#21 **Acid Neutralization by Antacid**

Reagents

6 M hydrochloric acid [HCl]	30 mL/pair
sodium hydroxide pellets [NaOH]	20 g/pair
phenolphthalein	1–2 mL/pair
distilled water	1300 mL/pair

Common Materials

antacid tablets, 3 brands (Alka Seltzer™ suggested)	2 tablets of each/pair

Special Equipment

1 50-mL pipette with safety bulb	1/pair
1 500-mL volumetric flask with solid stopper to fit	1/pair
mortar and pestle	1/pair

Laboratory Equipment

100-mL clean squeeze bottle
500-mL Erlenmeyer flask with solid stopper to fit
150-mL Erlenmeyer flask
50-mL graduated cylinder
centigram balance
hot plate

Notes

Tablets need to be crushed in order to dissolve quickly. White tablets are better. Colored tablets may obscure the endpoint determination.

Disposal

Flush all solutions down the drain with a lot of water.

ACID NEUTRALIZATION BY ANTACID PRE-LAB QUESTIONS

1) Some antacids neutralize acid very quickly, while others neutralize slowly over a longer period of time. The antacids that produce carbon dioxide gas neutralize acid the fastest, whereas antacids containing hydroxides tend to operate over a longer period of time. Name a common antacid that offers immediate relief.
Alka-Seltzer would provide fast relief because of all the carbon dioxide produced as it effervesces.

2) If an antacid tablet requires warming to dissolve, or if it dissolves slowly, would you expect it to work quickly or be designed to operate over an extended period of time?
It takes time for ingested substances to reach body temperature; therefore, one would expect the antacid described to act slowly, over an extended period of time.

3) What color would you expect phenolphthalein to be if it was added to the gastric juices of your stomach?
Phenolphthalein would appear clear, or colorless, in gastric juice because digestive secretions are acidic.

4) Why would it not be a good idea to use antacids as a calcium supplement?
Antacids are intended to alter the pH of the stomach environment. Other calcium supplements are available that will not increase the risk of alkalosis.

5) One of the principles of green chemistry is atom economy—that all reactants are included in the products. Why is it important that a chemist be able to determine exactly when a reaction is complete, that is, when the two reactants are completely reacted?
If a reaction has reached completion but one reactant continues to be added to the system, the excess is wasted. The ability to determine when a reaction is complete allows chemists to conserve reagents and conduct experiments in keeping with principles of green chemistry.

6) What happens to the pH of your stomach if you take more antacid than necessary to neutralize the acid?
When more antacid is taken than necessary, the pH of the stomach can be overneutralized, making it slightly basic. The condition can be harmful and is referred to as alkalosis.

ACID NEUTRALIZATION BY ANTACID SAMPLE REPORT SHEET

PART A: DENSITY OF NaOH

Mass of cylinder and NaOH solution _____ g
minus mass of cylinder − _____ g

Mass of 10 mL NaOH solution __*10.0-11.0*_____ g

$$\text{Density} = \frac{\text{mass of solution}}{\text{volume}} = \frac{10.0 - 11.0}{10\ \text{mL}} = \text{}$$ __*1.0-1.1*____g/mL

PART B: STANDARDIZATION OF THE SODIUM HYDROXIDE SOLUTION

Initial bottle mass _____ g
minus final bottle mass − _____ g

Mass of NaOH added ___*18.0-20.0*_____g

$$\text{Volume of NaOH added} = \frac{\text{mass added}}{\text{density}} = \frac{18.0 - 20.0\ \text{g}}{1.0 - 1.1\ \text{g/mL}} =$$ _*18.0*__mL

$$\text{Molarity of NaOH} = \frac{(0.36\ \text{M HCl})(50\ \text{mL HCl})}{\text{volume NaOH}} = \frac{(0.36\ \text{M HCl})(50\ \text{mL HCl})}{18.0\ \text{mL}} =$$ __*1.0*__M

**All other answers will depend on the brands used.*

PART C: NEUTRALIZATION WITH ANTACIDS

	#1	#2	#3
BRAND NAME OF TABLETS	_____	_____	_____
Mass	_____g	_____g	_____g
BASE ADDED			
Initial solution and bottle mass	_____g	_____g	_____g
Final solution and bottle mass	_____g	_____g	_____g
Difference (base added)	_____g	_____g	_____g
Volume of base = difference / density	_____mL	_____mL	_____mL
ACID ADDED = (50 mL)(0.36 M) =	18 mmol	18 mmol	18 mmol
BASE ADDED = volume times base molarity	= _____ mmol	_____mmol	_____mmol
ACID NEUTRALIZED = mmol acid added minus base added	= _____ mmol	_____mmol	_____mmol
ACID NEUTRALIZED PER TABLET	= _____mmol	_____mmol	_____mmol
ACID NEUTRALIZED PER GRAM = (answer above divided by mass of tablet)	= _____mmol	_____mmol	_____mmol

PART D: QUESTIONS

1. Read the antacid label to find the basic compounds and write balanced equations showing the reaction with the hydrogen ion.

   Brand #1

   The reactions will vary according to brand, but most will contain CO_3^{-2} or $Mg(OH)_2$:

   Brand #2 $CO_3^{-2} + 2H^+ \rightarrow H_2CO_3 \rightarrow H_2O + CO_2$

   Brand #3 $Mg(OH)_2 + 2H^+ \rightarrow Mg^{2+} + 2H_2O$

2. Which antacid appears to be best at relieving acid stomach?
   This varies according to the brands used.

3. Which antacid has more neutralizing power per gram?
   This varies according to the brands used.

4. In recent commercials, some antacids brag that they contain calcium. If calcium is used by the body to form bones and teeth, is it an advantage to be able to obtain calcium for the body as heartburn is treated?
   When basic compounds such as calcium carbonate react with the hydrogen ion, which is acidic, carbonic acid is produced and quickly dissociates into water and carbon dioxide. This leaves the calcium ion free to be used by the body to build bones and teeth. Any nontoxic metal ion that is combined with the carbonate ion will work, so providing a free ion that the body can use is logical.

#22 Nature's Indicators

Reagents

0.1 M hydrochloric acid [HCl]	20 mL/pair
0.1 M sodium hydroxide [NaOH]	20 mL/pair
pH test paper	1 roll/pair
red litmus paper	1 container/pair
blue litmus paper	1 container/pair

Common Materials

red cabbage	1 head/lab section
beets	1/pair
concentrated grape juice	20 mL/pair
lemon juice	1 mL/pair
ammonia household cleanser	1 mL/pair
vinegar	1 mL/pair
clear soft drink	1 mL/pair
white or clear shampoo (clear is better)	1 mL/pair
liquid drain cleaner	1 mL/pair
paring knife	1/pair

Laboratory Equipment

2 250-mL beakers
100-mL graduated cylinder
7 100-mL beakers
7 test tubes
stirring rod
eyedropper
hot plate

Notes

Canned beets and red cabbage will also work.

The skins of black grapes will also work well for indicator preparation; however, this gives essentially the same results as the concentrated grape juice. The grape juice should be 100% juice as opposed to a grape drink. Other plants that will produce indicators are petals from violets, petunias, hydrangea, and hibiscus; the skins of tomatoes, turnips, red apples, peaches, pears, and red onions; and the juices of pomegranates, cherries, raspberries, blueberries, and blackberries. (Source: WonderScience magazine published by the American Chemical Society)

The vegetables may also be heated (not boiled) in ethanol to produce an indicator. By this method, less time is required to evaporate the solution down to the desired concentration of color. However, care must be taken when heating ethanol.

There are both acidic and basic drain cleaners. A basic drain cleaner such as Drano™ will provide a second basic solution.

Disposal

Dispose of your pH solutions, one at a time, by pouring them down the drain with a large amount of water.

NATURE'S INDICATORS PRE-LAB QUESTIONS

1) Hydrangea plants (*Hydrangea macrophylla*) produce very large flower clusters and are common garden shrubs in central and southern states. Many people believe that there are two varieties of this shrub—blue and pink—when, in fact, there is only one. Many homeowners have planted a hydrangea of one "variety" only to have it slowly transform to the other over a period of years. Give an explanation for this phenomenon in light of the introductory information for this investigation.
The pH of the soil determines the color of the pigment in the petals because at least one component of that pigment is a natural indicator.

2) Litmus is either red or blue. It is useful only to determine if a substance is classified as an acid or a base. Indicators that are capable of specifying a particular pH exhibit a range of color changes. Would you expect these "universal indicators" to be a single compound, two compounds combined, or several compounds combined? Support your position.
Since most indicators exhibit only a single color change at a narrow pH range, a universal indicator must be a combination of several substances, each covering a separate range of transition.

3) Would an experiment using indicators to determine the pH of common substances work in an already colored substance, such as a cola beverage? Why or why not?
It would not be useful to use a color indicator in a colored substance, especially one that is darkly colored because the existing color would mask the color of the indicator.

4) Nearly all indicators are organic molecules that are sensitive to destruction by strong solutions, especially bleaching cleansers. Could the pH of chlorine bleach be determined with an indicator derived from a plant? Explain.
Probably not. Plant substances are organic, and chlorine bleach destroys organic molecules. If it gave an indication of pH, it would be short-lived.

5) A child goes to the kitchen sink to rinse the glass from which he just drank grape juice. As the water runs into the glass, the juice residue turns from purple to light blue. What is happening?
The grape juice contains a natural indicator that appears dark purple at a specific pH range. As the juice is diluted, the pH moves closer to neutral, and the transition range of the indicating substance is crossed so that it changes color.

6) Why is it important to know whether or not a home care product is strong acidic?
Substances that are strongly basic or acidic can damage living tissues and some objects. Care should be taken when using them.

NATURE'S INDICATORS SAMPLE REPORT SHEET

INDICATOR COLOR

	Cabbage	Beet	Grape	Blue Litmus	Red Litmus
pH = 1	*dark pink*	*dark pink*	*pink*	*red*	*red*
pH = 3	*light pink*	*light pink*	*light pink*	*red*	*red*
pH = 5	*light purple*	*very lt. pink*	*very lt. pink*	*red*	*blue*
pH = 7	*very lt. purple*	*very lt. pink*	*very lt. pink*	*red*	*blue*
pH = 9	*light blue*	*very lt. pink*	*clear*	*red*	*blue*
pH = 11	*green*	*pink*	*clear*	*blue*	*dark blue*
pH = 13	*lime green*	*yellow*	*green*	*blue*	*dark blue*

INDICATOR USED * __*Cabbage*_____

SUBSTANCE	pH by indicator	pH by paper
Lemon juice	__*1*___	__*2*___
Vinegar	__*3*___	__*3*___
Soft drink	__*5*___	__*7*___
Shampoo	__*7*___	__*7*___
Ammonia cleanser	_*11*___	_*10*___
Drain cleaner	_*11*___	__*8*___

**Beets give the following: 1,3,7,7,11,9.*
Grapes give the following: 1,3,5,7,11,9.

QUESTIONS

1. Are beverages usually acidic or basic?
   Beverages are usually acidic or neutral: water is neutral, while orange juice is acidic. This is true because many beverages contain fruit juices or have acid added for flavor.

2. Why shouldn't shampoo be too acidic or too basic?
   Shampoo must be neutral because the acid or base could damage the hair.

3. Which indicator did you like best and why?
   Student response here.

4. Which indicator covers the largest range of pH?
   The cabbage, beet, and grape juice cover the full pH scale, but the cabbage changes to a different color at each pH increment we checked.

5. Which indicator produced the most variation in color?
   cabbage

6. Why are there two types of drain cleaners?
   The bathroom drain cleaner has acid, which breaks down protein in hair that is usually found in bathroom drains. The second type is basic and is used to react with the grease in kitchen clogs and helps to free the clog.

7. Comment on how closely your pH determinations using the experimental indicator scale matched the pH determinations with the commercial pH paper.
   Answers will vary, but the results should be very close.

#23 pH and Flammability of Household Products

Reagents

ethanol [CH_3CH_2OH]	2 mL/pair
acetone [CH_3COCH_3]	2 mL/pair
sodium tripolyphosphate [$Na_5P_3O_{10}$]	2 mL/pair
sodium pyrophosphate [$Na_4P_2O_7$]	2 mL/pair
sodium carbonate [Na_2CO_3]	2 mL/pair
sodium silicate [Na_2SiO_3]	2 mL/pair
pH test paper	8-10 strips/pair

Common Materials

vanilla extract	2 mL/pair
nail polish remover	2 mL/pair
cologne	2 mL/pair
aftershave lotion	2 mL/pair
paint thinner	2 mL/pair
oven cleaner	2 mL/pair
hair spray	2 mL/pair
toilet bowl cleaner	2 mL/pair
hand dishwashing detergent	2 mL/pair
machine dishwashing detergent	2 mL/pair
chlorine bleach	2 mL/pair
vinegar	2 mL/pair
drain cleaner	2 mL/pair
ammonia cleaning product	2 mL/pair
other products from home	2 mL/pair
matches	1 book/pair

Laboratory Equipment

evaporating dish
50-mL beaker
stirring rod
laboratory burner

Notes

The unused paint thinner should not be flushed down the drain but should instead be carefully sealed for use in another semester. The small amount of paint thinner given to the students should be consumed by the flames. Be sure it is a flammable paint thinner.

There are both acidic and basic drain cleaners. Drano™ is basic; Works™ is acidic.

Disposal

Paint thinner will contaminate water. It should be completely consumed by the flames. It could also be evaporated in a fume hood.

pH and FLAMMABILITY PRE-LAB QUESTIONS

1) In many homes, multiple flammable compounds normally reside under the kitchen sink. Another common storage place for household cleaning supplies and solvents is the "utility" closet, which may also house a gas-fueled water heater or furnace. Comment on the risks and wisdom of this practice. Can you suggest alternatives?
Any place in which an open flame or electrical sparks exist is a hazardous place to store flammable substances; especially unventilated areas where vapors can build up. A good alternative is a ventilated storeroom where there are no gas-fueled appliances or appliances on thermostats that generate small sparks when they cycle on.

2) Assume you are the corporate attorney for a company that produces, packages, and markets multiple household cleaners and solvents. What suggestions would you make to the company CEO concerning consumer warnings?
Correct responses may include but may not be limited to the following:
   - *Flammables should be stored in ventilated areas and away from open flames and electrical sparks.*
   - *Never mix cleaning products.*
   - *Note caustic warnings on products of low or high pH.*
   - *Keep all household products away from children.*
   - *Obtain the toll-free Poison Control number.*

3) It has been suggested that a labeling system for easy identification of pH and flammability ratings for common substances should be instigated. If this system used color-coding for ease of identifying the characteristics of a substance, what suggestions would you make for the design?
Answers will vary.

4) Which of the substances we will use in this lab can you find in your own home, apartment, or dorm room?
Answers will vary.

5) How can you reduce the risk of accidents and injuries involving household chemicals in your domicile?
Read and follow all warnings and directions for household substances. Adhere to proper storage techniques. Use all household products in open or ventilated areas. Wear protective clothing and gloves when using caustic substances.

6) One principle of green chemistry regards inherently safer chemistry for accident prevention. Is this principle being followed by marking flammable or acidic or basic materials?
Yes. If consumers are conscious of the pH of compounds and the potential risks involved in their use, they can be more cautious and even perhaps use less.

pH and FLAMMABILITY OF HOUSEHOLD PRODUCTS
SAMPLE REPORT SHEET

I. FLAMMABILITY

	Ignites with Match	Ignites with Stronger Flame
Ethyl alcohol	X	
Acetone	X	
Vanilla extract		X
Nail polish remover	X	
Cologne	X	
Aftershave lotion		X
Paint thinner		X
Oven cleaner		
Hair spray	X	

II. pH

	Brand	pH
Toilet bowl cleaner	*Saniflush*	*2*
Hand dishwashing detergent	*Ajax*	*6*
Machine dishwashing detergent	*Sunlight*	*10*
Bleach	*Vista*	*10*
$Na_5P_3O_{10}$		*8*
Na_2CO_3		*10*
Na_2SiO_3		*10*
Ammonia cleaner		*10*
Vinegar		*4*
Oven cleaner		*14*

III. QUESTIONS

1. Which products include adequate warnings about flammability?
   Answers will vary depending on the brands used.

2. Which products need to include more warnings about flammability?
   Answers will vary depending on the brands used.

3. Which of the products tested are unsafe for skin contact? (Products with pH values between 5 and 10 are probably safe for at least short periods of time.)
   Toilet bowl cleaner
   Vinegar

4. Which of the products tested have adequate warnings concerning pH on the label?
   Answers will vary depending on the brands used.

5. Why wouldn't you use machine dishwashing detergent to wash dishes by hand?
   The pH of the machine dishwashing detergent is basic and is not safe for prolonged use.

6. Why is it suggested to use gloves when using oven-cleaning products?
   Oven cleaner is not safe for skin due to the pH.

7. Because of environmental concerns, phosphates have been replaced with other builders such as sodium carbonate and sodium silicate. Does this change make a difference in safety to the consumer?
   Sodium carbonate and sodium silicate are more basic than phosphates. That means that sodium carbonate and sodium silicate can be more dangerous to the consumer than phosphates.

#24 Buffers

Reagents

1 M acetic acid [CH_3COOH]	10 mL/pair
1 M sodium acetate [CH_3COONa]	10 mL/pair
1 M acetic acid and 1 M sodium acetate (buffer solution)	20 mL/pair
1 M hydrochloric acid [HCl]	50 mL/pair
1 M sodium hydroxide [NaOH]	50 mL/pair
wide range pH paper	1 roll/pair

Common Materials

Laboratory Equipment

50-mL beakers	5/pair
10-mL graduated cylinder	

Notes

Be sure students stir the solutions well after each addition before taking the pH measurement.

Disposal

All solutions may be mixed to neutralize and poured down the drain with lots of water.

BUFFERS PRE-LAB QUESTIONS

1) When a person exerts a great deal of physical energy, as in running a race or playing one-on-one basketball, one of the by-products of muscular activity that takes place is lactic acid. If the blood buffering system cannot handle the lowered pH, what condition could result?
Acidosis could result as the lactic acid lowers the pH of the blood. The lowered pH could in turn affect proteins in nearby cells. This is the cause of the stiffness and soreness associated with the use of muscles that are not accustomed to a higher level of activity.

2) Many consumer products are buffered to protect the body from dangerous pH changes. Pharmaceutical compounds are usually either basic or acidic and, less frequently, neutral compounds. What systems in the body need the protection of a buffer if the substance is ingested? Injected?
Ingested substances that are acidic or basic must be shielded from the stomach lining if the pH is very far from neutral, or if the exposure will be extended. Substances that are injected will make use of the blood buffer system. (Inhaled substances can cause irritation to the lining of the nose, mouth, throat, esophagus, and lungs.)

3) Many fertilizers are formulated to help maintain specific pH levels for certain applications. Will making the fertilizer the desired pH be enough to accomplish the result? Explain your reasoning.
Not necessarily. The nitrates in fertilizer enter the nitrogen cycle in which several nitrogen compounds take part. These various compounds can further alter the pH of the soil as the chemical processes progress.

4) Baking soda (sodium hydrogen carbonate, $NaHCO_3$) acts as a buffer, as does sodium tetraborate [$Na_2B_4O_7$], also called borax. Both are used as a water softener in laundry applications. Each compound raises the pH of the system and then buffers it to keep it consistent. Both of these compounds are active ingredients in pool maintenance products. The hypochlorite ion (ClO^-) is the ingredient used to "shock" a pool. What happens to the pH of the pool?
The hypochlorite ion acts as a base when introduced to the pool water, taking a hydrogen atom from a water molecule and forming hypochlorous acid. This leaves the remaining hydroxide ion free in the pool water. The hydroxide ion initially raises pH, but as sunlight, oxygenation from splashing, and the disinfecting action of the acid reduces the amount of hypochlorite in the water, the pH returns to a more neutral range. In the meantime, the pool has been cleared of bacteria and organic waste.

5) The hypochlorite ion is also the active ingredient in chlorine bleach. Why do people spend large sums of money for pool products that are labeled with cute names like "Alk-Up®" or "SoftSwim®" (actually, $Na_2B_4O_7 \cdot 10H_2O$) instead of buying the substances off grocery store shelves?
Most consumers do not have the knowledge necessary to maintain the pool water quality on their own. Testing solutions for pH and other indicators of water condition are available with instructions that allow a person with virtually no chemical experience to maintain their pool environment. It is also easier to purchase all the necessary chemicals at one place catering to pool needs than to get some things at a grocery store, while others are available only at specific businesses.

6) One of the principles of green chemistry concerns inherently safer chemistry for accident prevention. Might buffers be important in following that principle of green chemistry?
Any method of preventing extreme conditions of pH will reduce the occurrence of chemical-related accidents.

BUFFERS SAMPLE REPORT SHEET

I.

	Water	Acetic Acid	Acetate Ion Sodium Acetate	Acetic Acid-Acetate Buffer
	pH	pH	pH	pH
1 drop HCl	_____	_____	_____	_____
2 drops HCl	_____	_____	_____	_____
20 drops HCl	_____	_____	_____	_____
2 mL HCl	_____	_____	_____	_____
3 mL HCl	_____	_____	_____	_____
4 mL HCl	_____	_____	_____	_____
5 mL HCl	_____	_____	_____	_____
6 mL HCl	_____	_____	_____	_____
7 mL HCl	_____	_____	_____	_____
8 mL HCl	_____	_____	_____	_____
9 mL HCl	_____	_____	_____	_____
10 mL HCl	_____	_____	_____	_____
11 mL HCl	_____	_____	_____	_____

II. 1 drop NaOH _____ _____ _____ _____
20 drops NaOH_____ _____ _____ _____
2 mL NaOH _____ _____ _____ _____
3 mL NaOH _____ _____ _____ _____
4 mL NaOH _____ _____ _____ _____
5 mL NaOH _____ _____ _____ _____
6 mL NaOH _____ _____ _____ _____
7 mL NaOH _____ _____ _____ _____
8 mL NaOH _____ _____ _____ _____
9 mL NaOH _____ _____ _____ _____
10 mL NaOH _____ _____ _____ _____
11 mL NaOH _____ _____ _____ _____

III. Buffer pH _____ add 5 mL water _____ add 10 mL water _____

IV.QUESTIONS

1. Which is the best at resisting pH change when acid is added: water, acetic acid, acetate ion, or buffer?
   The buffer is the best.

2. Which is the worst at resisting pH change when acid is added: water, acetic acid, acetate ion, or buffer?
   The water is the worst.

3. Which is the best at resisting pH change when base is added: water, acetic acid, acetate ion, or buffer?
   The buffer is the best.

4. Which is the worst at resisting pH change when base is added: water, acetic acid, acetate ion, or buffer?
   The water is the worst.

5. Why does the buffer solution have a large pH change after 10 mL is added?
   The amount of acid added has overcome the conjugate base's ability to absorb. (i.e., the base has been used up.)

6. Why would it be useful to "buffer" an aspirin tablet? (Aspirin is acetyl-salicylic acid.)
   The acid can be uncomfortable in the digestive tract which is already acidic. With the buffer, the tablet will resist lowering the pH of the stomach even more.

#25 Oxidation - Reduction

Reagents

zinc, mossy	1 g/pair
tincture of iodine	20 mL/pair
1M copper (II) sulfate [$CuSO_4$]	30 mL/pair
1M sodium chloride [NaCl]	10 mL/pair
1M acetic acid [$HC_2H_3O_2$]	0.5 mL/pair

Common Materials

aluminum foil	2 (4 in. × 4 in.) squares/pair
coins, different metals	2/pair
paper towels	1 sheet/pair
chlorine bleach	0.5 mL/pair

Special Equipment

voltmeter with leads	1/lab

Laboratory Equipment

3 50-mL beakers

Notes

Disposal

Wet zinc dust exposed to air can burst into flames. It is important that students not put wet zinc dust in the trash; it can cause fires in the trash. The wet zinc solutions should be spread on a metal pan to dry. It must be in a metal pan for the chemical reaction to form zinc oxide. Dry zinc oxide will form, which can be buried in a landfill.

OXIDATION AND REDUCTION PRE-LAB QUESTIONS

1) Have you ever experienced a little jolt while the dental assistant was cleaning your teeth? It happens when the metal instrument he or she is holding touches a metallic filling, or more often, the metal base to a crown. It is called galvanic shock. What is happening?
A difference in voltage potential exists between the two metals that are in contact, the instrument and the dental work, and this potential is in a liquid environment with plenty of ions in solution. That is the perfect recipe for a small current.

2) Some people will test a small 9-volt battery to see if it is still usable by touching the terminal end of it to their tongue (not a wise practice, by the way). Why doesn't it work just as well to lay a finger across the two terminals?
The surface of a finger is often very dry, and therefore no current can be supported.

3) Explain why care must be taken when serving food from sterling silver if the food is acidic?
Acidic foods provide the necessary ions in solution to support a current. Depending uon whatever other substances are present, especially sulfur, an environment allowing the silver to be oxidized and bond with another element is likely.