Air Force Sr. Sec. School
First Term examination 2017-18
Class 12
Physics(Theory)

Time allowed: 3 Hrs *Maximum Marks: 70*

GENERAL INSTRUCTIONS:

1. All questions are compulsory.
2. There are 26 questions in total. Questions 1 to 5 are very short answer type questions and carry one mark each.
3. Questions 6 to 10 carry two marks each, question 11 to 22 carry three marks each, question 23 carry four marks is a value based, and questions 24 to 26 carry five marks each.
4. There is no overall choice.
5. Use of calculators is not permitted. However you may use log tables if necessary.
6. 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
$\mu_0 = 4\pi \times 10^{-7}$ Tm/A
$1/4\pi\varepsilon_0 = 9 \times 10^9$ Nm^2/s^2

Answer the following questions:

1. You are asked to measure e.m.f of a cell. Which instrument will you use? A high resistance Voltmeter or Potentiometer and why? (1)
2. An electron and a proton, having equal momenta, enter a uniform magnetic field at right angles to the field lines. What will be the ratio of their trajectories? (1)
3. If a wire is stretched to double its original length without loss of mass, how will the resistivity of the wire be influenced? (1)
4. If the potential difference across a capacitor is doubled, what happens to :

(a) The charge on the capacitor and
(b) The energy stored in the capacitors. (1)

5. At a place, the horizontal component of earth's magnetic field is B and angle of dip is 60°. What is the value of horizontal component of earth's magnetic field at equator? (1)

6. "n" identical capacitors when joined in series give an effective capacitance of C Units. What will be the capacitance if the capacitors are now placed in parallel combination? (2)

7. Two identical cells of emf 1.5V each joined in parallel, provide supply to an external circuit consisting of two resistors of 17 Ω. Each joined in parallel. A very high resistance voltmeter reads the terminal voltage of the cells to be 1.4V. What is the internal resistance of each cell? (2)

8. Draw a plot showing the variation of
(i) Electric field (E) and
(ii) Electric potential (V) with distance r due to a point charge Q. (2)

9. Write two properties of a material suitable for making a) a permanent magnet b) an electromagnet. (2)

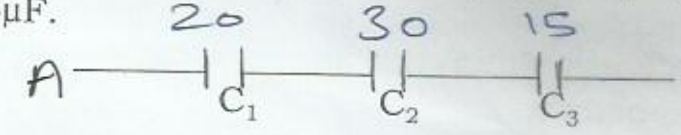
10. Find the condition under which the charged particles moving with different speeds in the presence of electric and magnetic field vector can be used to select charged particles of a particular speed. (2)

10 Write the principle of working of a potentiometer. Describe briefly, with the help of a circuit diagram, how a potentiometer is used to compare the emf of two cells? (3)

10. Give a labeled diagram and explain the principle and working of a cyclotron. (3)

12. Using Biot-Savarts law, derive the expression for the magnetic field in the vector form at a point on the axis of a circular current loop. (3)

12. Calculate the potential difference and the energy stored in the capacitor C_2 in the circuit shown in the figure . Given potential at A is 90 V , $C_1 = 20\mu F$, $C_2 = 30\mu F$, $C_3 = 15\mu F$. (3)



14. Establish a relation between electric current and drift velocity. (3)

15. Given the resistances of 1Ω, 2 Ω and 3 Ω. How will you combine them to get an equivalent resistance of 11/3 Ω and 11/5 Ω? (3)

16. Derive an expression for the magnetic field due to a solenoid. (3)

17. A short bar magnet of magnetic moment $M = 0.32 J/T$ is placed in a uniform magnetic field of 0.15 T. If the bar is free to rotate in the plane of the field , which orientation would correspond to it's a) stable and b) unstable equilibrium? What is the potential energy of the magnet in each case? (3)

18. Show by taking examples that Lenz's law is in accordance with the law of conservation of energy. (3)

18. How is a galvanometer converted into an ammeter? Find the expression for the resistance of the arrangement. (3)

19. Describe the working principle of a moving coil Galvanometer. Why is it necessary to use 1) a radial magnetic field and 2) a cylindrical soft iron core in a galvanometer. Can a galvanometer be used to measure the current ? Explain. (3)

20. Two long straight parallel conductors carry steady current I1 and I2 separated by a distance d. If the currents are flowing in the same direction , show how the magnetic field set up in one produces an attractive force on the other . Obtain the expression of this force . Hence define one ampere. (3)

20 Two cells of emfs 1.5V and 2.0V having internal resistance 0.2 Ω *and* 0.3 Ω respectively are connected in parallel. Calculate the emf and internal resistance of the equivalent cell. (3)

21. Prove that a solenoid behaves like a bar magnet . (3)

23. An elderly woman went alone to the Registrar's office to disburse her property. When she enquired in the office she was asked to get a Xerox copy of the document which works under electrostatic induction. The Xerox shop was far away and across the road. She took the help of the passer-by and got her Xerox done.

a) What values did the passer-by have?

b) How does a Xerox machine works, as the paper is neutral ? (4)

24. (a) Deduce an expression for the capacitance of a parallel plate capacitor when a conducting slab is inserted between the plates. Assume that the slab thickness to be less than the plate separation.
(b) A capacitor of 20 μF and charged to 500 V is connected in parallel to another capacitor of 10 μF charged to 200 V. Find the common potential. (5)

25. Define electric dipole moment. Is it scalar or vector ? Derive the expression for the electric field of a diople at a point on the equatorial plane of the diople.
Draw the equipotential surfaces due to an electric dipole . Locate the points where the potential due to the dipole is zero. (5)

26. State the principle of working of a potentiometer.
In the following potentiometer AB is a uniform wire of length 1m and resistance 10 Ω. Calculate the potential gradient along the wire and balance length AO (=l). (5)