

Science 10 Lab

ACIDS AND BASES

INTRODUCTION

The definitions for acids and bases used in Science 10 are

an **ACID** is a compound that forms ions in solution and whose formula starts with "H", and a **BASE** is a compound that forms ions in solution and whose formula ends with "OH".

The following properties can be used to help identify an acid or a base.

A substance is an ACID if it

- (a) conducts electricity when dissolved in water, and
 - (b) reacts with a base, and
 - (c) turns litmus paper RED*, and
 - (d) reacts with magnesium or zinc to produce hydrogen gas, and
 - (e) tastes sour.

A substance is a BASE if it

- (a) conducts electricity when dissolved in water, and
 - (b) reacts with an acid, and
 - (c) turns litmus paper BLUE*, and
 - (d) feels slippery, and
 - (e) tastes bitter.

A substance that is neither an acid nor a base is said to be a **NEUTRAL** substance.

IMPORTANT: There are only three **types** of solutions: acidic, neutral and basic. There is only one **neutral** solution. However, there is a wide range of acidic solutions, from **highly acidic** to **very slightly acidic**. (A “very slightly acidic” solution is almost neutral.) Similarly, there is a wide range of basic solutions, from **highly basic** to **very slightly basic**. (A “very slightly basic” solution is almost neutral.)

An **INDICATOR** helps us decide how acidic or basic a solution is. An indicator is a dilute solution of a type of dye that turns different colours depending on how acidic or basic a solution is. A few indicators also are able to differentiate between acidic, basic **and** neutral solutions.

The purpose of this experiment is to observe the behaviour of several different indicators in solutions which are neutral or have different amounts of acid or base and to use the observations to classify several unknown solutions as acidic, neutral or basic.

APPARATUS

Each group should obtain the following.

- two plastic well plates and 10 tiny plastic dropping pipettes
 - three pieces of neutral litmus paper
 - one dropper bottle of each of: methyl red, bromothymol blue, phenolphthalein and universal indicator
 - one "pH colour card"
 - one 100 mL bottle of each of the ten solutions labelled
HIGHLY ACIDIC, HIGHLY BASIC, NEUTRAL, A, B, C, D, E, F, G

DATA TABLE

PROCEDURE

1. Clean and dry your well plates, and place them on top of a white sheet of paper. Tear each of the three pieces of neutral litmus paper into small squares.

Note: In order to get the right amount of a solution for a test, squeeze a pipet bulb and completely fill the bulb with liquid. Then "squirt" the contents of the pipet into a large "well" in the well plate.

2. Put one full "squirt" of HCl solution into each of 5 different wells on a well plate.

- (a) Into the 1st well add a piece of litmus paper. **Record the paper's colour** in the Data Table.
- (b) Into the 2nd well add ONE drop of methyl red. **Record the solution's colour** in the Data Table.
- (b) Into the 3rd well add ONE drop of bromothymol blue. **Record the solution's colour** in the Data Table.

(c) Into the 4th well add ONE drop of phenolphthalein. **Record the solution's colour** in the Data Table.

- (d) Into the 5th well add ONE drop of universal indicator. **Record the solution's colour and its pH** in the Data Table.

3. Repeat step 2 of the Procedure using one full "squirt" of each of NaOH, NEUTRAL, A, B, C, D, E, F and G in different wells.

DISCUSSION QUESTIONS

1. What colour is each of neutral litmus, methyl red, bromothymol blue, phenolphthalein and universal indicator in

- (a) a highly acidic solution?
- (b) a highly basic solution?
- (c) a neutral solution?

2. Which TWO of neutral litmus, methyl red, bromothymol blue, phenolphthalein and universal indicator allow you to tell whether a solution is neutral (as opposed to being slightly to highly acidic or slightly to highly basic)?

3. Only one of the unknown solutions is neutral; all the others are either acidic or basic. Which of the unknown solutions (A to G) are acids, which is neutral and which are basic?

4. Only ONE pH is "NEUTRAL"; all other pH's refer to slightly to highly acidic or slightly to highly basic solutions.

- (a) What is the pH of a neutral solution?
- (b) Look at ALL the substances in your Data Table that bromothymol blue indicated are **acids**. According to your data, **ACIDIC** solutions are in what **pH RANGE**?
- (c) Look at ALL the substances in your Data Table that bromothymol blue indicated are **bases**. According to your data, **BASIC** solutions are in what **pH RANGE**?

5. Which of the following solutions are acidic, which are neutral and which are basic?

Solution	pH of Solution	Is the Solution Acidic, Neutral or Basic?
P	9.5	
Q	5.5	
R	10.5	
S	7.0	
T	4.5	

6. If you have to decide whether a solution is acidic, basic or neutral, and can only use one indicator, which of the indicators in this lab will you use? Justify your answer with a well-reasoned statement using complete sentences. Make it clear what you see that lets you know whether a solution is acidic, what you see that lets you know whether a solution is basic, and what you see that lets you know whether a solution is neutral. (There is more than one possible correct indicator.)