

ST. JOSEPH'S ACADEMY, DEHRADUN
CYCLIC TEST JULY, 2024-25

SUBJECT: PHYSICS

CLASS: XII

M.M.: 40 TIME: 1 HOUR 15 MINUTES

NAME OF THE STUDENT..... CLASS/SECTION..... ROLL NO.....

SECTION-A
(COMPULSORY)

Question 1. Answer the following questions: -

- (i) What are the dimensions of electric field intensity? [1]
- (ii) State Gauss Theorem. [1]
- (iii) Can two equi-potential surfaces intersect? Explain. [1]
- (iv) Connect three capacitors of $3\mu\text{F}$, $3\mu\text{F}$ and $6\mu\text{F}$ in such a way that their equivalent capacitance is $5\mu\text{F}$. [1]
- (v) Show graphically how electrical resistance of silicon and germanium varies when temperature is varied. [1]

Question 2. Answer the following questions: -

- (i) Two identical cells, whether joined together in series or in parallel, give the same current when connected to an external resistance of 1Ω . Find internal resistance of each cell. [2]
- (ii) We have a $30\text{ W}-6\text{ V}$ bulb which we want to glow by a supply of 120 V . What will have to be done for it. [2]
- (iii) A parallel-plate capacitor with air between the plates has a capacitance of 8 pF . What will be the capacitance if the distance between the plates is reduced by half and the space between them is filled with a substance of dielectric constant 6? [2]
- (iv) Give the properties of equi-potential surface. [2]
- (v) The electric field due to a charged conducting sphere of radius 10 cm , at a distance of 20 cm from the centre of the sphere is $1.5 \times 10^3\text{ N C}^{-1}$ and points radially inwards. What is the charge on the sphere? [2]

SECTION - B
(ATTEMPT ANY FIVE QUESTIONS)

Question 3. Two equal point charges $Q = \sqrt{2}\mu\text{C}$ are placed at each of the two opposite corners of a square and equal point charges q at each of the other two corners. What must be the value of q so that the resultant force on Q is zero. [5]

Question 4. A drop having a mass of $4.8 \times 10^{-10}\text{ gm}$ and a charge of $2.4 \times 10^{-18}\text{ C}$ is suspended between two charged horizontal plates at a distance 1.0 cm apart. Find the potential difference between the plates. If polarity of the plates be changed then calculate the instantaneous acceleration of the drop. [5]

Question 5. Derive an expression for capacitance of a parallel plate capacitor if this dielectric slab is kept between the plates. [5]

Question 6. A heating element using nichrome connected to a 230 V supply draws an initial current of 3.2 A which settles after a few seconds at a steady value of 2.8 A . What is the steady temperature of the heating element if the room temperature is 27°C ? Temperature coefficient of resistance of nichrome averaged over the temperature range involved is $1.7 \times 10^{-4}\text{ per }^\circ\text{C}$. [5]

Question 7. Two cells of emf 6 V and 12 V and internal resistances 1Ω and 2Ω respectively are connected in parallel so as to send current in the same direction through an external resistance of 15Ω . Draw the circuit diagram. Using Kirchhoff's Laws, calculate current through each branch of the circuit and PD across the 15Ω resistance. [5]

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