b, from the centre of the shell.



3 marks

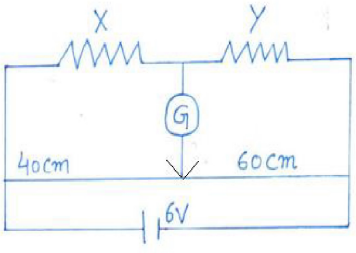
Q.12) The following table gives the length of three copper wires, their diameters, and the applied potential difference across their ends. Arrange the wires in increasing order according to the following: (a) The magnitude of the electric field within them, (b) The drift speed of electrons through them, and (c) The current density within them.

wire no.	Length	Diameter	Potential difference
1	L	3d	V
2	2L	d	V
3	3L	2d	2V

3 marks

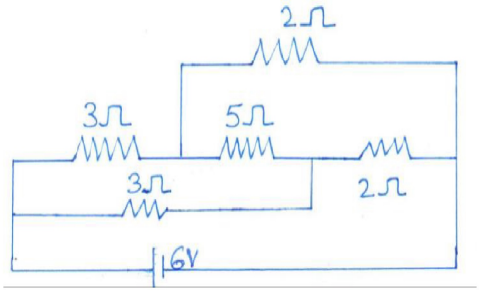
Q.13) If N drops of same size each having the same charge, coalesce to form a bigger drop. How will the following vary with respect to single small drop? (i) Total charge on bigger drop (ii) Potential on the bigger drop (iii) Capacitance 3 marks

Q.14) In the given circuit, a metre bridge is shown in the balanced state. The metre bridge wire has a resistance of 1 ohm cm-1. Calculate the unknown resistance X and the current drawn from the battery of a negligible internal resistance if the magnitude of Y is 6 ohm. If at the balancing point, we interchange the position of galvanometer and the cell, how it will affect the position of the galvanometer?



OR

Calculate the current drawn from the battery in the given network shown here. State Kirchhoff's loop law and name the law on which it is based on.



3 marks

Q.15) Two point charges q and -q are located at points (0, 0, -a) and (0, 0, a) respectively. (a) Find the electrostatic potential at (0, 0, z) and (x, y, 0) (b) How much work is done in moving a small test charge from the point (5, 0, 0) to (-7, 0, 0) along the x-axis ? (c) How would your answer change if the path of the test charge between the same points is not along the x-axis but along any other random path ? (d) If the above point charges are now placed in the same positions in a uniform external electric field $\vec{F}$, what would be the potential energy of the charge system in its orientation of unstable equilibrium ? Justify your answer in each case.

5 marks

Q.16) A capacitor of capacitance C_1 is charged to a potential V_1 while another capacitor of capacitance C_2 is charged to a potential difference V_2. The capacitors are now disconnected from their respective charging batteries and connected in parallel to each other. (a) Find the total energy stored in the two capacitors before they are connected. (b) Find the total energy stored in the parallel combination of the two capacitors. (c) Explain the reason for the difference of energy in parallel combination in comparison to the total energy before they are connected.

OR

Find the expression for the energy stored in the capacitor. Also find the energy lost when the charged capacitor is disconnected from the source and connected in parallel with the uncharged capacitor. Where does this loss of energy appear?

5 marks
