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# AP Chemistry Investigations

| Cat. No. | Description | Price |
|---|---|---|
| 470306-992 | Wards® AP Chemistry 16 Kit Bundle | Ea./ $695.00 |

# Wards® AP Chemistry 16 Kit Bundle

## 470303-012 Ward's® AP Chemistry Investigation 1: Spectroscopy: What is the Concentration of that Solution?

Meets AP Science Practices 2, 4, 5, and 6

Addresses Big Idea 1
Investigation includes updated literature aligned with new AP Chemistry curriculum standards

In this kit students will determine the concentration of blue dye in an unknown solution called Scienceade. Students will need to justify the selection of a particular type of spectroscopy to measure properties associated with vibrational or electronic motions of molecules and they will design and interpret the results of an experiment regarding the absorption of light to determine the concentration of an absorbing species in a solution. Requires spectrophotometer or colorimeter, and cuvettes, available separately.

## 470303-028 Ward's® AP Chemistry Investigation 2: Spectrophotometry: What is the Mass Percent of Copper in Brass?

Meets AP Science Practices 4, 5, and 6

Addresses Big Idea 1 & 3
Investigation includes updated literature aligned with new AP Chemistry curriculum standards

In this kit students will determine the mass percent of copper in a brass sample. Students will design and interpret the results of an experiment regarding the absorption of light to determine the concentration of an absorbing species in a solution and be able to relate measured mass of substances to identify stoichiometric relationships for a reaction. Requires spectrophotometer or colorimeter, and cuvettes, available separately.

⚠ WARNING: This product can expose you to chemicals including Strong inorganic acid mists containing sulfuric acid, which are known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

## 470303-030 Ward's® AP Chemistry Investigation 3: Gravimetric Analysis: How Hard is the Water?

Meets AP Science Practices 1, 2, 4, 5, 6, and 7

Addresses Big Idea 1, 2, & 3
Investigation includes updated literature aligned with new AP Chemistry curriculum standards

The central challenge in this kit is determining the harness of a water sample. Students will design a procedure in the guided inquiry section to determine the hardness of water. Students are tasked with determining which of six water samples, representing different areas in their community, require a water softening system. Gravimetric Analysis is the central technique used to analyze the sample. Requires a 250 mL Buchner funnel, No. 6 Buchner funnel rubber stopper, aspirator or vacuum pump, rubber tubing, analytical balance, drying oven, and ring stand/clamps, available separately.

## 470303-032 Ward's® AP Chemistry Investigation 4: Titrations: How Acidic are the Beverages we Drink?

Meets AP Science Practices 1, 2, 3, 4, 5, and 6

Addresses Big Ideas 1 & 3
Investigation includes updated literature aligned with new AP Chemistry curriculum standards

In this investigation, students will explore acid-base reactions using the analytical method of titration. In titration studies, an indicator is often used in order to determine the end point of the reaction via color change. In this activity, students will determine how the volume of the titrant added relates to the morality of the analyte. Students will apply this information as they decide which indicator to use in order to determine the pH of common juices and drinks. Requires 50 mL burettes and pH meter, available separately.

⚠ WARNING: This product can expose you to chemicals including Phenolphthalein, which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

# AP Chemistry Investigations

## 470303-034 Ward's® AP Chemistry Investigation 5: Thin Layer Chromatography: How Can we Separate a Mixture?

Meets AP Science Practices 1, 4, 5, and 6

Addresses Big Idea 2

Investigation includes updated literature aligned with new AP Chemistry curriculum standards

Students will explore the analytical technique of chromatography, to study how similar molecules can be separated from one another when in a solution. This kit challenges students to experiment with different solvent systems in order to understand polarity and the concept of "likes dissolve likes." Requires a 25-50 mL glass container with lid, available separately.

## 470303-036 Ward's® AP Chemistry Investigation 6: Bonding: How are Solids Held Together?

Meets AP Science Practices 1, 4, 5, 6, and 7

Addresses Big Idea 2

Investigation includes updated literature aligned with new AP Chemistry curriculum standards

In this lab, a series of tests will be performed in order to investigate the chemical and physical properties of known chemical compounds with ionic, covalent, or metallic bonding. Students will be required to make detailed observations and determine melting points in order to gather meaningful data and gain an understanding of these various types of chemical bonds. The information learned and gathered from these tests will ultimately be used to determine the bond type of unknown compounds. Requires a conductivity meter, Melt-Temp, thermometer, and magnifying lens, available separately.

⚠ WARNING: This product can expose you to chemicals including Methanol/Methyl isobutyl ketone and Phenolphthalein, which are known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

## 470303-038 Ward's® AP Chemistry Investigation 7: Stoichiometry: What is the Greenest Way to Separate a Mixture?

Meets AP Science Practices 2, 4, 5, and 6

Addresses Big Idea 3

Investigation includes updated literature aligned with new AP Chemistry curriculum standards

In this lab, students will gain deeper understanding of "green" chemistry, stoichiometry, and the peer review process. Students will investigate how to purify a mixture using green chemistry and then work through the peer review process to determine which submitted manuscript is the most complete and would be appropriate for publication in a hypothetical scientific journal. Requires Bunsen burner, striker, iron ring, ceramic triangle, ring stand/clamp, crucible/lid, balance, and crucible tongs, available separately.

## 470303-040 Ward's® AP Chemistry Investigation 8: Redox Titrations: How Much $H_2O_2$ is Actually in the Bottle?

Meets AP Science Practices 2, 4, 5, and 6

Addresses Big Ideas 1 & 3

Investigation includes updated literature aligned with new AP Chemistry curriculum standards

In this lab activity, students explore the concepts of oxidation-reduction reactions, solution stoichiometry, percent composition, and standardization of a solution. They will use an analyte titration to standardize the concentration of KMnO4 solution in order to ultimately determine the exact concentration of commercial hydrogen peroxide solutions. Includes phenolphthalein, potassium hydrogen phthalate, sodium hydroxide, potassium permanganate, iron ammonium sulfate hexahydrate, hydrogen peroxide, and sulfuric acid. Requires a burette, ring stand/clamps, volumetric pipettes, magnetic stirrer, and magnetic stir rod, available separately.

⚠ WARNING: This product can expose you to chemicals including Phenolphthalein, which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

# AP Chemistry Investigations

## 470303-042 Ward's® AP Chemistry Investigation 9: Liquid-Liquid Extraction: What's in that Powder?

Meets AP Science Practices 1, 4, and 6

Addresses Big Idea 3

Investigation includes updated literature aligned with new AP Chemistry curriculum standards

Liquid-liquid extraction is a method used for the separation of a mixture using two immiscible solvents. The ability to separate the different compounds in a mixture using this technique depends upon how differently the compounds of the sample mixture partition themselves between the two solvents. In this laboratory activity, students will explore liquid-liquid extraction techniques and ultimately separate and identify the components of an unknown pill powder. Requires hotplate, Separatory funnel, Buchner funnel, glass funnel, side arm flask, vacuum filter or aspirator, filter paper, analytical balance, Excedrin, watch glass and drying oven (optional), available separately.

## 470303-014 Ward's® AP Chemistry Investigation 10: Kinetics: How Long will that Statue Last?

Meets AP Science Practices 3, 4, 5, 6, and 7

Addresses Big Idea 4

Investigation includes updated literature aligned with new AP Chemistry curriculum standards

In this lab, chemical kinetics will be investigated as students explore how various conditions involved in a chemical reaction will affect its rate. Students will begin their investigation by studying the effect of the concentration of the acid on the reaction rate and will then consider other variables that may have an effect. By conducting studies in which these variables are altered, students will ultimately be able to determine the effect that each variable has on reaction rates. Requires a thermometer and stop watch, available separately.

⚠ WARNING: This product can expose you to chemicals including Respirable crystalline silica, which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

## 470303-016 Ward's® AP Chemistry Investigation 11: Kinetics: What is the Rate Law?

Meets AP Science Practices 1, 2, 4, 5, and 6

Addresses Big Idea 4

Investigation includes updated literature aligned with new AP Chemistry curriculum standards

In this lab, a spectrophotometric analysis will be done to determine the rate law for the reaction between crystal violet and sodium hydroxide. Students will use a spectrophotometer to produce a Beer's law calibration curve and collect absorbance data over time. The data gathered in this study will be plotted and ultimately used to determine the order of reaction with respect to crystal violet and sodium hydroxide. Requires spectrophotometer or colorimeter, and cuvettes, available separately.

## 470303-018 Ward's® AP Chemistry Investigation 12: Calorimetry: How Does a Hand Warmer Work?

Meets AP Science Practices 1, 2, 4, 5, 6, and 7

Addresses Big Idea 5

Investigation includes updated literature aligned with new AP Chemistry curriculum standards

In this lab, thermochemistry will be explored, as students conceptualize the chemistry of a hand warmer that is safe, cost effective, eco-friendly, and performs well. Students will use calorimetry to study the heat flow and enthalpy of dissolution of various aqueous solutions, and be required to set up a calorimeter and calculate changes in temperature, heat transfer, and the enthalpy of dissolution. The investigation begins as students study the heat flow of an aqueous solution of the ionic compound magnesium sulfate. Students will then study the heat flow of a variety of other ionic compounds and will determine the enthalpy of dissolution for these processes. The information learned from these studies help determine which ionic solid would be best to use in the design of a hand warmer. Requires a thermometer, analytical balance, magnetic stirrer, magnetic stir rod, coffee cups with lids, and hotplates, available separately. Ward's® DataHub not required to complete activity.

# AP Chemistry Investigations

## 470303-020 Ward's® AP Chemistry Investigation 13: Equilibrium: Can we Make the Colors of the Rainbow?

Meets AP Science Practices 4, 5, and 6

Addresses Big Idea 6

Investigation includes updated literature aligned with new AP Chemistry curriculum standards

In this lab, chemical equilibrium and Le Chatelier's principle will be explored as students study the effect of concentration, pressure, volume, and temperature on systems at equilibrium. An acid-base-indicator equilibrium, a hydrated cobalt complex-alcohol equilibrium, and a seltzer water-indicator equilibrium will be studyed. Students will be required to apply different stresses to these equilibrium reactions and observe how the system responds via a color change. The information learned from these tests will ultimately be used to produce solutions that make up all the colors of the rainbow. Requires test tubes, available separately.

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## 470303-022 Ward's® AP Chemistry Investigation 14: Acid-Base Titrations: How does Chemical Structure Affect pH?

Meets AP Science Practices, 1, 2, 3, 4, 5, 6, and 7

Addresses Big Ideas 1 & 6

Investigation includes updated literature aligned with new AP Chemistry curriculum standards

In this lab, acid-base titrations will be performed in order to investigate the relationship between pH, concentration, and the structure of acids and bases. Students will carry out multiple acid-base titrations and will use a pH meter to monitor the pH of the resulting solutions. Students will then construct titration curves. Using known information and the data that was gathered, students will ultimately be able to determine the concentration of the acid or base, the ionization constant, and the percent ionization. Includes hydrochloric acid, acetic acid, sodium hydroxide, and phenolphthalein. Requires pH meter, burette, ring stand/clamps, magnetic stirrer, and magnetic stir bar, available separately. Ward's® DataHub is not required to complete activity.

⚠ WARNING: This product can expose you to chemicals including Phenolphthalein, which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

## 470303-024 Ward's® AP Chemistry Investigation 15: Buffering: Will that Product Act as a Buffer?

Meets AP Science Practices 4, 5, and 6

Addresses Big Ideas 1 & 6

Investigation includes updated literature aligned with new AP Chemistry curriculum standards

In this lab, students will observe the buffering abilities of a number of different household products. Students will use the concepts of acid-base chemistry, titrations, pH, and buffers in order to determine if certain household products will act as buffers, and if so which chemicals are present. Titration curves will be constructed for known chemicals and then compared to the titration curves produced for the household products. Requires pH meter, ring stand/clamps, magnetic stirrer, magnetic stir rod, and burette, available separately. Ward's® DataHub not required to complete activity.

## 470303-026 Ward's® AP Chemistry Investigation 16: Buffering: How do the Components Change the Buffering Ability?

Meets AP Science Practices 1, 2, 4, 5, 6, and 7

Addresses Big Ideas 1 & 6

Investigation includes updated literature aligned with new AP Chemistry curriculum standards

In this lab, students will explore how components in a buffer solution affect the solution's buffering capacity. Students will prepare a number of different buffer solutions, and will determine the response of these buffers as acids and bases are added. The pH of these stressed buffers will then be compared with the calculated values from the Henderson-Hasselbalch equation. From the buffer solutions prepared, a buffer system will be proposed in order to address a specific pH buffering microbiology problem. Requires pH meter, magnetic stirrer, magnetic stir rod, analytical balance, burette, and ring stand/clamps, available separately. Ward's® DataHub not required to complete activity.

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