INDIAN SCHOOL SOHAR
UNIT TEST- 2017
PHYSICS – THEORY

CLASS:XII **MARKS:50**
DATE: 16 /5/17 **TIME: 2hrs**

General Instructions:

1. All questions are compulsory.
2. There are 19 questions in all .Questions 1 to 4 carry one mark each, questions 5 to 8carry two marks each, questions 9to 16 carry three marks each, questions 17 is a value based question of four marks and questions 18 and 19 carry five marks each.
3. There is no overall choice. However, internal choice has been provided in one question of two marks, one question of three marks and two question of five marks each. You have to attempt only one of the given choices in such questions
4. Use of calculator is not permitted.
5. You may use the following physical constants wherever necessary

$C = 3X\ 10^8$ m/s $h = 6.626\ X10^{-34}$ Js $e = 1.6X\ 10^{-19}$ c

$\frac{1}{4\pi\varepsilon o} = 9\ X\ 10^9\ Nm^2/c^2$ $N_A = 6.023\ X10^{23}$/mol

Mass of proton$=1.676\ X\ 10^{-27}$ kg Mass of neutron$=1.675\ X\ 10^{-27}$ kg

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1. A point charge Q is placed at a point O as shown in the figure. Is the potential difference $V_A - V_B$ positive, negative or zero, if Q is (i) positive (ii) negative ? (1)

•Q----------•A----------•B

2. A point charge (+ Q) is kept in the vicinity of uncharged conducting plate. Sketch electric field lines between the charge and the plate. (1)

3. Define electric flux. Mention its unit. (1)

4. Can two equipotential surfaces intersect? Justify. (1)

5. Derive an expression for the torque experienced by electric dipole of dipole moment **P** in a uniform electric field. (2)

OR

5. Derive an expression for potential energy stored by electric dipole of dipole moment **P** in a uniform electric field. (2)

6. Find the charge on the capacitor as shown in the circuit.

7. Plot a graph showing the variation of coulomb force (F) versus $(\frac{1}{r^2})$ where r is the distance between the two charges of each pair of charges :(1μC,2 μC) and (2 μC,-3 μC). Interpret the graphs obtained. (2)

8. Obtain an expression for the equivalent emf and equivalent internal resistance of two cells connected in series. (2)

9. Using Gauss's law in electrostatics, deduce an expression for electric field intensity due to uniformly charged infinite sheet. If another identical sheet is placed parallel to it, show that there is no electric field in the region between the two sheets. (3)

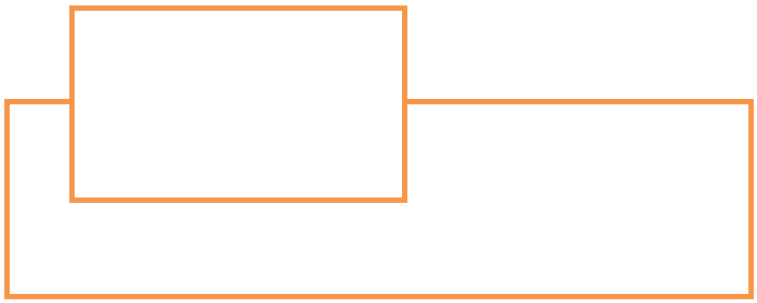
OR

9. Obtain an expression of potential energy to dissociate a system of three charges in the absence of external electric field. (3)

10. A charge Q is distributed uniformly over a metallic shell of radius R. Obtain the expression for the electric field (E) and electric potential (V) at a point $0 < x < R$.
Show on a plot the variation of E and V with x for $0 < x < 2R$. (3)

11. Three concentric metallic shells A, B and C of radii a, b and c ($a < b < c$) have surface charge densities $+\sigma$, $-\sigma$,$+\sigma$ respectively. If shells A and C are at the same potential, then obtain relation between the radii a,b,c. (3)

12. Determine the voltage drop and power across the resistor R_1 in the circuit given below with E = 60 V. (3)



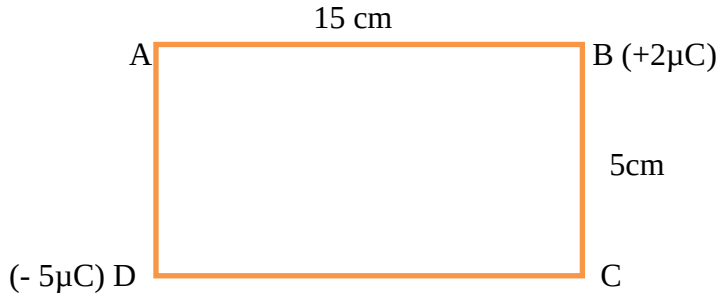
13 . (a) Depict the equipotential surfaces for a system of two identical positive point charges placed a distance 'd' apart.
(b) Deduce the expression for the potential energy of a system of two point charges q_1 and q_2 brought from infinity to the points $\vec{r_1}$ and $\vec{r_2}$ respectively in the presence of external electric field $\vec{E}$. (3)

14. Derive its relationship with relaxation time in terms of the electric field **E** applied to a conductor. A potential difference V is applied to a conductor of length L. How is the drift velocity affected when V is doubled and L is halved? (3)

15. Derive an expression for the resistivity of a good conductor, in terms of the relaxation time of electrons .Hence discuss the behaviour of a semiconductor with the increase in temperature. (3)

16. The sides of a rectangle ABCD are 15cm and 5cm as shown in the figure. Point

charges of -5μC and 2μC are placed at the corners D and B respectively. Calculate electric potential at A and C. Also , calculate work done in carrying a charge of 3 μC from A to C.



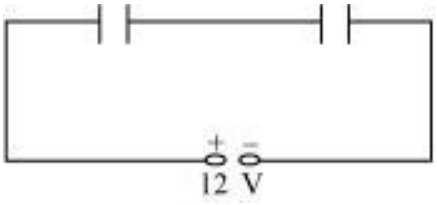
17. Some students of class XI were playing in the ground. All of a sudden, thunder storm with lightening occurred. Students ran towards a tree for protection. Akshil, student of class XII was playing with them. He advised students of class XI not to stand under a tree. They were asked by him to sit in a bus parked near the ground. All the students entered the bus and protected themselves.
(a) Why did Akshil advise the students to sit in the bus?
(b) What values are shown by Akshil? (4)

18.(a) Obtain an expression for the energy stored in a parallel plate capacitor of capacitance C with air as medium between its plates having charges Q and –Q. Hence obtain an expression for energy density.
(b)The two plates of a parallel plate capacitor are 4mm apart. A slab of dielectric constant 3 and thickness 3mm is introduced between the plates with its faces parallel to them. The distance between the plates is so adjusted that the capacitance of the capacitor becomes 2/3 of its original value. What is the new distance between the plates.

OR

18.(a) State Gauss's law in electrostatics. Use this law to derive an expression for the electric field due to an infinitely long straight wire of linear density λ C/m.
(b) Four equal charges each of +2μC are placed at the four corners of a square of side 50 cm. Find the force on any one of the charges. (5)

19. (a) Obtain the expression for the capacitance of a parallel plate capacitor in vacuum in terms of plate area A and separation d between the plates.
(b) Two parallel plate capacitors, X and Y, have the same area of plates and same separation between them. X has air between the plates while Y contains a dielectric medium of $\epsilon_r = 4$.



(i) Calculate capacitance of each capacitor if equivalent capacitance of the combination is 4 μF.
(ii) Calculate the potential difference between the plates of X and Y.
(iii) What is the ratio of electrostatic energy stored in X and Y?

OR

19. (a) Obtain an expression for the electric field due to electric dipole at a point P on the axis. What is the direction of this field.
(b) Two point charges of + 16μC and -9 μC are placed 8cm apart in air. Determine the position of the point at which the resultant electric field is zero. (5)