WILEY

Halliday/Resnick/Walker
Fundamentals of Physics

Classroom Response System Questions

Chapter 23 Gauss' Law

Interactive Lecture Questions

23.2.1. The end of a garden hose is enclosed in a mesh sphere of radius 4 cm. If the hose delivers five liters per minute, how much water flows through the sphere each minute?

a) 0.0013 liters

b) 0.67 liters

c) 3.2 liters

d) 5.0 liters

e) 20 liters

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23.2.3. In July, Joe set up his fixed array of solar panels to maximize the amount of electricity output from the array when the Sun was high in the sky. Unfortunately, Joe finds that the array doesn’t operate as well during the winter months, even though there is nothing physical wrong with the array. What is the most likely cause of Joe’s winter problem?

a) Less sunlight reaches the Earth during the winter months.

b) The sun is lower in the sky during the winter, so sunlight strikes the solar panels at an angle.

c) The average temperature is much colder during the winter months.

d) More sunlight is absorbed by the atmosphere during the winter months because the Sun is much lower in the sky.

e) The Sun is not as bright during winter months as it is during the summer months.

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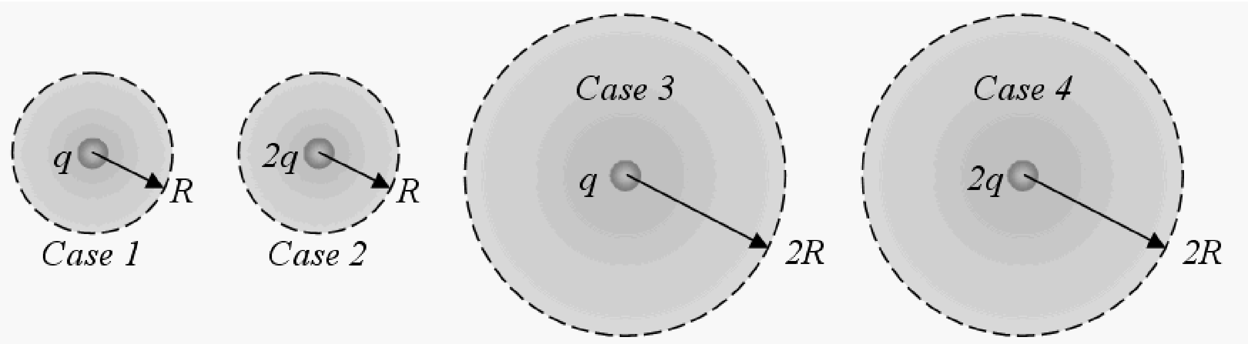
23.3.2. Consider the five situations shown. Each one contains either a charge q or a charge $2q$. A Gaussian surface surrounds the charged particle in each case. Considering the electric flux through each of the Gaussian surfaces, which of the following comparative statements is correct?



a) $\Phi_2 = \Phi_4 > \Phi_1 = \Phi_3$

b) $\Phi_1 = \Phi_3 > \Phi_2 = \Phi_4$

c) $\Phi_2 > \Phi_1 > \Phi_4 > \Phi_3$

d) $\Phi_3 = \Phi_4 > \Phi_2 = \Phi_1$

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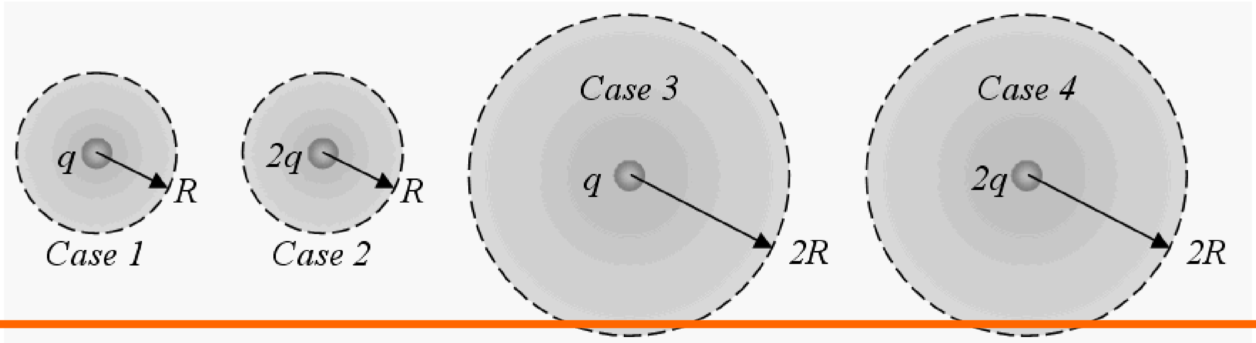

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23.3.3. When a particle with a charge *Q* is surrounded by a spherical Gaussian surface, the electric flux through the surface is Φ_S. Consider what would happen if the particle was surrounded by a cylindrical Gaussian surface or a Gaussian cube. How would the fluxes through the cylindrical Φ_{Cyl} and cubic Φ_{Cubic} surfaces compare to Φ_S?

a) $\Phi_S = \Phi_{Cubic} > \Phi_{Cyl}$

b) $\Phi_S > \Phi_{Cyl} = \Phi_{Cubic}$

c) $\Phi_S = \Phi_{Cyl} = \Phi_{Cubic}$

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23.4.2. Using Gauss' law, find the approximate magnitude of the electric field at the surface of a cube that has 0.10-m sides and a uniform volume charge density $\rho = 2.0 \times 10^{-10}$ C/m^3.

a) 0.042 N/C

b) 7.1 N/C

c) 23 N/C

d) 44 N/C

e) 116 N/C

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23.6.1. A conducting shell with an outer radius of 2.5 cm and an inner radius of 1.5 cm has an excess charge of 1.5×10^{-7} C. What is the surface charge density on the inner wall of the shell?

a) 1.5×10^{-9} C/m^2

b) 2.9×10^{-10} C/m^2

c) 4.8×10^{-10} C/m^2

d) 8.5×10^{-9} C/m^2

e) None of the above answers is correct.

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e) None of the above answers is correct.

23.7.2. A straight, copper wire has a length of 0.50 m and an excess charge of -1.0×10^{-5} C distributed uniformly along its length. Find the magnitude of the electric field at a point located 7.5×10^{-3} m from the midpoint of the wire.

a) 1.9×10^{10} N/C

b) 7.3×10^{8} N/C

c) 6.1×10^{13} N/C

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23.8.1. An infinite slab of electrically insulating material has a thickness t. The slab has a uniform volume charge density ρ. Which one of the following expressions gives the electric field at a point P at a depth $t - d$ relative to the surface?

a) $E = \dfrac{\rho t}{\varepsilon_0}$

b) $E = \dfrac{\rho d}{\varepsilon_0}$

c) $E = \dfrac{\rho}{(t-d)\varepsilon_0}$

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23.9.1. A spherical shell has an outer radius of 0.10 m and an inner radius of 0.040 cm. Within the shell is a charge $q = -2.0 \times 10^{-9}$ C. What is the surface charge density on the outer surface of the shell?

a) -2.0×10^{-9} C/m^2

b) -9.9×10^{-9} C/m^2

c) -1.6×10^{-8} C/m^2

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23.9.2. A total charge of –6.50 μC is uniformly distributed within a sphere that has a radius of 0.150 m. What is the magnitude and direction of the electric field at 0.300 m from the surface of the sphere?

a) 2.89×10^5 N/C, radially inward

b) 9.38×10^5 N/C, radially outward

c) 1.30×10^6 N/C, radially inward

d) 6.49×10^5 N/C, radially outward

e) 4.69×10^5 N/C, radially inward

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