OM SRI SAI RAM

SRI SATHYA SAI VIDYA VAHINI

Science is Fun- CHEMISTRY

ACIDS, BASES AND SALTS

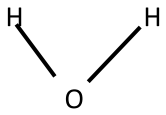
Intro Inquisitive Question

Have you heard of hydrochloric acid HCl? What about citric acid? Why is it that we actually drink citric acid (lemon juice), but it very dangerous to even touch HCl? Is it that one of them is 'stronger' and one of them is weaker? What if I give you an unknown acid? How will you know whether it is safe to touch or not? Today we will find the answers to all the above questions. We will learn about acids and bases, and also how to find out the 'strength' of the acid or base.

Main Script H^+ and OH^- as basis of study of acids and bases

The molecular formula of water is H2O.

It can be symbolized as



The line joining the individual atoms represents a 'chemical bond'.

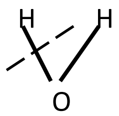
Side Explanation:

It is important here to clarify what a chemical bond is to students as we have found almost everywhere that the students do not have a clear understanding of this by class 10. The concept is explained by calling upon two student volunteers and using two pieces of chalk. The students are both given a chalk each and explained as follows:

Activity: Both the students have just one chalk, but both need two chalks. So how do they achieve that? By joining hands. When both the students join hands, they both have two chalks. But to continue having two chalks, they need to keep holding hands. This is called having a bond. Only difference is, in chemical bonds, instead of chalks we have electrons. (Ask students if they know charge of electron. Emphasize it as negative charge.) Now suppose we break the bond by pulling the hands separately. One of the students is strong, other is weak. What will happen? (One person has both chalks in his hand, other has zero.) The stronger person has two electrons. He started with one electron, now he has one extra electron which is negatively charged, so the stronger person gets a negative charge. The weaker person started with one electron, now has zero electron. So he has one less negative charge, so he has positive charge.

Main Script: Similarly in H_2O molecule, when we break the H-OH bond, since OH is 'stronger' it takes away H's electron also and we get:

When the O --- H bond breaks:



The OH is 'stronger' and takes both the electrons from the 'released handshake', whereas H is left without any electrons.

Main Script with Value Content: Just as, if a person loses a negative quality he becomes a good person, similarly since H initially had one electron and now has zero, H becomes positively charged and is denoted as H^+ ion (cation) (when an atom or molecule gets charged, it is called an ion). Since OH now has an extra electron (-ve charge), it therefore is negatively charged and is denoted as OH^- (anion) .

NOTE – Make sure that at the end of this discussion the students are able to clearly tell the difference between an Anion and Cation. You can make them remember this easily with the help of some tricks. For eg: A negative ion is an anion and cation is the opposite.

The entire study of acids and bases is based on these two: H^+ ions and OH^- ions (Hydrogen and oxygen, hence called hydroxide ion).

It is also important to remember at this point that H^+ and OH^- ions are like 'best friends'. Wherever they see each other, they immediately combine together and form H_2O.

ACIDS- Intro

Main Script: *Begin by asking students what all they know about acids. They generally speak out some of the words they've heard associated with it in the chapter on Acids and Bases in class 7, such as 'sour', 'HCl' etc. Keep noting down the words they are saying to encourage them to keep giving answers. Ask them to name acids they've heard of which are there in labs. Encourage them to answer Hydrochloric Acid and Nitric Acid (they also often mention Sulphuric Acid). Show how, like in H_2O, HCl and HNO_3 break up to give H^+ (can avoid showing how H_2SO_4 splits up and students get confused with the balancing).*

$$HCl \rightarrow H^+ + Cl^-$$
$$HNO_3 \rightarrow H^+ + NO_3^-$$

Then circle and point out what is common between the two: H^+

We thus define acids as those substances which give out H^+ ions.

Day to Day relevance: However acids are not only found in the lab. They are also present in substances all around us. Can you name any such acids?

(*Name the substance. Let the students guess the name of the acid.)*

Oranges/Lemons: Citric acids

Tamarind: Tartaric acid

Tea: Tannic acid

Apple: Mallic acid

Ant bite: Formic acid

Curds: Lactic acid

Our muscles produce lactic acid when we exercise

Interesting Aside: Car batteries use a strong acid called sulphuric acid. Chemical reactions between the acid and lead plates in the battery help make electricity that is required to start the car.

Main Script: What is common in taste in all of these? They all taste sour. That is a characteristic of acids. What about the lab acids HCl and H_2SO_4? They are also very sour. Now we will look at bases.

Bases:

As for acids, begin by asking students what all they know about bases. They generally speak out some of the words they've heard associated with it in the chapter on Acids and Bases in class 7, such as 'bitter', 'soapy' etc. Keep noting down the words they are saying to encourage them to keep giving answers. Ask them to name bases they've heard of which are there in labs. Encourage them to answer Sodium Hydroxide and Potassium Hydroxide. Show how, like in H_2O, NaOH and KOH break up to give OH.

$$NaOH \rightarrow Na^+ + OH^-$$
$$KOH \rightarrow K^+ + OH^-$$

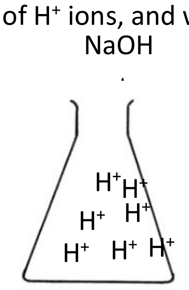
(Can explain the students that they can remember that when a molecule breaks into ions, the first part

becomes +vely charged, and the second part becomes –vely charged)

Then circle and point out what is common between the two: OH^-
We thus define bases as those substances which give out OH^- ions.

Inquisitive question: Do you know why bases feel soapy touch? Answer: Strong bases are able to react with the fatty acids and oils that naturally occur on the surface of your skin. The product of the reaction (which is known as saponification) is effectively a soap, which is why it feels slippery.
Day to day relevance: The pancreas secretes a fluid rich in the base bicarbonate to neutralize stomach acid before it reaches the small intestine.

There is also another way to look at bases.
Suppose we have a beaker full of H^+ ions, and we add a base NaOH to it:

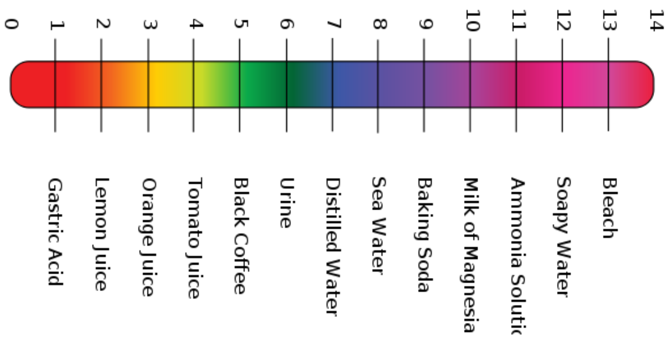


$NaOH + H^+$ --> $Na^+ + OH^- + H^+$ --> $Na^+ + H_2O$

'best friends'

We initially started with H^+ ions in the bowl, but are there any H^+ ions left after adding a base (NaOH)? No. The NaOH has removed the H^+ from the bowl. Thus, bases can be defined in two ways: Those substances which give OH^-, or those which take H^+
Therefore we can define acids and bases as:
Acids: Those substances which give H^+ ions
Bases: Those substances which take H^+ ions

Day to day relevance: This is just to give a visual idea to the volunteer on the pH ranges of commonly known solutions. The colour range is not correct though. Bases give blue color with pH paper.



Neutral Substances:
Now are these the only two kinds of substances possible? Those which give H^+ and those which take H^+ ?
What about NaCl? Does it have any H^+ to give? Or does it have any OH^- to take away H^+ with? No. So it is neither acid, nor base. It is neutral.
Similarly, what about H_2O? It give both H^+ and OH^-. It is like both acid and base. It is neutral.

Neutralization:

Now what happens now if an acid and a base come together?

HCl (acid)+ NaOH (base)----> $H^+ + Cl^- + Na^+ + OH^-$ ---> H_2O (neutral) + NaCl (neutral)

Since we started with acid and base, and we ended with both neutral products, we call it neutralization reaction. In this, acid and base react to give water and salt.

Day to day relevance of neutralization:

1) Acidity:

What feeling do we get in our stomach when we don't eat for very long? We get a burning sensation. Then what do we take to stop the burning feeling? We take Eno. Why did our stomach burn? And why did taking Eno stop the burning?

Our body produces HCl in our stomach to digest food. Once the HCl digests the food, it get used up. How does our stomach know when to produce the HCl? Our body is very smart. Suppose I have breakfast the first day at 9 am. My stomach notices I am having food and it produces HCl to digest the food. Now second day, again I have food at 9 am. Again my stomach notices and starts producing HCl. I do this for 10 days. Now what happens? My stomach is very smart. Now it knows I'm going to eat at 9 am, so it starts producing HCl at 8:45 am itself expecting the food at 9 am. Now suppose one day, I miss my breakfast. What happens in my stomach? Did my stomach know I am going to not eat breakfast? No. So my stomach started producing at HCl as normal at around 8:45 am. But what happened today? Since I didn't have food, the HCl remained unused in my stomach, and it started eating at the outer layer of my stomach. This causes the burning sensation that we call 'acidity', since it is caused by an acid- HCl. Then why does Eno stop the burning? Eno is called an antacid. It is nothing but a base. When we eat this base, it reacts with acid, and neutralizes it to give water and salt, which stops the burning.

2) Ant Bite:

Another example is of an ant bite. When an ant bites our foot, why does our foot burn? This is because when an ant bites, it releases formic acid, which burns. A good way to stop this burning is to apply a bit of toothpaste to he bitten area. Toothpaste is a base. So it neutralizes the formic acid and stops the burning.

3) Shampoo and Conditioner:

Shampoos are mild alkaline which causes small scales on each hair . To solve the problem we use hair conditioner. Hair conditioners are mild acidic. When used, the acidity in the hair conditioner will neutralise the alkali and cause the scales to close up.

Main Script Strong & Weak Acids and Bases

Is lemon juice acid, base or neutral? It is an an acid. Is HCl acid, base or neutral? It is an acid. If both are acids, then why is it that we drink lemon juice, but we should not even touch HCl? This is because HCl is strong acid, and lemon juice is weak acid.

What are strong acids and weak acids? What is the job of an acid? The job of an acid is to give H^+. Therefore, a strong acid is an acid which gives more H^+. Weak acid is an acid that gives less H^+. HCl gives more H^+ and is therefore strong acid. Lemon juice gives less H^+ and is therefore weak acid.

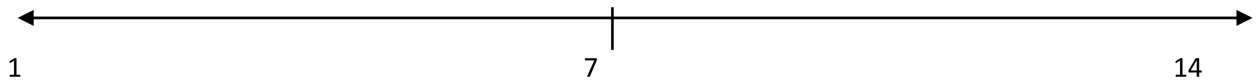
Similarly what does a base do? A base gives OH^- and take away H^+. So a strong base is a base which gives more OH^- and takes away more H^+. A weak base is one which gives less OH^- and thus takes away less H^+. Example of strong base is NaOH, and example of weak base is toothpaste.

<u>pH Scale:</u>

Now be able to study whether a substance is an acid or a base, and whether it is weak or strong, we use what is called a pH scale.

pH scale goes from 1 to 14.

Draw this much:

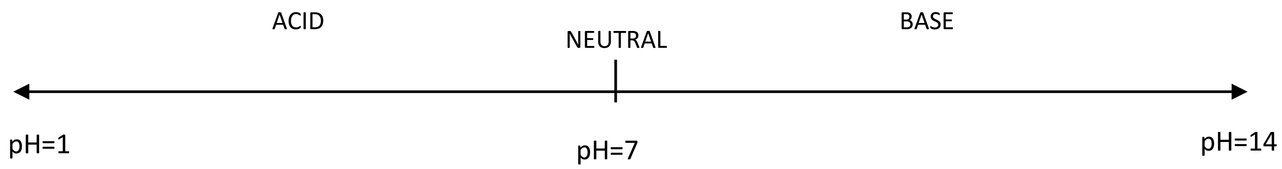


pH stands for “power of H+”. It is like a ranking scale which measure the power of a substance to give H+.

Now suppose you finish 1^{st} in a race and your friend finished 2^{nd}. Who ran faster? You ran faster.
Suppose you got 5^{th} rank in class, and your friend got 7^{th} rank. Who got more marks? You got more marks.

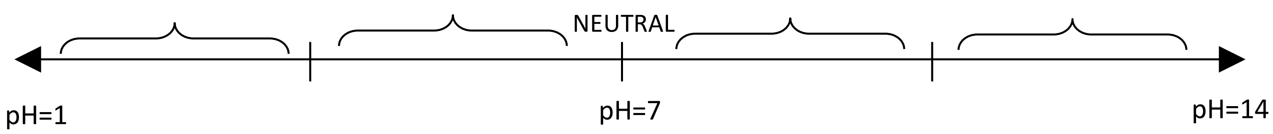
Similarly if one substance has pH = 5 and other has pH = 9, which has better ranking? pH = 5. Therefore, which has more power to give pH = 5.

Now out of acids and bases which has more power to give H+? Acids. So which will have better ranking, acids or bases? Acids. So in this pH scale, which will come on left? Acids or base? Acids. And which will come on the right? Bases. And where will neutral substances come? In the middle.
Therefore:
Acids have pH < 7
Bases have pH >7
Neutral substances (H2O/Salts) have pH = 7

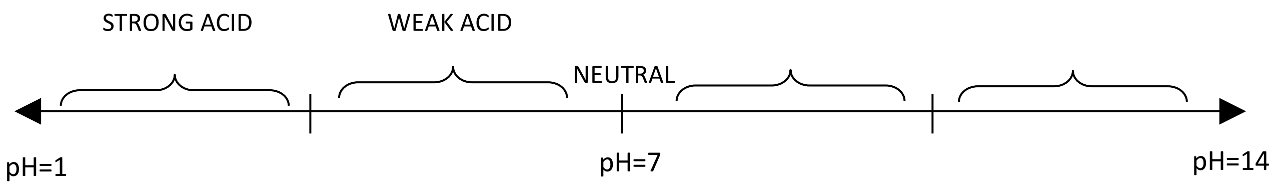


So on the left, with the best ranking, we have the substance with most power to give H+, that is acids. In the middle we have the substance which neither has power to give H+ nor to take H+, that is neutral substances. On the right, we have those substances which first of all have no power to give H+. On top of that, whichever H+ is present also, it takes that away. These are the bases.

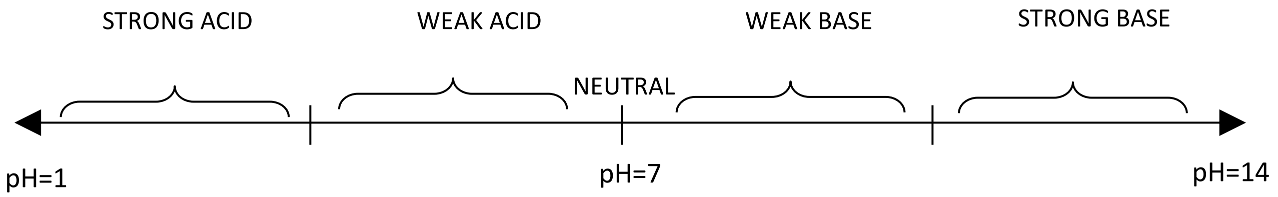
Now what about strong and weak acids and bases?



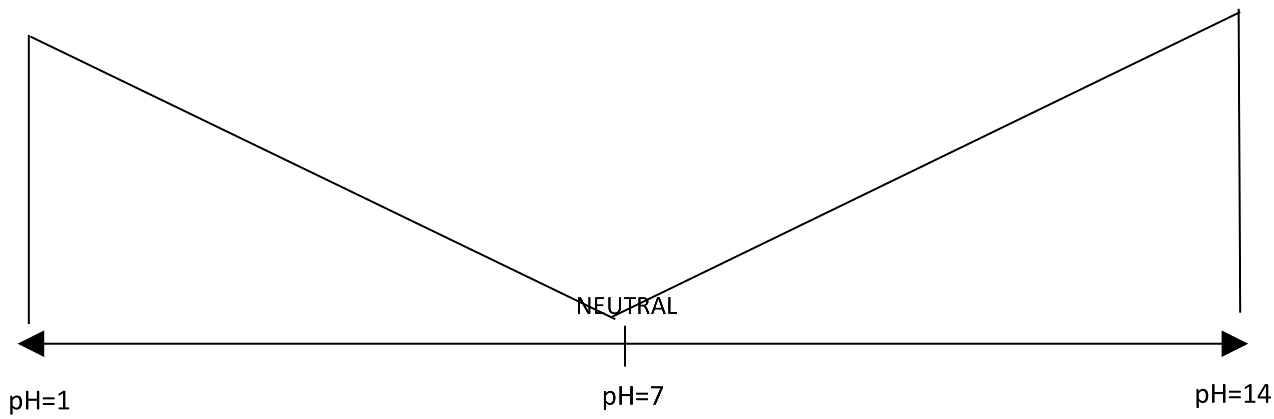
Out of strong acids and weak acids, which has more power to give H+? Strong acids. So will it have better ranking or worse ranking? Better ranking? So will it come on the left or the right? On the left.



Now if a substance A takes away more H+ than substance B, will it have better ranking or worse ranking than substance B? It will have worse ranking. Which takes away more H+, strong base or weak base? Strong base. So which will have worse ranking, strong base or weak base? Strong base. So which will come on right side? Strong base. And which will come on the left side? Weak base.



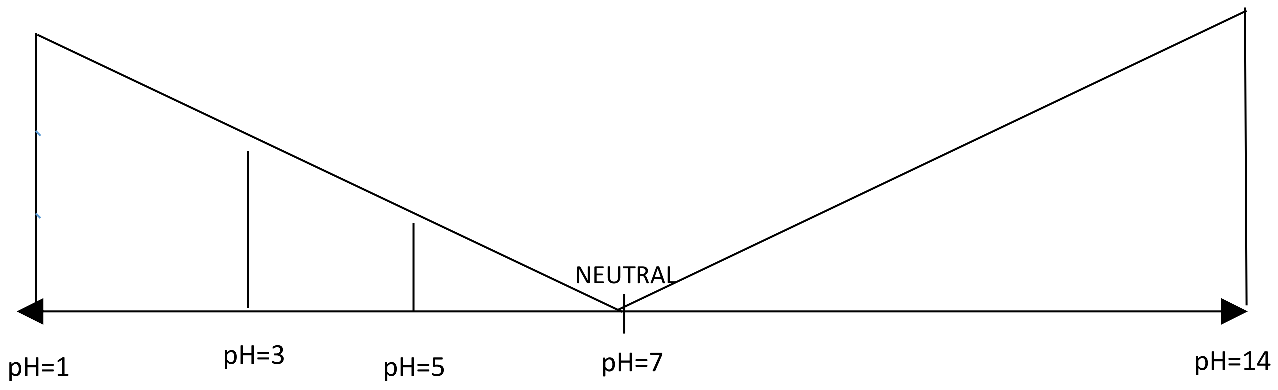
An easy way of drawing this is by drawing an M on the pH scale.



Now if you want to check between two substances, which is stronger and which is weaker, just draw lines from both from pH scale to the M and follow the rule- "Whichever line is stronger, that substance is stronger."

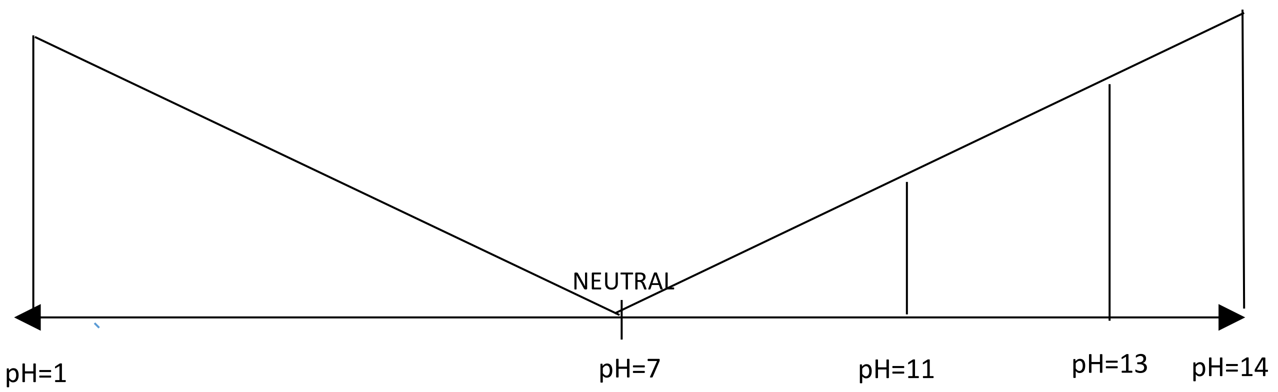
For example if we are comparing two substance with pH = 3 and pH = 5.

We mark them on the pH scale and then draw lines to M from each of them:



Since pH of both is <7, both are bases. But the line for pH=3 is longer, so acid with pH = 3 is stronger.

Similarly, we can check for two substances with pH =11 and pH = 13. Are both acids or bases? Since both have pH >7, both are bases. But which is stronger and which is weaker?



Since the line for pH = 13 is longer, therefore substance with pH = 13 is the stronger base.

Indicators:

Now why we do we need to study pH? Is there any use?

Day to day relevance: Suppose a farmer wants to grow rice? He reads a book and finds out which is the perfect temperature and which is the perfect amount of water required to grow rice. If temperature is more or less, the crops will die. Similarly if the water is more than prescribed, or less than prescribed, the crops will die. He makes sure he keeps this exact temperature and water while growing the crop. Still the plant dies. Why? Just like every crop needs the exact temperature and exact amount of water to grow, similarly the soil in which the crop is being grown needs to be of the exact pH value required. In this case, because the farmer has not maintained the perfect pH value of the soil in which he is growing the crop, so the crop died.

The pH value of soil required varies from crop to crop. For example, for rice it is 5.5-6.5 , and for wheat it is 5.5-6.5 .

Let us look at another use of pH. When we are very unwell, sometimes we have to get a blood test. In the blood test, the doctor checks the Red Blood Cells, White Blood Cells, and Haemoglobin etc. Another thing which is checked in the blood is pH value. For all the chemical reactions to happen in the blood, the blood needs to be of the exact pH value of 7.4. If the pH is less or more than this, the reactions don't properly occur, and we fall sick.

But now if the farmer wants to measure the temperature, he will use a thermometer. What will he use to measure pH? For this, we have substances known as indicators, which help us find out is a substance is acidic, basic or neutral. How will it tell us this? The substance will be one colour in acid and another colour in basic. Thus by observing the colour of the indicator after adding it to the substance, we can check whether the substance is acidic or basic.

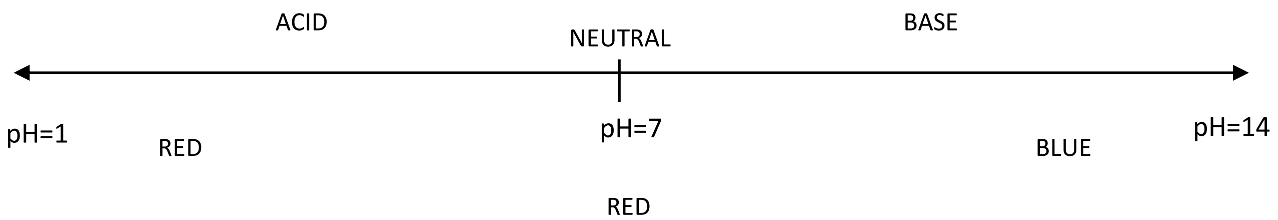
Main Script: There are two types of indicators: Natural and Synthetic

Natural indicators are those which can be extracted from naturally occurring substances. For example, the natural indicators Red Litmus and Blue Litmus are prepared simply by removing the extract from the plant lichens.

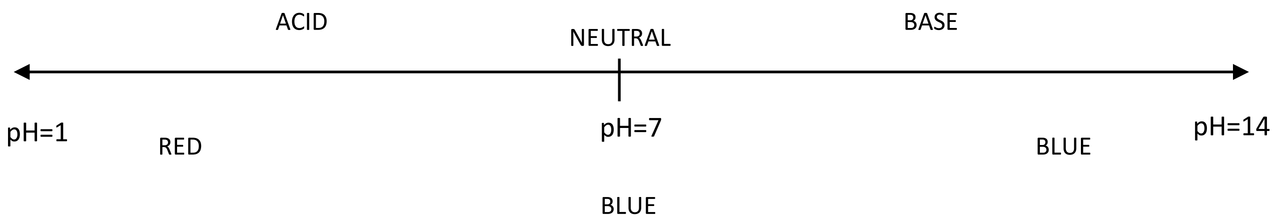
Synthetic indicators are those which are prepared by scientists in the lab by mixing various chemicals in different combinations. Eg: Phenolphthalein , Thymolphthalein

<u>Pre-Activity for Activity 1:</u>

HCl, lemon in water, distilled water, $NaHCO_3$ and NaOH to be taken in 5 separate 500 ml beakers. Students are not told which is which.
Firstly the students are told the pH range of colors of red litmus and blue litmus as below:



<u>ILLUSTRATION 1- COLOUR CHARACTERISTICS OF INDICATOR: **RED LITMUS**</u>



<u>ILLUSTRATION 1- COLOUR CHARACTERISTICS OF INDICATOR: **BLUE LITMUS**</u>

To help remember, we can remember that for both litmus papers, B for Base, B for Blue. If it is red litmus, it turns Blue with Base. If it is Blue litmus, it stays Blue with Base. Thus, B for Base, B for Blue.
When in acid, both red litmus and blue litmus give red colour. Neutral substances of property of leaving indicators unchanged. So with neutral substances, blue litmus remains blue, and red litmus remains red.

Activity: Next, the strong acid, neutral and strong base beakers are kept on the demo tables. The following table is drawn on the board and filled as red or blue one by one as students come and test the litmus papers.

BEAKER	RED LITMUS	BLUE LITMUS	ACID/NEUTRAL/BASE
1			
2			
3			

The students are called forward one by one to the table to help classify the substances as acid, base or neutral. First, all 3 are tested with red litmus, next all with blue litmus. Once all are filled, students are asked to compare the results with the pH range of colours for red litmus and blue litmus, and asked to guess whether each of the three substances are acids, bases or salts.

After this is completed, the students are explained the use of pH paper. One of the students is called up to use the pH paper on any one of the beakers. The students are then explained how to measure the pH by comparing the dipped pH paper against the pH colour strip.

Value Content: The student can tear the pH / litmus strip into two and use the smaller pieces to do litmus or pH test for one substance. Inculcate the quality of using resources judiciously.

After this, once the students have understood the use of both litmus and pH paper, we move on to the main red cabbage activity.

Activity 1: Indicator X

Aim: To learn how Indicator X changes colours across the pH scale, using 5 given substances ranging from strong acid to strong base.

Materials required: 5 x 100 ml beakers, conc. HCl, NaOH, distilled water, lemon, $NaHCO_3$, blue litmus paper, red litmus paper, universal indicator paper, red cabbage indicator, test tube stand, test tubes.

Pre-Preparation:

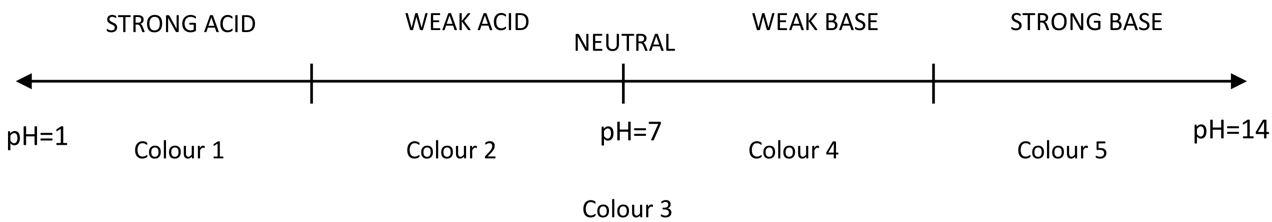
1. Prepare 500 ml of Indicator X (red cabbage):
   Take a medium sized vessel (steel or aluminium). It should be able to hold around 1000 ml of water). Make sure that it is completely clean (no dust, stains and traces of oil). Use Pril/Vim to wash it well. **Then use distilled water to wash the inside again**. Put around 200 ml to 300 ml distilled water depending on how much is required for the session (depends on the number of kids). Keep it on the gas stove for boiling (don't light the stove yet).
   Take a medium sized red-cabbage. Wash it lightly with distilled water. Remove the outer layer completely (the one exposed to the atmosphere). Then remove the leaves one by one and immerse them completely in the vessel containing distilled water. Light the stove and start boiling the water in the vessel steadily on medium flame. Slowly, the water will start turning purple. Continue boiling till the cabbage leaves become completely pale in color and the water is dark purple (will take around 15 to 20 mins of boiling on a medium flame).
   Under no circumstances tap water is to be used in place of distilled water. This is required to maintain neutrality of the solution. Drain the purple liquid into a 500 ml beaker. This the the Indicator X solution.
2. Prepare one 500 ml beaker each of HCl (strong acid) (1:1 $HCl:H_20$), lemon juice (weak acid) (squeeze 5-6 drops of lemon in distilled water) , distilled water (neutral), sodium bicarbonate (4-5 spatulas of Sodium Bicarbonate) /very dilute NaOH (weak base) and NaOH (strong base).
3. NOTE- Check pH for each of the stock solutions before starting the session to ensure that we get the right results.
4. Each table is given a 100 ml beaker with 50 ml of indicator X and one test tube stand with 5 test-tubes (the 5 test tubes are filled 10-15 ml of one each of the 5 main reagents, in a random

order).

5. Explain the colour characteristics again of red litmus and blue litmus, and draw out their colour change across the pH range on the blackboard.
6. List out the five substances in the various beakers without mentioning which is which.
7. Have the students draw out the table below in their books:

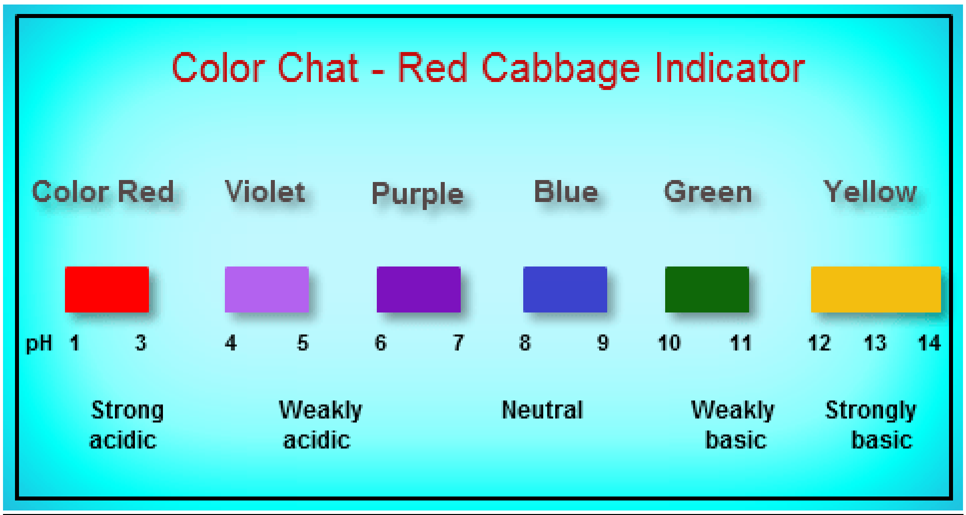
Test Tube No.	**Red Litmus (R/B)**	**Blue Litmus (R/B)**	**Acid/Base/ Neutral**	**pH Paper (1-14)**	**SA/WA/N/ WB/SB**	**Color with Indicator X**
1						
2						
3						
4						
5						

8. Tell the students that the first step is to find out which of the 5 is acid, which is base and which is neutral. For this, first each of the tables is given 3 strips each of red litmus. They have to tear each strip into half, place it in the test tube, and tilt the test tube till the substance touches the litmus paper. They have to then note down the colour change in the table, and **<u>place the strip just below the test tube tested</u>** on to avoid mixing up.
9. After this, each group is given 3 strips of blue litmus each, and the exercise is repeated.
10. Based on the observations from step 7 and 8, students are assisted in filling out column 3 of the table, and deducing whether each of the substances is acid, base or neutral (by comparing against the pH colour ranges of blue litmus and red litmus drawn on the table).
11. After this, each group is given 3 strips of pH paper each, and same exercise followed to fill pH values in column 4. Using this value, and by using the 'M-technique' each group is assisted in filling column 5 (**SA/WA/N/WB/SB)**.
12. Finally, the Indicator X is added to each test tube and the colour observed is noted in the last column.
13. The students then map out the colours on the scale as below on their sheets:



<u>ILLUSTRATION 3- COLOUR CHARACTERISTICS OF INDICATOR: **RED CABBAGE INDICATOR**</u>

(Strong and weak are relative terms, and the labelling is for illustrative purposes only)



14. Finally, the test-tubes in each stand are re-arranged in the order SA-WA-N-WB-SB using the above scale.
15. The students are then explained about Indicator X- which is red cabbage. They are explained how it was prepared, and shown the vessel with the red cabbage leaves. Then it is explained how this natural indicator available freely in nature is actually more useful in distinguishing **SA/WA/N/WB/SB** than even indicators such as pH paper prepared by scientists after hours and hours in the lab.

<u>Activity 2: The Two-Faced Handkerchief</u>

Aim: To learn the characteristics of phenolphthalein and thymolphthalein as indicators, and further the understanding of indicators.

Materials required: Thymolphthalein (small bottle), Phenolphthalein (small bottle), 250 ml beakers (x2), stirrers/glass rods (x2), 3 M NaOH soln. (150 ml soln./ 15 g of powder), small spray bottle, white handkerchief

Procedure:

1. Firstly, both indicators are introduced as synthetic indicators, and their colour characteristics across pH scale are explained using below diagrams.

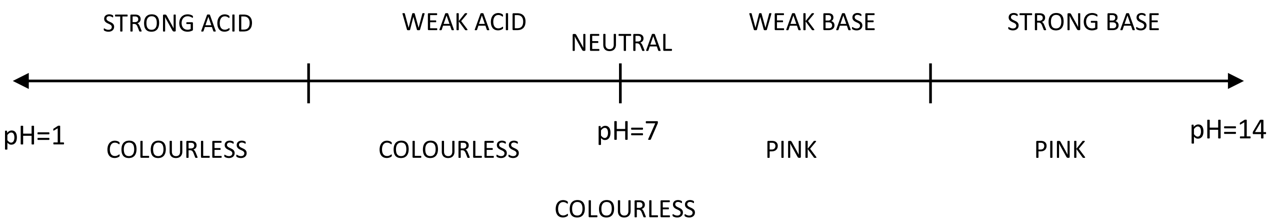
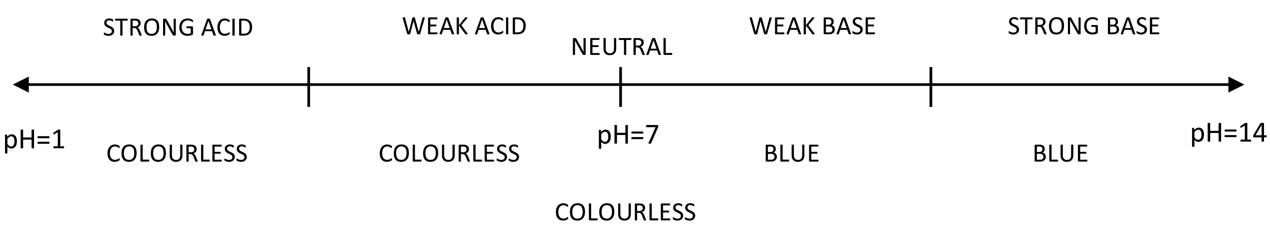


ILLUSTRATION 4- COLOUR CHARACTERISTICS OF INDICATOR: **PHENOLPHTHALEIN**
(Strong and weak are relative terms, and the labelling is for illustrative purposes only)



It is to be noted that both are colourless in acid and neutral. It is only in base, that they give different colours and we can differentiate between them. To help students remember, the tip can be given between the two of P for Phenolphthalein, P for Pink. And the other is Blue.

2. Take 90 ml of distilled water in each the two beakers and, in front the students, pour 6-7 drops of phenolphthalein in one of the beaker and 15-20 drops of thymolphthalein in the other. Before pouring in each, tell them that the beakers contain distilled water and ask the students what colour the substance should change into after adding the indicators (remains colourless in both).
3. Note – Thymolphthalein is very costly when compared to phenolphthalein. Hence the thymolphthalein available in the market is very diluted. We need to add more of Thymolphthalein when compared to Phenolphthalein.
4. Exchange around the two flasks on the table 3-4 times. Now ask the students whether they can differentiate which had phenolphthalein and which had thymolphthalein. Then ask them, pointing to the two pH scales, which is the only region in which we can differentiate between the two (basic).
5. Fill the spray bottle with the NaOH solution.
6. Hold the white handkerchief over a sink and pour the phenolphthalein solution over one side of the handkerchief and the thymolphthalein solution over the other. (handkerchief still completely white, still can't differentiate)
7. Hold up the handkerchief and call up a student to spray over the white handkerchief using the NaOH in the spray bottle. (The phenolphthalein half turns distinctly pink and the thymolphthalein half distinctly blue, thus differentiating the two).
8. It is explained that the spray bottle had NaOH, a base, thus the colour of both indicators changed.
9. A tip can be given to the students to remember whether the two indicators give colour in acid or in base. The only thing to be remembered is that the spray bottle had NaOH (a base), and the handkerchief gained colour only after spraying. Thus, the indicators must give colour only in base.

<u>Activity 3: The Race to Colourless</u>

Aim: To drive home the understanding of phenolphthalein and thymolphthalein as indicators.

Materials required: Distilled water, 250 mL Erlenmeyer/conical flask (x3), Regular Stirrer/Glass rod (x1), Straws/Hollow Stirrers (x3),phenolphthalein,thymolphthalein, NaOH solution, Dropper (x1)

Procedure:

1. Pour 50 ml of distilled water in each of the 4 conical flasks and add 2 drops of NaOH in each, while telling the students so.
2. Pour 10-15 drops of phenolphthalein and 15-20 drops of thymolphthalein in alternate flasks (2 phen, 2 thymol, changes to pink/blue), while asking the students which is being poured, and which colour they expect the solution to change into based on the scales drawn on the board.

3. Now tell the students that all the solutions have to made colourless. If the students are left alone in a room with these flasks and nothing else, how will they make them colourless.
   Help guide the students to reach the answer:
   The only way to make both colourless is to make the solutions from basic to acidic/neutral, and the only way to do that is to add an acid. But how to add acid in an empty room? Ask the students which gas we breathe out (CO_2). Then ask them what was the first substance in each of the flasks (H_2O). Then explain the following reaction which occurs if we blow CO_2 into the flasks:
   $H_2O + CO_2 \text{-->} H_2CO_3$(carbonic acid)
   Thus blowing into the flasks creates an acid, which neutralizes the solution and thus turns it colourless (pointing to the pH scales of the indicators on the board)
4. Now we explain the students, that the faster we blow CO_2 into the flasks, the faster the solutions will turn colourless. To help this, we provide a straw into each flask. After that, 4 students are called upon for a race to turn their flasks colourless. (The students are advised to take a deep breath and then blow in such a way that the solution bubbles. Care is to be taken not to blow so hard that the solution overflows. Also, whenever the students want to take a breath, they should be careful to remove their mouths from the straws, take a deep breath, and then put their mouth back on the straws. Under no circumstances, should aany student suck in any liquid, even by mistake.)
5. The first person to change the liquid in their flask back to colourless wins.

<u>Finally summarize the whole discussion by listing the following topics discussed:</u>

H^+ and OH^- as basis of whole discussion and best friends

Acids which give H+, Bases which take away H+, neutral as both or neither, along with neutralization reaction (acidity and ant bite)

Strong and Weak Acids and Bases, and use of M-Technique to measure

Use of pH scale and need of pH (soil for crops, blood tests)

What is an indicator and how does it work

Natural and Synthetic Indicators with examples

(Natural: red and blue litmus, red cabbage ; Synthetic: pH paper, phenolphthalein and thymolphthalein). Summarizing the three experiments: (Indicator X, Two-Faced Hanky & Race to Colourless)