This print-out should have 10 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

**Charged Rod**

001 10.0 points
A rod 20.9 cm long is uniformly charged and has a total charge of \(-12.7 \, \mu C\).

Determine the magnitude of the electric field along the axis of the rod at a point 46.3062 cm from the center of the rod. The Coulomb constant is \(8.98755 \times 10^9 \, \text{N} \cdot \text{m}^2/\text{C}^2\).

Correct answer: \(5.60877 \times 10^5 \, \text{N/C}\).

**Floating Styrofoam**

002 10.0 points
A 4.2 g piece of Styrofoam carries a net charge of \(-0.5 \, \mu C\) and floats above the center of a very large horizontal sheet of plastic that has a uniform charge density on its surface.

The acceleration of gravity is \(9.8 \, \text{m/s}^2\) and the permittivity of free space is \(8.85419 \times 10^{-12} \, \text{C}^2/\text{N} \cdot \text{m}^2\).

What is the charge per unit area on the plastic sheet?

Correct answer: \(-1.45775 \, \mu C/\text{m}^2\).

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003 (part 1 of 4) 10.0 points
A 4.25 \(\mu C\) charge is uniformly distributed on a ring of radius 10 cm.

The value of the Coulomb constant is \(8.99 \times 10^9 \, \text{N} \cdot \text{m}^2/\text{C}^2\).

Find the electric field on the axis at 1.2 cm from the center of the ring.

Correct answer: \(4.48762 \times 10^5 \, \text{N/C}\).

004 (part 2 of 4) 10.0 points
Find the electric field on the axis at 4.2 cm from the center of the ring.

Correct answer: \(1.25767 \times 10^6 \, \text{N/C}\).

005 (part 3 of 4) 10.0 points
Find the electric field on the axis at 4.5 m from the center of the ring.

Correct answer: 1885.39 N/C.

006 (part 4 of 4) 10.0 points
Find the electric field on the axis at 4.5 m assuming that the ring is a point charge at the origin.

Correct answer: 1886.79 N/C.

**Charged Nonconducting Plate**

007 10.0 points
A nonconducting plate with infinite dimensions carries a uniform surface charge density of \(11.72 \, \mu C/cm^2\).

What is the electric field 5.2 cm in front of the plate?

Correct answer: \(6.61834 \times 10^9 \, \text{N/C}\).

**Charged Semicircle**

008 (part 1 of 3) 10.0 points
Consider the setup shown in the figure below, where the arc is a semicircle with radius \(r\). The total charge \(Q\) is negative, and distributed uniformly on the semicircle. The charge on a small segment with angle \(\Delta \theta\) is labeled \(\Delta q\).

\[\Delta q \text{ is given by} \]

1. \[\Delta q = \frac{Q \, \Delta \theta}{\pi} \text{ correct}\]

2. \[\Delta q = \frac{Q \, \Delta \theta}{2\pi}\]

3. \[\Delta q = \frac{Q}{\pi}\]
4. \( \Delta q = \frac{2Q \Delta \theta}{\pi} \)

5. None of these

6. \( \Delta q = \frac{2Q}{\pi} \)

7. \( \Delta q = \frac{Q}{2\pi} \)

8. \( \Delta q = 2\pi Q \)

9. \( \Delta q = \pi Q \)

10. \( \Delta q = Q \)

009 (part 2 of 3) 10.0 points
The magnitude of the x-component of the electric field at the center, due to \( \Delta q \), is given by

1. \( \Delta E_x = k |\Delta q| (\cos \theta) r^2 \)

2. \( \Delta E_x = k |\Delta q| (\cos \theta) r \)

3. \( \Delta E_x = k |\Delta q| (\sin \theta) r^2 \)

4. \( \Delta E_x = \frac{k |\Delta q| \sin \theta}{r^2} \)

5. \( \Delta E_x = \frac{k |\Delta q| \cos \theta}{r^2} \) correct

6. \( \Delta E_x = \frac{k |\Delta q| \cos \theta}{r} \)

7. \( \Delta E_x = \frac{k |\Delta q|}{r^2} \)

8. \( \Delta E_x = k |\Delta q| (\sin \theta) r \)

9. \( \Delta E_x = k |\Delta q| r^2 \)

10. \( \Delta E_x = \frac{k |\Delta q| \sin \theta}{r} \)

010 (part 3 of 3) 10.0 points
Determine the magnitude of the electric field at \( O \). The total charge is \(-20.9 \mu C\), the radius of the semicircle is 114 cm, and the Coulomb constant is \( 8.98755 \times 10^9 \text{ N} \cdot \text{m}^2/\text{C}^2 \).

Correct answer: 92014.9 N/C.