ELECTRICITY AND MAGNETISM PRACTICE TEST (SAMPLE)

STUDY GUIDE

SAMPLE STUDY GUIDE WITH LIMITED QUESTIONS

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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. **Doubling the point charge q while keeping distance r fixed changes the electric field magnitude by what factor?**

   A. It remains the same

   B. It doubles

   C. It quadruples

   D. It halves

2. **How does a good conductor affect an electromagnetic wave, and what is the formula for skin depth?**

   A. Waves propagate with no attenuation; $\delta = 1/\sqrt{(\mu \sigma \omega)}$

   B. Waves are strongly attenuated; $\delta = \mathrm{sqrt}(2/(\mu \sigma \omega))$

   C. Waves amplify; $\delta = \mu \sigma \omega$

   D. Waves reflect completely; $\delta = \sqrt{(\varepsilon/\mu)}$

3. **Magnetic field from a finite straight current-carrying wire segment at a distance d is given by which expression?**

   A. $B = \mu_0 I/(2\pi d) (\cos \theta_1 - \cos \theta_2)$

   B. $B = \mu_0 I/(4\pi d) (\cos \theta_1 - \cos \theta_2)$

   C. $B = \mu_0 I/(4\pi d) (\cos \theta_1 + \cos \theta_2)$

   D. $B = \mu_0 I/(4\pi d) (\cos \theta_2 - \cos \theta_1)$

4. **An ideal transformer with turns ratio N1:N2 = 2:1 has secondary current 3 A. What is the primary current?**

   A. 6 A

   B. 3 A

   C. 1.5 A

   D. 0.5 A

5. **State Faraday's law of electromagnetic induction in integral form.**

   A. $\varepsilon = - d\Phi_B/dt$

   B. $\varepsilon = d\Phi_B/dt$

   C. $\varepsilon = \Phi_B / dt$

   D. $\varepsilon = - \Delta\Phi_B$

6. What is it called when electric charge is transferred through direct contact?

A. Charging by Induction
B. Static Electricity
C. Charging by Friction
D. Charging by Conduction

7. What is the flow of electric charge called?

A. Voltage
B. Current
C. Resistance
D. Power

8. Which of the following expresses the relationship between the electric field E and the electric potential V?

A. $\times E = -\partial B/\partial t$
B. $E = -V$
C. $V = \times E$
D. $E = \varepsilon 0 \; V$

9. A device that shows all circuit components and their connections with symbols is called what?

A. Circuit diagram
B. Electric circuit
C. Conductor
D. Polarization

10. Which circuit characteristic allows current to take many paths, so a single path failure does not stop all devices?

A. Series circuit
B. Open circuit
C. Parallel circuit
D. Short circuit

Answers

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

Explanations

1. **Doubling the point charge q while keeping distance r fixed changes the electric field magnitude by what factor?**

   A. It remains the same

   B. It doubles

   C. It quadruples

   D. It halves

The electric field magnitude from a point charge at a fixed distance r scales directly with the charge. For a point charge, E = k q / r^2. With r constant, k and r^2 are fixed, so E is proportional to q. If you double q to 2q, the field becomes E = k (2q) / r^2 = 2 (k q / r^2), which is twice the original. So the factor is two. The other options would require no change, a fourfold increase, or a decrease, which don't happen when only the charge is increased while distance stays the same.

2. **How does a good conductor affect an electromagnetic wave, and what is the formula for skin depth?**

   A. Waves propagate with no attenuation; $\delta = 1/\sqrt{\mu \sigma \omega}$

   B. Waves are strongly attenuated; δ = sqrt(2/(μ σ ω))

   C. Waves amplify; $\delta = \mu \sigma \omega$

   D. Waves reflect completely; $\delta = \sqrt{\varepsilon/\mu}$

When a good conductor is exposed to an oscillating electromagnetic field, currents flow near the surface and dissipate energy as heat. These currents oppose the changing field, so the wave loses amplitude as it penetrates the material. The depth at which the wave amplitude falls to 1/e of its surface value is called the skin depth, δ. In a good conductor, solving Maxwell's equations for a plane wave gives a complex propagation constant whose magnitude leads to α ≈ β ≈ sqrt(ω μ σ / 2), where α is the attenuation constant. The skin depth is the reciprocal of that attenuation, so δ = 1/α = sqrt(2/(μ σ ω)). This shows that higher conductivity, higher frequency, or greater permeability shrink the skin depth and cause stronger attenuation of the wave as it goes in. That is why a good conductor causes strong attenuation of the wave. The other formulas either miss the correct factors or describe other behaviors (like amplification or complete reflection) that don't match how skin depth depends on μ, σ, and ω.

3. **Magnetic field from a finite straight current-carrying wire segment at a distance d is given by which expression?**

   A. $B = \mu_0 I /(2\pi d) (\cos \theta_1 - \cos \theta_2)$

   B. $B = \mu_0 I /(4\pi d) (\cos \theta_1 - \cos \theta_2)$

   C. $B = \mu_0 I /(4\pi d) (\cos \theta_1 + \cos \theta_2)$

   D. $B = \mu_0 I /(4\pi d) (\cos \theta_2 - \cos \theta_1)$

The essential idea is to use the Biot–Savart law and integrate along the finite straight wire. Each little segment dl carries current I and contributes a small magnetic field that, when you sum all along the wire, adds up to a simple result at a point a distance d away from the wire. Because the observation point is at a fixed perpendicular distance d, the geometry depends only on how the lines from the observation point to the wire's ends subtend angles with the wire's axis. Denoting those end angles by θ1 and θ2, the integration over the wire gives a magnitude B = μ0 I /(4π d) times (cos θ1 − cos θ2). The cos terms come from the way the contributions add up with the varying direction along the wire, and the difference reflects the finite length. This expression reduces to the well-known infinite-wire result in the appropriate limit: as the ends recede to infinity, the angles arrange so that (cos θ1 − cos θ2) becomes 2, giving B = μ0 I /(2π d), the field of an infinite straight wire. The direction of B is tangential around the wire, given by the right-hand rule.

4. An ideal transformer with turns ratio N1:N2 = 2:1 has secondary current 3 A. What is the primary current?

A. 6 A

B. 3 A

C. 1.5 A

D. 0.5 A

The key idea is how currents relate to turns in an ideal transformer. Power is conserved, so $V_1 I_1 = V_2 I_2$, and voltages scale with turns: $V_1/V_2 = N_1/N_2$. With a turns ratio of 2:1, the primary has twice as many turns as the secondary, which means V_1 is twice V_2. To keep power equal, the primary current must be half of the secondary current: $I_1 = I_2 \times (N_2/N_1) = 3\text{ A} \times (1/2) = 1.5\text{ A}$. So the primary current is 1.5 A.

5. State Faraday's law of electromagnetic induction in integral form.

A. $\varepsilon = - d\Phi_B/dt$

B. $\varepsilon = d\Phi_B/dt$

C. $\varepsilon = \Phi_B / dt$

D. $\varepsilon = - \Delta\Phi_B$

An induced electromotive force appears when the magnetic flux through a loop changes in time, and its direction follows Lenz's law to oppose that change. The magnetic flux through the loop is $\Phi_B = \int B \cdot dA$, and the integral form of Faraday's law is expressed as the line integral of the electric field around the loop: $E \cdot dl = - d\Phi_B/dt$. The EMF around the loop, often denoted ε, is this line integral, so $\varepsilon = - d\Phi_B/dt$. This captures both that the emf is driven by how quickly the flux is changing and that the change is opposed by the induced current. The other expressions fail to match this relation because they miss the minus sign, representing the opposing direction required by Lenz's law; or they use a simple division by dt or a finite change $\Delta\Phi_B/dt$ instead of the instantaneous rate of change $d\Phi_B/dt$. The correct form explicitly ties the emf to the instantaneous rate at which the magnetic flux through the loop is changing, with the sign enforcing opposition to that change.

6. What is it called when electric charge is transferred through direct contact?

A. Charging by Induction

B. Static Electricity

C. Charging by Friction

D. Charging by Conduction

Direct contact lets charges move because conductors allow electrons to flow when they touch. This transfer of charge through contact is called charging by conduction (charging by contact). When the charged object and the other object touch, electrons flow until both reach the same electric potential, so they share some of the charge. This is different from charging by friction, which involves rubbing two materials to transfer charge, and from charging by induction, which rearranges charges in a conductor without direct contact. Static electricity is the broad idea of an excess or deficit of charge on surfaces.

7. What is the flow of electric charge called?

A. Voltage

B. Current

C. Resistance

D. Power

The flow of electric charge is called current. It tells you how much charge passes a point in a circuit per unit time, measured in amperes (A). One ampere means one coulomb of charge passing per second. In metals, conventional current is the direction of positive charge flow, even though electrons move opposite to that direction. Voltage is the potential difference that pushes charges to move, resistance is what opposes that flow, and power is the rate at which electrical energy is transferred. These distinctions help you see why current is the right term for describing the actual flow of charge.

8. Which of the following expresses the relationship between the electric field E and the electric potential V?

A. × E = − ∂B/∂t

B. E = − V

C. V = × E

D. E = ε0 V

The field is the negative spatial rate of change of the electric potential: E = - V. This means the electric field points in the direction in which the potential decreases most rapidly. If you imagine V as a landscape, a positive test charge "rolls" downhill, along the direction of steepest descent, which is why the field points toward lower potential. In electrostatics, where the field has no curl, this gradient relationship holds and the line integral of E between two points equals the negative change in potential: ∫ E·dl = V(initial) - V(final). The other statements don't capture this connection: curl E = -∂B/∂t is Faraday's law about changing magnetic fields, not about potential; V = ×E would misattribute a curl operator to a scalar potential; and E = ε0 V lacks the necessary minus sign and is not the correct expression.

9. A device that shows all circuit components and their connections with symbols is called what?

A. Circuit diagram

B. Electric circuit

C. Conductor

D. Polarization

A circuit diagram is a map of a circuit showing all components and how they connect, using standardized symbols for each part and lines for wires. This visual plan makes it clear how current would flow and how components interact, without needing to physically build the circuit. It's different from an electric circuit, which is the actual hardware and wiring in the real world. A conductor is simply a material that lets current pass, not a diagram. Polarization relates to the orientation of charges or a dielectric effect, not to circuit layouts. So the term that matches a device that shows all circuit components and their connections with symbols is circuit diagram.

10. Which circuit characteristic allows current to take many paths, so a single path failure does not stop all devices?

A. Series circuit

B. Open circuit

C. Parallel circuit

D. Short circuit

In a parallel circuit, current has multiple paths because each device is connected across the same voltage source in its own branch. This means the circuit can split the total current into several branch currents, and each branch can carry current independently of the others. If one path opens or a branch fails, the remaining branches still provide a path for current, so the other devices keep operating. The voltage across every branch is the same as the source, which is why devices on different branches operate without needing the same path for the entire current. In contrast, a series circuit uses only one path for current, so a break in that path stops current everywhere and all devices go out. An open circuit is simply a break that stops current completely. A short circuit creates a low-resistance path that can bypass devices, causing a surge in current, but it doesn't describe the multi-path reliability characteristic of parallel wiring.

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://electricitymagnetism.examzify.com

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