Electrostatics Practice Test (Sample)

Study Guide

BY EXAMZIFY

Everything you need from our exam experts!

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Introduction

Preparing for a certification exam can feel overwhelming, but with the right tools, it becomes an opportunity to build confidence, sharpen your skills, and move one step closer to your goals. At Examzify, we believe that effective exam preparation isn't just about memorization, it's about understanding the material, identifying knowledge gaps, and building the test-taking strategies that lead to success.

This guide was designed to help you do exactly that.

Whether you're preparing for a licensing exam, professional certification, or entry-level qualification, this book offers structured practice to reinforce key concepts. You'll find a wide range of multiple-choice questions, each followed by clear explanations to help you understand not just the right answer, but why it's correct.

The content in this guide is based on real-world exam objectives and aligned with the types of questions and topics commonly found on official tests. It's ideal for learners who want to:

- **Practice answering questions under realistic conditions,**
- **Improve accuracy and speed,**
- **Review explanations to strengthen weak areas, and**
- **Approach the exam with greater confidence.**

We recommend using this book not as a stand-alone study tool, but alongside other resources like flashcards, textbooks, or hands-on training. For best results, we recommend working through each question, reflecting on the explanation provided, and revisiting the topics that challenge you most.

Remember: successful test preparation isn't about getting every question right the first time, it's about learning from your mistakes and improving over time. Stay focused, trust the process, and know that every page you turn brings you closer to success.

Let's begin.

How to Use This Guide

This guide is designed to help you study more effectively and approach your exam with confidence. Whether you're reviewing for the first time or doing a final refresh, here's how to get the most out of your Examzify study guide:

1. Start with a Diagnostic Review

Skim through the questions to get a sense of what you know and what you need to focus on. Your goal is to identify knowledge gaps early.

2. Study in Short, Focused Sessions

Break your study time into manageable blocks (e.g. 30 – 45 minutes). Review a handful of questions, reflect on the explanations.

3. Learn from the Explanations

After answering a question, always read the explanation, even if you got it right. It reinforces key points, corrects misunderstandings, and teaches subtle distinctions between similar answers.

4. Track Your Progress

Use bookmarks or notes (if reading digitally) to mark difficult questions. Revisit these regularly and track improvements over time.

5. Simulate the Real Exam

Once you're comfortable, try taking a full set of questions without pausing. Set a timer and simulate test-day conditions to build confidence and time management skills.

6. Repeat and Review

Don't just study once, repetition builds retention. Re-attempt questions after a few days and revisit explanations to reinforce learning. Pair this guide with other Examzify tools like flashcards, and digital practice tests to strengthen your preparation across formats.

There's no single right way to study, but consistent, thoughtful effort always wins. Use this guide flexibly, adapt the tips above to fit your pace and learning style. You've got this!

Questions

1. **In a series circuit with a light and no capacitor to store charge, what happens when the switch is closed?**
   - A. It would be bright at first, then gradually dim and go out
   - B. It remains bright indefinitely
   - C. It never lights
   - D. It flickers on and off

2. **Three charges form a triangle: top is positive; bottom left is positive; bottom right is negative with equal magnitudes for bottom charges. What is the horizontal direction of the net force on the top positive charge?**
   - A. Left
   - B. Upward
   - C. Right
   - D. Downward

3. **If the capacitance doubles while the voltage remains the same, what happens to the stored energy?**
   - A. It doubles
   - B. It halves
   - C. It remains the same
   - D. It quadruples

4. **In an insulator, where do charges tend to reside?**
   - A. They spread evenly through the interior.
   - B. They are completely removed after charging.
   - C. They remain on or near the surface and do not move through the material.
   - D. They disappear once external fields are removed.

5. **Field inside a thin spherical shell of radius R carrying total charge Q. Which statement is correct?**
   - A. E_inside = Q / (4π ε0 r^2); E_outside = 0
   - B. E_inside = Q / (4π ε0 r^2); E_outside = Q / (4π ε0 r^2)
   - C. E_inside = 0; E_outside = Q / (4π ε0 r^2)
   - D. E_inside = Q / (4π ε0 R^2); E_outside = Q / (4π ε0 r^2)

6. **State the energy density in a vacuum and in a linear dielectric in terms of E and D.**

   A. **Vacuum: u = (1/2) ε0 E^2; Dielectric: u = (1/2) E · D = (1/2) ε E^2**

   B. **Vacuum: u = ε0 E^2; Dielectric: u = (1/2) E · D**

   C. **Vacuum: u = (1/2) D^2 / ε0; Dielectric: u = (1/2) ε E^2**

   D. **Vacuum: u = (1/2) ε0 E^2; Dielectric: u = (1/2) ε0 E^2**

7. **How is the net electric field at a point computed when multiple charges contribute?**

   A. **E = sum of the magnitudes of the individual fields**

   B. **E = vector sum of the individual fields**

   C. **E = product of the individual fields**

   D. **E = maximum of the individual fields**

8. **What are the standard SI units for electric field and potential?**

   A. **E in N/C or V/m; V in volts**

   B. **E in J/C; V in volts**

   C. **E in V/m; V in N/C**

   D. **E in C/N; V in volt**

9. **A capacitor with plate area A and separation d is filled with a dielectric κ. Provide the capacitance.**

   A. **C = ε0 A / d**

   B. **C = ε0 A / (κ d)**

   C. **C = κ ε0 A / d**

   D. **C = ε0 κ A d**

10. **Which statement correctly describes insulators?**

    A. **Conductors allow charges to flow freely.**

    B. **Insulators allow charges to move easily.**

    C. **Semiconductors allow charges to move only at high temperatures.**

    D. **Insulators - charges cannot move freely; examples include glass, rubber, silk, and plastic.**

Answers

1. A
2. C
3. A
4. C
5. C
6. A
7. B
8. B
9. C
10. D

Explanations

1. **In a series circuit with a light and no capacitor to store charge, what happens when the switch is closed?**

   A. It would be bright at first, then gradually dim and go out

   B. It remains bright indefinitely

   C. It never lights

   D. It flickers on and off

When the switch is closed in a simple series circuit, current starts flowing immediately and the lamp responds to that current. The filament is cold at the instant of switch-on, so its resistance is relatively low. That small moment lets a larger current pass, making the lamp appear brighter right away. As the filament heats up to its operating temperature, its resistance increases, which reduces the current and causes the brightness to fade. If the power source can't sustain the current or is rapidly depleted, the light can eventually go out. Since there is no capacitor to store charge, there isn't a charging transient to worry about—the change you see is due to the filament heating and the finite energy delivery from the source.

2. **Three charges form a triangle: top is positive; bottom left is positive; bottom right is negative with equal magnitudes for bottom charges. What is the horizontal direction of the net force on the top positive charge?**

   A. Left

   B. Upward

   C. Right

   D. Downward

Think in terms of vector forces and symmetry. The top positive charge experiences a repulsive force from the left-bottom positive charge and an attractive force toward the right-bottom negative charge. The force from the left-bottom charge points up and to the right, while the force toward the right-bottom charge points down and to the right. If the bottom charges have equal magnitude and the top is centered above the base, the two forces have equal magnitudes and their vertical components cancel (one goes up, the other goes down). The horizontal components, both to the right, add up, giving a net force directed horizontally to the right.

3. **If the capacitance doubles while the voltage remains the same, what happens to the stored energy?**

   A. It doubles

   B. It halves

   C. It remains the same

   D. It quadruples

The stored energy in a capacitor with a fixed voltage is proportional to the capacitance, since U = (1/2) C V^2. If the capacitance doubles while the voltage stays the same, the energy becomes U' = (1/2) (2C) V^2 = 2 × [(1/2) C V^2], so the energy doubles. A larger capacitance at the same voltage means you can store more charge (Q = C V), and that extra charge translates into more electric field energy. For completeness, using U = Q^2/(2C) with V fixed gives the same result: Q doubles, and U increases by a factor of two.

4. In an insulator, where do charges tend to reside?

A. They spread evenly through the interior.

B. They are completely removed after charging.

C. They remain on or near the surface and do not move through the material.

D. They disappear once external fields are removed.

The key idea here is that charges in an insulator are not free to move. In an insulator, electrons are bound to atoms and resist flowing like they do in a conductor, so any charge you place tends to stay where it is. Because mobility is so limited, charges accumulate on the outer surface or very near it, and an external field mainly causes polarization (producing surface charges) rather than pushing charge through the bulk. Therefore, charges remain on or near the surface and do not move through the material. This is why the statement about surface or near-surface residence best fits insulators. Charges aren't automatically removed after charging, and they don't simply disappear when external fields are removed; they can persist until discharged or leak away.

5. Field inside a thin spherical shell of radius R carrying total charge Q. Which statement is correct?

A. $E_{inside} = Q / (4\pi \varepsilon_0 r^2)$; $E_{outside} = 0$

B. $E_{inside} = Q / (4\pi \varepsilon_0 r^2)$; $E_{outside} = Q / (4\pi \varepsilon_0 r^2)$

C. $E_{inside} = 0$; $E_{outside} = Q / (4\pi \varepsilon_0 r^2)$

D. $E_{inside} = Q / (4\pi \varepsilon_0 R^2)$; $E_{outside} = Q / (4\pi \varepsilon_0 r^2)$

Gauss's law with spherical symmetry is the key. For a point inside the thin spherical shell (radius less than R), a Gaussian sphere encloses no net charge, so the total flux through that sphere is zero. With the symmetry of the shell, the field on the Gaussian surface must be the same in all directions, which forces the electric field magnitude to be zero inside: $E_{inside} = 0$. Outside the shell ($r > R$), all the charge Q behaves as if it were concentrated at the center. A Gaussian sphere of radius r then yields $E \cdot 4\pi r^2 = Q/\varepsilon_0$, so $E_{outside} = Q/(4\pi \varepsilon_0 r^2)$. The field depends on r in this region, falling off with distance, and it points radially. So the correct statement is that the field is zero inside, and outside it follows the inverse-square law with total charge Q. For reference, at the surface $r = R$ the outside value is $Q/(4\pi \varepsilon_0 R^2)$, showing the usual field discontinuity across the shell's surface.

6. **State the energy density in a vacuum and in a linear dielectric in terms of E and D.**

   A. **Vacuum: u = (1/2) ε0 E^2; Dielectric: u = (1/2) E · D = (1/2) ε E^2**

   B. **Vacuum: u = ε0 E^2; Dielectric: u = (1/2) E · D**

   C. **Vacuum: u = (1/2) D^2 / ε0; Dielectric: u = (1/2) ε E^2**

   D. **Vacuum: u = (1/2) ε0 E^2; Dielectric: u = (1/2) ε0 E^2**

The main idea is how electric-field energy is stored in different media. In vacuum there's no polarization, so the energy per volume depends on the field as u = (1/2) ε0 E^2. In a dielectric, it's natural to use the general expression u = (1/2) E·D, which already accounts for the medium's response. For a linear dielectric, the relation D = ε E holds (with ε = ε0 εr), so u = (1/2) E·D becomes (1/2) ε E^2, which can also be written as (1/2) ε0 εr E^2. So the correct statements are: vacuum energy density is (1/2) ε0 E^2, and dielectric energy density is (1/2) E·D (equivalently (1/2) ε E^2). This matches the standard definitions and shows how E and D relate in different media.

7. **How is the net electric field at a point computed when multiple charges contribute?**

   A. **E = sum of the magnitudes of the individual fields**

   B. **E = vector sum of the individual fields**

   C. **E = product of the individual fields**

   D. **E = maximum of the individual fields**

The net electric field from several charges is found by adding the field vectors from each charge. Each charge produces a field with a specific magnitude and direction at the point of interest, and these vectors must be combined considering both size and direction. This is why the total is the vector sum: E_total = E1 + E2 + ..., added component-wise. This approach reflects the superposition principle and explains why simply adding magnitudes can be wrong. If some fields point in opposite directions, their effects can cancel; if they point the same way, they reinforce each other. For example, two equal positive charges on opposite sides of a point produce fields that point away from each charge; along the line between them, those fields point in opposite directions and can cancel, giving a smaller net field or even zero. So the vector sum captures all that, whereas multiplying magnitudes or taking the maximum ignores direction and can lead to incorrect results.

8. **What are the standard SI units for electric field and potential?**

   A. **E in N/C or V/m; V in volts**

   B. **E in J/C; V in volts**

   C. **E in V/m; V in N/C**

   D. **E in C/N; V in volt**

Electric field units come from E = F/q, so its SI unit is newtons per coulomb. Since N/C is the same as V/m (because E = -dV/dx), you can express the field either way. Electric potential is measured in volts, and one volt is defined as one joule per coulomb, so its unit is V (which equals J/C). So the standard pairing is E in N/C or V/m, and potential in volts (V). The option that assigns the field unit as J/C would mix units that belong to potential with the field, since J/C is the unit of potential, not the field.

9. A capacitor with plate area A and separation d is filled with a dielectric κ. Provide the capacitance.

A. $C = \varepsilon_0 A / d$

B. $C = \varepsilon_0 A / (\kappa d)$

C. $C = \kappa \varepsilon_0 A / d$

D. $C = \varepsilon_0 \kappa A d$

The key idea is that the capacitance of a parallel-plate capacitor depends on the permittivity of the material between the plates. For a uniform field, C equals ε times the plate area over the separation: $C = \varepsilon A / d$. A dielectric with relative permittivity κ means the actual permittivity between the plates is $\varepsilon = \kappa \varepsilon_0$, where ε_0 is the vacuum permittivity. Substituting gives $C = \kappa \varepsilon_0 A / d$. This is why the correct form scales the vacuum result by κ. If κ were 1, you'd recover the vacuum case $C = \varepsilon_0 A / d$. The other expressions either use vacuum permittivity incorrectly, or place κ in the wrong place or even mix in the distance in a way that isn't dimensionally correct.

10. Which statement correctly describes insulators?

A. Conductors allow charges to flow freely.

B. Insulators allow charges to move easily.

C. Semiconductors allow charges to move only at high temperatures.

D. Insulators - charges cannot move freely; examples include glass, rubber, silk, and plastic.

Insulators resist electric current because their electrons are tightly bound to atoms, giving them high electrical resistance. When a voltage is applied, they don't allow charges to flow freely; instead, the material may polarize, but the actual current remains very small. This is why glass, rubber, silk, and plastic are classic insulators—they're good at preventing charge from moving through them. Think of what that means in contrast: a conductor is a material where charges can move freely, so it conducts current readily. Saying insulators allow charges to move easily contradicts their defining property. Semiconductors behave differently: their conductivity depends on temperature and impurities, so they don't fit the simple picture of insulators.

Next Steps

Congratulations on reaching the final section of this guide. You've taken a meaningful step toward passing your certification exam and advancing your career.

As you continue preparing, remember that consistent practice, review, and self-reflection are key to success. Make time to revisit difficult topics, simulate exam conditions, and track your progress along the way.

If you need help, have suggestions, or want to share feedback, we’d love to hear from you. Reach out to our team at hello@examzify.com.

Or visit your dedicated course page for more study tools and resources:

https://electrostatics.examzify.com

We wish you the very best on your exam journey. You've got this!