

SI Chemistry - Full Discipline Demo

Digital pH of Common Materials

Final Report - Answer Guide

Institution	Science Interactive University
Session	SI Chemistry - Full Discipline Demo
Course	SI Chemistry - Full Discipline Demo
Instructor	Sales SI Demo

Test Your Knowledge

Match each term with the best description.

Terms to match:

- Acid
- Anthocyanin
- Base
- Neutralization
- pH Scale

Descriptions to match with:

1. A chemical present in numerous plants that can be used as a pH indicator
2. Used to measure the acidity of a solution
3. The chemical reaction between an acid and a base
4. A substance that tastes sour and forms hydrogen ions when dissolved in water
5. A substance that tastes bitter and feels slippery

Correct answers:

1 Anthocyanin 2 pH Scale 3 Neutralization 4 Acid 5 Base

Order the items from the least acidic at the top to the most acidic at the bottom.

≡ Concentrated sodium hydroxide solution	1	Correct answer: pH = 14
≡ Orange juice	2	Correct answer: Concentrated sodium hydroxide solution
≡ pH = 1	3	Correct answer: Soap
≡ pH = 7	4	Correct answer: pH = 7
≡ pH = 14	5	Correct answer: Orange juice
≡ Soap	6	Correct answer: Concentrated sulfuric acid solution
≡ Concentrated sulfuric acid solution	7	Correct answer: pH = 1

Exploration

Characteristics of bases include ____.

- ☐ being slippery to the touch
- ☐ having a bitter taste
- ☐ a clear color
- ☒ being slippery to the touch and having a bitter taste
- ☐ All of the above



Weak bases often feel slippery to the skin because they ____.

- ☐ coat the skin with their chemical configuration
- ☐ react with natural substances in the skin to form a protective coating
- ☒ degrade the fatty acids and oils on the skin

✓

Substances are classified as acids or bases depending on ____.

- ☐ their color and thickness
- ☒ how they react with other chemicals
- ☐ the type of container used to hold them

✓

On the pH scale, 7 represents a neutral substance. As the number of H^+ increases in solution, the pH ____; as the number of OH^- ions increases in solution, the pH ____.

- ☒ decreases; increases
- ☐ increases; decreases

✓

Anthocyanins serve as natural pH indicators, because they change color at different pH values.

- ☒ True
- ☐ False

✓

Exercise 1

Why is the pH scale important in science? Give several examples of scientific applications.

What information can be inferred about a chemical solution by knowing its pH value?

If a chemical solution has a pH of 4, how could you alter its pH to be more basic? Give at least two options.

Antacids such as TUMS™ can be taken to help manage heartburn. If heartburn is caused by too much stomach acid, what can we assume about the active ingredient of TUMS™?

The presence of what ion in solution indicates the presence of an acid? What ion indicates a base?

What happens to the concentration (mol/L) of a species in a solution when water is added to it? What happens to the number of moles of that species when water is added to it?

Data Table 1: pH of Household Materials
(SAMPLE ANSWER BELOW)

Solution Identity	Macro Simulation pH	Acidic, Neutral, or Basic?	[H ₃ O ⁺]	[OH ⁻]
(solutions can be listed in any order) Water	7	Neutral	1EE-7	1EE-7
Drain cleaner	13	Basic	1EE-13	1EE-1
Hand soap	10	Basic	1EE-10	1EE-4
Blood	7.4	Neutral	4EE-8	2.5EE-7
Spit	7.4	Neutral	4EE-8	2.5EE-7
Milk	6.5	Neutral	3.2EE-7	3.2EE-8
Chicken soup	5.8	Acidic	1.6EE-6	6.3EE-9
Coffee	5	Acidic	1EE-5	1EE-9
Orange	3.5	Acidic	3.2EE-4	3.2EE-11
Soda pop	2.5	Acidic	3.2EE-3	3.2EE-12
Vomit	2	Acidic	1EE-2	1EE-12
Battery acid	1	Acidic	1EE-1	1EE-13

Data Table 2: Concentration and Quantity During Dilution
(SAMPLE ANSWER BELOW)

What changed?	When Viewing Concentration (mol/L) Scale	When Viewing Quantity (mol) Scale
When Adding More Drain Cleaner	nothing	increased quantities
When Adding Water	concentration decreased for hydroxide and hydronium	only increased water molecules

Data Table 3: pH Changes During Dilution
(SAMPLE ANSWER BELOW)

	Solution identity	Starting pH	Diluted pH
Acidic solution	Soda pop (or other acidic solution)	2.5 (or respective pH)	2.88 (pH should rise from Starting pH)
Basic solution	Hand soap (or other basic solution)	10 (or respective pH)	9.62 (pH should lower from Starting pH)

Competency Review

A cleaning product with a pH of 8 is considered ____, whereas a product with a pH of 4 is considered ____.

- ☐ acidic; basic
- ☐ neutral; acidic
- ☒ basic; acidic ✓
- ☐ basic; neutral

____ are found in everyday food items such as lemons, limes, and oranges.

- ☒ Acids ✓
- ☐ Bases

An example of a base is ____.

- ☐ citrus
- ☐ soap
- ☐ drain cleaner
- ☒ both soap and drain cleaner ✓
- ☐ All of the above

A solution with a pH of 1 is less acidic than a solution with a pH of 6.

- ☐ True
- ☒ False ✓

A pH indicator allows scientists to ____ measure the pH of a substance.

- ☒ qualitatively ✓
- ☐ quantitatively
- ☐ electrically

The pH of soap is nearest to the pH of ____ because both are ____.

- ☒ NaOH; basic
- ☐ NaOH; acidic
- ☐ HCl; basic
- ☐ HCl; acidic

✓

The acidity of an acid in a solution can be decreased by ____.

- ☐ adding water to the solution.
- ☐ pouring out some of the solution.
- ☐ neutralizing the solution with a base.
- ☐ All of the above
- ☒ Both adding water and neutralizing the solution with a base.
- ☐ Both pouring out some of the solution and neutralizing the solution with a base.

✓

Extension Questions

Swimming pools are recommended to be at a pH of 7.2 - 7.8. If the pool is too acidic, it will corrode metal equipment and cause skin irritation. If it is too basic, it will cause scaling and make the water cloudy.

You measure the pH of your pool and it reads a pH of 6.8. What can you do to raise the pH to the proper range?

(SAMPLE ANSWER BELOW)

Add a weak base to the pool water. Some students may say to empty some of the water and refill it with neutral water, which is also technically correct.

Did any of your pH results surprise you? Was there a substance that you thought was basic and it is acidic, or vice versa? Explain. (SAMPLE ANSWER BELOW)

No sample answer provided