International Indian School Dammam

First Term Examination-2017

Class-XII

Physics (Theory)

Time allowed: 3 Hours *Maximum Marks: 70*

Set A

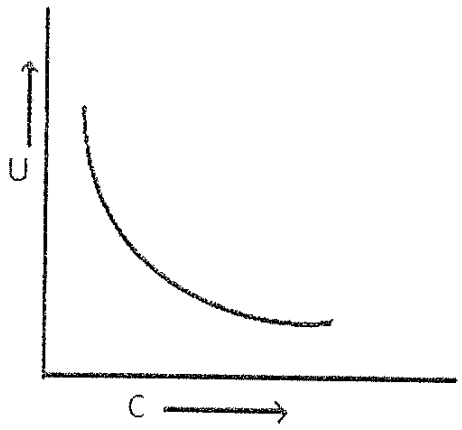
GENERAL INSTRUCTIONS:

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.***

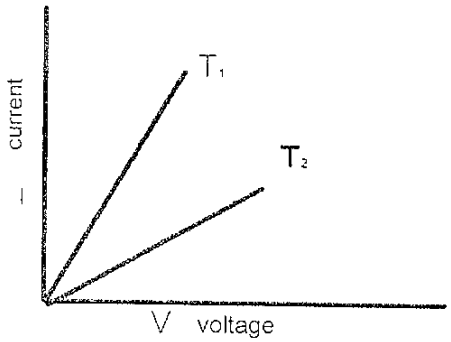
$c = 3 \times 10^{8}$ m/s
$e = 1.6 \times 10^{-19}$ C
$\varepsilon_0 = 8.854 \times 10^{-12}\ C^2\ N^{-1}\ m^{-2}$
$m_e = 9.1 \times 10^{-31}$ kg
$m_n = 1.675 \times 10^{-27}$ kg
$h = 6.63 \times 10^{-34}$ J s
$\mu_0 = 4\pi \times 10^{-7}\ T\ m\ A^{-1}$
$1/4\pi\varepsilon_0 = 9 \times 10^{9}\ N\ m^2/C^2$
$m_p = 1.673 \times 10^{-27}$ 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. Define Angle of inclination. What is its magnitude at North pole.
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. I-V graph for a metallic wire at two temperature shown in the figure. which of these two temperature is higher.



4. Draw the graph to show the variation of resistivity of silicon as function of temperature.
5. Why two electric field lines never cross each other.

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 such that $q_1q_2 > 0$.

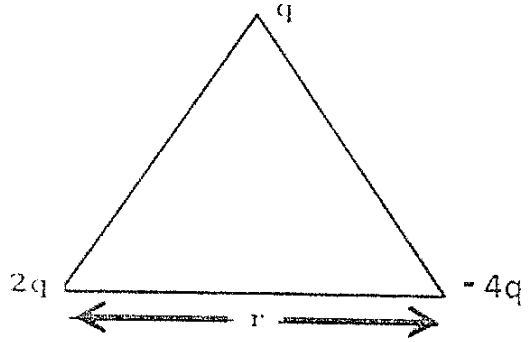
8. State and prove the principle of Wheatstone bridge.

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. Why do we prefer a potentiometer to measure the emf of a cell rather than volt-meter.

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.



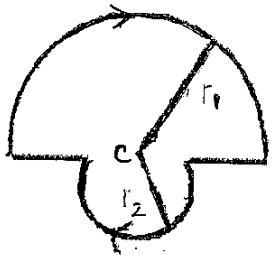
12. A conductor of length L is uniformly stretched to four times of its original length, keeping V constant, explain its effect on drift speed of electrons and resistance of the conductor.

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

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

15. Derive relation for electric field at distance r on the perpendicular bisector of a short dipole of charges $\pm q$ and dipole length $2a$.

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 long 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

Explain the Classification of substances on the basis of magnetic properties- permeability, Relative permeability and susceptibility.

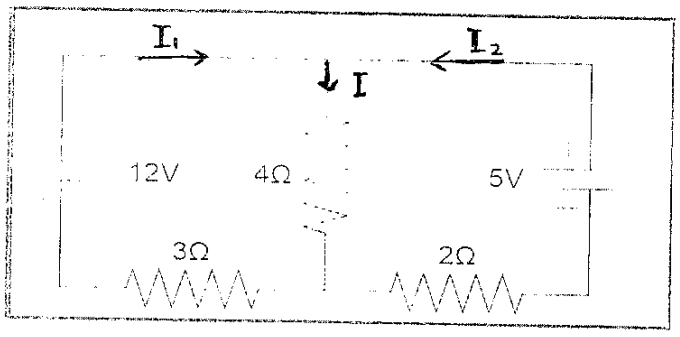
Give atleast one example of each category.

State curie's law and draw a graph to show susceptibility as a function of temperature in case of a ferromagnetic substance.

18. Derive an expression for effective emf $\mathcal{E}_{eq}$, and internal resistance r_{eq}, if two cells of $(\mathcal{E}_1, r_1)$ and $(\mathcal{E}_2, r_2)$ are connected in parallel.

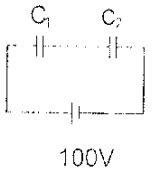
19. An electron of mass m and charge e is revolving around nucleus of hydrogen atom with speed v. Derive necessary relation for its magnetic moment. Also define Bohr Magneton.

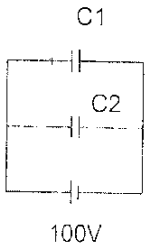
20. Determine the current flowing through each resistor in the electrical network given below.



21. An ammeter and milliammeter are converted from same type of moving coil galvanometer. Out of the two which measuring meter have higher resistance. Explain your answer using formula.

22. Two capacitors of unknown capacitances C_1 and C_2 are connected first in series and then in parallel across a battery of 100 V. If the energy stored in the two combinations is 0.045 J and 0.25 J respectively, determine the value of C_1 and C_2.





Section D

23. Value Based Question

Harshal's sister was using washing machine and being in a hurry put few extra the lid had not closed properly. Even on taking out the extra clothes from the machine the lid did not close. Harshal was requested to help her but he also could not succeed. On closer observation Harshal observed that the mechanism of lid closure was of a different nature and not mechanical.

He went through the machines user manual and found that it was a different mechanism and had to be replaced. He later bought a magnetic lid closer and replaced the old one. The machine started working. Sister expressed her thanks to Harshal.

Answer the following questions based on above information.

(i) Which Physics concept is used in the functioning of lid/ door closer of electric devices used commonly.

(ii) Name any two common devices in which this concept is used.

(iii) Which values are reflected in Harshal's behavior and action.

Section E

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

(ii) Two long and parallel straight wires carrying currents of 2 A and 5 A in the opposite directions are separated by a distance of 1 cm. Find the nature and magnitude of the force.

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 15 Ω and the meter shows full

scale deflection for a current of 5 mA. Calculate the shunt resistance required to convert into a voltmeter of range 0-12 V.

25. (a) Derive relation for electric field due to a long line charge distribution of linear charge density λ C m^{-1} using Gauss theorem.

(b) A point charge of 5 μ C is placed at the centre of a cubical Gaussian Surface of 12 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 having uniform surface charge density σ Cm^{-2} using Gauss theorem.

(b) Two charges 5μC and -2 μC are placed at points (5cm,0,0) and (23cm,0,0) in a region of space where there is no external field. Calculate the electro static potential energy of this charge system.

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) Given the resistances of 1Ω, 2 Ω and 3 Ω respectively, how will you combine them to get equivalent resistance of (i) 11/3 Ω and (ii) 6/11 Ω.

OR

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

(c) Five lead-acid type of secondary cells each of specification (2V,1.0 Ω) are joined in series to provide a supply to a resistance of 10 Ω. What are the current drawn and its terminal voltage.