

This week we are learning about **dilution**.

Success Criteria:

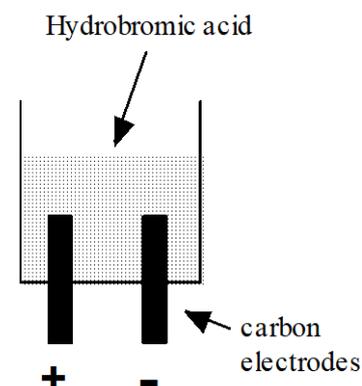
- I can explain what happens to the pH of acids when they are diluted.
- I can explain what happens to the pH of alkalis when they are diluted

This document contains:

1. Answers to last week's homework – **please mark your work**
 2. This week's experiment – **follow the instructions to complete the work in class jotter**
 3. This week's notes – **copy or print and glue into notes jotter**
 4. This week's homework – **complete in homework jotter**
- > Then complete this week's form ACIDS 5 which you can access on teams.**

Producing Acids and Alkalis

1. Electricity is passed through a solution of hydrobromic acid (H^+Br^-). A gas is produced at one electrode and a brown coloured liquid at the other electrode.



- (a) For the gas:

(i) Name the gas, give its formula and the mass of 1 mole.

Hydrogen, H_2 , $2 \times 1\text{g} = 2\text{g}$

(ii) What is the test for this gas?

Hydrogen burns with a "pop".

- (b) For the brown liquid:

(i) Name the liquid.

Bromine

(ii) Which electrode would the liquid be produced at? Explain your answer.

Positive electrode, the bromide ions are negatively charged so are attracted to the positive electrode where bromine will form.

2. From the following list:

potassium oxide, phosphorous oxide, iron(II) oxide,
lithium oxide, sulfur dioxide, lead(II) oxide

(a) Name **two** oxides which dissolve in water to produce acidic solutions.

Phosphorous oxide and sulfur dioxide

(b) Name **two** metal oxides which are insoluble in water.

Iron(II) oxide and lead(II) oxide

(c) Name **two** oxides which dissolve in water to produce an alkaline solution.

Lithium oxide and potassium oxide

3. When sodium oxide is added to water the pH of the water rises.

(a) What new substance is produced when sodium oxide dissolves in water?

Sodium hydroxide

(b) Give an equation for the reaction which occurs when sodium oxide reacts with water.

Sodium oxide + water \rightarrow sodium hydroxide

$\text{Na}_2\text{O} + \text{H}_2\text{O} \rightarrow 2\text{NaOH}$

4. Ammonia gas dissolves in water easily to form an alkaline solution.

(a) What is the formula of ammonia? **NH_3**

(b) Write a word equation for the reaction of ammonia gas with water.

Ammonia + water \rightarrow Ammonium hydroxide

(c) Which ion is present in all alkaline solutions?

Hydroxide ions (OH^-)

Complete the following work in your classwork jotter.

1. **Copy out the title, aim and table of results for the experiment:**

Title: Dilution

Aim: To investigate the change in the pH when acids and alkalis are diluted.

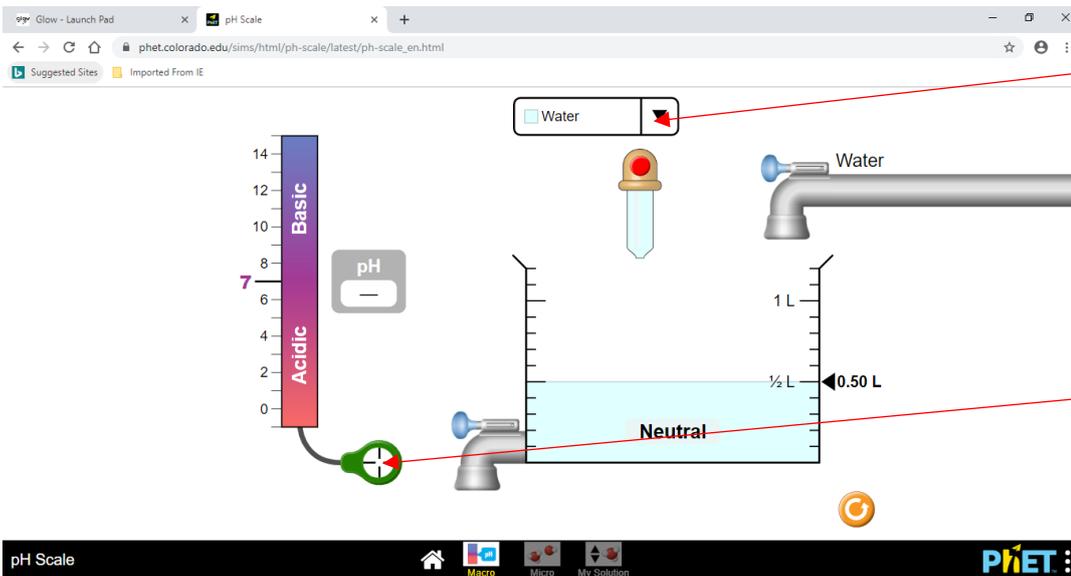
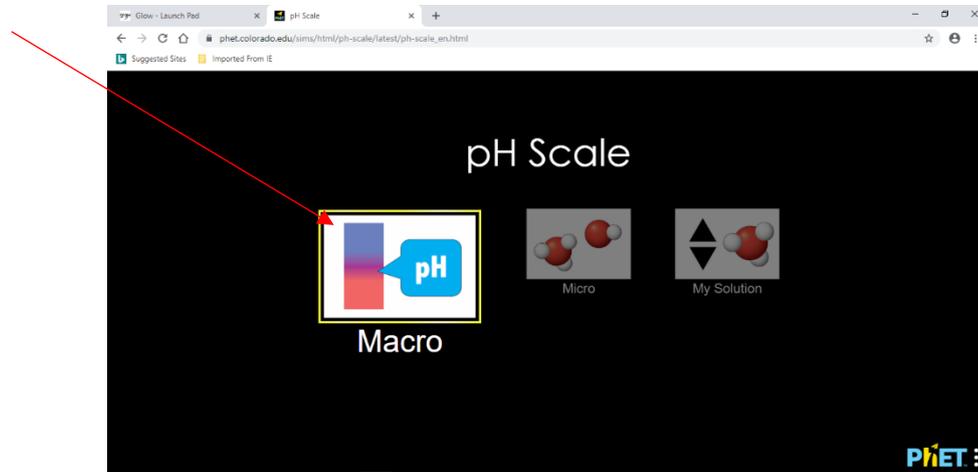
Results:

Substance	pH before dilution	Acid or Alkali	pH after dilution

READ THROUGH ALL THE INSTRUCTIONS ON THE NEXT 4 PAGES BEFORE YOU GO ON THE WEBSITE.

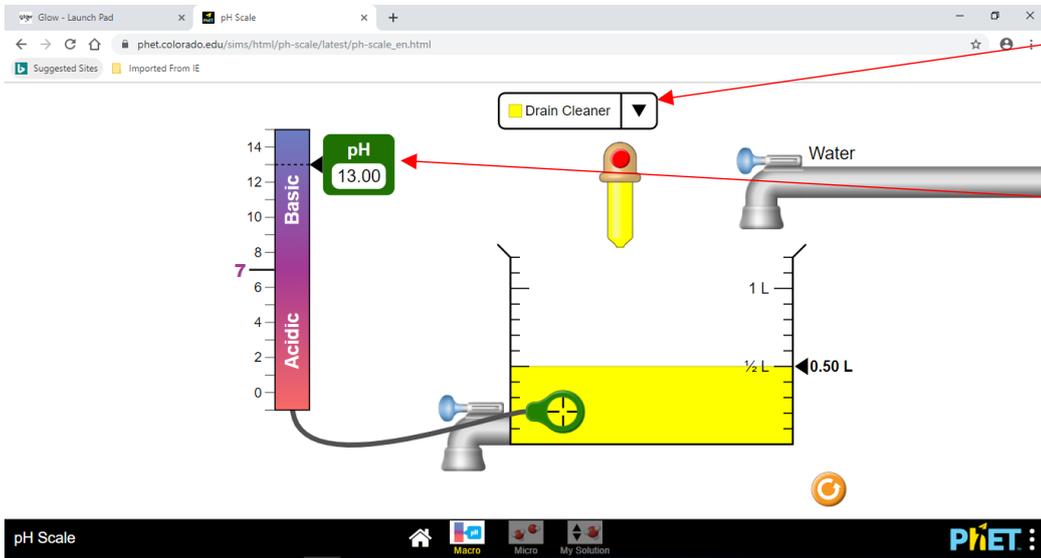
Go to this website: https://phet.colorado.edu/sims/html/ph-scale/latest/ph-scale_en.html

Click on "Macro"



From the drop down menu choose your first substance and this will fill up the tank.
Write the name of the substance in your table.

Drag this over your substance to measure the pH and fill in the pH in the "pH before dilution" column.

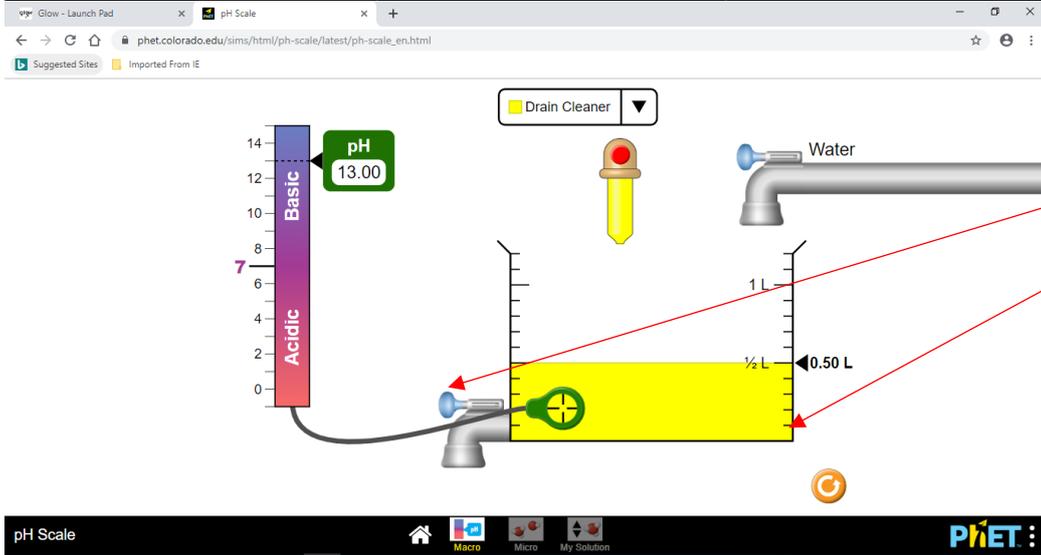


I have chosen "Drain Cleaner"

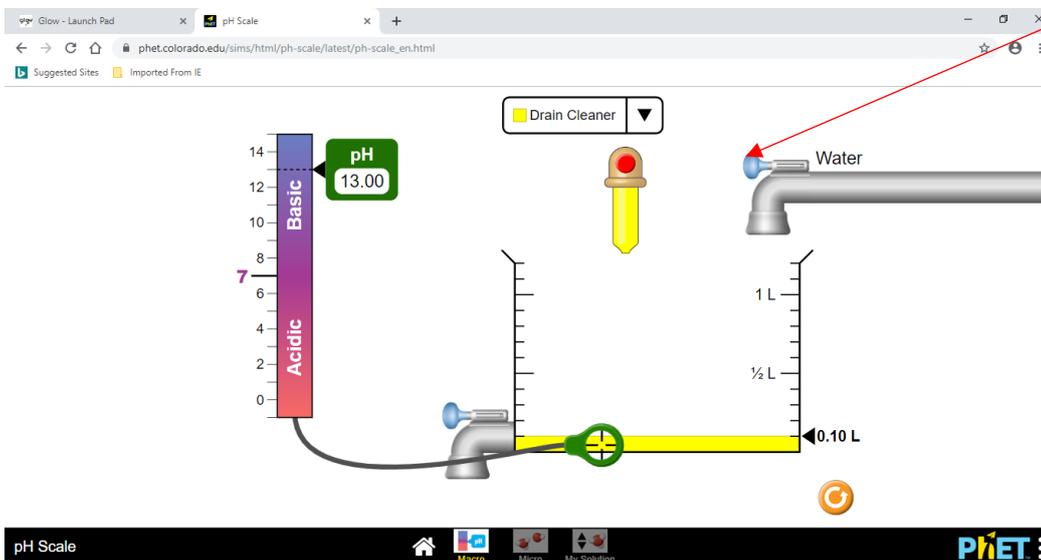
The pH of drain cleaner before dilution is 13.

I can put this information into my table.

Substance	pH before dilution	Acid or Alkali	pH after dilution
Drain Cleaner	13	Alkali	



Use the bottom tap to empty out most of the substance, down to the first line on the beaker.



Use the top tap to dilute the drain cleaner by adding water.

Keep adding water to fill the beaker to the top.

What happens to the pH when you add water?

Drain Cleaner

Water

pH 11.93

1.20 L

1 L

½ L

Acidic

Basic

14

12

10

8

7

6

4

2

0

We want to keep diluting the drain cleaner until the pH no longer changes.

To do this empty the beaker, using the bottom tap, to the bottom line again.

Drain Cleaner

Water

pH 11.93

0.11 L

1 L

½ L

Acidic

Basic

14

12

10

8

7

6

4

2

0

Then dilute with water, by using the top tap to fill the beaker to the top.

Drain Cleaner

Water

pH 10.88

1.20 L

1 L

½ L

Acidic

Basic

14

12

10

8

7

6

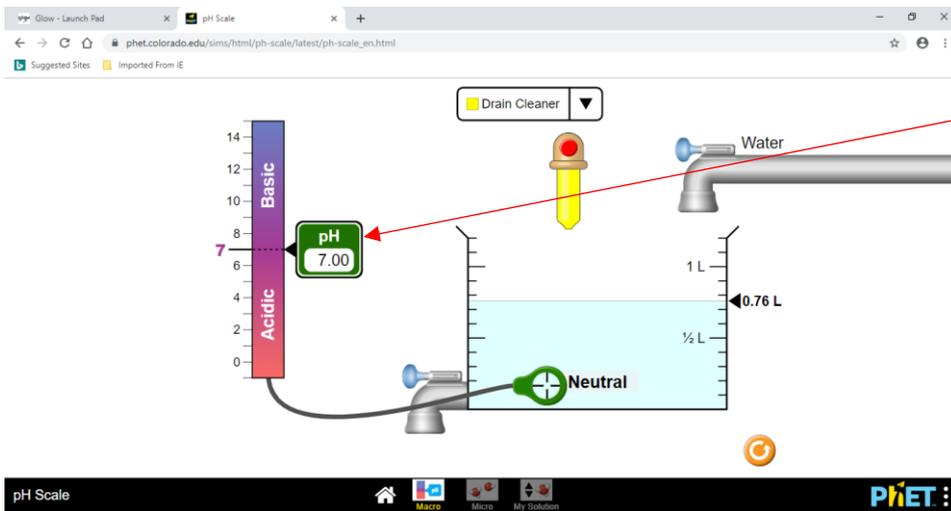
4

2

0

What do you notice happening to the pH?

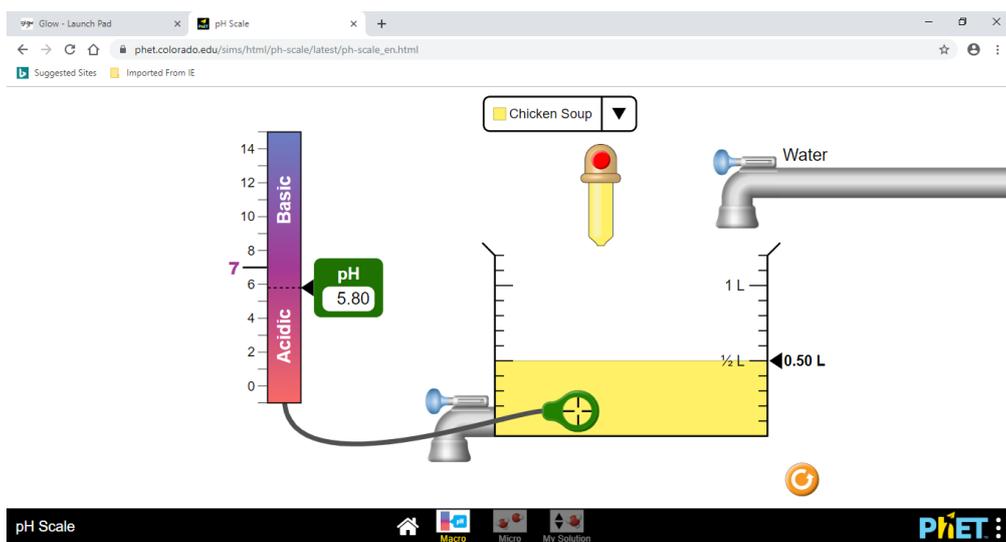
Keep emptying the beaker to the bottom line and refilling (diluting) with water until the pH no longer changes.



When the pH no longer changes complete the column "pH after dilution"

Substance	pH before dilution	Acid or Alkali	pH after dilution
Drain Cleaner	13	Alkali	7

Repeat the experiment with other substances you chose from the drop down menu. Make sure you do at least one acid and alkali and fill in your table of results as you go. For example:



Substance	pH before dilution	Acid or Alkali	pH after dilution
Drain Cleaner	13	Alkali	7
Chicken soup	5.80	Acid	

Copy out the conclusion and chose the correct option from the brackets to complete the sentence:

Conclusion:

Dilution of an alkaline solution with water will (decrease/ increase) the concentration of hydroxide ions and the pH will (decrease/ increase) towards (7/ 14).

Dilution of an acidic solution with water will (decrease/ increase) the concentration of hydrogen ions and the pH will (decrease/ increase) towards (7/ 1).

Check your conclusion:

Conclusion:

Dilution of an alkaline solution with water will **decrease** the concentration of hydroxide ions and the pH will **decrease** towards **7**.

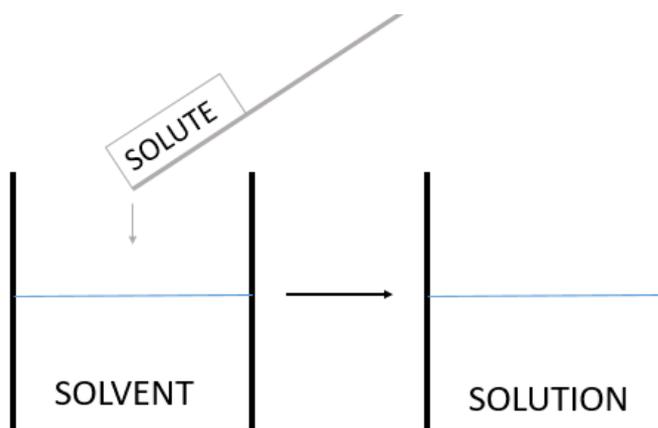
Dilution of an acidic solution with water will **decrease** the concentration of hydrogen ions and the pH will **increase** towards **7**.

Watch video on this week's notes: <https://youtu.be/WFU8Vva7LBY>

Copy out the following note or print and glue into your notes jotter.

Solutions

When a solute is dissolved in a solvent a solution is produced. For example: Dissolving sodium chloride in water produces salt water. Sodium chloride is the solute, water is the solvent and salt water is the solution.



Dilution

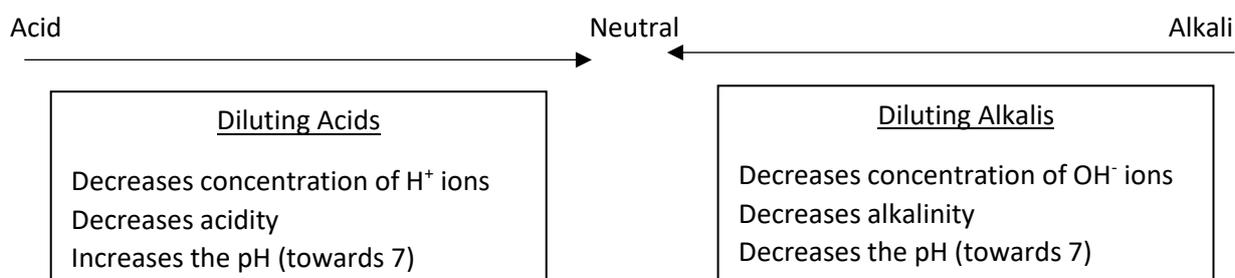
A concentrated solution is has a lot of solute dissolved in a certain volume of water. To dilute a solution, water is added.



If we compare the same volume of a concentrated and dilute solution the dilute solution will have less dissolved substance than the concentrated solution.



Adding water to an acid or an alkali dilutes the solution. This affects both the acidity/alkalinity and the pH of the solutions:



When acids and alkalis are diluted the concentration of ions in solution decreases so the electrical conductivity decreases.

Diluting Acids and Alkalis

1. Look at the following statements:

- A** the pH rises
- B** the pH falls
- C** the electrical conductivity rises
- D** the electrical conductivity falls

Which statement(s) is/are true when

- (a) an alkali is added to water
- (b) water is added to an alkali
- (c) an acid is added to water
- (d) water is added to an acid

2. Pure water is added to a solution of pH 12.

- (a) Which contains more hydroxide ions, the solution or pure water?
- (b) What happens to the concentration of hydroxide ions as water is added?

3. A solution has a pH of 3.

- (a) How will the concentration of hydrogen ions compare with the hydroxide ions in the solution?
- (b) The solution is diluted with water. Explain what will happen to the pH of the solution.

4. Ethanoic acid is a carboxylic acid with the formula CH_3COOH . Ethanoic acid is dissolved in water to produce vinegar.

- (a) Identify the solute, solvent and solution.
- (b) Calculate the mass of one mole of ethanoic acid.

This week's quiz:

<https://forms.office.com/Pages/ResponsePage.aspx?id=oyzTzM4Wj0KVQTctawUZKWuHxssNNghPm8XlfK7Z5UxUMUVZUEZUMTRQOTA0OEFBTDINMUJZMVg0Mi4u>