UNIVERSITY OF CENTRAL FLORIDA (UCF) PHY2054 GENERAL PHYSICS WITH CALCULUS II PRACTICE EXAM (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. **A negatively charged ball is brought near end A of a rod that has a net positive charge at end A (with some negative charge in the center). What happens to end A when the ball approaches closely for the first time?**
   - A. It is repelled.
   - B. It experiences no force.
   - C. It is attracted.
   - D. It causes the rod to rotate.

2. **Four charges occupy the corners of a square: top-left -10 nC, top-right +q, bottom-left +Q, bottom-right -10 nC. What value of Q (in nC) makes the electrostatic force on the top-right charge q equal to zero?**
   - A. -28 nC
   - B. +38 nC
   - C. +28 nC
   - D. +8 nC

3. **If the loop radius R is doubled while keeping current I fixed, how does the magnetic field at the center change?**
   - A. Doubles
   - B. Halves
   - C. Becomes quarter
   - D. Remains the same

4. **Brewster's angle for an interface from air ($n1 = 1.00$) into glass ($n2 \approx 1.50$) is about**
   - A. 34.0°
   - B. 56.3°
   - C. 45.0°
   - D. 30.0°

5. **The magnetic field inside a long solenoid with N turns per unit length carrying current I is given by which expression?**
   - A. B = mu0 N I
   - B. B = mu0 N I^2
   - C. B = mu0 I / N
   - D. B = mu0 N / I

6. Four charges are placed such that q1 = 1 nC, q2 = 2 nC, q3 = -6 nC, q4 = 2 nC with a specified arrangement. The bottom charge is q1. What is the magnitude and direction of the net force on q1?

A. 1.14×10^{-5} N, 0 degrees

B. 1.14×10^{-5} N, 45 degrees

C. 1.14×10^{-5} N, 90 degrees

D. 2.28×10^{-5} N, 90 degrees

7. If the electric field amplitude doubles for a plane wave in vacuum, what happens to the magnetic field amplitude B0?

A. B halves

B. B unchanged

C. B becomes zero

D. B doubles

8. Three point charges q1 and q2 separated by distance r. Which expression gives the potential energy and what is its sign for like versus opposite charges?

A. U = k (q1^2 + q2^2) / r

B. U = k (q1 - q2) / r

C. U = k q1 q2 / r; positive for like charges, negative for opposite charges

D. U = k q1 q2 r

9. If the current through an inductor is doubled, how does the energy stored change?

A. It quadruples

B. It doubles

C. It halves

D. It remains the same

10. The force between two point charges Q and Q' separated by distance d is F = k|QQ'|/d^2. If the distance is doubled, how does F change?

A. It becomes one-half

B. It becomes one-quarter

C. It doubles

D. It remains the same

Answers

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

Explanations

1. A negatively charged ball is brought near end A of a rod that has a net positive charge at end A (with some negative charge in the center). What happens to end A when the ball approaches closely for the first time?

A. It is repelled.

B. It experiences no force.

C. It is attracted.

D. It causes the rod to rotate.

When charges are involved, opposite charges attract. The end A of the rod carries a net positive charge, while the approaching ball is negatively charged. The negative ball feels an attractive force toward the positive end because Coulomb's law tells us that the force between opposite charges is directed along the line joining them and toward each other. Even though there is some negative charge in the center of the rod, that region is farther from the ball when it first comes near end A. Since the electrostatic force weakens with distance, the stronger, closer attraction from the positive end dominates. So the end A is pulled toward the ball (and equivalently, the ball is pulled toward end A). If the rod were free to move, that localized force could also produce torque, but the immediate effect at the first approach is an attractive interaction between the ball and the positively charged end.

2. Four charges occupy the corners of a square: top-left -10 nC, top-right +q, bottom-left +Q, bottom-right -10 nC. What value of Q (in nC) makes the electrostatic force on the top-right charge q equal to zero?

A. -28 nC

B. +38 nC

C. +28 nC

D. +8 nC

Think of the force on the top-right charge q as a sum of forces from the other three charges (superposition). The two charges at the adjacent corners are at distance equal to the side of the square, so the forces from them on the top-right charge have equal magnitudes and point left and down, respectively. Specifically, each of those forces has magnitude F0 = k q (10 nC) / s^2, with one directed to the left and the other downward. The third charge, bottom-left, is diagonally opposite and sits a distance √2 s away. The force it exerts on the top-right charge has magnitude Fdiag = k q |Q| / (√2 s)^2 = k q |Q| / (2 s^2). Its direction depends on the sign of Q: if Q is positive, the force is along the diagonal away from bottom-left, i.e., up and to the right. For the net force on the top-right charge to be zero, the diagonal force must supply horizontal and vertical components that exactly cancel the leftward and downward forces. Along the diagonal (45 degrees), each component is Fdiag/√2. Thus we need: Fdiag/√2 = F0. Plugging in F0 = k q (10 nC) / s^2 and Fdiag = k q |Q| / (2 s^2), (k q |Q| / (2 s^2)) / √2 = k q (10 nC) / s^2. Cancel common factors to get |Q|/2 = √2 × 10 nC, so |Q| = 20 √2 nC ≈ 28 nC. Sign must be positive to point the diagonal force up and to the right, which cancels the left and down forces. Therefore Q ≈ +28 nC.

3. If the loop radius R is doubled while keeping current I fixed, how does the magnetic field at the center change?

A. Doubles

B. Halves

C. Becomes quarter

D. Remains the same

At the center of a circular loop, the magnetic field from a current I is B = μ0 I / (2R). This shows the field is inversely proportional to the radius for a fixed current. If the radius is doubled, the denominator doubles, so the field becomes half of its original value. The intuition is that spreading the same current over a larger loop weakens the magnetic influence at the center. The magnitude is halved (the direction would still be along the axis given by the right-hand rule, if you care about orientation).

4. Brewster's angle for an interface from air (n1 = 1.00) into glass (n2 ≈ 1.50) is about

A. 34.0°

B. 56.3°

C. 45.0°

D. 30.0°

Brewster's angle is the incidence angle at which the reflected light becomes perfectly polarized parallel to the interface. At this angle, the reflected and refracted rays are perpendicular to each other, which gives a simple relationship from Snell's law. From Snell's law, n1 sin θi = n2 sin θt, and at Brewster's angle θi + θt = 90°, so sin θt = cos θi. This leads to n1 sin θi = n2 cos θi, and rearranging gives tan θi = n2 / n1. Plugging in n1 = 1.00 (air) and n2 ≈ 1.50 (glass), tan θB = 1.50, so θB = arctan(1.50) ≈ 56.3°. Therefore the Brewster angle for this air-to-glass interface is about 56.3°. The other angles don't satisfy tan θ = 1.50 (for example, tan 34° ≈ 0.674, tan 45° = 1, tan 30° ≈ 0.577), so they aren't Brewster angles here.

5. The magnetic field inside a long solenoid with N turns per unit length carrying current I is given by which expression?

A. B = mu0 N I

B. B = mu0 N I^2

C. B = mu0 I / N

D. B = mu0 N / I

Ampere's law applied to an ideal long solenoid gives a uniform magnetic field inside and negligible field outside. If you draw a rectangular Amperian loop with a long side of length L along the solenoid's axis, the line integral is essentially B times L inside (the outside contribution is zero). The current enclosed by the loop is the total current from all turns within length L, which is (turns per unit length) times L times the current per turn: N L I. Ampere's law then reads B L = μ0 (N L I), so the magnetic field inside is B = μ0 N I. This shows the field grows linearly with both the current and the density of turns.

6. Four charges are placed such that q1 = 1 nC, q2 = 2 nC, q3 = -6 nC, q4 = 2 nC with a specified arrangement. The bottom charge is q1. What is the magnitude and direction of the net force on q1?

A. 1.14×10^-5 N, 0 degrees

B. 1.14×10^-5 N, 45 degrees

C. 1.14×10^-5 N, 90 degrees

D. 2.28×10^-5 N, 90 degrees

Coulomb forces from multiple charges add as vectors, so the net force on q1 is the vector sum of the individual forces from q2, q3, and q4. Each force has magnitude k|q1 qi|/ri^2 and lies along the line joining q1 to qi. In this arrangement the horizontal components of those forces cancel each other out due to symmetry or equal opposing distances, leaving a net force that has only a vertical component. When you sum the vertical components, they point in the same direction and add to a magnitude of 1.14×10^-5 N. Since there is no horizontal component, the resultant is purely vertical, i.e., at 90 degrees to the horizontal.

7. If the electric field amplitude doubles for a plane wave in vacuum, what happens to the magnetic field amplitude B0?

A. B halves

B. B unchanged

C. B becomes zero

D. B doubles

In vacuum, a plane electromagnetic wave has its electric and magnetic field amplitudes tied by E0 = c B0, so B0 = E0 / c. Because c is a constant, the two amplitudes scale together. If the electric-field amplitude doubles, the magnetic-field amplitude must also double: B0_new = (2E0)/c = 2(E0/c) = 2B0.

8. Three point charges q1 and q2 separated by distance r. Which expression gives the potential energy and what is its sign for like versus opposite charges?

A. U = k (q1^2 + q2^2) / r

B. U = k (q1 - q2) / r

C. U = k q1 q2 / r; positive for like charges, negative for opposite charges

D. U = k q1 q2 r

The potential energy of two point charges depends on the product of their charges and their separation. For charges q1 and q2 separated by distance r, the energy is U = k q1 q2 / r, with k the Coulomb constant. The sign comes from the product q1 q2: if the charges are the same sign, q1 q2 is positive and U is positive; if the charges have opposite signs, q1 q2 is negative and U is negative. This matches the idea that like charges resist being brought together (positive energy to assemble), while opposite charges release energy as they come together (negative energy). The other proposed forms don't fit the distance dependence or the dimensionality of energy, since they omit the product, use a difference or sum, or place r instead of dividing by r.

9. If the current through an inductor is doubled, how does the energy stored change?

A. It quadruples

B. It doubles

C. It halves

D. It remains the same

Energy stored in an inductor scales with the square of the current. For an inductor with constant inductance L, the stored energy is W = (1/2) L I^2. If the current doubles from I to 2I, the energy becomes (1/2) L (2I)^2 = 4 × (1/2) L I^2. So the energy quadruples. Intuitively, the magnetic field inside the coil is proportional to the current, and the field energy goes as the square of the field strength, leading to a fourfold increase when the current doubles. This holds as long as the inductance remains effectively constant.

10. The force between two point charges Q and Q' separated by distance d is F = k|QQ'|/d^2. If the distance is doubled, how does F change?

A. It becomes one-half

B. It becomes one-quarter

C. It doubles

D. It remains the same

Coulomb's law tells us that the electrostatic force between two point charges is proportional to 1 over the distance squared. So if the separation doubles, the factor 1/d^2 becomes 1/(2d)^2 = 1/(4d^2), which is one quarter of the original value. Therefore the force becomes one-quarter of its initial strength. This matches the inverse-square dependence: doubling distance reduces the force by a factor of four. The other options would contradict the 1/d^2 relationship.

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://ucf-phy2054.examzify.com

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