ACS General Chemistry 2 Practice Exam (Sample)

Study Guide

Everything you need from our exam experts!

Sample study guide. For the full version with hundreds of questions, visit: https://acsgenchem2.examzify.com

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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. **For the reaction: NO_2 (g) + F_2 (g) ⇌ 2 NO_2F (g), a proposed mechanism has the slow step NO_2 + F_2 ⇌ NO_2F + F and a fast step NO_2 + F ⇌ NO_2F. What is the rate law for this mechanism?**

   A. A rate = k [NO2]^2 [F2]

   B. rate = k [NO2]

   C. rate = k [NO2][F2]

   D. rate = k [F2]

2. **For the reaction CH_3COCH_3(g) + 4 O_2(g) → 3 CO_2(g) + 3 H_2O(l) at 25 °C with ΔH' = −184 kJ/mol and ΔS' = −236 J/mol·K, what is ΔG'?**

   A. −70 kJ/mol

   B. −114 kJ/mol

   C. 0 kJ/mol

   D. −184 kJ/mol

3. **An acetate buffer is prepared with 0.100 M HOAc and 0.100 M NaOAc. If pKa(HOAc) = 4.74, what is the pH?**

   A. 4.26

   B. 4.74

   C. 4.94

   D. 7.00

4. **In the gas-phase equilibrium 2BrCl(g) ⇌ Br_2(g) + Cl_2(g), what happens if the container volume is decreased (pressure increased) at constant temperature?**

   A. Shift to left

   B. Shift to right

   C. No shift

   D. Kp changes

5. **An oxidation-reduction reaction in which 3 electrons are transferred has a Delta G° = 18.55 kJ/mol at 25 degrees C. What is the value of E°?**
   - **A. 0.192 V**
   - **B. -0.064 V**
   - **C. -0.192 V**
   - **D. -0.577 V**

6. **In a sealed container at 25°C, the gas-phase equilibrium $2BrCl(g) \rightleftharpoons Br_2(g) + Cl_2(g)$ has $K_p = 0.130$. If initially BrCl(g) = 0.400 atm, Br2(g) = 0.800 atm, and Cl2(g) = 0.800 atm, what is the BrCl(g) partial pressure at equilibrium?**
   - **A. 0.781 atm**
   - **B. 0.419 atm**
   - **C. 1.16 atm**
   - **D. 1.21 atm**

7. **Which action increases the concentration of gas dissolved in a liquid?**
   - **A. Cooling the solution**
   - **B. Heating the solution**
   - **C. Increasing the volume of the solution**
   - **D. Decreasing the volume of the solution**

8. **For the reaction $2SO_2 + O_2 \rightleftharpoons 2SO_3$, when the pressure is increased, the forward rate increases and the yield of SO3 increases because the forward reaction reduces the total number of gas molecules. Which statement best explains this observation?**
   - **A. The system shifts toward the side with more moles of gas.**
   - **B. The system shifts toward the side with fewer moles of gas.**
   - **C. There is no effect on equilibrium.**
   - **D. The equilibrium constant increases with pressure.**

9. Which statement correctly describes a galvanic cell with a positive standard cell potential E°cell?

- **A. The reaction is spontaneous under standard conditions.**
- **B. The reaction is nonspontaneous under standard conditions.**
- **C. The reaction is at equilibrium under standard conditions.**
- **D. Spontaneity cannot be predicted from E°cell.**

10. Which statement regarding chemical reactions is true according to collision theory?

- **A. All molecular collisions result in chemical equations.**
- **B. Increasing the temperature of a reaction decreases the kinetic energy of molecules, making collisions more effective.**
- **C. Catalysts make individual collisions more effective, increasing reaction rates.**
- **D. Proper orientation of molecules is required for collision to result in chemical reactions.**

Answers

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

Explanations

1. For the reaction: NO2 (g) + F2 (g) ⇌ 2 NO2F (g), a proposed mechanism has the slow step NO2 + F2 ⇌ NO2F + F and a fast step NO2 + F ⇌ NO2F. What is the rate law for this mechanism?

   A. A rate = k [NO2]^2 [F2]

   B. rate = k [NO2]

   C. rate = k [NO2][F2]

   D. rate = k [F2]

The rate law is determined by the slow (rate-determining) step. That step is bimolecular, involving one NO2 and one F2 molecule reacting to form NO2F and F. For an elementary step, the rate law follows the reactants in that step: rate = k [NO2][F2]. The fast step that follows does not set the overall rate, since it occurs after the slow step and involves intermediates (NO2F and F) rather than the starting reactants. Therefore the rate depends on both NO2 and F2—first order in each—giving rate = k [NO2][F2]. The other options imply dependence on only one species or on a different combination, which doesn’t match the slow, bimolecular step.

2. For the reaction CH3COCH3(g) + 4 O2(g) → 3 CO2(g) + 3 H2O(l) at 25 °C with ΔH' = −184 kJ/mol and ΔS' = −236 J/mol·K, what is ΔG'?

   A. −70 kJ/mol

   B. −114 kJ/mol

   C. 0 kJ/mol

   D. −184 kJ/mol

Gibbs free energy change is found from ΔG = ΔH − TΔS. At 25 °C, T = 298 K. Convert ΔS to kJ: ΔS = −236 J/(mol·K) = −0.236 kJ/(mol·K). Then TΔS = 298 × (−0.236) = −70.3 kJ/mol. Now ΔG = (−184 kJ/mol) − (−70.3 kJ/mol) ≈ −113.7 kJ/mol, i.e., about −114 kJ/mol. Since ΔG is negative, the reaction is spontaneous at 25 °C. The negative ΔS indicates a loss of disorder (gas → liquid water), but the exothermic enthalpy dominates at this temperature, giving a negative ΔG.

3. An acetate buffer is prepared with 0.100 M HOAc and 0.100 M NaOAc. If pKa(HOAc) = 4.74, what is the pH?

   A. 4.26

   B. 4.74

   C. 4.94

   D. 7.00

The pH of a buffer depends on the ratio of its conjugate base to the weak acid, described by the Henderson–Hasselbalch equation: pH = pKa + log([A-]/[HA]). In this acetate buffer, the weak acid is HOAc (HA) and its conjugate base is OAc− (A−). Since both components are present at equal concentrations (0.100 M each), the ratio [A−]/[HA] is 1, and log(1) = 0. Therefore the pH equals the pKa, which is 4.74. This is the key reason the pH is 4.74.

4. In the gas-phase equilibrium 2BrCl(g) ⇌ Br2(g) + Cl2(g), what happens if the container volume is decreased (pressure increased) at constant temperature?

   A. Shift to left

   B. Shift to right

   C. No shift

   D. Kp changes

When a gas-phase equilibrium is subject to a change in volume at a constant temperature, the direction of shift depends on the change in the number of gas moles. If the total number of gas moles is the same on both sides, there’s no shift. In this reaction, there are 2 moles of gas on the left and 2 moles on the right, so Δn_gas = 0. If you decrease the volume (increase pressure), each gas’ partial pressure increases by the same factor, so the expression for the equilibrium constant Qp, which is (P_Br2 × P_Cl2)/(P_BrCl2)^2, remains unchanged. Because temperature is fixed, Kp stays the same as well. Therefore the system does not shift its position, even though the pressure is higher.

5. An oxidation-reduction reaction in which 3 electrons are transferred has a Delta G° = 18.55 kJ/mol at 25 degrees C. What is the value of E°?

   A. 0.192 V

   B. -0.064 V

   C. -0.192 V

   D. -0.577 V

The relationship between Gibbs free energy and standard cell potential is ΔG° = -n F E°. Here n is the number of electrons transferred, and F is Faraday’s constant (96485 C/mol). Solve for E°: E° = -ΔG°/(nF). Convert ΔG° to joules: 18.55 kJ/mol = 18550 J/mol. With n = 3 and F = 96485 C/mol, E° = -18550 / (3 × 96485) ≈ -0.064 V. So the standard reduction potential is about -0.064 V. The negative sign means the reaction, as written, is non-spontaneous under standard conditions; the reverse reaction would be spontaneous.

6. In a sealed container at 25°C, the gas-phase equilibrium 2BrCl(g) ⇌ Br2(g) + Cl2(g) has Kp = 0.130. If initially BrCl(g) = 0.400 atm, Br2(g) = 0.800 atm, and Cl2(g) = 0.800 atm, what is the BrCl(g) partial pressure at equilibrium?

A. 0.781 atm

B. 0.419 atm

C. 1.16 atm

D. 1.21 atm

The key idea is using the expression for Kp and the stoichiometry to relate how the pressures change as the system shifts toward equilibrium. For 2 BrCl ⇌ Br2 + Cl2, Kp = (P_Br2)(P_Cl2) / (P_BrCl)^2. Since initially BrCl is 0.400 atm while Br2 and Cl2 are both 0.800 atm, the system will shift to form more BrCl (the reverse direction), so let x be the amount of Br2 and BrCl that react in the reverse direction. Then Br2 and Cl2 decrease by x, and BrCl increases by 2x: P_Br2 = 0.800 − x P_Cl2 = 0.800 − x P_BrCl = 0.400 + 2x Plug into Kp: 0.130 = (0.800 − x)(0.800 − x) / (0.400 + 2x)^2 Taking the square root gives: √0.130 ≈ 0.3606 = (0.800 − x) / (0.400 + 2x) Solve: 0.3606(0.400 + 2x) = 0.800 − x → 0.14424 + 0.7212x = 0.800 − x → 1.7212x = 0.65576 → x ≈ 0.381 Thus the equilibrium BrCl pressure is: P_BrCl = 0.400 + 2x ≈ 0.400 + 0.762 ≈ 1.16 atm So the BrCl partial pressure at equilibrium is about 1.16 atm.

7. Which action increases the concentration of gas dissolved in a liquid?

A. Cooling the solution

B. Heating the solution

C. Increasing the volume of the solution

D. Decreasing the volume of the solution

Gas solubility in liquids is greatly affected by temperature. For most gases, the dissolution process releases heat, so heating the liquid tends to push gas back into the gas phase and lowers the amount dissolved. Cooling, on the other hand, reduces molecular energy and makes it easier for gas molecules to stay dissolved, increasing their concentration in the liquid. Volume changes don’t directly increase the amount dissolved at a given temperature and pressure—they mainly change concentration by diluting or concentrating the dissolved gas, which isn’t the same as increasing the solubility. So cooling the solution increases the concentration of dissolved gas.

8. **For the reaction $2SO_2 + O_2 \rightleftharpoons 2SO_3$, when the pressure is increased, the forward rate increases and the yield of SO_3 increases because the forward reaction reduces the total number of gas molecules. Which statement best explains this observation?**

   - **A. The system shifts toward the side with more moles of gas.**
   - **B. The system shifts toward the side with fewer moles of gas.**
   - **C. There is no effect on equilibrium.**
   - **D. The equilibrium constant increases with pressure.**

When pressure is increased in a gaseous equilibrium, the system shifts to the side that has fewer gas molecules to reduce the overall pressure. In this reaction, the left side has 3 moles of gas (2 SO_2 and O_2) while the right side has 2 moles of gas (2 SO_3). So the equilibrium moves toward the production of SO_3, increasing its yield. The forward rate also speeds up because higher pressure means more frequent collisions, and because it leads to fewer gas molecules on the product side, the overall shift favors the forward direction. Importantly, the equilibrium constant stays the same at a given temperature; increasing pressure changes the position of equilibrium, not the value of K. Therefore, the statement that best explains the observation is that the system shifts toward the side with fewer moles of gas.

9. **Which statement correctly describes a galvanic cell with a positive standard cell potential E°cell?**

   - **A. The reaction is spontaneous under standard conditions.**
   - **B. The reaction is nonspontaneous under standard conditions.**
   - **C. The reaction is at equilibrium under standard conditions.**
   - **D. Spontaneity cannot be predicted from E°cell.**

A positive standard cell potential means the redox reaction as written tends to proceed on its own under standard conditions. This happens because the free energy change is $\Delta G° = -nF E°_{cell}$; with E°cell positive, ΔG° becomes negative, so the reaction is spontaneous. In a galvanic cell, E°cell is positive when the cathode has the larger reduction potential and the anode the smaller, giving $E°_{cell} = E°_{cathode} - E°_{anode} > 0$. Under standard conditions (1 M solutions, 1 atm gases, 25°C), this positive E°cell indicates the cell will generate electrical energy spontaneously. If E°cell were negative, the process would be nonspontaneous under standard conditions; if it were zero, the system would be at equilibrium.

10. Which statement regarding chemical reactions is true according to collision theory?

A. All molecular collisions result in chemical equations.

B. Increasing the temperature of a reaction decreases the kinetic energy of molecules, making collisions more effective.

C. Catalysts make individual collisions more effective, increasing reaction rates.

D. Proper orientation of molecules is required for collision to result in chemical reactions.

In collision theory, a reaction occurs only when reacting molecules collide with enough energy to overcome the activation barrier and with the proper orientation of their reactive parts. Even when energy is sufficient, if the molecules strike each other in the wrong geometry, bonds won’t break and new bonds won’t form, so no reaction happens. This is why orientation matters: it determines whether the electrons and orbitals involved can rearrange to form products. The statement about proper orientation being required is the best reflection of this idea. It captures the fact that not all collisions lead to products, and orientation is a key gatekeeper for whether a collision can be successful. Misleading choices either flip energy behavior (temperature increases kinetic energy, not decreases) or generalize catalysts too much. Catalysts don’t make each collision more effective in isolation; they provide an alternative, lower-energy pathway that increases the fraction of collisions that lead to products, effectively speeding up the reaction without changing the fundamental orientation requirement for every collision.

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://acsgenchem2.examzify.com

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