Kalyani School

PERIODIC TEST- I (2025-26)
QUESTION PAPER

Subject: Physics (042) | **Grade: XII**
Marks: 25 | **Time: 1 Hour**
Name: ---------- | **Date: 24-06-2025**

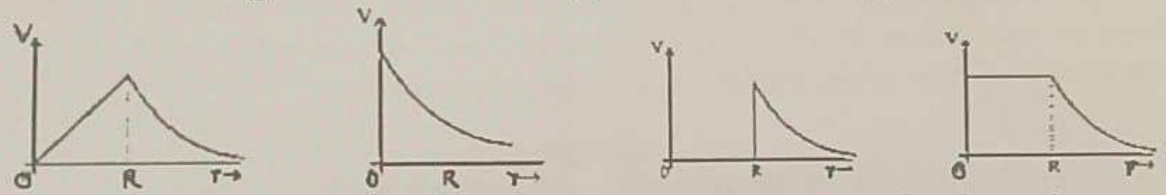
General Instructions:

i. The question paper comprises five sections– A, B, C, D & E. There are 12 questions in the question paper. All questions are compulsory.
ii. Section A - Question Nos. 1 to 4 contain Multiple Choice Questions, carrying 1 mark each and Question Nos. 5 and 6 are Assertion - Reason Type Questions, carrying 1 mark each.
iii. Section B - Question Nos. 7 and 8 are Short Answer Type Questions, carrying 2 marks each.
iv. Section C - Question Nos. 9 and 10 are Short Answer Type Questions, carrying 3 marks each.
v. Section D - Question No. 11 is a Long Answer Type Question, carrying 5 marks.
vi. Section E - Question No. 12 is a Case Based Question, carrying 4 marks.
vii. There is no overall choice. However, internal choices have been provided in some questions. Attempt only one of the alternatives in such questions.

SECTION - A

1 Which of the following graphs shows the variation of electric potential 'V' due to a hollow spherical conductor of radius 'R' as a function of distance 'r' from the centre of the sphere? [1]

(a) (b) (c) (d)



2 S_1 and S_2 are two hollow concentric spheres (S_2 outer sphere and S_1 inner sphere) enclosing charges 9Q and 3Q respectively. The ratio of electric flux through S_1 and S_2 when a medium of dielectric constant 3 is filled in S_2 is _____: [1]

(a) 9 : 10 (b) 10 : 9 (c) 1 : 3 (d) 3 : 1

3 Two spheres have their surface charge densities in the ratio of 2 : 3, and their radii are in the ratio of 3 : 2. The ratio of the charges on them is: [1]

(a) 3 : 2 (b) 4 : 2 (c) 2 : 4 (d) 2 : 3

4 A parallel plate capacitor having an area 'A' and separated by a distance 'd' is filled by a copper plate of dielectric constant 'K = 2', area 'A' and thickness 'b' (b< d). The new capacitance is: [1]

(a) $\varepsilon_0 A / (d - b/2)$ (b) $\varepsilon_0 A / 2d$ (c) $\varepsilon_0 A / (d - b)$ (d) $\varepsilon_0 A / (d + b/2)$

For Question Nos. 5 and 6, two statements are given - one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the options given below:

(a) Both Assertion and Reason are true, and Reason is the correct explanation of the Assertion.
(b) Both Assertion and Reason are true, but Reason is not the correct explanation of the Assertion.
(c) Assertion is true, but Reason is false.
(d) Both Assertion and Reason are false.

5 **Assertion (A):** An electric dipole is placed in a non-uniform electric field parallel to it. The dipole will not move in any direction. [1]
Reason (R): The net force and net torque acting on a dipole in a non-uniform electric field are always zero.

6 **Assertion (A):** When two conductors charged to different potentials are connected, the negative charge always flows from the lower potential to the higher potential. [1]
Reason (R): In the charging process, there is only a flow of electrons.

SECTION - B

7 (a) Define electric flux. Write its SI units. [1+1]
(b) A spherical rubber balloon carries a charge that is uniformly distributed over its surface. As the balloon is blown up and increases in size, how does the total electric flux coming out of the surface change? Give reason.

8 (a) Draw the pattern of electric field lines when a point charge is kept near an uncharged conducting plate. [1+1]
(b) Plot a graph showing the variation of coulomb force (F) versus $(1/r^2)$ where 'r' is the distance between the two pair of charges: $(3\mu C, 3\mu C)$ and $(2\mu C, -3\mu C)$.

SECTION - C

9 A charged ball 'B' hangs from a silk thread 'S', which makes an angle 'θ' with a large charged conducting sheet 'P', as shown in the figure given below. Determine the surface charge density of the sheet in terms of θ. [3]

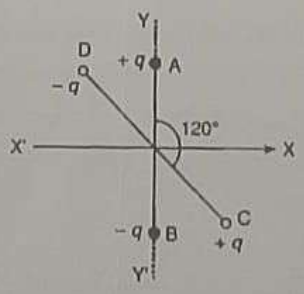
10 The capacitance of a parallel plate capacitor is 50 pF, and the distance between the plates is 4 mm. It is charged to 200 V, and then the charging battery is removed. Now, a dielectric slab (K = 4) of thickness 2 mm is placed. Determine (i) the final charge on each plate, (ii) the final potential difference between the plates, and (iii) the final energy of the capacitor. [3]

SECTION - D

11 (a) Use Gauss' law to derive the expression for the electric field 'E' due to a uniformly charged infinite thin sheet of charge density 'σ' Cm^{-2}. [3+2]
(b) Draw a graph to show the variation of 'E' with perpendicular distance 'r' from the sheet.
(c) Find the work done by bringing a charge 'q' from perpendicular distance 'r_1' to 'r_2' ($r_2 < r_1$) against the electric field of an infinite charged wire, having linear charge density 'λ'.

OR

(a) Two small identical electrical dipoles AB and CD, each of dipole moment 'p' is kept at an angle of 120° as shown in the figure given below. Determine the resultant dipole moment of this combination. If this system is subjected to an electric field 'E' directed along x - axis, what will be the magnitude and direction of the torque acting on this?



(ii) Two infinitely thin charged parallel wires 1 and 2 having linear charge densities 'λ' and '-2λ' are separated by a distance 'd'. Calculate the distance from the wire '2' where the electric field is zero.

Van't Hoff factor is used in such cases, which is the ratio of normal molecular mass over observed molar mass.

(a) What will happen if blood cells are placed in saline water (hypertonic solution)? [1]

(b) What is the effect of temperature and pressure on the solubility of gas in liquid? [1]

(c) For a 5% solution of urea (molar mass 60 g mol^{-1}), calculate the osmotic pressure at 300 K. ($R = 0.0821$ L atm k^{-1}). [2]

OR

(c) At what mole fraction of 'A', will the vapour pressure of A ($P^\circ_A = 450$ mm) and the vapour pressure of B ($P^\circ_B = 200$ mm) in solution be equal if both A and B form an ideal solution?

SECTION – E

12. (a) The electrical resistance of a column of 0.05 M KOH solution of diameter 1 cm and length 45.5 cm is 4.55×10^3 ohm. Calculate its molar conductivity. [3]

(b) State the law that helps to determine the limiting molar conductivity of a weak electrolyte. [1]

(c) What is limiting molar conductivity? [1]

OR

(a) Calculate the emf of the following cell at 25° C: [3]

$Fe|Fe^{2+}(0.001\ M)\ ||\ H^+(0.01\ M)\ |H_2(g)\ (1bar)\ |Pt(s)$

$E^\circ(Fe^{2+}|Fe) = -0.44$ V

$E^\circ(H^+|H_2) = 0.00$ V

(b) In a galvanic cell, the following cell reaction occurs: [2]

$Zn(s) + 2Ag^+(aq) \rightarrow Zn^{2+}(aq) + 2Ag(s)$ $\quad E^0$ cell $= +1.56$ V

(i) Is the direction of flow of electrons from zinc to silver or from silver to zinc?

(ii) How will the concentration of Zn^{2+} ions and Ag^+ ions be affected when the cell functions?
