2009 ap physics c free response

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The system is deployed in a space region where the impact of external charges is negligible. Now answer the following questions about the above system, assuming that the electrical field and potential expressions are related to the point charging:(a) What is an electric field in the center of the ring? Substantiate your answer. (b): (b) What is the electrical potential in the centre of the ring? (ii) If the charge on the ring is negative, will there be any changes in electrical potential in the centre of the ring? Substantiate your answer. (c) the axis of the positively charged ring produces an expression of electrical potential at a point such as P. (Suppose that the axis of the ring is in direction x and the centre of the ring is at source). :((i)Using the electrical potential of point (c), the expression of the electric field at point P on the axis of the ring is obtained. (ii) show that the electric field on the axle is not more than the $r/\sqrt{2}$ from the centre of the diagram (e) showing qualitatively the type of variation of the electric field along the axis of the ring covering both sides of the ring. As promised, I provided below a sample to the above question:(a) the electric field in the center of the ring is zero. This follows from the definition of an electric field: The electric field at any point shall be the force per test charge per unit placed at the point. The test charge placed in the centre of the ring shall be unbrepulsed equally with the positive charge tariffs evenly distributed on the ring in such a way that the net force of the test charge is zero. [Note that the charge Q placed in position A on the ring will be evenly distributed immediately throughout the ring]. (b):(i) The ring charges at the same distance R from the centre of the ring and therefore $Q/4\pi\pi\varepsilon_0 R$ is possible in the centre of the ring. (ii) If the charge on the ring is negative, the potential will be negative. In this case, the potential will be $-Q/4\pi\varepsilon_0 R$. c) Consider a small amount (dQ) at a charge point, such as A on the ring. The electrical potential of dV at P due to this elementary charge is given with $dV = dQ/4\pi\varepsilon_0 r$. The total potential (V) at P resulting from all charge costs per ring is calculated from $V = \int dV = \int dQ/4\pi\varepsilon_0 r = Q/4\pi\pi\varepsilon_0 r$ (as all the charging elements are at the same distance r from point P). d) the electric field at P, because the element dQ in the toll point, e.g. A, is facing along the AP. This field can be solved in two components: one component along the ring axis and a second component perpendicular to the axis of the ring (normal component). For each elementary charge at any time on the ring, the same elementary charge is located diametrically opposite it. The diametrically opposite element will produce the same field axial component in the same direction. But the normal component diametrically opposite due to elementary charging will be equal in volume, but in the opposite direction. Therefore, all axial components are added where all normal components are removed. Therefore, the electric field, because the charged guided ring is facing along the axis of the ring. The electrical field at point P is calculated with E = –Grad V. we have $E = -\partial V/\partial x = -\partial/\partial x\,(Q/4\pi\varepsilon_0 r) = -\partial/\partial x\,[Q/4\pi\varepsilon_0\sqrt{(R^2+x^2)}]$ Or, $E = (1/4\pi\varepsilon_0)\,[Qx/(R^2+x^2)^{3/2}]$Because the ring is positive, field E is in a positive x-direction. If the electric field is maximum, $dE/dx = 0$T.9. $(1/4\pi\varepsilon_0)\,[\{-3/2\}(R^2+x^2)^{-5/2} \times 2x \times x\} + (R^2+x^2)^{-3/2}] = 0$Or, $3x^2\,(R^2+x^2)^{-1}$ Or, $3x^2 = R^2+x^2$, of which $x = R/\sqrt{2}$. (e) The type of variation of the electric field along the axis of the ring is shown in the adjacent figure in which O is the centre of the ring. The maximum field size shall be at points far $R/\sqrt{2}$ from the centre and shall be symmetrically on both sides of the centre. The positive direction of the field is a positive direction of x, even if it is depicted with a positive y-plot in the image. The negative direction of the field is negative x direction and is represented by a negative y point in the picture. You can access all posts related to electrostatic (including multiple optional practice issues) on this site by clicking on the label electrostatics below this post post.