SAMPLE PAPER - 2014
PHYSICS
Class – XII

Time:- 3hrs   Max. Marks- 70

Instructions:

➢ All questions are compulsory.

➢ There are <u>26</u> questions in total. Questions <u>1to5</u> are very short answer type questions and carry one mark each.

➢ Questions <u>6to10</u> carry two marks each, questions <u>11to22</u> carry three marks each, question <u>23</u> carries four marks and questions <u>24to26</u> carry five marks each.

➢ There is no overall choice. However an internal choice has been provided in one question of two marks, one question of three marks and all three questions of five marks each. You have to attempt only one of the choices in such questions.

➢ Use of Calculator is not permitted. However, you may use log tables if necessary.

➢ You may use the following values of physical constants whenever necessary:

$c = 3 \times 10^8 m/s$ $e = 1.6 \times 10^{-19} c$ $h = 6.63 \times 10^{-34} Js$

$\mu = 4\pi \times 10^{-7} TmA^{-1}$ $1/4\pi\varepsilon_0 = 9 \times 10^9 Nm^2 c^{-2}$ $m_e = 9.1 \times 10^{-31} kg$

1. What is the work done in moving a test charge over an equipotential surface?

2. Sketch a graph to show how the charge Q acquired by a capacitor of capacitance C varies with increase in potential difference between its plates.

3. Why is the terminal voltage of a cell less than its emf ?

4. What is the function of soft iron cylinder between the poles of a galvanometer?

5. Why is spark produced in the switch of a fan, when it is switched off?

6. The given graph shows the variation of charge q versus potential difference v for two capacitors c_1 and c_2. The two capacitors have same plate separation but the plate area of c_2 is double than that of c_1. Which of the lines in the graph corresponds to c_1 and c_2 and why?
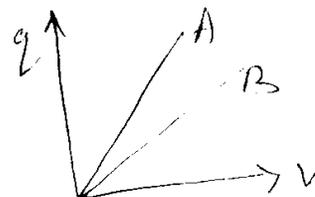
7. Nichrome and copper wires, having same length and same area of cross section, are connected across a battery in turn. In which case the rate of production of heat will be higher?

OR

Why an electric bulb becomes dim when an electric heater in parallel circuit is switched on? Why dimness decreases after some time?

8. Two identical circular wires P and Q each of radius Rand carrying current I are kept in perpendicular planes such that they have a common centre as shown. Find the magnitude and direction of the magnetic field at the common centre of the two coils.
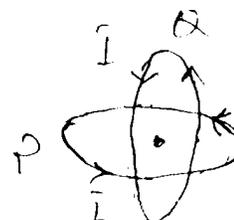
9. A light bulb and an open coil inductor are connected to an a.c source through a key as shown in the figure. The switch is closed and after some time, an iron rod is inserted into the interior of the inductor. The glow of the light bulb:

   (a) increases, (b) decreases, (c) is unchanged as the iron rod is inserted.

   Give your answer with reasons. What will be your answer if a.c source is replaced by d.c?
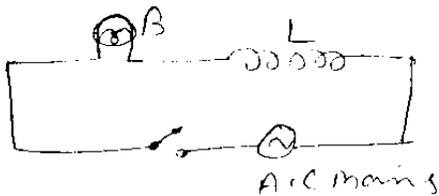
10. Half life and decay constant of a radioactive sample is $T_{1/2}$ and λ respectively. Derive the relation between them.

11. State Gauss's theorem in electrostatics. Using this theorem, derive an expression for the electric field intensity due to an infinitely long straight wire of linear charge density λ c/m.

12. A slab of material of dielectric constant K has the same area as the plates of a parallel plate capacitor but thickness d/2, where 'd' is the separation between the plates. Find the expression for the capacitance when the slab is inserted between the plates.

13. Define the term drift velocity. Establish a relation between current and drift velocity.

14. Define the term potential gradient. With the help of a circuit diagram, explain how a potentiometer can be used to compare the emfs of two primary cells.

15. Use Kirchoff's laws to calculate the values of currents I_1, I_2 & I_3 in the circuit diagram.
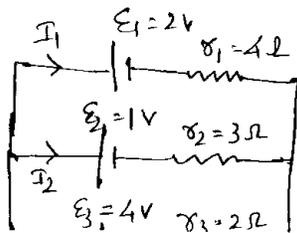
16. State Ampere's circuital law. Use this law to calculate the magnetic field due to a toraidal solenoid.

17. Two straight long parallel wires carrying current I_1 and I_2 in the same direction. Deduce the expression for the force per unit length between them. Hence define an ampere.

18. A wheel with 10 metallic spokes each 0.5m long is rotated with a speed of 120 rev/min in a plane normal to the horizontal component of earth's magnetic field B_H at a place. If B_H= 0.4 Gauss at the place, what is the induced emf between the axel and the rim of the wheel?

19. Define mutual inductance. Derive an expression for the mutual inductance of two long co-axial solenoids of same length around over the other.

<div align="center">OR</div>

   Define self inductance. Derive an expression for the self inductance of a long solenoid.

20. Describe Davisson and Germer experiment to establish the wave nature of electrons.

21. Show that the speed of an electron in the innermost orbit of H- atom is 1/137 times the speed of light in vacuum.

22. State the law of radioactive disintegration. Using this law, show that the radio active decay is exponential in nature.

23. Vikas once observed that the large number of electric generators used in areas where small workshop existed, produced lot of pollution. He decided to do something for controlling pollution. He along with his some friends, made a survey and concluded that like in society apartments, a common generator could be set up for all such workshop, so that noise and air pollution could be reduced considerably. They had a tough time in convincing the local bodies and they were going to some NGOs and other financiers to help them to set up a big generator. It was admirable to see their perseverance.

   (a)   What are the values being displayed by Vikas and his friends?

   (b)   State the factors on which the induced emf in a coil rotating in a uniform magnetic field depends.

24. (a)   Why does the capacitance of a conductor increase, when an earth connected conductor is placed near it? Briefly explain.

   (b)   Three identical capacitors C_1, C_2 & C_3 of capacitance $6\mu F$ each are connected to a 12 v battery as shown:
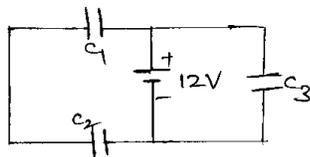
    Find (i)   Charge on each capacitor

           (ii)   Equivalent capacitance of the network

          (iii)   Energy stored in the network of capacitor.

OR

Show that the electric field of a short dipole at a distance 'r' along its axis is twice the electric field at the same distance along the equatorial line.

25. Discuss the principle, construction and working of a cyclotron with a labeled diagram.

OR

Describe the principle, construction and working of a moving coil galvano meter with labeled diagram.

26 (a)   Using Phasor diagram, derive an expression for the impedance of a series LCR circuit.

   (b)   Obtained the resonant frequency w_0 of a series LCR circuit with L=2.0H, C=32μF and R=10Ω. What is the Q – value of the circuit?

OR

As shown in the diagram, the arm PQ of the rectangular conductor is moved from x=0 to the right side. The uniform magnetic field is perpendicular to the plane and extends from x=0 to x=b and is zero for x>b. Only the arm PQ possesses substantial resistance 'r'. Consider the situation when the arm PQ is pulled out wards from x=0 to x=2b and is then moved back to x=0 with constant speed v. Obtain expression for the flux, the induced emf, the force necessary to pull the arm and the power dissipated as Joule heat. Sketch the variation of these quantities with time.

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