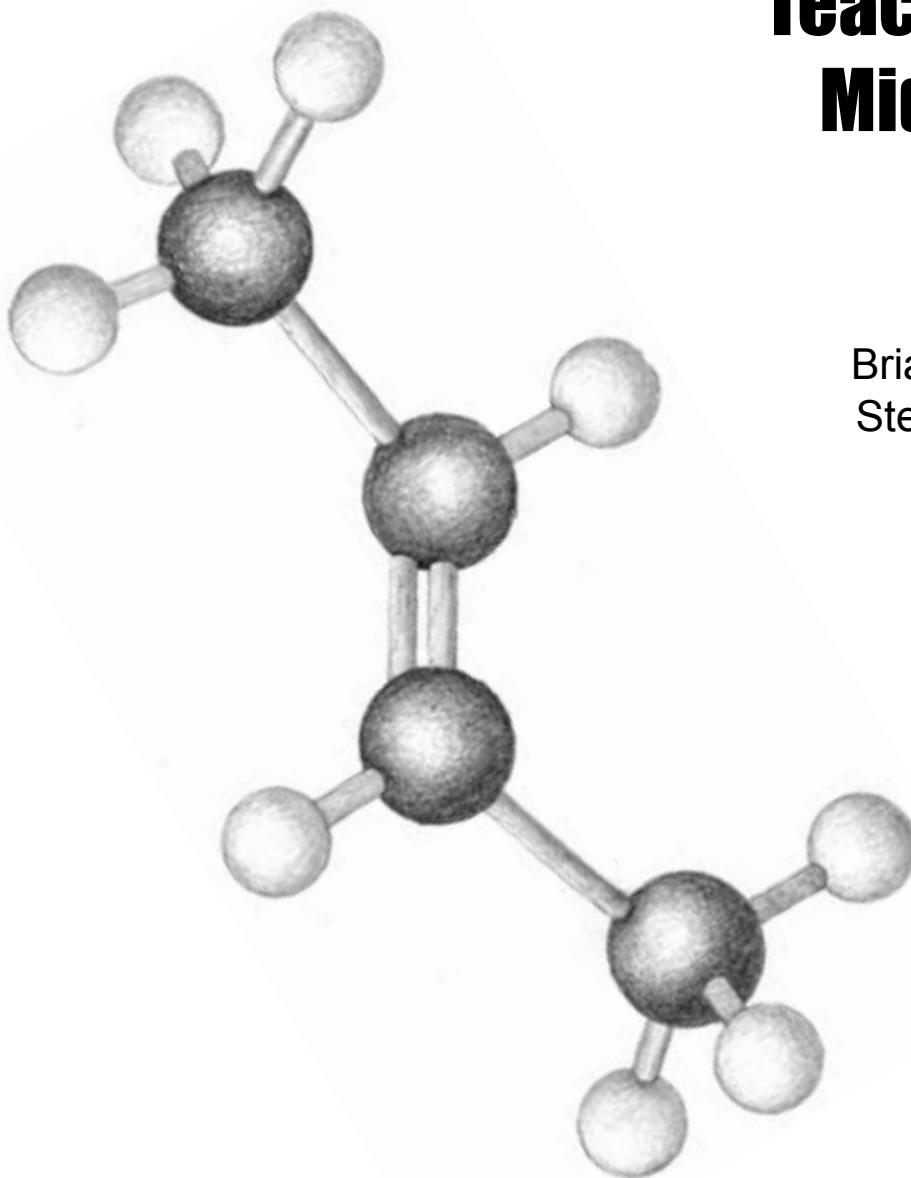


Compounds in Chemistry

Teacher's Guide Middle School



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A Message from our Company...

Dear Educator:

Thank you for your interest in the educational videos produced by the Visual Learning Company. We are a Vermont-based, family owned and operated business specializing in the production of quality educational science videos and materials.

We have a long family tradition of education. Our grandmothers graduated from normal school in the 1920's to become teachers. Brian's mother was an elementary teacher and guidance counselor, and his father was a high school teacher and superintendent. This family tradition inspired Brian to become a science teacher, and to earn a Ph.D. in education, and led Stephanie to work on science educational programs at NASA.

In developing this video, accompanying teacher's guide, and student activities, our goal is to provide educators with the highest quality materials, thus enabling students to be successful. In this era of more demanding standards and assessment requirements, supplementary materials need to be curricular and standards based - this is what we do!

Our videos and accompanying materials focus on the key concepts and vocabulary required by national and state standards and goals. It is our mission to help students meet these goals and standards, while experiencing the joy and thrill of science.

Sincerely,

Brian and Stephanie Jerome



National Standards Correlations

National Science Education Standards

(Content standards: 5-8, National Academy of Sciences, c. 1996)

Physical Science

Content Standard B

Properties and Changes of Properties in Matter

As a result of activities in grades 5-8, all students should develop an understanding that:

- Chemical elements do not break down during normal laboratory reactions involving such treatments as heating, exposure to electric current, or reaction with acids. There are more than 100 known elements that combine in a multitude of ways to produce compounds, which account for the living and nonliving substances we encounter.

Benchmarks for Science Literacy

(Project 2061 – AAAS, c. 1993)

The Physical Setting

4D Structure of Matter

By the end of 8th grade, students should know that:

- All matter is made up of atoms, which are far too small to see directly through a microscope. The atoms of any element are alike but are different from atoms of other elements. Atoms may stick together in well-defined molecules or may be packed together in large arrays. Different arrangements of atoms into groups compose all substances.
- There are groups of elements that have similar properties, including highly reactive metals, highly reactive nonmetals (such as chlorine, fluorine, and oxygen), and some almost completely nonreactive gases (such as helium and neon). An especially important kind of reaction between substances involves the combination of oxygen with something else - as in burning or rusting. Some elements don't fit into any of the categories; among them are carbon and hydrogen, essential elements of living matter.



Student Learning Objectives

Upon viewing the video and completing the enclosed student activities, students will be able to do the following:

- Define the terms atom, element, and compound.
- Describe acids as substances that produce hydrogen ions in solution.
- Provide some examples of foods which are acidic such as lemons, limes, and grapefruit.
- List some of the properties of acids including their ability to conduct electricity and their sour taste.
- Describe a base as a substance that produces hydroxide ions in a solution.
- Provide an example of a common base such as soap or ammonia.
- List some of the properties of bases including their tendency to feel slippery and their ability to conduct electricity.
- Differentiate between the strength and concentration of an acid or a base.
- Explain that pH is a measure of the concentration of hydronium ions in a solution.
- Outline the general layout and meaning of the pH scale.
- Describe how a salt is made in a neutralization reaction between an acid and a base.
- Explain that an organic compound is a compound based on the element carbon.
- State an example of a common organic compound.
- Define hydrocarbons as compounds containing only hydrogen and carbon atoms.
- Differentiate between saturated and unsaturated hydrocarbons, and provide an example of each.



Assessment

Preliminary Assessment:

The Preliminary Assessment, provided in the Student Masters section, is an assessment tool designed to gain an understanding of students' pre-existing knowledge. It can also be used as a benchmark upon which to assess student progress based on the objectives stated on the previous pages.

Video Review:

The Video Review, provided in the Student Masters section, can be used as an assessment tool or as a student activity. There are two main parts. The first part contains questions that can be answered during the video. The second series of ten questions consists of a video quiz to be answered at the conclusion of the video.

Post Assessment:

The Post Assessment, provided in the Student Masters section, can be utilized as an assessment tool following completion of the video and student activities. The results of the Post Assessment can be compared against the results of the Preliminary Assessment to evaluate student progress.



Introducing the Video

Before showing the video, gather together a lemon and some dish washing soap or liquid hand soap. Begin the lesson by asking for a volunteer. Have the volunteer come forward. Cut a wedge of the lemon. Hand the wedge to the student and ask them to taste it. Tell the class to watch the expression on the person's face when they taste it. Ask the student to describe the taste. Ask for another volunteer to come forward. Squirt a little bit of soap on their hand and ask the student to rub it between their fingers. Have the student describe how it feels.

Tell students that both these substances are chemical compounds. Ask them if they know what made the lemons taste sour and the soap feel slippery. What two categories do these compounds fall into? Explain to students that lemons are acidic. Acids tend to have a characteristic sour taste. The soap is a base. Bases tend to feel slippery.

Write the words acid and base on the board. Tell students to pay close attention to the video so they can learn more about some of the characteristics of acids and bases. Tell them at the end of the program they will write the characteristics of each on the board.

Video Viewing Suggestions

The student Master "Video Review" is provided for distribution to students. You may choose to have your students complete this Master while viewing the program or to do so upon its conclusion.

The program is approximately twenty minutes in length and includes a ten question video quiz. Answers are not provided to the Video Quiz on the video, but are included in this teacher's guide. You may choose to grade student quizzes as an assessment tool or to review the answers in class.

The video is content-rich with numerous vocabulary words. For this reason you may want to periodically stop the video to review and discuss new terminology and concepts.



Video Script: Compounds in Chemistry

1. Whenever you wash your hair. . .
2. . . . eat an ice cream cone. . .
3. . . . or put a disc into a CD player, you are using chemical compounds.
4. There are millions of different examples of chemical compounds.
5. Most things we see, touch, wear, and eat are made up of compounds.
6. What exactly are chemical compounds?
7. How are they formed?
8. What are some of the different types of chemical compounds?
9. How are chemical compounds grouped?
10. And how are they useful to us?
11. During the next few minutes we are going to explore these questions and others as we investigate the fascinating world of chemical compounds.
- 12. Graphic Transition – What are Chemical Compounds?**
13. When you look at the water in a lake. . .
14. . . . or admire a waterfall, have you ever wondered what water is made of?
15. Everything you see, whether it is a non-living thing such as rocks. . .
16. . . . or water. . .
17. . . . or living things such as these ducks all are made up of millions of particles that cannot be seen with the human eye.
18. The smallest particle of a pure substance is an atom
19. When you have a pure substance made up of only one type of atom, we call this an element.
20. There are over 100 elements on Earth.
21. Aluminum in this can is an element.
22. As is iron found in this hot metal.
23. Oxygen in the air we breathe is also an element.
24. Neon gas in this sign is made up of neon atoms. . .
25. . . . that when magnified millions of times looks something like this.
26. And the iron atom found in this nail looks. . .
27. . . . something like this when magnified millions of times.
28. In nature, atoms are not usually found in their pure isolated form. . .
29. . . . but instead are commonly found attached to other atoms.
30. A chemical compound is a substance made up of the combined atoms of two or more elements.



Script (cont.)

31. When two atoms of hydrogen combine with an atom of oxygen, they form the compound known as water, or H_2O .
32. There are thousands of different compounds. Scientists have developed different ways to describe and group compounds. Let us take a look at some of the ways this is done.
- 33. Graphic Transition – Acids**
- 34. You Compare!** What do orange juice and vinegar have in common?
35. If you said they are both acids then you are correct.
36. Acids are substances that produce hydrogen ions in a solution.
37. When acids are dissolved in water some of the hydrogen ions, symbolized by H^+ , are released.
38. It is the tendency to produce H^+ ions that gives acids their characteristic properties.
39. Acidic foods such as lemons, limes, and grapefruit tend to have a sour taste.
40. Even though acids tend to have a sour taste, you should never taste an unknown substance to test for the presence of acids.
41. Many acids also tend to be corrosive, meaning they eat away at materials they come in contact with as shown here.
42. Many acids also tend to conduct electricity.
43. Strong acids are good electrolytes. An electrolyte is a substance that separates into ions in a water solution.
44. Electrolytes are also capable of conducting an electric current.
45. One of the most widely used chemicals in the world is sulfuric acid.
46. It is used in a wide range of products from car batteries to. . .
. . . paints.
47. Other common acids used in manufacturing include phosphoric acid, hydrochloric acid, and nitric acid.
- 48. Graphic Transition – Bases**
49. In your kitchen you probably can find soap, as well as ammonia. These are examples of bases.
50. A base is a substance that produces hydroxide ions in a solution. Hydroxide ions are symbolized OH^- .
51. Bases in solution often feel slippery, like liquid soap.
52. Like acids, strong bases can be corrosive, and contact with skin may cause burns.
53. Basic solutions are also electrolytes and are able to conduct electricity.



Script (cont.)

54. Liquid ammonia is a common base and is used as a household cleaner.
55. Magnesium hydroxide is a base commonly used as a stomach antacid.
56. Another base, calcium hydroxide, sometimes called caustic lime, is used in the production of mortar used by masons.
57. It is also a common ingredient in drain cleaners.
- 58. Graphic Transition – Measuring Acids and Bases**
59. Why is it safe to eat some acids such as oranges, . . .
60. . . . but it is not safe to swallow this solution of sulfuric acid?
61. The answer lies in the fact that all acids are not alike. The same holds true for bases.
62. The strength of an acid or base depends on how well or completely a compound forms ions when dissolved in water.
63. For example, an acid that ionizes almost completely in solution is a strong acid.
64. And one that does not ionize much is a weak acid.
65. Concentration, on the other hand, refers to the amount of acid or base dissolved in a solution.
66. The terms dilute and concentrated refer to the concentration of a solution.
67. This person is testing the pH of pool water.
68. pH is a measure of the concentration of hydronium ions in a solution.
69. In other words, it is a measure of the acidity of a solution.
70. The pH scale uses a series of numbers from 0 to 14.
- 71. You Decide!** What does seven on the pH scale represent?
72. Seven is in the middle of the scale and represents the neutral point.
73. A neutral solution has a pH of seven and is neither an acid nor a base.
74. Distilled water has a pH of seven and is neutral.
75. Solutions such as vinegar with a pH of less than seven are acids.
76. And solutions such as hand soap with a pH of greater than seven are bases.
77. One simple way to test the pH of a substance is with pH paper, which undergoes a color change.
78. First the pH paper is dipped into a solution. The final color of the paper is then matched with the colors in a chart to identify the pH level.
- 79. You Observe!** What is the pH of this pickle juice?
80. As you can see the color on the pH paper when dipped in pickle juice most closely matches this color on the scale, which has a pH of three.



Script (cont.)

81. Graphic Transition – Salts

82. **You Predict!** What is formed when you mix this acid with this base?
83. When they are mixed a salt is formed. A salt is a neutral compound formed from the negative ion of an acid and a positive ion from a base.
84. This type of reaction is called a neutralization reaction.
85. In the process of neutralization, the properties of the acid and the base are lost.
86. In turn, neutral substances - salt and water are formed.
87. An example of a neutralization reaction occurs when you take an antacid tablet to relieve an upset stomach.
88. When your stomach produces more acid than needed, this often causes discomfort.
89. The antacid tablet is a base, which reacts with stomach acid and produces salt and water. The reaction raises the pH level to the normal value and may ease the discomfort.

90. Graphic Transition – Carbon Compounds

91. Every time you ride in a car. . .
92. . . . write with a pencil. . .
93. . . . and put on your sneakers, you are using some type of carbon compound.
94. **You Decide!** What is carbon?
95. Carbon is an element that is quite common and is found in all living things including both plants. . .
96. . . . and animals.
97. Carbon is found here in the periodic table.
98. Compounds containing carbon are often referred to as organic compounds. Organic compounds are based on the element carbon.
99. Nonliving things also may be made up of organic compounds as is the graphite in this pencil tip.
100. It is estimated that over 90% of all compounds are organic compounds.
101. A great deal of chemical research focuses on the development and manufacturing of organic compounds resulting in products such as these.
102. The ability of carbon to bond with other elements explains why there are millions of carbon compounds.
103. One of the simplest organic compounds involves two carbon atoms.
104. And the most complex may involve thousands of carbon atoms.
105. Carbon compounds can form long straight chains. . .



Script (cont.)

106. . . . or branched chains, single rings, or rings linked together.
107. It is the multiple ways carbon atoms bond with each other and other elements that result in millions of different kinds of organic compounds.
- 108. Graphic Transition - Hydrocarbons**
- 109. You Predict!** What will happen when we bring a match toward the gas coming out of this nozzle?
110. As you can see it ignites.
111. The gas is a type of compound called propane.
112. Gases such as butane, propane and octane belong to a group of organic compounds called hydrocarbons.
113. They play a vital role in heating our homes...
114. ...and even provide heat for hot air balloons.
115. What exactly is a hydrocarbon? A hydrocarbon is an organic compound that contains only hydrogen and carbon atoms.
116. Propane, shown here, has three carbon atoms and eight hydrogen atoms.
117. In propane the carbon atoms are joined by single covalent bonds.
118. Compounds such as propane and methane are called saturated hydrocarbons, and form relatively short chains.
119. In unsaturated hydrocarbons one or more of the bonds between carbon atoms is a double covalent or triple covalent bond.
120. Unsaturated hydrocarbons often form large chains.
121. Hydrocarbons, as well as organic compounds such as alcohol, esters, and organic acids all play a very important role in creating products we use everyday.
- 122. Graphic Transition- Summing Up**
123. During the past few minutes we have explored some of the fascinating characteristics of compounds in chemistry.
124. We discussed how living and non-living things are made up of compounds.
125. And we saw the general way in which compounds are formed from the bonding together of atoms of two or more elements.
126. One way of grouping compounds is by classifying them as acids or bases.
127. Acids are substances that produce hydrogen ions in a solution.
128. Acids have a pH of less than seven.
129. And acids tend to have a sour taste and may corrode substances.
130. Bases produce hydroxide ions in solution.
131. Bases have a pH of greater than seven, and often have a slippery feel to them.
132. We also differentiated between strength and concentration of acids and



Script (cont.)

bases.

133. The strength of an acid or base is dependent on how well a compound forms ions when dissolved.
134. Whereas concentration refers to the amount of acid or base dissolved in solution.
135. We also reviewed some of the characteristics of salts.
136. We explored many of the fascinating features of carbon compounds, often called organic compounds.
137. More specifically we discussed some of the features of hydrocarbons, an economically valuable group of organic compounds.
138. So the next time you eat an orange,....
139. ...write with a pencil,...
140. ...or put on your sneakers...
141. ...think about some of the dozens of chemical compounds we use every day.
142. You just might think about your world a little differently.
- 143. Graphic Transition - Video Assessment**

Fill in the correct word to complete the sentence. Good luck and let us get started.

1. The smallest part of a pure substance is an _____.
2. Water is an example of a chemical _____.
3. Orange juice is an _____.
4. Soap is an example of a _____.
5. Seven on the pH scale represents the _____ point.
6. Bases have a pH _____ than seven.
7. The strength of an acid or base depends on how completely it forms _____.
8. Organic compounds are based on the element _____.
9. Propane is an example of a _____.
10. Hydrocarbons contain carbon and _____ atoms.



Student Assessments and Activities

Assessment Masters:

- Preliminary Assessment
- Video Review
- Post Assessment

Student Activity Masters:

- Testing for pH
- Electrolytes in Action
- Vocabulary of *Compounds in Chemistry*



Answers to Student Assessments

Preliminary Assessment (pgs. 20-21)

1. atom
2. element
3. acids
4. hydrogen
5. sour
6. slippery
7. greater
8. salt
9. carbon
10. hydrocarbons
11. true
12. false
13. false
14. true
15. true
16. true
17. true
18. true
19. false
20. true

Video Review (pg. 22)

1. Orange juice and vinegar are both acids.
2. Seven on the pH scale is the middle of the scale and it represents the neutral point.
3. This pickle juice has a pH of 3.
4. When you mix this acid with this base, a salt is formed. A salt is a neutral compound formed from the negative ion of an acid and a positive ion of a base.
5. Carbon is an element that is quite common and is found in all living things including both plants and animals.

6. When we bring a match toward the gas coming out of this canister, the gas ignites.

Video Quiz (p. 22)

1. atom
2. compound
3. acid
4. base
5. neutral
6. greater
7. ions
8. carbon
9. hydrocarbon
10. hydrogen

Post Assessment (pgs. 23-24)

1. hydrogen
2. salt
3. acids
4. atom
5. slippery
6. hydrocarbons
7. sour
8. element
9. greater
10. carbon
11. true
12. true
13. true
14. true
15. false
16. true
17. false
18. false
19. true
20. true



Answers to Student Activities

Testing for pH (pgs. 25-27)

1. An acid is a substance that produces hydrogen ions in solution. A base is a substances that produces hydroxide ions in solution. Acids have a pH of less than 7 and bases have a pH of more than 7.
2. pH is a measure of the concentration of hydronium ions in a solution.
3. The orange juice, vinegar, lemon juice, and cola are all acidic.
4. The strongest acid is the lemon juice.
5. The baking soda, shampoo, liquid hand soap, and antacid tablets were all bases. The milk is close to neutral with a pH of about 7.
6. The strongest base was the baking soda.
7. Answers will vary. Rain that is strongly acidic is called acid rain. Acid rain is formed by a chemical reaction resulting from pollutants in the air.

Substance	pH	Acid or base?
Orange juice	4	acid
Vinegar	2	acid
Lemon juice	2	acid
Milk	7	neutral
Baking soda	8	base
Shampoo	6	acid
Cola	3	acid
Liquid hand soap	8	base
Antacid tablets	8	base
Rainwater	will vary	will vary

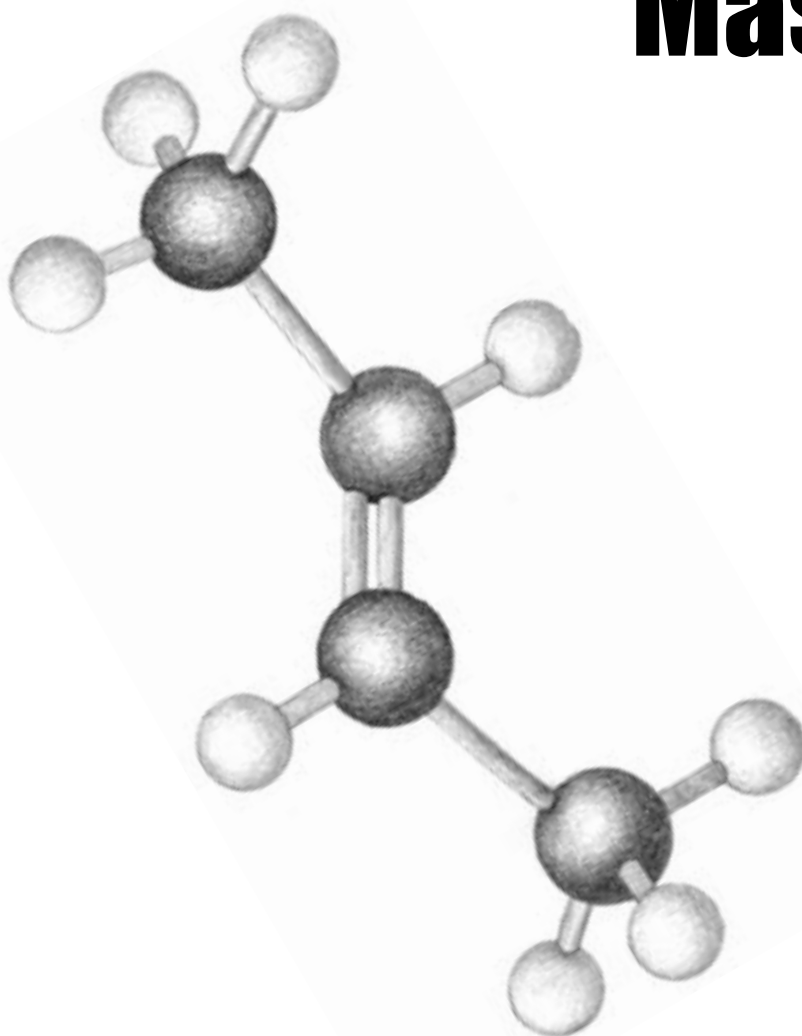
Electrolytes in Action (pgs. 28-29)

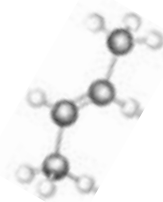
1. An electrolyte is a substance that separates into ions in a water solution. Electrolytes can conduct an electric current.
2. The lemon can conduct electricity because it is a strong acid and therefore releases lots of hydrogen ions, which makes it an electrolyte.
3. Acids and bases both produce ions in a water solution. This makes them good electrolytes, and they can conduct electricity.
4. Hydrochloric acid conducted electricity because it is a good electrolyte. It seperates into ions in solution and can conduct an electric current.
5. Answers will vary.

Vocabulary of Compounds in Chemistry (p. 30)

1. i - bases
2. c - organic compounds
3. d - neutralization reaction
4. f - salt
5. e - acids
6. g - chemical compound
7. j - hydrocarbon
8. a - concentration
9. h - unsaturated
10. b - saturated

Assessment and Student Activity Masters





Preliminary Assessment

Directions: Fill in the blank with the correct word. A list of possible answers is provided at the bottom of the page.

1. The smallest particle of a pure substance is an _____.
2. An _____ is a chemically pure substance made up of just one kind of atom.
3. Orange juice and vinegar are examples of _____.
4. When acids are dissolved in water, _____ ions are released.
5. Acids tend to have a _____ taste.
6. Bases in a solution often feel _____.
7. Bases have a pH _____ than 7.
8. When an acid and base are mixed a _____ is formed.
9. Organic compounds contain the element _____.
10. Butane, propane, and ethane are organic compounds referred to as _____.

acids
atom
carbon
element
greater

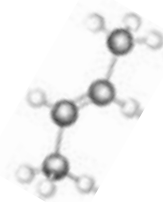
hydrocarbons
hydrogen
salt
slippery
sour



Preliminary Assessment

Directions: Decide whether the statement is true (T) or false (F).

- | | | |
|---|---|---|
| 11. There are millions of different examples of chemical compounds. | T | F |
| 12. A chemical compound is always made up of just one type of atom. | T | F |
| 13. A substance with a pH of 2 is a base. | T | F |
| 14. Electrolytes are solutions capable of conducting an electric current. | T | F |
| 15. A base produces hydroxide ions in solution. | T | F |
| 16. A strong base can cause severe burns. | T | F |
| 17. Hydrocarbons contain carbon and hydrogen atoms. | T | F |
| 18. All living things contain carbon. | T | F |
| 19. Hydrocarbons are relatively rare compounds. | T | F |
| 20. Concentration refers to the amount of acid or base dissolved in solution. | T | F |



Video Review

Directions: During the course of the program, answer the questions as they are presented in the video. At the end of the video, answer the Video Quiz questions.

You Compare!

1. What do orange juice and vinegar have in common?

You Decide!

2. What does seven on the pH scale represent?

You Observe!

3. What is the pH of this pickle juice?

You Predict!

4. What is formed when you mix this acid with this base?

You Decide!

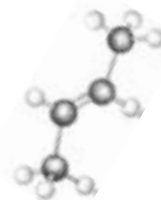
5. What is carbon?

You Predict!

6. What will happen when we bring a match toward the gas coming out of this nozzle?

Video Quiz:

1. The smallest part of a pure substance is an _____.
2. Water is an example of a chemical _____.
3. Orange juice is an _____.
4. Soap is an example of a _____.
5. Seven on the pH scale represents the _____ point.
6. Bases have a pH _____ than seven.
7. The strength of an acid or base depends on how completely it forms _____.
8. Organic compounds are based on the element _____.
9. Propane is an example of a _____.
10. Hydrocarbons contain carbon and _____ atoms.



Post Assessment

Directions: Fill in the blank with the correct word. A list of possible answers is provided at the bottom of the page.

1. When acids are dissolved in water, _____ ions are released.
2. When an acid and base are mixed a _____ is formed.
3. Orange juice and vinegar are examples of _____.
4. The smallest particle of a pure substance is an _____.
5. Bases in a solution often feel _____.
6. Butane, propane, and ethane are organic compounds referred to as _____.
7. Acids tend to have a _____ taste.
8. An _____ is a chemically pure substance made up of just one kind of atom.
9. Bases have a pH _____ than 7.
10. Organic compounds contain the element _____.

acids
atom
carbon
element
greater

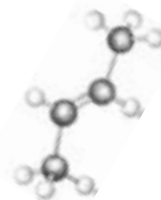
hydrocarbons
hydrogen
salt
slippery
sour



Post Assessment

Directions: Decide whether the statement is true (T) or false (F).

- | | | |
|---|---|---|
| 11. All living things contain carbon. | T | F |
| 12. Electrolytes are solutions capable of conducting an electric current. | T | F |
| 13. There are millions of different examples of chemical compounds. | T | F |
| 14. A strong base can cause severe burns. | T | F |
| 15. A chemical compound is always made up of just one type of atom. | T | F |
| 16. Hydrocarbons contain carbon and hydrogen atoms. | T | F |
| 17. A substance with a pH of 2 is a base. | T | F |
| 18. Hydrocarbons are relatively rare compounds. | T | F |
| 19. A base produces hydroxide ions in solution. | T | F |
| 20. Concentration refers to the amount of acid or base dissolved in solution. | T | F |



Testing for pH

Background:

What do vinegar and grapefruit juice have in common? That's right, they are both acids. Acids, as well as bases, make up important groups of chemical compounds. Acids are substances which produce hydrogen ions when they are in solution. Bases, on the other hand, are substances which produce hydroxide ions in a solution.

Different acids and bases have different concentrations of hydronium ions. The concentration of hydronium ions in a solution is often measured using the pH scale. The numbers on the pH scale run from 0 to 14, where 7 is in the middle and represents a neutral solution. Substances with a pH of less than 7 are considered acidic and those with a pH of more than 7 are considered basic.

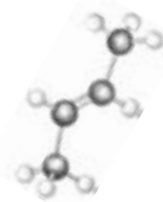
There are a variety of techniques used to measure the pH of substances. Scientists commonly use digital pH meters to obtain very accurate readings. An older method uses litmus paper as an acid-base indicator. It is also possible to use solutions to quantify pH. In this activity, we will use a universal pH indicator. This consists of a small piece of special paper which changes color when dipped in a solution. It can change to several different colors depending on the pH of the solution. The color indicates a specific pH value.

Materials:

Distilled water, universal pH indicator, orange juice, vinegar, lemon juice, milk, shampoo, cola, liquid hand soap, antacid tablets, cups or test tubes, a test tube rack (if using test tubes) and rain water

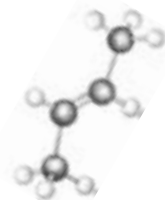
Directions:

1. Obtain ten cups or test tubes in a test tube rack.
2. Label each cup or test tube with the name of the substance that it will contain.
3. Pour 30 ml of each liquid into its appropriate container. If the substance is a solid then measure out about 1 teaspoon (5 ml) and stir it into 30 ml of distilled water.
4. Once you have prepared all the substances you will test, obtain a universal pH kit from your teacher. Tear off approximately 10 cm of the paper. Carefully place the tip of the paper into the first substance to be tested.
5. Compare the color of the paper to the color on the side of the paper dispenser.
6. Record the color and pH of the substances in the appropriate space in the data table.
7. Complete this procedure for all ten substances.



Testing for pH

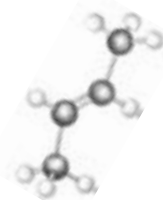
Substance	pH	Acid or base?
Orange juice		
Vinegar		
Lemon juice		
Milk		
Baking soda		
Shampoo		
Cola		
Liquid hand soap		
Antacid tablets		
Rainwater		



Testing for pH

Questions:

1. What is the difference between an acid and a base?
2. What is pH?
3. Which substances that you tested were acidic?
4. What was the strongest acid?
5. Which substances were bases?
6. What was the strongest base?
7. What was the pH of the rain water? If it was acidic, describe what you think may account for the acidity.



Electrolytes in Action

Background:

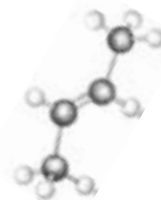
Remember that acids and bases have strong chemical and physical properties when dissolved in water. One such property is conductivity. Conductivity is the ability of a substance to conduct electricity. When acids are dissolved in water they produce hydrogen ions, and when bases dissolve in water they produce hydroxide ions.

The presence of ions in a solution creates an electrolyte. An electrolyte is a substance which conducts electricity when in solution with water. Strong acids, as well as strong bases, tend to create good electrolytes. In this activity we will see how well a lemon can conduct an electrical current.

Materials:

Dry cell battery, three leads, 2 strips of copper, light bulb in socket, lemon, protective eyeglasses or goggles, hydrochloric acid, water, beaker.





Electrolytes in Action

Directions:

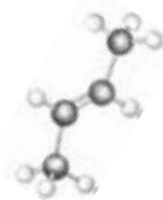
1. **Put on protective eyeglasses or goggles. Wear them throughout this activity.**
2. Obtain a lemon. Roll and squeeze the lemon to loosen the tissues inside the lemon. Do this for several minutes.
3. Obtain a battery, three leads, two copper strips, and a small lightbulb in a socket.
4. Connect the copper strips to the ends of two of the leads.
5. Cut two slits opposite each other on the lemon. Make the slits about three centimeters wide.
5. Carefully insert the copper strips into the lemon through the rind. Do not let the copper strips touch each other inside the lemon.
6. Make the connections as seen in the diagram on the previous page. Connect the leads to the battery last. Observe what happens to the light bulb.

Teacher demonstration:

1. First your teacher will put on protective eyeglasses or goggles.
2. Next he or she will pour about 50 ml of hydrochloric acid in a small beaker.
3. Your teacher will then test the conductivity of the acid with a setup similar to the one you just used when testing the lemon.
4. Make sure the copper strips do not touch each other. See if the acid conducts electricity.

Questions:

1. What is an electrolyte?
2. Why do you think the lemon conducted electricity?
3. What does an electrolyte have to do with being an acid or a base?
4. Why did the hydrochloric acid conduct electricity?
5. What are some other substances you think would be good conductors of electricity?



Vocabulary of Compounds in Chemistry

Directions: Unscramble the vocabulary words in the first column. Match the words to the definitions in the second column.

- | | |
|---|--|
| _____ 1. absse _____ | a. refers to the amount of acid or base dissolved in a solution |
| _____ 2. rcoiagn nmudoospc
_____ | b. organic compounds in which the carbons are all joined by single covalent bonds; they form relatively short chains |
| _____ 3. eaazntiirlount etnocira
_____ | c. compounds based on the element carbon |
| _____ 4. atsl _____ | d. a type of chemical reaction in which an acid and base react and the properties of the acid and base are lost |
| _____ 5. cdasi _____ | e. substances that produce hydrogen ions in solution and have a pH of less than 7 |
| _____ 6. hciceaml oopucndm
_____ | f. the neutral compound formed from the negative ion of an acid and a positive ion of a base |
| _____ 7. yaohrbncdor _____ | g. a substance made up of the combined atoms of two or more elements |
| _____ 8. onetrcnitcoan _____ | h. hydrocarbons in which one or more of the bonds between carbon atoms is a double or triple covalent bond |
| _____ 9. anrtusedaut _____ | i. substances that produce hydroxide ions in solution and have a pH of more than 7 |
| _____ 10. aartteuds _____ | j. an organic compound that contains hydrogen and carbon atoms |