Some Salts Can Be Neutralizers

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Topic

Hydrolysis

Time

30 minutes

Safety

Please click on the safety icon to view the safety precautions. Do not taste any of these substances. After the experiment, dispose of solutions by washing them down the drain. Use plenty of water.

Materials

grape juice
baking soda (sodium bicarbonate)
alum
washing soda (Arm & Hammer™ brand works well)
antacid tablet (Tums™ or Rolaids™ brands, for example)
table salt
Epsom salts
soap flakes (Ivory Flakes™ brand works well)
cream of tartar
vinegar
ammonia cleaning solution
distilled water
10 clear plastic cups
plastic measuring spoons

Procedure

1. Use grape juice as the acid-base indicator. First, put several drops of grape juice in ½ cup vinegar to determine the color of grape juice in an acid. Stir and note the color here:_____
2. Now put several drops of grape juice in ½ cup ammonia cleaning solution to determine the color of grape juice in a base. Stir and note the color here: _____
3. Dissolve ¼ tsp salt in individual ½ cups of distilled water. Stir to dissolve each solution.
4. Add several drops of grape juice to each solution and note the color.
5. Fill in the data table.
6. Carefully dispose of all solutions.
7. Identify the salts that produce an acidic solution.

DATA TABLE			
Salt	Common name	Color of solution + grape juice	Type of solution: acid, base, or neutral
$NaHCO_3$	Baking soda		
$KA1(SO_4)_2 \cdot 12H_2O$	Alum		
$Na_2CO_3 \cdot 10H_2O$	Washing soda		
$CaC0_3$	Tums™		
NaC1	Table salt		
$MgSO_4 \cdot 7H_2O$	Epsom salts		
C*x*H*y*COONa	Soap		
$KHC_4H_4O_6$	Cream of tartar		

8. Identify the salts that produce a basic solution.
9. Why are antacid tablets used for upset stomachs caused by acid indigestion?
10. Identify the neutral salt solutions.
11. Explain why the colors vary for different acids and bases.
12. If a salt forms a basic solution in water, what kind of pH does this solution have? Which ion is in excess, $[H_3O^{+1}]$ or $[OH^{-1}]$? Where do these ions come from?

What's Going On

Grape juice is red in acidic solutions, green in basic solutions, and purple (dilute juice color) in neutral solutions. The salts that produce acidic solutions are alum and cream of tartar. The salts that produce basic solutions are baking soda, washing soda, antacids, and soap. The neutral salt solutions are table salt and Epsom salts. The acidic and basic colors produced are approximately as follows:

cream of tartar: bright red
alum: reddish purple
soap: blue
baking soda: blue green
antacids: grayish green
washing soda: green

The colors you obtain from different substances may vary somewhat from the list above, depending on the brands you use. The range of colors produced in the experiment indicates that the different solutions have different levels of acidity or basicity. The more red a solution, the more acidic; the more green, the more basic. A basic solution has a pH > 7. The excess $[OH^{-1}]$ came from the reaction of the negative ion with water. Example:

$$HCO_3^{-1} + HOH_2CO_3 + OH^{-1}$$

Connections

Salts can be either acidic, basic, or neutral in solution. An acidic solution is one containing more H^+ ions than pure water; a basic solution is one containing more OH^- ions than pure water. Neutral solutions are neither acidic nor basic because they contain an equal amount of H_3O^{+1} and OH^{-1} ions. Scientists use a scale of value 1 to 14, known as pH, to define hydrogen ion concentration. For neutral solutions, pH = 7; for basic solutions, pH > 7; and for acid solutions, pH < 7. You can test whether a solution is acidic, basic, or neutral by using a substance called an *indicator.* In this demonstration, you used grape juice to analyze some common household substances that are salts.

Safety Precautions

READ AND COPY BEFORE STARTING ANY EXPERIMENT

Experimental science can be dangerous. Events can happen very quickly while you are performing an experiment. Things can spill, break, even catch fire. Basic safety procedures help prevent serious accidents. Be sure to follow additional safety precautions and adult supervision requirements for each experiment. If you are working in a lab or in the field, do not work alone.

This book assumes that you will read the safety precautions that follow, as well as those at the start of each experiment you perform, and that you will *remember* them. These precautions will not always be repeated in the instructions for the procedures. It is up to you to use good judgment and pay attention when performing potentially dangerous procedures. Just because the book does not always say "be careful with hot liquids" or "don't cut yourself with the knife" does not mean that you should be careless when simmering water or stripping an electrical wire. It *does* mean that when you see a special note to be careful, it is extremely important that you pay attention to it. If you ever have a question about whether a procedure or material is dangerous, stop to find out for sure that it is safe before continuing the experiment. To avoid accidents, always pay close attention to your work, take your time, and practice the general safety procedures listed below.

PREPARE

- Clear all surfaces before beginning work.
- Read through the whole experiment before you start.
- Identify hazardous procedures and anticipate dangers.

PROTECT YOURSELF

- Follow all directions step by step; do only one procedure at a time.
- Locate exits, fire blanket and extinguisher, master gas and electricity shut-offs, eyewash, and first-aid kit.
- Make sure that there is adequate ventilation.
- Do not horseplay.
- Wear an apron and goggles.
- Do not wear contact lenses, open shoes, and loose clothing; do not wear your hair loose.
- Keep floor and work space neat, clean, and dry.
- Clean up spills immediately.
- Never eat, drink, or smoke in the laboratory or near the work space.
- Do not taste any substances tested unless expressly permitted to do so by a science teacher in charge.

USE EQUIPMENT WITH CARE

- Set up apparatus far from the edge of the desk.
- Use knives and other sharp or pointed instruments with caution; always cut away from yourself and others.
- Pull plugs, not cords, when inserting and removing electrical plugs.
- Don't use your mouth to pipette; use a suction bulb.
- Clean glassware before and after use.
- Check glassware for scratches, cracks, and sharp edges.
- Clean up broken glassware immediately.

- Do not use reflected sunlight to illuminate your microscope.
- Do not touch metal conductors.
- Use only low-voltage and low-current materials.
- Be careful when using stepstools, chairs, and ladders.

USING CHEMICALS

- Never taste or inhale chemicals.
- Label all bottles and apparatus containing chemicals.
- Read all labels carefully.
- Avoid chemical contact with skin and eyes (wear goggles, apron, and gloves).
- Do not touch chemical solutions.
- Wash hands before and after using solutions.
- Wipe up spills thoroughly.

HEATING INSTRUCTIONS

- Use goggles, apron, and gloves when boiling liquids.
- Keep your face away from test tubes and beakers.
- Never leave heating apparatus unattended.
- Use safety tongs and heat-resistant mittens.
- Turn off hot plates, bunsen burners, and gas when you are done.
- Keep flammable substances away from heat.
- Have a fire extinguisher on hand.

WORKING WITH MICROORGANISMS

- Assume that all microorganisms are infectious; handle them with care.
- Sterilize all equipment being used to handle microorganisms.

GOING ON FIELD TRIPS

- Do not go on a field trip by yourself.
- Tell a responsible adult where you are going, and maintain that route.
- Know the area and its potential hazards, such as poisonous plants, deep water, and rapids.
- Dress for terrain and weather conditions (prepare for exposure to sun as well as to cold).
- Bring along a first-aid kit.
- Do not drink water or eat plants found in the wild.
- Use the buddy system; do not experiment outdoors alone.

FINISHING UP

- Thoroughly clean your work area and glassware.
- Be careful not to return chemicals or contaminated reagents to the wrong containers.
- Don't dispose of materials in the sink unless instructed to do so.
- Wash your hands thoroughly.
- Clean up all residue, and containerize it for proper disposal.
- Dispose of all chemicals according to local, state, and federal laws.

BE SAFETY-CONSCIOUS AT ALL TIMES