ETS Major Field Test Chemistry 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. What is the main purpose of chromatography in chemistry?

A. To determine the molecular weight of compounds

B. To separate mixtures based on their interactions with a stationary phase

C. To measure the pH of solutions

D. To identify pure substances

2. What is the result of a spontaneous reaction?

A. The reaction occurs with external influence

B. The reaction occurs without external influence

C. The reaction is always exothermic

D. The reaction needs a catalyst

3. Which gas law states that the volume of a gas is inversely proportional to its pressure at a constant temperature?

A. Charles's Law

B. Avogadro's Law

C. Boyle's Law

D. Dalton's Law

4. What is the unit of measurement for the rate constant in a second-order reaction?

A. 1/M·s

B. M/s

C. s

D. M^2/s

5. What is the oxidation number of oxygen in hydrogen peroxide (H_2O_2)?

A. 0

B. -1

C. -2

D. +1

6. Which element has the highest electronegativity?

- **A. Chlorine (Cl)**
- **B. Oxygen (O)**
- **C. Helium (He)**
- **D. Fluorine (F)**

7. What is the key difference between alkanes and alkenes?

- **A. Alkenes contain a carbon-carbon triple bond**
- **B. Alkenes contain at least one carbon-carbon double bond**
- **C. Alkanes are unsaturated hydrocarbons**
- **D. Alkanes have a higher boiling point than alkenes**

8. How is ionization energy defined?

- **A. The energy required to remove the outermost electron from a gaseous atom**
- **B. The energy released when an electron is added to a gaseous atom**
- **C. The potential energy of an atom when it is ionized**
- **D. The energy required to ionize an electron in a solid state**

9. What is the first ionization energy?

- **A. The energy required to remove the outermost electron from a neutral atom in the gas phase**
- **B. The energy released when an electron is added to an atom**
- **C. The energy needed to break ionic bonds in a compound**
- **D. The energy associated with the stability of the electron cloud**

10. What is the term for the measure of a solution's concentration at saturation?

- **A. Concentration**
- **B. Solubility**
- **C. Molarity**
- **D. Normality**

Answers

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

Explanations

1. What is the main purpose of chromatography in chemistry?

A. To determine the molecular weight of compounds

B. To separate mixtures based on their interactions with a stationary phase

C. To measure the pH of solutions

D. To identify pure substances

Chromatography is primarily utilized in chemistry to separate mixtures into their individual components. The technique relies on the interactions between the substances in the mixture and a stationary phase, which is often a solid or a viscous liquid that remains fixed in place, and a mobile phase, which is a liquid or gas that carries the components of the mixture. As the mobile phase moves through or over the stationary phase, different components of the mixture will interact with the stationary phase to varying degrees, causing them to move at different rates. This differential migration allows for the components to be separated and subsequently analyzed. The focus of chromatography is on the separation process, which is fundamental for various analytical applications, including purifying compounds, analyzing complex mixtures, and identifying substances based on their unique separation characteristics. Other techniques mentioned, such as determining molecular weight or measuring pH, do not relate to the primary function of chromatography, which centers on separating compounds rather than analyzing or quantifying them directly.

2. What is the result of a spontaneous reaction?

A. The reaction occurs with external influence

B. The reaction occurs without external influence

C. The reaction is always exothermic

D. The reaction needs a catalyst

A spontaneous reaction is defined as a process that occurs naturally under a given set of conditions without the need for external influence. This means that once the reactants are in proper conditions (such as temperature and pressure), the reaction proceeds on its own, producing products and releasing energy in some cases. A key aspect of spontaneity is that it is intrinsically related to the thermodynamic favorability of the reaction, which can be determined by changes in enthalpy and entropy. Spontaneous reactions can be exothermic, but they are not limited to that category; some spontaneous reactions are endothermic but still proceed due to a change in entropy that outweighs the enthalpic contribution. This understanding of spontaneity distinguishes it from other forms of reactions that may require catalysts, external energy, or specific conditions to start or sustain the reaction. Hence, the statement that it occurs without external influence correctly encapsulates the nature of spontaneous reactions.

3. Which gas law states that the volume of a gas is inversely proportional to its pressure at a constant temperature?

A. Charles's Law

B. Avogadro's Law

C. Boyle's Law

D. Dalton's Law

The statement that identifies the volume of a gas as being inversely proportional to its pressure at a constant temperature is known as Boyle's Law. According to this law, when the temperature of a gas is held constant, increasing the pressure on the gas results in a decrease in its volume, and conversely, decreasing the pressure results in an increase in its volume. The mathematical representation of Boyle's Law is expressed as \(P \cdot V = k \), where \(P \) is the pressure, \(V \) is the volume, and \(k \) is a constant for a given amount of gas. This relationship highlights the inverse nature; as one quantity increases, the other decreases while the temperature remains unchanged. Understanding this principle is fundamental in various scientific and practical applications, such as in understanding how syringe operations or internal combustion engines work. In contrast, other gas laws like Charles's Law deal with volume and temperature directly, Avogadro's Law relates volume and the number of moles of gas, and Dalton's Law focuses on the partial pressures of gases in a mixture, making them unsuitable for this specific relationship between volume and pressure.

4. What is the unit of measurement for the rate constant in a second-order reaction?

A. 1/M·s

B. M/s

C. s

D. M^2/s

In a second-order reaction, the rate law can be expressed as rate = $k[A]^2$ or rate = k[A][B], where [A] and [B] are the concentrations of the reactants. The rate of reaction is measured in units of concentration per time, typically moles per liter per second (M/s). To determine the units of the rate constant (k) for a second-order reaction, we can rearrange the rate equation. If we consider the general form of the rate equation: rate = $k[A]^2$ Rearranging gives: $k = rate / [A]^2$ Substituting the units for rate and concentration, we have: $k = (M/s) / (M^2) = M/s * 1/M^2 = 1/(M·s)$ Thus, the unit of measurement for the rate constant in a second-order reaction is indeed 1/M·s. This makes sense in terms of dimensional analysis and ensures that the units are consistent with the kinetic theory of reactions.

5. What is the oxidation number of oxygen in hydrogen peroxide (H_2O_2)?

A. 0

B. -1

C. -2

D. +1

In hydrogen peroxide (H_2O_2), the oxidation number of oxygen is -1. This is derived from the rules governing oxidation states. Typically, oxygen has an oxidation state of -2 in most compounds; however, in peroxides, which is the category hydrogen peroxide belongs to, the oxidation state changes due to the unique bonding characteristics of the peroxide ion (O-O linkage). In H_2O_2, the two oxygen atoms share a single bond with each other, and as a result, they do not exhibit the typical -2 oxidation state. Instead, each oxygen in the peroxide has an oxidation state of -1. To confirm this, if we assign the oxidation state of hydrogen as +1 (which is generally how it behaves), we can see that the overall charge on the molecule must equal zero (since it is a neutral molecule). Therefore, the total contributions from the two hydrogens (+2) must be balanced by the contributions from the two oxygens, leading to the conclusion that each oxygen is indeed at -1. Thus, the correct oxidation number for oxygen in hydrogen peroxide is -1.

6. Which element has the highest electronegativity?

A. Chlorine (Cl)

B. Oxygen (O)

C. Helium (He)

D. Fluorine (F)

Fluorine is recognized as the element with the highest electronegativity due to its position in the periodic table and its atomic structure. Electronegativity is the measure of an atom's ability to attract and hold onto electrons when it is part of a compound. Fluorine, being in group 17 (the halogens), has a very high effective nuclear charge and a small atomic radius, which enables it to pull electrons towards itself more effectively than other elements. Its electron configuration, with a single unpaired electron in its outer shell, allows it to be very eager to gain one more electron to achieve a full valence shell, reflecting a strong tendency to attract electrons. This extreme electronegativity is what makes fluorine highly reactive, particularly with alkali and alkaline earth metals. Hence, when considering electronegativity trends across the periodic table, fluorine stands out as the most electronegative element. Chlorine and oxygen also have notable electronegativities but do not match that of fluorine. Helium, being a noble gas, does not participate in bonding in the same way, hence it is not relevant in this context of electronegativity.

7. What is the key difference between alkanes and alkenes?

A. Alkenes contain a carbon-carbon triple bond

B. Alkenes contain at least one carbon-carbon double bond

C. Alkanes are unsaturated hydrocarbons

D. Alkanes have a higher boiling point than alkenes

The key difference between alkanes and alkenes lies in their bonding and saturation levels. Alkenes are characterized by the presence of at least one carbon-carbon double bond (C=C) within their structure. This double bond results in a degree of unsaturation, which differentiates alkenes from alkanes, the latter of which consist only of single carbon-carbon bonds (C-C) and are thus classified as saturated hydrocarbons. The presence of this double bond in alkenes allows them to engage in additional types of chemical reactions, such as additions, that alkanes cannot. This fundamental distinction is crucial for understanding their chemical behavior, reactivity, and properties. In contrast, alkanes are more stable and less reactive due to their saturated nature, making the identification of this double bond in alkenes the defining factor that separates them from alkanes.

8. How is ionization energy defined?

A. The energy required to remove the outermost electron from a gaseous atom

B. The energy released when an electron is added to a gaseous atom

C. The potential energy of an atom when it is ionized

D. The energy required to ionize an electron in a solid state

Ionization energy is defined as the amount of energy required to remove the outermost electron from a gaseous atom. This process involves overcoming the attractive forces between the negatively charged electron and the positively charged nucleus. When an atom is in a gaseous state, the removal of an electron results in the formation of a positively charged ion. The energy needed for this process can vary significantly among different elements, as it is influenced by factors such as atomic size, effective nuclear charge, and electron shielding. This definition captures the essence of ionization energy by emphasizing the gaseous state of the atom and focusing on the removal of the outermost electron, which is typically the one most easily removed due to its distance from the nucleus and its interactions with other electrons. The other choices present alternative concepts related to atomic interactions, such as electron affinity or energy considerations in different states, which do not directly define ionization energy.

9. What is the first ionization energy?

A. The energy required to remove the outermost electron from a neutral atom in the gas phase

B. The energy released when an electron is added to an atom

C. The energy needed to break ionic bonds in a compound

D. The energy associated with the stability of the electron cloud

The first ionization energy refers specifically to the energy required to remove the outermost electron from a neutral atom in the gas phase. This concept is crucial in understanding how elements behave in chemical reactions and how they form ions. When an atom is in its gaseous state, it is considered isolated, and the outermost electron experiences the effective nuclear charge exerted by the protons in the nucleus. The first ionization energy is a measure of how strongly this outer electron is bound to the atom. Generally, this energy increases across a period on the periodic table due to an increase in nuclear charge without a significant increase in shielding effect, making it more challenging to remove an electron. Conversely, it decreases down a group as the added electron shells increase the distance between the nucleus and the outermost electron, leading to a reduced effective nuclear charge experienced by that electron. This definition aligns perfectly with the correct answer, distinguishing it from the other options, which refer to different concepts entirely, such as electron affinity or the energies associated with breaking bonds and electron stability.

10. What is the term for the measure of a solution's concentration at saturation?

A. Concentration

B. Solubility

C. Molarity

D. Normality

The measure of a solution's concentration at saturation is referred to as solubility. Solubility describes the maximum amount of a solute that can dissolve in a specific amount of solvent at a given temperature and pressure, resulting in a saturated solution. This concept is crucial in understanding how substances interact in solution and allows chemists to predict whether a solute will dissolve or precipitate under certain conditions. Concentration, while related to how much solute is in a solution, does not specify that the solution is saturated. Molarity and normality are specific ways to express concentration but only refer to the amount of solute in a liter of solution without reference to saturation. Molarity is based on volume, while normality is based on the equivalent weight of solutes. Therefore, solubility is the most appropriate term for indicating how much solute can be contained in a saturated solution.

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://etsmajfieldtestchem.examzify.com

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