PERIODIC TEST 1 (APRIL, 2023)

GRADE- XII SUBJECT- PHYSICS

TIME: 90MIN. **Max. Marks.- 40**

GENERAL INSTRUCTIONS:

i. This question paper consists of 20 questions in 5 sections.

ii. All questions are compulsory. However, an internal choice is provided in some questions. A student is expected to attempt only one of these questions.

iii. Section A consists of 11 objective type questions carrying 1 mark each.

iv. Section B consists of 3 Very Short questions carrying 02 marks each.

v. Section C consists of 3 Short Answer type questions carrying 03 marks each.

vi. Section D consists of 2 Long Answer type questions carrying 05 marks each.

vii. Section E consists of 1 source-based/case-based units of assessment of 04 marks each with sub-parts.

SECTION - A

Q1. If there are two charges Q, q and distance between them is r, then define electric field intensity due to Q.

Q2. What is the amount of work done in moving a point charge 'Q' around a circular arc of radius 'r' at the center of which another point charge 'q' is located?

Q3. In an electric field, an electron is kept freely. If the electron is replaced by a proton, what will be the force experienced by the proton?

Q4. Three charges +3q, +q and Q are placed on a straight line with equal separation. In order to make the net force on +q to be zero, what will be the value of Q?

Q5. Each of the two point charges are doubled and their distance is halved. Force of interaction becomes _____ times.

Q6. Coulomb's law can be written as

$$F = \frac{1}{4\pi\epsilon_0}\frac{q_1 q_2}{r^2}$$

Where ϵ_0 is the permittivity of free space. What are SI units of ϵ_0?

Q7. A paisa coin is made up of AI-Mg alloy and weighs 0.75g. It has a square shape, and its diagonal measures 17 mm. It is electrically neutral and contains equal amounts of positive and negative charges. Treating the paisa coins made up of only Al, find the magnitude of the equal number of positive and negative charges. What conclusion do you draw from this magnitude?

Q8. If a positive charge is moved from a low to high potential region, what happens to electric potential energy?

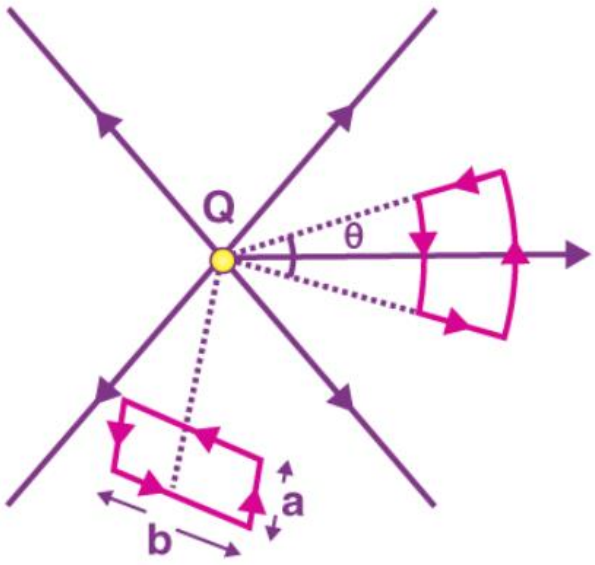
Q9. TConsider a scenario of a coin. It is naturally electrically neutral and contains equal amounts of the negative and positive charge of magnitude 34.8 kC. Suppose that these equal charges were concentrated in two point charges separated by (i) 1 cm (~ 1/2 diagonal of the one paisa coin), (ii) 100 m (~ length of along building), and (iii) 106 m (radius of the Earth). Find the force on each such point charge in each of the three cases. What do you conclude from these results?

Q10. If a dipole is placed in a uniform electric field, what is experienced by it?

Q11. In which form capacitors store energy?

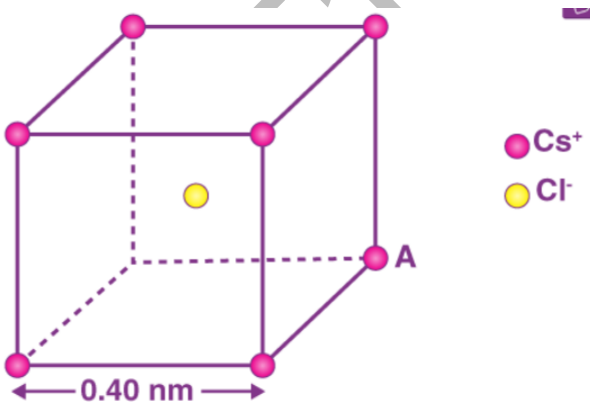
SECTION – B

Q12. A test charge q is made to move in an electric field of a point charge Q along the two different closed paths. The first path has sections along and perpendicular to the lines of an electric field. The second path is a rectangular loop of the same area as the first loop. How does the work done compare in the two cases?



Q13. Consider two conducting spheres of radii R1 and R2 with R1 > R2. If the two are at the same potential, the larger sphere has more charge than the smaller sphere. State whether the charge density of the smaller sphere is more or less than that of the larger one.

Q14. The below diagram represents a crystal unit of caesium chloride, CsCl. The caesium atoms, represented by open circles, are situated at the corners of a cube of 0.40nm, whereas a Cl atom is situated at the centre of the cube. The Cs atoms are deficient in one electron, while the Cl atom carries an excess electron.



SECTION - C

Q15. An electric dipole with dipole moment 3×10^{-8} Cm placed with its axis making an angle of 30^{o} with a uniform electric field, experiences a torque of 1.2×10^{3} N. Calculate the magnitude of the electric field.

Q16. Define Gauss theorem. (Definition and derivation)

Or

What charge would be required to electrify a sphere of radius 25 cm so as to get a surface charge density of $\frac{3}{\pi}$ C m^{-2}?

Q17. Derive the expression for capacitance of parallel plate capacitor.

Or

Derive the expression for potential energy of a system of two charges.

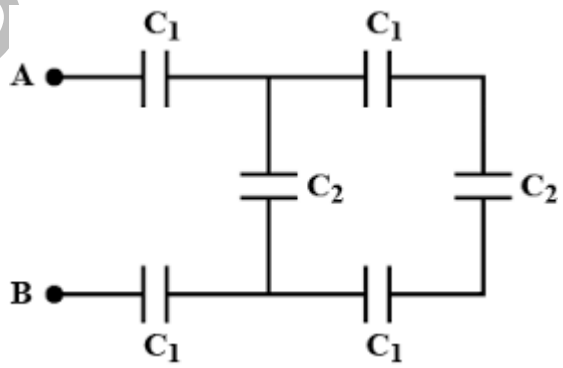
SECTION - D

Q18. Prove that if an insulated, uncharged conductor is placed near a charged conductor and no other conductors are present, the uncharged body must be intermediate in potential between that of the charged body and that of infinity.

Or

Calculate potential on the axis of a ring due to charge Q uniformly distributed along the ring of radius R.

Q19. If C_1 = 3 pF and C_2 = 2 pF, calculate the equivalent capacitance of the network shown in the figure between points A and B



SECTION - E

Q20. Coulomb's law states that the electrostatic force of attraction or repulsion acting between two stationary point charges is given by

$$F = \frac{1}{4\pi\epsilon_0}\frac{q_1 q_2}{r^2}$$

Where F denotes the force between two charges q_1 and q_2 separated by a distance “r” in free space, “ϵ_0" is a constant known as permittivity of free space. Free space is vacuum and may be taken to be air practically. If free space is replaced by a medium, then “ϵ_0" is replaced by “ϵ_0k” or “$\epsilon_0\epsilon_r$” where k is known as dielectric constant or relative permittivity.

i) In Coulomb’s law, on which factors does the proportionality constant k depend?

ii) What is the dimensional formula for the permittivity ϵ_0 of the free space?

iii) What is the force of repulsion between two charges of 1 C each, kept 1 m apart in vacuum?

iv) How force varies with respect to distance?