

Summary of Part D Questions on the AP Chemistry Exam

<u>YEAR</u>	<u>QUESTION #</u>	<u>DESCRIPTION</u>
Beginning in 2007, there are only two essay questions but BOTH are required. There is no choice.		
2007	5	Redox titration with ferrous ion and permanganate
	6	Lewis dot structures and potential energy diagram for a chemical reaction both catalyzed and uncatalyzed
2006	5	Laboratory analysis
	6	Explanation of inter/intra molecular interactions
	7	Lewis structures, hybridization, molecular geometries
	8	Properties of a fictional element: electron configuration, atomic radius, reactions, solubility
2005	5	Laboratory observations. Identification through chemical tests and properties
	6	Lewis dot structures, molecular geometry, sigma and pi bonding
	7	Explanation of chemical principles by atomic structure, bonding, intermolecular forces
	8	Thermodynamics, electrochemistry
2004	5	Identification of compounds by chemical tests
	6	Electrochemical cell, standard potentials, Nernst equation
	7	Use appropriate chemical principles to explain observations
	8	Lewis structures, molecular geometry, molecular root-mean-square velocity
2003	5	Spectrophotometry, Beer's Law
	6	Explanation of chemical/physical processes
	7	Bond energies/thermodynamics
	8	Organic chemistry, isomers, bond hybridization
2002	5	Calorimetry
	6	Explanation of chemical principles by atomic structure and/or chemical bonding
	7	Kinetics, rate law, reaction mechanism, catalyst.
	8	Entropy, enthalpy, potential energy diagram.
2001	5	Solutions. Boiling point, pH, precipitate, oxidize, conductor.
	6	Type of reaction, reaction rate graph, order of reaction.
	7	Electrochemical cell with salt bridge, standard cell potential.
	8	Principles of chemical bonding and/or intermolecular forces.
2000	5	Freezing point depression laboratory experiment
	6	Thermodynamics, rate law, rate law mechanism
	7	Isotopes, electron configuration, atomic structure, Lewis dot structure
	8	Acid/base titration, titration curve, indicators

Beginning in 1999, there is a new essay format. In the new format there will be two required essay questions, and students will choose a third question from a pair of other essays. Importantly, one of the

required essays will always be related to laboratory, while the topic of the other required essay will vary from year to year. Hence, only four essay questions with the new format.

1999	5	Molar mass determination by collecting over water
	6	Thermodynamics, kinetic molecular theory
	7	Solutions: conductivity, freezing point, vapor pressure, pH
	8	Principles of chemical bonding/molecular structure, Lewis dot structures
1998	5	Acid-Base titration curves.
	6	Reaction kinetics; reaction orders.
	7	LeChâtelier's Principle.
	8	Electrochemical cells.
	9	Altitude and boiling point; copper-ammonia complex; molecular polarity; redox agents.
1997	5	Molecular geometry and Lewis structures, polarity, group V fluorides.
	6	Atomic/molecular structure related to ionization energies and radii.
	7	Thermodynamics, ΔS° , ΔG° , LeChatelier's Principle.
	8	Nuclear decay process, mass defect, particle properties.
	9	Lab process in determination of mass percent of sulfate in an unknown.
1996	5	Kinetic theory, ideal/real gas law considerations
	6	Laboratory procedures affecting acid/base titration
	7	Oxidation/Reduction, cell potentials
	8	Reaction mechanism
	9	Observations explained in terms of electronic structure and bonding
1995	5	Conductivity explanation based on chemical bonding and/or atomic or molecular structure.
	6	Phase diagram explanation.
	7	Explanation in terms of electronic structure and bonding.
	8	Solubility, thermodynamics explanation.

- 1994
- 9 Chemical reaction potential energy diagram explanation.
- 5 Provide explanations for various physical and chemical phenomena.
- 6 Thermodynamics. ΔS° , ΔG° , ΔH° and spontaneity.
- 7 Acid-base titration curve.
- 8 Various chemical principles. Ice melted with salt. Ammonia is a gas, water is a liquid at room temperature. Graphite is lubricant, diamond is abrasive. Vinegar in kettle used for boiling, fizzes.
- 9 Atomic structure and bonding explanations.
- 1993
- 5 Explain reactions of H_2SO_4 using acid/base theory, oxidation-reduction, and bonding and/or intermolecular forces.
- 6 Principles of atomic structure: ionization energy, atomic radii, magnetic fields, and geometry of molecules.
- 7 Galvanic cell diagram.
- 8 Thermodynamics. ΔS° , ΔG° , ΔH° , and spontaneity.
- 9 Kinetic Molecular Theory. Atomic explanations of gas observations.
- 1992
- 5 Rate law. LeChatlier's Principle, potential energy vs reaction coordinate, distribution of molecular energies.
- 6 Buffer solutions. Identify buffer pairs, preparation of buffer, manipulations with buffers.
- 7 Identification of four bottles of substances. Describe tests to identify the four from each other.
- 8 Physical properties explained by atomic and molecular forces and/or intermolecular forces.
- 9 Lewis dot structures. Provide bond angles, hybridization and dimerization.
- 1991
- 5 Thermodynamics. Prediction of sign of ΔS for a reaction, predict sign of ΔH , spontaneity based on temperature.
- 6 Laboratory experiment. Determine molecular mass of liquid by vapor density method.
- 7 Electrolysis. Anode, cathode reactions, explanation for observations on potential changes as concentration changes.
- 8 Physical properties differences explained by structure and bonding.

	9	Nuclear chemistry. Alpha, beta particles and fission and fusion.
1990	5	Bond lengths and angle measurements explained by structure and bonding models.
	6	Ionization energy differences explained by atomic structure.
	7	Factors which affect reaction rates. Collision theory, temperature, and catalysts.
	8	Strength of acids explanation.
	9	Laboratory experiment. Empirical formula determined experimentally.
1989	5	Lewis dot structures and VSEPR theory for prediction of geometry, angles and polarity.
	6	Melting point differences as explained by bonding principles.
	7	Descriptive chemistry. Identification of three metals by chemical tests.
	8	Reaction rates. Explanation of changes in reaction rates when changes occur in concentration, temperature, surface area.
	9	Nuclear chemistry. Alpha, beta particles and balanced nuclear equations. C-14 dating.
1988	5	Explain physical properties based on bonding and intermolecular forces.
	6	LeChatlier's principle.
	7	Acid/Base titration. Explain shape of titration curve, how to select indicator, differences in shape of curve with strong or weak acid and strong or weak base.
	8	Phase diagram.
	9	Laboratory experiment. Heat(Enthalpy) of neutralization for strong acid/strong base.
1987	5	Explanation of periodic properties based on atomic theory.
	6	Electrolysis. Prediction of anode and cathode reactions.
	7	Explanation of ionization of salts in water.
	8	Thermodynamics. Prediction of signs for ΔS , ΔH , and ΔG .

	9	Heisenberg Uncertainty Principle. Bohr theory of the hydrogen atom.
1986	5	Factors affecting the heat of formation.
	6	Rate law and reaction mechanisms.
	7	Strength of oxyacids.
	8	Scientific explanations for ice melting with salt, graphite conducting while diamond does not, hot air balloons must be bigger than helium balloons, carbon dioxide used on oil fires instead of water.
	9	Explanation of observation as zinc metal and copper metal are added to acids.
1985	5	Periodic properties explained by atomic structure.
	6	Thermodynamics. Explanation and prediction for enthalpy, entropy and free energy changes.
	7	Laboratory experiment. Preparation of salts.
	8	Reaction rate, rate law.
	9	Melting point trends explained by bonding and intermolecular forces.
1984	4	Scientific explanation for longer time to cook egg in Denver than New York, burning coal leads to acid rain, perspiring leads to cooling of body, antifreeze keeps engine from freezing or boiling.
	5	Discuss role of indicators in acid/base titrations.
	6	Van der Waals real gas law and explanation of <i>a</i> and <i>b</i> constants.
	7	Physical differences between metals and non-metals.