



Educational Outreach  
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# DIY Air Force Activities:

## Off Base pH Indicator



### Materials:

- 2 cups of chopped red cabbage
- boiling water
- coffee filter or strainer
- mason jar and lid
- small clear plastic portion cups
- Test liquids, for example: lemon juice, vinegar, baking soda, dish soap, milk, water, coffee, and bleach

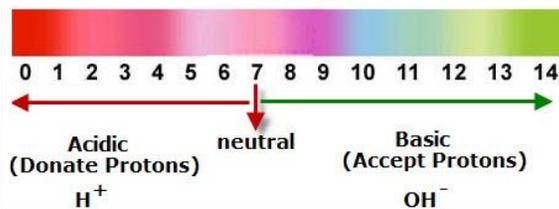
If you have ever had an upset tummy and taken an antacid to calm it then you have experimented with pH! The term pH means “potential for hydrogen;” it is a measure of the acidity of a solution. It is measured on a scale of 1-14, with low values indicating acids and high values indicating bases. A pH of 7 is neutral. Acids and bases can come together and cancel each other out to become neutral. Indicators can be used to determine something’s pH. Red cabbage contains a pigment called Flavin that is a natural pH indicator. When it comes into contact with an acid it is reddish, and turns green when in the presence of a base. Following the directions below you will make a pH indicator solution out of red cabbage and be able to test a variety of household liquids to determine their pH! **Don’t forget to ask for adult assistance!**

### Directions:

1. Submerge 2 cups of chopped red cabbage in boiling water. Be careful not to burn yourself!
2. Let the cabbage soak for 10 minutes.
3. Once it’s cool, pour the mixture through a strainer or coffee filter to separate the cabbage from the liquid.
4. The liquid is now your very own pH indicator! Store it in a mason jar.

**Discover:** Fill the portion cups halfway with small amounts of the substances you wish to test. Add some of your homemade indicator. Experiment with the amount needed to change the color. Use the chart on the left to estimate the pH; is it an acid or a base? Test different substances to make a rainbow! You can soak strips of paper in the indicator and let them dry, then dip them into different liquids to see what colors the paper changes. Soak a large piece of paper and once it dries “paint” on it with different acids and bases!

Red Cabbage pH Scale



### Air Force Associations:

Corrosion is a never-ending challenge. According to the Aircraft Owners and Pilots Association, in just a few years it can make an aircraft unsuitable for flight. Corrosion can be affected by many factors, including changes in pH and temperature. Corrosion weakens structures and accelerates metal fatigue. Military airplanes, especially those operating in salty marine environments, in deserts with salt-laden sand, and in polluted airspace, are particularly susceptible to corrosion. The Air Force has spent as much as \$5.4 billion a year on aviation and missile corrosion issues.





← **ACIDIC** ————— pH ————— **ALKALINE** →



RED (pH <3)



VIOLET (pH 4-7)



BLUE (pH 7-8)



YELLOW GREEN (AT pH >8)

*Hydrogens on carbon atoms implied; each carbon has 4 bonds.*

The red cabbage extract can be used to determine whether substances are acidic or alkaline. The structures of the anthocyanin pigments which give the red cabbage its colour are subtly changed at varying pH. These different structures give a range of colours.