National Council of Examiners for Engineering and Surveying (NCEES) Fundamentals of Engineering (FE) Chemical Practice Exam (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. How do you determine if an element is oxidized or reduced in a redox reaction?

A. By observing the reactants only

B. By analyzing the mass of the products

C. By checking the oxidation state of each element

D. By measuring the temperature change

2. What is the correlation in spring dynamics involving kinetic and potential energy?

A. KE equals PE of the spring when at rest

B. KE of the object equals PE of the spring being compressed

C. PE of the object hitting the spring equals KE of the spring

D. PE of the spring equals total energy of the system

3. What is an annuity?

A. A one-time payment

B. A uniform series of payments

C. A variable series of payments

D. A loan that accrues interest

4. What defines relative volatility?

A. The ratio of pressure to temperature of a component

B. The ratio of mole fractions of two components in one phase to that in the other phase

C. The ratio of mass to volume of a substance

D. The change in temperature over a fixed pressure

5. What is the proper formula for calculating impulse using momentum?

A. Impulse = mass x ($\Delta v/\Delta t$)

B. Impulse = total force / total time

C. Impulse = change in energy / time

D. Impulse = force + time

6. When control blocks are in series, how do their transfer functions combine?

- **A. Their transfer functions add**
- **B. Their transfer functions multiply**
- **C. Their transfer functions subtract**
- **D. Their transfer functions remain unchanged**

7. What characterizes equimolar counter diffusion?

- **A. Molar fluxes of A and B are equal and constant**
- **B. Moles of A diffusing in exceed moles of B diffusing out**
- **C. Molar fluxes of A and B are constant and unidirectional**
- **D. Moles of A diffusing out are replaced by moles of B diffusing in**

8. What is the first step in finding the equation of a line tangent to a function?

- **A. Use the slope-intercept formula**
- **B. Evaluate the function at the point of tangency**
- **C. Take the derivative of the function**
- **D. Calculate the area under the curve**

9. When calculating potential energy, which variable represents the height of the object above a reference point?

- **A. m (mass)**
- **B. g (gravitational acceleration)**
- **C. h (height)**
- **D. v (velocity)**

10. In an equilibrium state, which variable would be used to represent the liquid composition?

- **A. X1***
- **B. Y1***
- **C. Y2**
- **D. X2***

Answers

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

Explanations

1. How do you determine if an element is oxidized or reduced in a redox reaction?

A. By observing the reactants only

B. By analyzing the mass of the products

C. By checking the oxidation state of each element

D. By measuring the temperature change

In a redox reaction, identifying whether an element is oxidized or reduced hinges on the changes in oxidation states of the elements involved. Oxidation refers to the loss of electrons, resulting in an increase in the oxidation state, while reduction involves the gain of electrons, leading to a decrease in the oxidation state. To determine these changes, one must assign oxidation states to each element before and after the reaction. If the oxidation state of an element increases, this indicates that it has been oxidized; conversely, if the oxidation state decreases, that element has been reduced. This systematic approach allows chemists to track electron transfer effectively, which is the fundamental aspect of redox processes. Other methods mentioned, such as observing the reactants or analyzing product mass, do not directly provide insight into the electron transfer or the changes in oxidation states, making them insufficient for determining oxidation and reduction in a redox reaction. Measuring temperature change may indicate energy changes in the reaction but does not correlate to the redox status of the elements involved. Hence, the most reliable method is checking the oxidation state of each element.

2. What is the correlation in spring dynamics involving kinetic and potential energy?

A. KE equals PE of the spring when at rest

B. KE of the object equals PE of the spring being compressed

C. PE of the object hitting the spring equals KE of the spring

D. PE of the spring equals total energy of the system

The correlation between kinetic energy (KE) and potential energy (PE) in the context of spring dynamics is best illustrated by the relationship that occurs when a spring is compressed or stretched. When an object compresses a spring, it does work on the spring, which converts the kinetic energy of the object into potential energy stored in the spring. As the spring is compressed, the potential energy in the spring increases, and this energy is directly related to the amount of compression according to Hooke's law, which states that the force exerted by a spring is proportional to its displacement. At full compression, the object's kinetic energy is at its maximum just before the point of maximum compression, and it is 0 as the spring reaches its maximum compression. At that point, all the kinetic energy has been transformed into the potential energy of the spring. As the spring decompresses, the potential energy converts back into kinetic energy, thereby demonstrating the conservation of mechanical energy in the system. This connection conveys the dynamic exchange of energy between kinetic and potential forms during the motion of objects interacting with springs. This reasoning confirms why the correct answer involves the kinetic energy of the object equaling the potential energy of the spring being compressed, illustrating the energy transfer during the interaction.

3. What is an annuity?

A. A one-time payment

B. A uniform series of payments

C. A variable series of payments

D. A loan that accrues interest

An annuity is defined as a uniform series of payments made at regular intervals over a specified period. This financial product involves either receiving or making a series of payments, typically used in contexts such as retirement savings or loan repayments. The term "uniform" indicates that the payments are consistent in amount and are spaced evenly over time, whether it's monthly, quarterly, or annually. When considering other options, a one-time payment does not represent the concept of an annuity since it involves a single transaction rather than a series of transactions. A variable series of payments does not fit the definition of an annuity either, as this would imply that the payment amounts can change over time, which contradicts the premise of uniform payments. Additionally, a loan that accrues interest describes a different financial mechanism; while it may involve repayments over time, it does not specifically relate to the consistent payment structure that characterizes annuities. Thus, the definition of an annuity as a uniform series of payments is accurate and highlights the key features of this financial concept.

4. What defines relative volatility?

A. The ratio of pressure to temperature of a component

B. The ratio of mole fractions of two components in one phase to that in the other phase

C. The ratio of mass to volume of a substance

D. The change in temperature over a fixed pressure

Relative volatility is defined as the ratio of the mole fractions of two components in one phase to those in another phase, specifically in a mixture undergoing phase separation, such as in distillation processes. This measure provides insight into how easily one component can be separated from another based on their differing volatilities. When a liquid mixture is heated, the more volatile component preferentially vaporizes, and relative volatility quantifies this preference. A higher relative volatility suggests that one component can be separated more readily from the other, making it a crucial concept in chemical engineering, particularly in designing and optimizing separation processes like distillation columns. The other options do not correctly capture the essence of relative volatility. The first option refers to pressure and temperature, which are related to phase behavior but do not define volatility. The third option about mass to volume does not relate to the separation characteristics of components in a mixture. The last option discusses temperature change over fixed pressure, which is pertinent to thermodynamic processes, but not to the specific concept of relative volatility in separation processes.

5. What is the proper formula for calculating impulse using momentum?

A. Impulse = mass x (Δv/Δt)

B. Impulse = total force / total time

C. Impulse = change in energy / time

D. Impulse = force + time

The concept of impulse in relation to momentum is grounded in the fundamental principle that impulse is the change in momentum of an object when a force is applied over a certain period of time. The formula for impulse can be expressed as the product of mass and the change in velocity (Δv) over the change in time (Δt). This essentially derives from Newton's second law, which states that force is equal to mass times acceleration. When you integrate this over a time interval, you arrive at impulse. Impulse is therefore calculated by taking the mass of an object and multiplying it by the change in velocity that occurs during a particular time interval. This relationship emphasizes that the larger the change in velocity or the longer the force is applied, the greater the impulse produced. When evaluating other options, they do not accurately reflect the relationship defined by physics. Impulse is specifically linked to the change in momentum via a change in velocity and time, making the first option the correct representation of what impulse represents in a momentum context.

6. When control blocks are in series, how do their transfer functions combine?

A. Their transfer functions add

B. Their transfer functions multiply

C. Their transfer functions subtract

D. Their transfer functions remain unchanged

When control blocks are connected in series, the overall transfer function of the system is found by multiplying the individual transfer functions of each block. This reflects how the output of one block becomes the input for the next block in the series. Each block applies its own transformation to the input signal, and the effect of these transformations combines multiplicatively. For example, if you have two transfer functions, represented as H1(s) and H2(s), the total transfer function H(s) for the series connection would be expressed as H(s) = H1(s) * H2(s). This multiplication preserves the system dynamics and appropriately represents the cumulative effect of the control blocks in influencing the final output based on the inputs. Therefore, the multiplication of transfer functions in series is fundamental to control theory and helps in analyzing complex systems systematically.

7. What characterizes equimolar counter diffusion?

- A. Molar fluxes of A and B are equal and constant
- B. Moles of A diffusing in exceed moles of B diffusing out
- C. Molar fluxes of A and B are constant and unidirectional
- D. Moles of A diffusing out are replaced by moles of B diffusing in

Equimolar counter diffusion refers to a process where, in a given system, the number of moles of one species diffusing in is equal to the number of moles of another species diffusing out, maintaining a constant overall balance of species. This characteristic ensures that as moles of substance A leave a region, an equivalent number of moles of substance B enter that same region. In this context, the answer correctly identifies that moles of A diffusing out are replaced by moles of B diffusing in. This replacement is crucial for maintaining equimolarity in the diffusion process. The underlying principle is driven by concentration gradients as A and B seek to achieve equilibrium; thus, the fluxes of both species adjust to ensure that the system remains in equilibrium while allowing continuous transfer of materials. This process can be contrasted with options suggesting unidirectional fluxes or unequal diffusion rates, which would indicate a lack of equilibrium, countering the fundamental idea of equimolar counter diffusion.

8. What is the first step in finding the equation of a line tangent to a function?

- A. Use the slope-intercept formula
- B. Evaluate the function at the point of tangency
- C. Take the derivative of the function
- D. Calculate the area under the curve

The correct approach to finding the equation of a line tangent to a function starts with taking the derivative of that function. The derivative provides the slope of the tangent line at any given point on the curve. By calculating the derivative, you can evaluate it at the specific point of tangency to determine the slope of the tangent line. To find the equation of the tangent line, you will need both a point on the curve and the slope at that point. After finding the derivative, you can then substitute the x-coordinate of the point of tangency into the derivative to get the slope. This slope, along with the coordinates of the point on the function, will allow you to use the point-slope form of a line to write the equation of the tangent line. While the other choices may seem relevant in different contexts, they do not address the foundational step necessary for deriving the tangent line. Evaluating the function at the point of tangency is important but comes after determining the slope from the derivative. The slope-intercept form is a way to express the line once you have both the slope and the point, rather than being a first step. Calculating the area under the curve pertains to integral calculus, which is not necessary for finding a tangent line.

9. When calculating potential energy, which variable represents the height of the object above a reference point?

A. m (mass)

B. g (gravitational acceleration)

<u>C. h (height)</u>

D. v (velocity)

The correct choice identifies height with the variable h, reflecting its role in the calculation of potential energy. Potential energy in a gravitational field is given by the formula: \[PE = mgh \] In this formula, m represents the mass of the object, g is the acceleration due to gravity, and h is the height of the object above a specified reference point. The height, or h, is crucial because it indicates how far the object is displaced vertically from the reference point, influencing the potential energy it possesses due to its position. Understanding that h is the vertical distance is fundamental for potential energy calculations. As the height increases, the potential energy also increases linearly, assuming mass and gravitational acceleration are constant. This relationship highlights why h is critical to the concept of gravitational potential energy—an object elevated to a greater height can do more work if it were to fall, thereby increasing its potential energy.

10. In an equilibrium state, which variable would be used to represent the liquid composition?

<u>A. X1*</u>

B. Y1*

C. Y2

D. X2*

In the context of phase equilibrium in a chemical process, the variable that typically represents the liquid composition is denoted as X, specifically in the format X1* or X2*. This notation indicates the molar fraction of a component in the liquid phase at equilibrium conditions. Choosing X1* suggests that it refers to the composition of the first component in the liquid phase at equilibrium. This is consistent with the convention in thermodynamics and chemical engineering where liquid compositions are symbolized using X, while gas compositions are represented by Y. At equilibrium, the liquid and vapor phases have specific compositions that correspond to the same temperature and pressure conditions. The asterisk (*) indicates that this is the composition at equilibrium, which is crucial in phase diagrams and calculations related to phase behavior, such as in distillation or absorption processes. Understanding this distinction is important for analysis and process design, where knowing the liquid composition at equilibrium informs decisions about separation processes and material balances.

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://ncees-fe-chemical.examzify.com

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