Review | Constants

A long coaxial cable consists of an inner cylindrical conductor with radius a and an outer coaxial cylinder with inner radius b and outer radius c. The outer cylinder is mounted on insulating supports and has no net charge. The inner cylinder has a uniform positive charge per unit length λ.

Part A

Calculate the magnitude of the electric field at any point between the cylinders a distance r from the axis.

Express your answer in terms of some or all of the variables a, b, c, r, λ and constants π and ϵ_0.

$E(r)$ =

Submit Request Answer

Part B

Find the direction of the electric field at any point between the cylinders a distance r from the axis.

- parallel cylinders' axis
- radially outward
- radially inward

Submit Request Answer

Review | Constants

Part C

Calculate the magnitude of the electric field at any point outside the outer cylinder a distance r from the axis.

Express your answer in terms of some or all of the variables a, b, c, r, λ and constants π and ϵ_0.

ΑΣφ ?

$E(r)$ =

Submit Request Answer

Part D

Find the direction of the electric field at any point outside the outer cylinder a distance r from the axis.

- parallel cylinders' axis
- radially outward
- radially inward

Submit Request Answer

Part E

Find the charge per unit length on the inner surface and on the outer surface of the outer cylinder.

Express your answers in terms of some or all of the variables a, b, c, r, λ and constants π and ϵ_0. Enter your answers separated by a comma.

λ_{inner} , λ_{outer} = $-\lambda, \lambda$

Submit Previous Answers

Correct

Review | Constants

Part A

How much work is needed to assemble an atomic nucleus containing three protons (such as Li) if we model it as an equilateral triangle of side 2.00×10^{-15} m with a proton at each vertex? Assume the protons started from very far away.

Express your answer in million electron volts.

W = MeV

Submit Request Answer

Provide Feedback

Next

Exercise 23.7 - Enhanced - with Feedback

Two protons are aimed directly toward each other by a cyclotron accelerator with speeds of $2.10 \times 10^5\ \mathrm{m/s}$, measured relative to the earth.

Review | Constants

Part A

Find the maximum electrical force that these protons will exert on each other.

Express your answer with the appropriate units.

F = Value Units

Submit Request Answer

Provide Feedback

Next

Exercise 23.11

Review | Constants

Points a and b lie in a region where the y-component of the electric field is $E_y = \alpha + \beta/y^2$. The constants in this expression have the values α = 600 $\mathrm{N/C}$ and β = 5.00 $\mathrm{N \cdot m^2/C}$. Points a and b are on the y-axis.

Part A

Point a is at y = 2.00 cm and point b is at y = 3.00 cm. What is the potential difference $V_a - V_b$ between these two points.

Express your answer with the appropriate units.

μÅ ?

$V_a - V_b$ = Value Units

Submit Request Answer

Part B

Which point, a or b, is at higher potential?

- a
- b
- equal

Submit Request Answer

Review | Constants

A uniformly charged thin ring has radius 14.0 cm and total charge 22.0 nC. An electron is placed on the ring's axis a distance 28.0 cm from the center of the ring and is constrained to stay on the axis of the ring. The electron is then released from rest.

For related problemsolving tips and strategies, you may want to view a Video Tutor Solution of A ring of charge.

Part A

Describe the subsequent motion of the electron.

Match the words in the left column to the appropriate blanks in the sentences on the right.

Reset Help

- is
- away from
- is not
- attractive
- repulsive
- toward

When the electron is on either side of the center of the ring, the ring exerts an ____ force directed ____ the center of the ring. This force produces oscillatory motion of the electron along the axis of the ring, with amplitude 28.0 cm. The force on the electron ____ of the form $F = -kx$ so the oscillatory motion ____ simple harmonic motion.

Submit Request Answer

Part B

Find the speed of the electron when it reaches the center of the ring.

Express your answer in meters per second.

$v =$ 1.66×10^{7} $\mathrm{m/s}$

Submit Previous Answers

Exercise 23.33 - Enhanced - with Solution

A very long insulating cylindrical shell of radius 6.40 cm carries charge of linear density 8.70 $\mu\mathrm{C}/\mathrm{m}$ spread uniformly over its outer surface.

For related problem-solving tips and strategies, you may want to view a Video Tutor Solution of An infinite line charge or charged conducting cylinder.

Review | Constants

Part A

What would a voltmeter read if it were connected between the surface of the cylinder and a point 4.50 cm above the surface?

Express your answer in volts.

ΑΣφ ?

ΔV = V

Submit Request Answer

Part B

What would a voltmeter read if it were connected between the surface and a point 1.00 cm from the central axis of the cylinder?

Express your answer in volts.

ΑΣφ ?

ΔV = V

Exercise 23.41

Review | Constants

A metal sphere with radius r_a is supported on an insulating stand at the center of a hollow, metal, spherical shell with radius r_b. There is charge $+q$ on the inner sphere and charge $-q$ on the outer spherical shell. Take V to be zero when r is infinite.

Part A

Calculate the potential $V(r)$ for $r < r_a$. (*Hint:* the net potential is the sum of the potentials due to the individual spheres.)

Express your answer in terms of some or all of the variables q, r, r_a, r_b, and Coulomb constant k.

ΑΣφ ?

$V(r)$ =

Submit Request Answer

Part B

Calculate the potential $V(r)$ for $r_a < r < r_b$.

Express your answer in terms of some or all of the variables q, r, r_a, r_b, and Coulomb constant k.

ΑΣφ ?

$V(r)$ =

Part C

Calculate the potential $V(r)$ for $r > r_b$.

Express your answer in terms of some or all of the variables q, r, r_a, r_b, and Coulomb constant k.

$V(r)$ =

Submit

Request Answer

Part D

Find the potential of the inner sphere with respect to the outer.

Express your answer in terms of some or all of the variables q, r, r_a, r_b, and Coulomb constant k.

V_{ab} =

Part E

Use the equation $E_r = -\frac{\partial V}{\partial r}$ and the result from part B to find the electric field at any point between the spheres $(r_a < r < r_b)$.

Express your answer in terms of some or all of the variables q, r, r_a, r_b, and Coulomb constant k.

ΑΣφ ?

E =

Submit

Request Answer

Part F

Use the equation $E_r = -\frac{\partial V}{\partial r}$ and the result from part C to find the electric field at a point outside the larger sphere at a distance r from the center, where $r > r_b$.

Express your answer in terms of some or all of the variables q, r, r_a, r_b, and Coulomb constant k.

ΑΣφ ?

E =

Part G

Suppose the charge on the outer sphere is not $-q$ but a negative charge of different magnitude, say $-Q$. Find the potential of the inner sphere with respect to the outer.

Express your answer in terms of some or all of the variables q, Q, r, r_a, r_b, and Coulomb constant k.

ΑΣφ ?

V_{ab} =

Submit

Request Answer

Part H

Suppose the charge on the outer sphere is not $-q$ but a negative charge of different magnitude, say $-Q$. Find the electric field at any point between the spheres ($r_a < r < r_b$).

Express your answer in terms of some or all of the variables q, Q, r, r_a, r_b, and Coulomb constant k.

ΑΣφ ?

E =

Part I

Suppose the charge on the outer sphere is not $-q$ but a negative charge of different magnitude, say $-Q$. Find the electric field at a point outside the larger sphere at a distance r from the center, where $r > r_b$.

Express your answer in terms of some or all of the variables q, Q, r, r_a, r_b, and Coulomb constant k.

E =

Submit

Request Answer

Problem 23.50

A small sphere with mass $5.00 \times 10^{-7}\ \mathrm{kg}$ and charge +8.00 $\mu\mathrm{C}$ is released from rest a distance of 0.500 m above a large horizontal insulating sheet of charge that has uniform surface charge density σ = +8.00 $\mathrm{pC/m^2}$.

Review | Constants

Part A

Using energy methods, calculate the speed of the sphere when it is 0.100 m above the sheet.

Express your answer to three significant figures and include the appropriate units.

μÅ ?

v = Value Units

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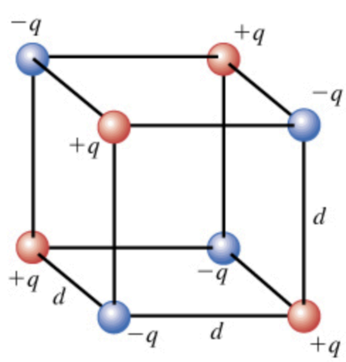
Next

Problem 23.57

✔ Complete

([Figure 1]) shows eight point charges arranged at the corners of a cube with sides of length d. The values of the charges are $+q$ and $-q$, as shown. This is a model of one cell of a cubic ionic crystal. In sodium chloride (NaCl), for instance, the positive ions are Na^+ and the negative ions are Cl^-.

Figure



Review | Constants

Part A

Calculate the potential energy U of this arrangement. (Take as zero the potential energy of the eight charges when they are infinitely far apart.)

Express your answer in terms of the variables q, d, and Coulomb constant k.

$$U = \frac{q^2}{\pi\epsilon_0 d}\left[\frac{3\sqrt{3}-3\sqrt{6}-\sqrt{2}}{\sqrt{6}}\right]$$

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✔ **Correct**

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Next >

A solid sphere of radius R contains a total charge Q distributed uniformly throughout its volume.

Review | Constants

Part A

Find the energy needed to assemble this charge by bringing infinitesimal charges from far away. This energy is called the "self-energy" of the charge distribution. (*Hint:* After you have assembled a charge q in a sphere of radius r, how much energy would it take to add a spherical shell of thickness dr having charge dq? Then integrate to get the total energy.)

Express your answer in terms of the variables Q, R, and constants ϵ_0, π.

ΑΣφ ?

U =

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