Chapter 22 Homework Solutions Physics Upenn

Chapter 22

22.3 What is the magnitude of a point charge whose electric field 50 cm away has the magnitude of 2.00N/C.

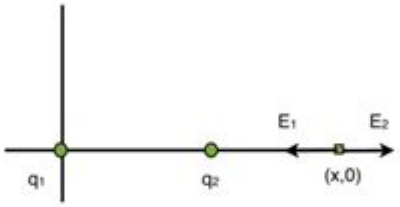
$$E = \frac{q}{4\pi\varepsilon_0 r^2}$$
$$q = 4\pi\varepsilon_0 r^2 E$$
$$= 5.56\times10^{-11} C$$

22.5 An atom of plutonium-239 has a nuclear radius of 6.64 fm and atomic number Z=94. Assuming that the positive charge is distributed uniformly within the nucleus, what are the magnitude and direction of the electric field at the surface of the nucleus due to the positive charge.

Outside a uniformly charged sphere, the field looks like that of a point charge at the center of the sphere.

$$E = \frac{q}{4\pi\varepsilon_0 r^2}$$
$$= \frac{94\cdot1.6\times10^{-19} C}{4\pi\varepsilon_0(6.64\times10^{-15} m)^2}$$
$$= 3.07\times10^{21} N/C!$$

22.8 In Fig. 22-31, particle 1 of charge $q_1 = -5q$ and particle 2 of charge $q_2 = +2q$ are fixed to an x-axis (a) As a multiple of distance L, at what coordinate on the axis is the net electric field of the particles zero? (a) Sketch the net electric field lines.



Chapter 22 homework solutions physics upenn is a critical resource for students navigating the complexities of physics courses at the University of Pennsylvania. As students delve into the intricacies of electromagnetism, understanding the solutions to Chapter 22 is essential for mastering concepts like electric fields, potential differences, and capacitance. This article provides an in-depth look at the topics covered in Chapter 22, emphasizes the importance of homework solutions, and offers guidance on how to effectively utilize these resources for academic success.

Understanding the Context of Chapter 22

Chapter 22 typically focuses on electrostatics, which is the study of electric charges at rest. A fundamental understanding of electrostatics is crucial for students, as it lays the groundwork for more advanced topics in physics. This chapter often covers:

- Electric Charge: The basic unit of electric charge, types of charges (positive and negative), and the principle of conservation of charge.
- Coulomb's Law: The mathematical relationship that describes the force between two point charges.
- Electric Field: A vector field around charged particles that represents the force exerted per unit charge at any point in space.
- Electric Potential: The amount of work done per unit charge in bringing a charge from infinity to a point in space.
- Capacitance: The ability of a system to store charge per unit voltage, often explored through parallel plate capacitors.

The Importance of Homework Solutions

The chapter 22 homework solutions physics upenn serve several important purposes:

1. Reinforcement of Concepts: By working through homework solutions, students can reinforce their understanding of key concepts presented in the chapter. Repetition and practice are essential for mastering physics.

2. Problem-Solving Techniques: The solutions often illustrate various problem-solving techniques that can be applied to different types of questions, enhancing students' analytical skills.

3. Identifying Mistakes: Reviewing solutions allows students to identify and understand mistakes made in their own work, promoting a deeper understanding of the material.

4. Preparation for Exams: Homework solutions provide valuable preparation for exams, as they cover similar types of problems that may appear on assessments.

5. Resource for Study Groups: Students can use these solutions as a collaborative tool in study groups, discussing different approaches and solutions to the same problems.

Key Topics and Problem Types in Chapter 22

As students review the chapter, they will encounter several key topics and problem types that are

essential for mastering the material. Below are some of the most common themes and examples of the problems that students may face:

1. Electric Force and Coulomb's Law

Coulomb's Law is fundamental in calculating the force between two charged particles. The formula is given by:

$$
F = k \frac{|q_1 q_2|}{r^2}
$$

where:
- F is the force between the charges,
- k is Coulomb's constant ($8.99 \times 10^9 \, N \cdot m^2/C^2$),
- q_1 and q_2 are the magnitudes of the charges, and
- r is the distance between the centers of the two charges.

Example Problem: Calculate the force between two charges of $+1 \, C$ and $-1 \, C$ separated by a distance of $1 \, m$.

Solution Steps:
1. Identify the values: $q_1 = 1 \, C$, $q_2 = -1 \, C$, $r = 1 \, m$.
2. Apply Coulomb's Law:
$$
F = (8.99 \times 10^9) \frac{|1 \times -1|}{1^2} = -8.99 \times 10^9 \, N
$$
3. Interpret the result: The negative sign indicates that the force is attractive.

2. Electric Field Calculation

The electric field E created by a point charge is defined as:

$$
E = \frac{F}{q}
$$

where F is the force experienced by a small test charge q.

Example Problem: Determine the electric field produced by a charge of $+3 \, \mu C$ at a distance of 0.5

\, m\).

Solution Steps:
1. Use Coulomb's Law to find the force on a test charge \(q = +1 \, C\).
2. Calculate \(E\):
\[
E = k \frac{|q|}{r^2} = (8.99 \times 10^9) \frac{3 \times 10^{-6}}{(0.5)^2} = 107880 \, N/C
\]

3. Electric Potential Energy

Electric potential energy \(U\) between two point charges is given by:

\[
U = k \frac{q_1 q_2}{r}
\]

Example Problem: What is the electric potential energy of two charges of \(+2 \, \mu C\) and \(-3 \, \mu C\) separated by \(0.2 \, m\)?

Solution Steps:
1. Substitute values into the formula:
\[
U = (8.99 \times 10^9) \frac{(2 \times 10^{-6})(-3 \times 10^{-6})}{0.2}
\]
2. Calculate \(U\):
\[
U = -0.2697 \, J
\]

4. Capacitance and Capacitors

Capacitance \(C\) is defined as:

\[
C = \frac{Q}{V}
\]

where \(Q\) is the charge stored and \(V\) is the voltage across the capacitor.

Example Problem: Calculate the capacitance of a capacitor storing $5 \, \mu C$ at $10 \, V$.

Solution Steps:
1. Apply the capacitance formula:
$$
C = \frac{5 \times 10^{-6}}{10} = 5 \times 10^{-7} \, F = 0.5 \, \mu F
$$

Strategies for Utilizing Homework Solutions

To effectively use the chapter 22 homework solutions physics upenn, students should consider the following strategies:

- Active Engagement: Rather than passively reading through solutions, students should actively engage by solving problems independently first, then comparing their answers with the provided solutions.

- Group Study Sessions: Form study groups where members can discuss different problems and solutions, facilitating a deeper understanding of the material.

- Seek Clarification: If certain solutions are unclear, students should seek help from professors or teaching assistants to clarify their understanding.

- Practice Additional Problems: Use the solutions as a guide to tackle additional problems from textbooks or online resources to reinforce learning.

- Time Management: Allocate specific times for reviewing homework solutions to ensure consistent study habits without overwhelming oneself before exams.

Conclusion

In conclusion, the chapter 22 homework solutions physics upenn provide a vital tool for students studying electrostatics. By understanding the fundamental concepts, practicing problem-solving techniques, and effectively utilizing homework solutions, students can enhance their grasp of physics and perform better academically. Mastering the topics covered in this chapter is not only crucial for success in physics courses but also lays a strong foundation for future studies in electromagnetism and related fields.

Frequently Asked Questions

What topics are covered in Chapter 22 of the physics curriculum at UPenn?

Chapter 22 typically covers electric fields, electric potential, and capacitance, focusing on the concepts and applications of electrostatics.

Where can I find the homework solutions for Chapter 22 for UPenn physics?

Homework solutions can usually be found on the course's learning management system, such as Canvas or Blackboard, or through the course's dedicated resources provided by the instructor.

Are the Chapter 22 homework solutions available for all students?

Yes, the homework solutions are generally made available to all students enrolled in the course, often as part of the course materials.

What types of problems can I expect in the Chapter 22 homework?

Problems may include calculations involving electric field strength, potential difference, and the behavior of capacitors, as well as conceptual questions about electrostatic phenomena.

How can I effectively study the material in Chapter 22?

To study effectively, review lecture notes, complete practice problems, and discuss challenging concepts with peers or attend office hours for clarification.

Are there any recommended textbooks or resources for Chapter 22?

The primary textbook used for the course is often recommended, along with supplemental resources such as online lecture notes, tutorial videos, and physics problem-solving websites.

What is the importance of understanding electric fields in physics?

Understanding electric fields is crucial as they describe how charged objects interact and influence each other, forming the basis for many concepts in electromagnetism.

Can I collaborate with classmates on the Chapter 22 homework?

Yes, collaboration is often encouraged, but ensure to follow the academic integrity guidelines set by UPenn regarding group work and individual submissions.

What should I do if I'm struggling with the Chapter 22 concepts?

Consider seeking help from the professor, teaching assistants, or utilizing tutoring services offered by UPenn to gain a better understanding of the material.

How does Chapter 22 relate to real-world applications?

Chapter 22 concepts are foundational for understanding various technologies such as capacitors in electronic devices, electric fields in power systems, and even biological processes like nerve signal transmission.

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