# AP® Chemistry

## About the Advanced Placement Program® (AP®)

The Advanced Placement Program® has enabled millions of students to take college-level courses and earn college credit, advanced placement, or both, while still in high school. AP Exams are given each year in May. Students who earn a qualifying score on an AP Exam are typically eligible, in college, to receive credit, placement into advanced courses, or both. Every aspect of AP course and exam development is the result of collaboration between AP teachers and college faculty. They work together to develop AP courses and exams, set scoring standards, and score the exams. College faculty review every AP teacher's course syllabus.

## AP Chemistry Course Overview

The AP Chemistry course provides students with a college-level foundation to support future advanced coursework in chemistry. Students cultivate their understanding of chemistry through inquiry-based investigations, as they explore content such as: atomic structure, intermolecular forces and bonding, chemical reactions, kinetics, thermodynamics, and equilibrium. The AP Chemistry course is designed to be the equivalent of the general chemistry course usually taken during the first college year.

### PREREQUISITES

Students should have successfully completed a general high school chemistry course and Algebra II.

### LABORATORY REQUIREMENT

This course requires that 25 percent of instructional time engages students in lab investigations. This includes a minimum of 16 hands-on labs (at least six of which are guided inquiry). It is required that students keep a lab notebook throughout.

## AP Chemistry Course Content

The course content is organized into nine commonly taught units, which have been arranged in the following suggested, logical sequence:

- **Unit 1:** Atomic Structure and Properties
- **Unit 2:** Molecular and Ionic Compound Structure and Properties
- **Unit 3:** Intermolecular Forces and Properties
- **Unit 4:** Chemical Reactions
- **Unit 5:** Kinetics
- **Unit 6:** Thermodynamics
- **Unit 7:** Equilibrium
- **Unit 8:** Acids and Bases
- **Unit 9:** Applications of Thermodynamics

Each unit is broken down into teachable segments called topics.

In addition, the following big ideas serve as the foundation of the course, enabling students to create meaningful connections among concepts and develop deeper conceptual understanding:

- **Scale, Proportion, and Quantity:** Quantities in chemistry are expressed at both the macroscopic and atomic scales, and relationships exist both within and between these two scales.
- **Structure and Properties:** Properties of substances observable at the macroscopic scale emerge from the structures of atoms and molecules and the interactions between them.
- **Transformations:** Chemistry is about the rearrangement of matter, both macroscopically and sub-microscopically.
- **Energy:** Energy plays important roles in characterizing and controlling chemical systems.

## AP Chemistry Science Practices

The following science practices describe what skills students should develop during the course:

- **Models and Representations:** Describe models and representations, including across scales.
- **Question and Method:** Determine scientific questions and methods.
- **Representing Data and Phenomena:** Create representations or models of chemical phenomena.
- **Model Analysis:** Analyze and interpret models and representations on a single scale or across multiple scales.
- **Mathematical Routines:** Solve problems using mathematical relationships.
- **Argumentation:** Develop an explanation or scientific argument.

## AP Chemistry Exam Structure

AP CHEMISTRY EXAM: 3 HOURS, 15 MINUTES

### Assessment Overview

The AP Chemistry Exam assesses student understanding of the science practices and learning objectives outlined in the course framework. The exam is 3 hours and 15 minutes long and includes 60 multiple-choice questions and 7 free-response questions. A scientific or graphing calculator is recommended for use on Section II of the exam. No calculators are permitted for use on Section I. Students are provided with the periodic table and a formula sheet that lists specific and relevant formulas for use on the exam.

### Format of Assessment

**Section I:** Multiple-choice | 60 Questions | 90 Minutes | 50% of Exam Score

- Science Practices 1, 2, 4, 5, and 6 are all assessed in the multiple-choice section (Science Practice 3 is not assessed).

**Section II:** Free-response | 7 Questions | 105 Minutes | 50% of Exam Score

- All six science practices are assessed in the free-response section.
- 3 long-answer questions **(10 points each).**
- 4 short-answer questions **(4 points each).**

## Exam Components

### Sample Multiple-Choice Question

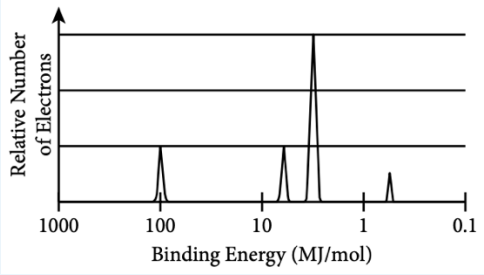
Four identical 50 mL cups of coffee, originally at 95°C, were stirred with four different spoons, as listed in the table. In which cup will the temperature of the coffee be highest at thermal equilibrium? (Assume that the heat lost to the surroundings is negligible.)

| Cup | Material of Spoon | Initial Temperature of Spoon (°C) | Mass of Spoon (g) | Specific Heat Capacity (J/g °C) |
|---|---|---|---|---|
| A | Aluminum | 20 | 10.0 | 0.90 |
| B | Ceramic | 20 | 10.0 | 0.80 |
| C | Steel | 20 | 20.0 | 0.45 |
| D | Silver | 20 | 40.0 | 0.23 |

(A) Cup A
(B) Cup B
(C) Cup C
(D) Cup D

Correct Answer: B

### Sample Free-Response Question




The complete photoelectron spectrum of an unknown element is given above.

(a) Draw an X above the peak that corresponds to the orbital with electrons that are, on average, closest to the nucleus. Justify your answer in terms of Coulomb's law.

(b) Based on the spectrum, write the complete electron configuration of the element.

(c) On the graph, draw the peak(s) corresponding to the valence electrons of the element that has one more proton in its nucleus than the unknown element has.

Educators: apcentral.collegeboard.org/courses/ap-chemistry
Students: apstudents.collegeboard.org/courses/ap-chemistry



00558-040 (Updated January 2021)