International Indian School Dammam

First Term Examination-2015

Class-XII

Physics (Theory)

Time allowed: 3 Hours *Maximum Marks: 70*

Set A

GENERAL INSTRUCTIONS:

1. *All questions are compulsory.* ***There are 26 questions in all.***
2. *Question paper contains five sections: section A, section B, section C, section D and section E.* ***Total number of printed pages is 7.***
3. *Section A contains five questions of one mark each, Section B contains five questions of two marks each, Section C contains twelve questions of three marks each, Section D contains one value based question of four marks and Section E contains three questions of five marks each*
4. *There is no overall choice. However an internal choice has been provided in one question of two marks, one question of three mark and all three questions of five marks each. You have to attempt only one of the given choices in such questions.*
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.*
7. *Attempt all parts of a question together. Symbols have their usual meaning.*
8. ***Draw necessary diagrams to explain your answer.***

$c = 3 \times 10^8\ m/s$ $h = 6.63 \times 10^{-34}\ J\,s$

$e = 1.6 \times 10^{-19}\ C$ $\mu_0 = 4\pi \times 10^{-7}\ T\,m\,A^{-1}$

$\varepsilon_o = 8.854 \times 10^{-12}\ C^2\,N^{-1}\,m^{-2}$ $1/4\pi\varepsilon_0 = 9 \times 10^9\ N\,m^2/C^2$

$m_e = 9.1 \times 10^{-31}\ kg$ $m_p = 1.673 \times 10^{-27}\ kg$

$m_n = 1.675 \times 10^{-27}\ kg$

Avogadro Number = 6.022×10^{23} per gram mole

Boltzmann constant = $1.38 \times 10^{-23}\ J\,K^{-1}$

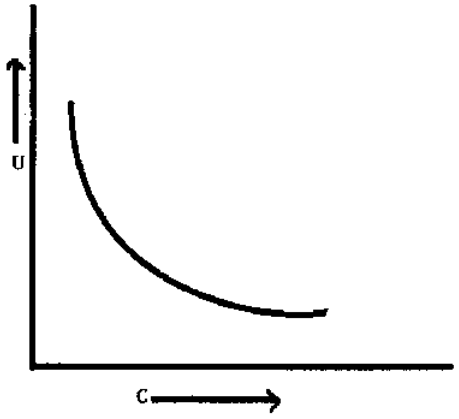
Rydberg Constant $R = 1.097 \times 10^7\ m$

Section A

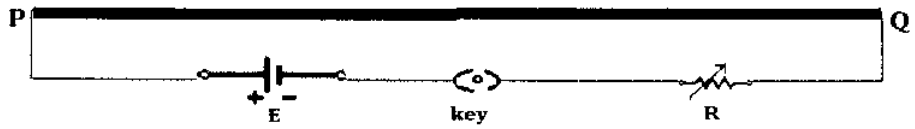
1. When is the force F experienced by a moving charge in magnetic field B is

   (i) maximum (ii) minimum

2. The graph given below shows the variation of stored potential energy U with capacitance C of a capacitor. Which quantity kept constant during charging for this graph.



3. In the circuit given below what is the effect on potential gradient along wire PQ if the variable resistance R increases.



4. Draw the graph to show the variation of resistivity of silicon as function of temperature.

5. The electric field due to a charge configuration is independent of distance from the charge. Identify the charge configuration.

Section B

6. Why the connections between the resistors in a meter bridge made of thick copper strips.

7. Show that **E = - dV/dr.**

OR

Draw electric field lines for a pair of charges $q_1q_2>0$

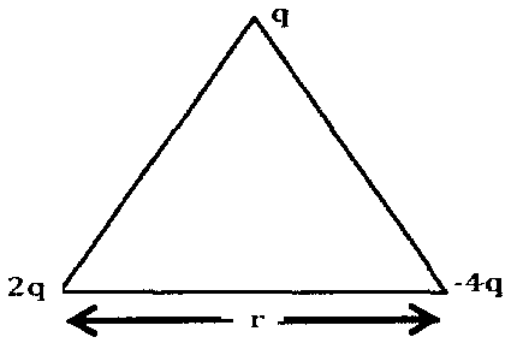
8. State and prove the principle of Wheatstone bridge.

9. A beam of alpha particles and of protons enters perpendicular to the uniform magnetic field B with same speed v. What is the ratio of radii of their circular path.

10. A low voltage supply from which one needs high currents must have very low internal resistance. Why?

Section C

11.Calculate the amount of work done required to dissociate the charges of given configuration placed at the vertices of an equilateral triangle of side r .



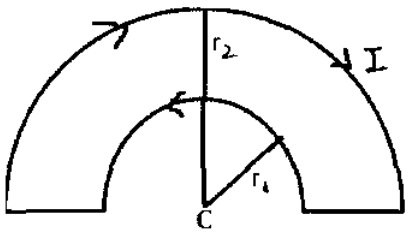
12. A conductor of length L is connected to a dc source of potential V. If conductor is uniformly stretched to three times of its original length, keeping V constant, explain its effect on drift speed of electrons and resistance of the conductor.

13. Derive an expression for the electric potential due to point charge. Define SI unit of electric potential.

14. Derive relation for electric field at distance r from midpoint on the axis of a short dipole of charges $\pm q$ and dipole length $2a$.

15. Derive relation for electrostatic energy stored and energy density in a parallel plate capacitor of plate area A and separation d having surface charge density $\sigma\ Cm^{-2}$.

16. Two concentric semicircular loops of radii r_1 and r_2 are arranged as figure. What is the magnetic field B at the centre C of the configuration .



17. Derive an expression for the force between two parallel conductors carrying currents I_1 and I_2 in same direction placed in air at distance d and hence define SI unit of electric current.

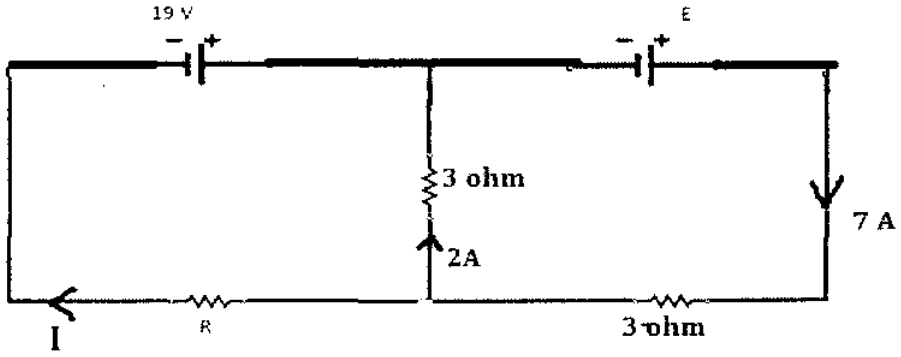
OR

A current carrying rectangular loop of area A is placed in uniform external magnetic field B. Derive an expression for torque experienced and hence define SI unit of magnetic field.

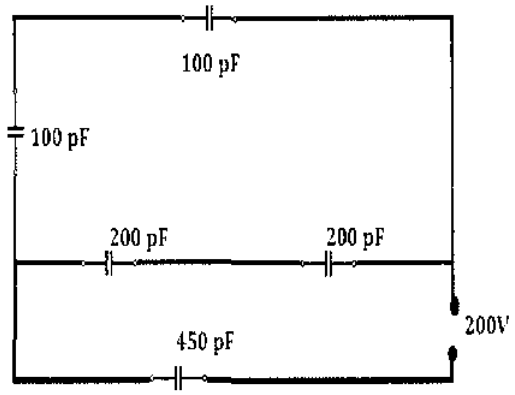
18. Derive an expression for effective emf and internal resistance if two cells of ε_1, r_1 and ε_2, r_2 are connected in parallel.

19. An electron of mass m and charge e is revolving around nucleus of hydrogen atom with speed v. Derive necessary relation for its magnetic moment.

20. What is the current I, emf E and resistance R in the electrical network given below.



21. Calculate C_{eq} and net charge accumulated in network given below.



22. A voltmeter, an ammeter and a resistance are connected in series. When this arrangement is connected with a battery some deflection shown in voltmeter but explain why deflection of ammeter is zero.

Section D

23. *chelsia, a science student of grade 12 during her studies was very interested in working of nervous system. She studied that nervous system depends on the electrical signals. Neurons pass on signals from sensory organs to the brain.*

The passage of an electrical signal constitute current. Chelsia was curious to know about the range of currents in different situations. In nervous system it is in range of few micro amperes while during lightning its range is of tens of thousands of amperes.

She discussed with her teacher about the range of magnetic field produced by these currents.

(i) What are the values shown by Chelsia.

(ii) A charged particle enters an environment of a strong and non-uniform magnetic field varying from point to point both in magnitude and direction, and comes out of it following complicated trajectory. What will be the relation, in magnitude and direction, in its final speed and initial speed if it suffers no collisions with the environment.

Section E

24. (i) With help of schematic diagram explain the principle and working of a cyclotron.

(ii) The wires which connect the battery of an automobile to its starting motor carry a current of 300 A for a short time interval. What is the force per unit length between the wires if they are 70 cm long and 1.5 cm apart? Is the force is attractive or repulsive?

OR

(i) With help of schematic diagram explain the principle and working of a moving coil galvanometer.

(ii) A galvanometer coil has a resistance of 12 Ω and the metre shows full scale deflection for a current of 3mA. Calculate the resistance 'R' required to convert into a voltmeter of range 0-18 V.

25. (a) Derive relation for electric field due to a long line of charge using Gauss theorem.

(b) A point charge of 2 μ C is placed at the centre of a cubic Gaussian surface of 10 cm side. Calculate the net electric flux through one face of cube.

OR

(a) Derive relation for electric field due to a plane sheet of charge using Gauss theorem.

(b) An infinite line charge produces a field of 9×10^4 N/C at a distance of 2 cm. Calculate the linear charge density.

26. (a) State the principle of potentiometer. Explain with help of a circuit diagram how can you find internal resistance of a cell using potentiometer.

(b) A battery of 10V,3Ω is connected to a resistor R. If the current in the circuit is 0.5 A, calculate the resistance of the resistor and terminal voltage across it.

OR

(a) State the principle of meter bridge. Explain with help of a circuit diagram how can you find unknown resistance using meter bridge.

(b) n identical resistors each of resistance R given. How you will combine them to get (i) maximum (ii) minimum effective resistance. Also find the ratio of maximum to minimum resistance.
