S.N.B.P's International School
Academic Year 2025-26

Periodic Test – I

SET B

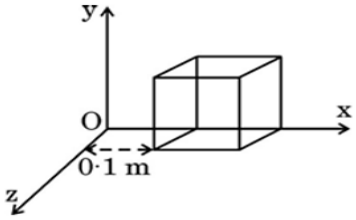
Class: XII | **Day : Monday**
Subject: Physics (042) | **Date : 07/07/25**
Marks: 40 | **Time : 2 Hours**

General Instructions:

1. There are 18 questions in all. All questions are compulsory
2. This question paper has five sections: Section A, Section B, Section C, Section D and Section E. All the sections are compulsory.
3. Section A contains 6 MCQs & 2 Assertion and Reason based question of 1 mark each
4. Section B contains 3 questions of 2 marks each
5. Section C contains 4 questions of 3 marks each
6. Section D contains 1 Case based question of 4 mark each and
7. Section E contains 2 long answer question of 5 marks each.
8. There is no overall choice. However, an internal choice has been provided in section B, C, E. You have to attempt only one of the choices in such questions.
9. Use of calculators is not allowed.

Q No.		Marks
	SECTION A **(Section A consists of 6 Multiple choice questions and 2 Assertion and Reason based questions carrying 1 mark each)**	
1	A battery supplies 0.9 A current through a 2 Ω resistor and 0.3 A current through a 7 Ω when connected one by one. The internal resistance of the battery is : a) 2 Ω b) 1.2 Ω c) 1 Ω d) 0.5 Ω	1
2	The capacitors, each of 4 μF are to be connected in such a way that the effective capacitance of the combination is 6 μF. This can be achieved by connecting a) All three in parallel b) All three in series c) Two of them connected in series and the combination in parallel	1

	to the third. d) Two of them connected in parallel and the combination in series to the third.	
3	The plates P_1 and P_2 of a 2 μF capacitor are to potentials 25 V and – 25 V respectively. The charge on plate P_1 will be : a) 0.02 mC b) 0.1 mC c) 0.1 μC d) 1 μC	1
4	A thin plastic rod is bent into a circular ring of radius R. It is uniformly charged with charge density λ. The magnitude of the electric field at its centre is : a) $\lambda/2\varepsilon_0 R$ b) Zero c) $\lambda/4\pi\varepsilon_0 R$ d) $\lambda/4\varepsilon_0 R$	1
5	The number of electrons flowing through a conductor per second is 3.3×10^{19}. The current flowing through the conductor is : a) 2.0 A b) 3.4 A c) 4.8 A d) 5.3 A	1
6	A point charge situated at a distance 'r' from a short electric dipole on its axis, experiences a force F. If the distance of the charge is '2r', the force on the charge will be : a) F/16 b) F/8 c) F/4 d) F/2	1
	For Questions 7 and 8, two statements are given –one labelled Assertion (A) and other labelled Reason (R). Select the correct answer to these questions from the options as given below. (A) If both Assertion and Reason are true and Reason is correct explanation of Assertion. (B) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion. (C) If Assertion is true but Reason is false. (D) If both Assertion and Reason are false.	
7	Assertion : Work done in moving a charge around a closed path, in an electric field is always zero. Reason : Electrostatic force is conservative force.	1
8	Assertion : The internal resistance of a cell is constant. Reason : Ionic concentration of the electrolyte remains same during use of a cell.	1

	SECTION B **(Section B consists of 3 Very Short questions carrying 02 marks each)**	
9	Obtain an expression for electrostatic potential energy of a system of three charges q, 2q and -3q placed at the vertices of an equilateral triangle of side a.	2
10	Four point charges of 1 μC, -2 μC, 1 μC and -2 μC are placed at the corners A, B, C and D respectively, of a square of side 30 cm. Find the net force acting on a charge of 4 μC placed at the centre of the square. **OR** Three point charges, 1 pC each, are kept at the vertices of an equilateral triangle of side 10 cm. Find the net electric field at the centroid of triangle.	2
11	A wire of resistance X ohm is gradually stretched till its length becomes twice its original length. If its new resistance becomes 40 **Ω**, find the value of X.	2
	SECTION C **(Section C consists of 4 Short Answer type questions carrying 03 marks each)**	
12	a) Define 'temperature coefficient of resistance' of a metal. b) Show the variation of resistivity of copper with rise in temperature. c) The resistance of a wire is 10 **Ω** at 27 ◦C. Find its resistance at -73 ◦C. The temperature coefficient of resistance of the material of the wire is 1.70×10^{-4} ◦C^{-1}.	3
13	A cube of side 0.1 m is placed, as shown in the figure, in a region where electric field E = 500 x i exists. Here x is in meters and E in N/C Calculate : a) The flux passing through the cube, and b) The charge within the cube.  **OR** a) Define the term 'electric flux' and write its dimensions. b) A plane surface, in shape of a square of side 1 cm is placed in an electric field E = (100 N/C) i such that the unit vector normal to the surface is given by $\hat{n} = 0.8\hat{i} + 0.6\hat{k}$. Find the electric flux through the surface.	3

14	A capacitor of plate area A and plate separation d is charged by a battery to voltage V. The battery is disconnected and plates are slowly pulled apart till the separation becomes 2d. Find the value of : Potential difference between the plates, Electric field between the plates, Work done in pulling the plates apart.	3
15	Obtain a relation between the current flowing in a conductor and drift velocity of electrons in it. Hence, obtain Ohm's law.	3
	SECTION D **(Section D consists 1 Case based study questions carrying 04 marks each)**	
16	Dielectrics play an important role in design of capacitors. The molecules of a dielectric may be polar or non-polar. When a dielectric slab is placed in an external electric field, opposite charges appear on the two surfaces of the slab perpendicular to electric field. Due to this an electric field is established inside the dielectric. The capacitance of a capacitor is determined by the dielectric constant of the material that fills the space between the plates. Consequently, the energy storage capacity of a capacitor is also affected. Like resistors, capacitors can also be arranged in series and/or parallel. (i) Which of the following is a polar molecule ? (A) O_2 (B) H_2 (C) N_2 (D) HCl (ii) Which of the following statements about dielectrics is correct ? (A) A polar dielectric has a net dipole moment in absence of an external electric field which gets modified due to the induced dipoles. (B) The net dipole moments of induced dipoles is along the direction of the applied electric field. (C) Dielectrics contain free charges. (D) The electric field produced due to induced surface charges inside a dielectric is along the external electric field.	4

(iii) When a dielectric slab is inserted between the plates of an isolated charged capacitor, the energy stored in it :

(A) increases and the electric field inside it also increases.

(B) decreases and the electric field also decreases.

(C) decreases and the electric field increases.

(D) increases and the electric field decreases.

(iv) (a) An air-filled capacitor with plate area A and plate separation d has capacitance C_0. A slab of dielectric constant K, area A and thickness $\left(\frac{d}{5}\right)$ is inserted between the plates. The capacitance of the capacitor will become

(A) $\left[\frac{4K}{5K+1}\right]C_0$ (B) $\left[\frac{K+5}{4}\right]C_0$

(C) $\left[\frac{5K}{4K+1}\right]C_0$ (D) $\left[\frac{K+4}{5K}\right]C_0$

OR

(iv) (b) Two capacitors of capacitances 2 C_0 and 6 C_0 are first connected in series and then in parallel across the same battery. The ratio of energies stored in series combination to that in parallel is

(A) $\frac{1}{4}$ (B) $\frac{1}{6}$

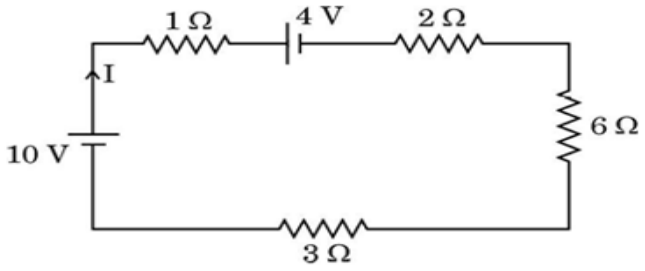
(C) $\frac{2}{15}$ (D) $\frac{3}{16}$

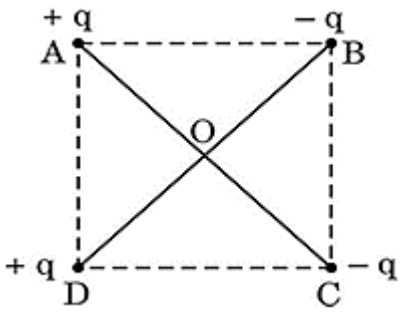
SECTION E
(Section E consists of 2 Long Answer type questions carrying 05 marks each)

17 a) Define electrical conductivity of a wire. Give its SI unit. 5

b) High current is to be drawn safely from (1) a low – voltage battery, and (2) a high – voltage battery. What can you say about the internal resistance of the two batteries ?

c) Calculate the total energy supplied by the batteries to the circuit shown in the figure, in one minute.



18	a) A thin spherical shell of radius R has a uniform surface charge density σ. Using Gauss's law, deduce an expression for electric field (i) outside and (ii) inside the shell. b) Two long straight thin wires AB and CD have linear charge densities 10 μC/m and -20 μC/m, respectively. They are kept parallel to each other at a distance 1 m. Find magnitude and direction of the net electric field at a point midway between them. **OR** a) Derive an expression for the electric field at a point on the equatorial plane of an electric dipole consisting of charges q and – q separated by a distance 2a. b) The distance of a far off point on the equatorial plane of an electric dipole is halved. How will the electric field be affected for the dipole? C) Two identical electric dipoles are placed along the diagonals of a square ABCD side $\sqrt{2}\,m$ as shown in the figure. Obtain the magnitude and direction of the net electric field at the centre (O) of the square.  	5