

AP Chemistry Practice Worksheet

Fifty questions across atomic structure, bonding, intermolecular forces, reactions, kinetics, thermodynamics, equilibrium, and acids/bases. Questions 45 to 50 ask for written explanations.

QUESTIONS	50	MULTIPLE CHOICE	28	WRITTEN	22
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Instructions

Explain at the particle level where a question asks why, not just what.

- 1** Ionization energy generally:
 - A) Increases left to right, increases top to bottom
 - B) Increases left to right, decreases top to bottom
 - C) Decreases left to right, decreases top to bottom
 - D) Stays constant across a period
- 2** An atom's electron configuration determines:
 - A) Its mass number only
 - B) Its chemical behavior and bonding tendencies
 - C) Its number of neutrons
 - D) Its physical state at room temperature only
- 3** Coulomb's law shows that force between charges:
 - A) Increases with distance
 - B) Decreases with distance squared
 - C) Is independent of charge
 - D) Only applies to ions
- 4** A Lewis structure shows:
 - A) Only the molecular shape
 - B) Bonding and lone pairs of electrons
 - C) Only ionic bonds
 - D) Reaction rates
- 5** VSEPR theory predicts molecular geometry based on:
 - A) Atomic mass
 - B) Minimizing repulsion between electron domains
 - C) Boiling point
 - D) Color
- 6** A bond between atoms with a large electronegativity difference is:
 - A) Nonpolar covalent
 - B) Polar covalent or ionic
 - C) Metallic only
 - D) Absent
- 7** Which type of solid is held together by a repeating lattice of covalent bonds (e.g. diamond)?
 - A) Ionic solid
 - B) Molecular solid
 - C) Covalent network solid
 - D) Metallic solid
- 8** London dispersion forces are present in:
 - A) Only polar molecules
 - B) Only ionic compounds
 - C) All molecules
 - D) Only metals
- 9** Hydrogen bonding requires hydrogen bonded directly to:
 - A) Carbon, sulfur, or phosphorus
 - B) Nitrogen, oxygen, or fluorine
 - C) Any nonmetal
 - D) Any metal
- 10** 'Like dissolves like' explains why:
 - A) Oil and water mix well
 - B) Polar solvents dissolve polar solutes well
 - C) All substances are soluble in water
 - D) Nonpolar solvents dissolve ionic solids well

11 How many moles are in 6.022×10^{24} particles?

12 Find the molar mass of CaCO_3 . (Ca=40, C=12, O=16)

13 How many moles are in 50 grams of CaCO_3 ? (molar mass 100 g/mol, round to 1 decimal)

14 A net ionic equation:

- A) Shows all ions including spectators
- B) Omits spectator ions and shows only reacting species
- C) Only applies to gases
- D) Never includes charges

15 In the reaction $\text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$, what is the oxidation number change of Zn?

16 In the same reaction, what is the oxidation number change of H?

17 The exponents in a rate law are determined by:

- A) The balanced equation's coefficients
- B) Experimental data
- C) The reaction's enthalpy
- D) Guessing

18 A rate law is $\text{rate} = k[\text{A}]^1[\text{B}]^2$. What is the overall reaction order?

19 A catalyst increases reaction rate by:

- A) Increasing the concentration of reactants
- B) Lowering the activation energy
- C) Increasing the temperature
- D) Being consumed in the reaction

20 A reaction with a high activation energy at room temperature is generally:

- A) Very fast
- B) Slow, since fewer molecules have enough energy to react
- C) Always exothermic
- D) Always at equilibrium

21 A reaction releasing heat to the surroundings has:

- A) Positive ΔH (endothermic)
- B) Negative ΔH (exothermic)
- C) ΔH equal to zero
- D) Undefined ΔH

22 Using Hess's law, if reaction 1 has $\Delta H = -100 \text{ kJ}$ and reaction 2 has $\Delta H = +30 \text{ kJ}$, and the target reaction is $1 + 2$, find its ΔH .

23 A reaction that increases the number of gas moles generally has:

- A) Negative ΔS (entropy decreases)
- B) Positive ΔS (entropy increases)
- C) Zero ΔS
- D) Undefined ΔS

- 24 Find ΔG if $\Delta H = -80 \text{ kJ}$, $\Delta S = -0.05 \text{ kJ/K}$, and $T = 400 \text{ K}$. ($\Delta G = \Delta H - T\Delta S$)

- 25 A negative ΔG indicates a reaction is:

- A) Nonspontaneous
- B) Spontaneous
- C) At equilibrium exactly
- D) Endothermic only

- 26 For the reaction $A + B \rightleftharpoons C$, write the equilibrium expression K .

- 27 A very large K ($K \gg 1$) at equilibrium indicates:

- A) Mostly reactants present
- B) Mostly products present
- C) Equal reactants and products
- D) No reaction occurs

- 28 Adding more reactant to a system at equilibrium shifts the equilibrium:

- A) Toward reactants
- B) Toward products
- C) It has no effect
- D) The reaction stops

- 29 Increasing pressure (decreasing volume) on a gas-phase equilibrium shifts it toward the side with:

- A) More moles of gas
- B) Fewer moles of gas
- C) No effect regardless of moles
- D) Only liquid species

- 30 Find the pH of a solution with $[H_3O^+] = 1 \times 10^{-4} \text{ M}$.

- 31 A strong acid in water:

- A) Partially dissociates
- B) Fully dissociates
- C) Does not dissociate
- D) Forms a buffer automatically

- 32 A buffer solution resists pH change because it contains:

- A) Only a strong acid
- B) A weak acid/base and its conjugate
- C) Pure water only
- D) Only a strong base

- 33 A galvanic cell converts:

- A) Electrical energy into chemical energy
- B) Chemical energy from a spontaneous redox reaction into electrical energy
- C) Heat into light
- D) Mass into energy

- 34 A cell has $E_{\text{cathode}} = +0.80 \text{ V}$ and $E_{\text{anode}} = -0.76 \text{ V}$. Find E_{cell} . ($E_{\text{cell}} = E_{\text{cathode}} - E_{\text{anode}}$)

- 35 A positive E_{cell} indicates the redox reaction is:

- A) Nonspontaneous
- B) Spontaneous
- C) At equilibrium
- D) Undefined

- 36 Photoelectron spectroscopy (PES) data is used to:

- A) Measure reaction rates
- B) Identify electron binding energies and confirm electron configuration
- C) Measure pH
- D) Determine molecular geometry

- 37 Which best describes an isotope?

- A) Same protons, different neutrons
- B) Same neutrons, different protons
- C) Same mass number, different atomic number
- D) Same electrons, different protons

- 38** A 2.0 L container holds 4.0 moles of gas at 300 K. Find the pressure using $PV=nRT$ ($R=0.0821$). (round to 1 decimal)

- 39** Which best explains why ice floats on liquid water?
- A) Ice is a different chemical compound
 - B) Hydrogen bonding creates a less dense, open crystal structure in ice
 - C) Ice has fewer molecules
 - D) Water is denser as a gas

- 40** Explain, at the particle level, why increasing temperature increases reaction rate.

- 41** Explain why a catalyst does not appear in the overall balanced equation despite being essential to the reaction.

- 42** Explain, using Le Chatelier's principle, why increasing temperature shifts an endothermic reaction's equilibrium toward products.

- 43** A student dissolves table salt (NaCl) in water and observes the solution conducts electricity. Explain this at the particle level.

- 44** Explain why a buffer solution's pH changes only slightly when a small amount of strong acid is added.

- 45** Explain why real gases deviate from ideal gas behavior at high pressure and low temperature.

- 46** A reaction has a very negative ΔH and a very negative ΔS . Explain under what temperature condition it is spontaneous.

- 47** Explain why the actual yield of a reaction is often less than the theoretical yield.

- 48** How many significant figures are in the measurement 3.0500 g?

- 49** A titration requires 25.0 mL of 0.100 M NaOH to neutralize 50.0 mL of HCl (1:1 reaction). Find the molarity of the HCl.

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$\text{Na} + \text{Cl}_2 \rightarrow \text{NaCl}$ (before balancing) is best classified as a:

- A) Decomposition reaction
- B) Synthesis (combination) reaction
- C) Single replacement reaction
- D) Double replacement reaction

Answer key

Direct answers only, in question order. Work the set first, then check.

1. B) Increases left to right, decreases top to bottom	2. B) Its chemical behavior and bonding tendencies	3. B) Decreases with distance squared	4. B) Bonding and lone pairs of electrons	5. B) Minimizing repulsion between electron domains
6. B) Polar covalent or ionic	7. C) Covalent network solid	8. C) All molecules	9. B) Nitrogen, oxygen, or fluorine	10. B) Polar solvents dissolve polar solutes well
11. 10	12. 100	13. 0.5	14. B) Omits spectator ions and shows only reacting species	15. 0 to +2 (oxidized)
16. +1 to 0 (reduced)	17. B) Experimental data	18. 3	19. B) Lowering the activation energy	20. B) Slow, since fewer molecules have enough energy to react
21. B) Negative delta H (exothermic)	22. -70	23. B) Positive delta S (entropy increases)	24. -60.0	25. B) Spontaneous
26. $K = [C]/([A][B])$	27. B) Mostly products present	28. B) Toward products	29. B) Fewer moles of gas	30. 4
31. B) Fully dissociates	32. B) A weak acid/base and its conjugate	33. B) Chemical energy from a spontaneous redox reaction into electrical energy	34. 1.56	35. B) Spontaneous

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| 36. B) Identify electron binding energies and confirm electron configuration | 37. A) Same protons, different neutrons | 38. 49.3 | 39. B) Hydrogen bonding creates a less dense, open crystal structure in ice | 40. Higher temperature increases the average kinetic energy of particles, so more collisions occur with enough energy to exceed the activation energy, and collisions also occur more frequently |
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| 41. A catalyst is consumed in an early step and regenerated in a later step, so it does not undergo a net change and is not consumed overall, even though it lowers the activation energy throughout | 42. Heat acts like a reactant in an endothermic reaction, so adding heat (increasing temperature) shifts the equilibrium toward the products to absorb the added energy | 43. NaCl dissociates into Na^+ and Cl^- ions when dissolved in water, and these freely moving charged ions allow the solution to carry an electric current, unlike the solid ionic lattice which cannot conduct | 44. The buffer's conjugate base reacts with and neutralizes the added H^+ ions, converting them into the weak acid form, so the free H_3O^+ concentration (and thus pH) changes only slightly instead of dropping sharply | 45. At high pressure and low temperature, gas particles are forced close together, so the volume of the particles themselves and the intermolecular attractions between them (both ignored in the ideal gas law) become significant |
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46. Using $\Delta G = \Delta H - T\Delta S$, since ΔS is negative, the $-T\Delta S$ term is positive and grows with temperature; the reaction is spontaneous (ΔG negative) only at low temperatures, where the negative ΔH term dominates
47. Side reactions, incomplete reactions, impure reactants, and mechanical loss of product during collection or purification all reduce the amount of product actually recovered compared to the stoichiometric prediction
48. 5
49. 0.05
50. B) Synthesis (combination) reaction
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Error log

Bring this page to your next session so the tutor can start from what actually blocked you.

Questions I answered incorrectly:

Was it the concept, the setup, or the calculation?

The single topic I want to start the next session with:
