**ACIDS, BASES AND pH**

\* Turn to page 197 of the textbook and read the introduction to the topic.

**QUESTION 1**:

Identify the following as either an ACID or a BASE.

1. tastes sour
2. feels slippery
3. tastes bitter
4. causes burning sensation in muscles

\* Turn to page 197 of your textbook and read “Acids and Bases”. Find out which acids and bases are key components in familiar products.

**QUESTION 2**:

Match the following.

1. antacid tablets A. aluminum
2. household and industrial strength cleaners B. phosphoric acid
3. a strong acidic electrolyte in car batteries C. sodium hydroxide
4. a tangy flavour in food D. sulfuric acid

The colour change of a **CHEMICAL INDICATOR** can show you how acidic or basic a liquid is. The reading on a pH meter scale (the **pH SCALE**) can also show you this information in a quantitative way.

\* Turn to pages 198 and 199 of your textbook and read “The Observable Properties of Acids and Bases” and “pH: A Powerful Scale”.



**QUESTION 3**:

Suppose red litmus paper turns blue in solution 1 and blue litmus paper turns red in solution 2. Neither one changes colour in solution 3. What could you infer about solutions 1, 2, and 3?

**QUESTION 4**:

List the following substances according to their pH, going from **lowest to highest** pH:

* baking soda • household ammonia
* car battery acid • human blood
* drain cleaner • normal rain

Red cabbage juice solution is a universal pH indicator. It is purple when neutral, and it ranges through beautiful golds and greens (basic), and blues and reds (acidic) as the pH of the solution changes.

If you have an upset stomach, you might take an antacid to help you feel better. An antacid is a mild base that reacts with the acid in your stomach to neutralize it. The base in the antacid and the acid in your stomach react to form compounds that are less upsetting to your stomach. This acid-base reaction is called neutralization. The neutralization reaction produces water and a compound called a salt. For example, table salt can be produced by combining hydrochloric acid with a sodium hydroxide solution. Here is the equation for that neutralization reaction:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| HCl(aq) | + | NaOH(aq) |  | NaCl(s) | + | H2O(l) |
| acid | + | base |  | salt | + | water |

Acidic lakes are sometimes treated with lime (calcium hydroxide) to neutralize them. The lime is mixed with water so that it dissolves. A chemical reaction takes place between this limewater, which is a base, and the dilute sulfuric acid of the lake’s water. The reaction produces calcium sulfate (a salt) and water.

**KEY TERMS**:

* **ACID:** a substance soluble in water with a pH of less than 7.
* **BASE:** a substance with a pH of more than 7.
* **CHEMICAL INDICATOR:** a substance containing a chemical that changes colour according to acidity or alkalinity
* **pH SCALE:** a quantitative scale that indicates how acidic or alkaline a solution is

**ACID PRECIPITATION, NEUTRALIZING, AND EMISSIONS**

Carbon dioxide escapes when fossil fuels are burned. These emissions react chemically with water in the atmosphere to produce acids. The result is acid precipitation.

\* Turn to pages 204 and 205 of your textbook and read “Acid Precipitation – a Global Concern”. Also read the margin items.

Acid snow can be particularly bad because snow accumulates over the winter. The spring thaw releases the buildup. This causes a large influx of acid into ground water and surface water systems. This “acid shock” occurs just as organisms are laying eggs. Fresh eggs are vulnerable to acidity. In ground water the acid shock destroys the tiny root hairs of plants, which are vital for water and nutrient absorption. The high acid concentration also kills important bacteria.

**QUESTION 5**:

Where does at least 50% of the acid precipitation in eastern Canada come from?

\* Turn to page 207 of your textbook and read the entire page.

**QUESTION 6**:

Acid rain affects soil and even rock.

1. What is marble formed from (you may need to look this one up)? Why would marble statues be affected by acid rain?
2. How does acid precipitation affect the soil?

\* Refer to the “Inquiry Investigation” on page 206 of your textbook.

One group of students used a drop of liquid from each test tube as samples. They made wet mount slides to do a count of yeast cells under a microscope. The students used the cell counts in the samples as relative population densities of yeast at the different pH levels. Their results were as follows:



**QUESTION 7**:

Answer question 1 from “Analyze” and questions 2 and 3 from “Conclude and Apply”. Base your answers on the results given in the data table above.

\* Refer to the “Inquiry Investigation” on page 208 of your textbook.

Bromothymol blue is a pH indicator that turns yellow in an acid solution and remains blue in a neutral or basic solution. For this investigation, the indicator is first placed in an alkaline solution and turns the solution blue.

Hydrochloric acid is added drop – by – drop until the indicator turns yellow. At this point, the solution has just changed from being neutral to being acidic. This point can be viewed as the neutralization point. All the drops released from the dropper will be the same size. The technique of adding a chemical drop by drop until a change occurs is referred to as **TITRATION**.

\* Read “Investigation 3F”. Use the following representative data in the column “Number of Drops . . .” to answer the following questions.



**QUESTION 8**:

Complete the table. **Hint**: Refer to “Figure 3.9” on page 198 and 199 of your textbook for levels of pH and relative strength.

\* Turn to page 209 – 211 of your textbook and read “Using Chemistry to Control Harmful Emissions” and “Scrub Those Cares Away”.

**QUESTION 9**:

There are solutions to the threat of acid precipitation. Fortunately, many of Alberta’s soils and water systems are naturally buffered against acid precipitation.

1. Why is liming only a temporary solution to acid precipitation?
2. List two ways to remove oxides from car and factory emissions.

**KEY TERM**:

* **TITRATION:** the precise addition of a solution in a burette – or a graduated glass tube – into a measured volume of a sample solution