SAI International School
Lesson Notes
Subject - Chemistry
Ch-Acids, Bases & Salts
Topic- pH of Acids & Bases

Module -11 **Dt_ /04/2020**

Suggested Videos-

1. **https://youtu.be/ckbsHM2igT0**
   - pH Scale
2. **https://youtu.be/gRZ-2IbLd34**
   -Acids, Bases, and the pH Scale Explanation.

To be done in CW Copy-

- **[pH] OR Potenz of Hydrogen ion Concentration in a Solution-**

- **pH stands for potential of hydrogen with-**
  - **"p" meaning potential and**
  - **"H" standing for hydrogen**

- **pH** is a measure of **hydrogen ion concentration** in a solution**,**

  ie. a measure of-
  - **acidity [conc. of H^+ ions]**

    or
  - **alkalinity [conc. of $(OH)^-$ ions]** of a solution**.**

- An aqueous solution may be –
  a. **Neutral**
  b. **Acidic**
  c. **Basic**

  Depending on the **concentration of H+ ion.**

- In a **neutral solution**,

  The **concentration of H^+ ions** {represented as **$[H^+]$**} is **equal to** the **concentration of $(OH)^-$ ions** {represented as **$[OH^-]$**}

  Hence in a **neutral solution**, **$[H^+] = [OH^-]$**

- In an **acidic solution**,

The **concentration of H^+ ions** {represented as $[H^+]$} is **more than** the **concentration of $(OH)^-$** ions {represented as $[OH^-]$}

Hence in an **acidic solution**, **$[H^+] > [OH^-]$**

- In a **basic solution,**

The **concentration of H+ ions** {represented as **[H+]**} **is less than** the **concentration of (OH)- ions** {represented as **[OH-]**}

Hence in an acidic solution, [H+] < [OH-]

So we can determine the **acidity or basicity** of a solution by taking in to consideration, **the concentration of H^+ ions ie. [H+] present in it.**

- **Universal indicator/pH solution**

The [H+] of a solution can be determined using**:**
Universal indicator/pH solution.

Universal indicator/pH solution-

- It is a **mixture of dyes that changes colour gradually over a range of pH.**
- It is used as an indicator paper in testing for **acid/base/neutral** solutions.

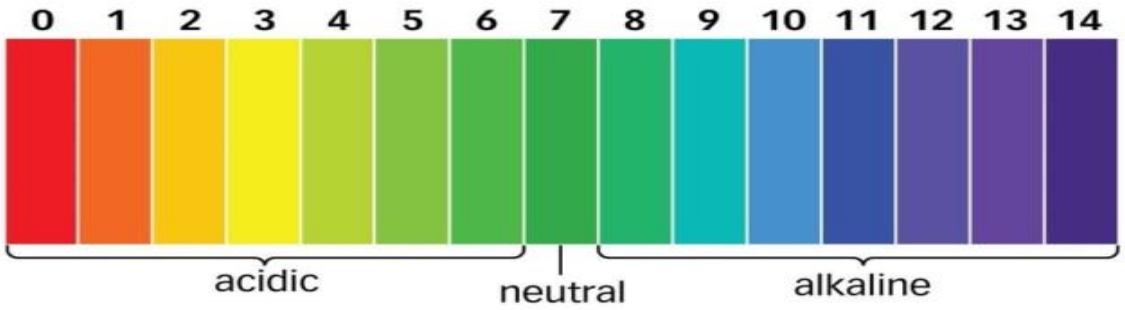
- **pH Scale-**

The pH scale is a scale that is used to determine the **relative basicity or acidity of substances to other substances,** based on **the amount of Hydrogen ion concentration present in a substance**

It ranges from 0 to 14 where-

- **Acid- 0 to 6**
- **Neutral – 7**
- **Base – 8 to 14**

https://youtu.be/PdprNTwb4Ks
Video on change of colours in Universal indicator solution.



An aqueous solution may be-

Acidic solution	Neutral solution	Basic Solution
$[H^+] > [OH^-]$	$[H+] = [OH-]$	$[H+] < [OH-]$

Why is pH=7, Neutral in Aqueous Solutions?
To see why this should be so, consider the following:
Water exists as an equilibrium between-
Molecules (H2O) and ions H^+ ions & $(OH)^-$ ions.
$H2O \rightleftharpoons H^+ + OH^-$
Reason- H2O being a very weak electrolyte, under goes partial dissociation.
The multiplication product of the concentrations of -
[H+] and [OH-] ie. Ionic product of water is a constant;
it is water's dissociation constant [K_W],
which has a known value of 10-14 M^2. (Experimentally determined)
So,
Kw = [H+][OH-] = 10^{-14} M2
For neutrality, [H+] must be equal to [OH-].
This means these quantities must both be equal to 10^{-7} M.
Or, [H+] = [OH-] = 10^{-7}M
If we put [H+] = 10^{-7} M into the equation for pH:
pH = -log10[H+]
we get pH = 7 for neutrality.

ALL AQUEOUS SOLUTIONS HAVE WATER AS THE SOLVENT.
So all aqueous solutions have H^+ & $(OH)^-$ ions.

Assessment

MCQs

Q.1	You are having five solutions *A*, *B*, *C D* and *E* with pH values as follows: *A*=18, *B*=7, *C*=8.5, *D* = 8 and *E* = 5 Which solution would be most likely to liberate hydrogen with magnesium powder? (a) Solution *A* and *B* (b) Solution *A* (c) Solution *C* (d) All of the above
Q.2	The correct statement regarding universal indicator is (a) it is an indicator having pH = 7 (b) it gives blue colour at pH = 3 (c) it becomes colourless at pH = 7 (d) it gives orange colour at pH = 3
Q.3	The pH of a solution is 4.0. What should be the change in the hydrogen ion concentration of the solution, if its pH is to increased to 5.0. (a) decreases to 1/10 of its original concentration (b) halved (c) doubled (d) increases by 10 times

- For Assertion& Reason question follow the following directions.

DIRECTION: Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.

(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.

(c) If Assertion is correct but Reason is incorrect.

(d) If Assertion is incorrect but Reason is correct.

(e) If Assertion & Reason both are incorrect.

Q.4	Assertion : Pure water is neither acidic not basic. Reason: The pH of a solution is inversely proportional to the concentration of hydrogen ions in it.

Q.5	Assertion : pH = 7 signifies pure water. Reason : At this pH, [H+] = [OH] = 107

Home assignment

S.L No.	Questions	Mark	Skill
Q.1	What is meant by p and H in pH? [CBSE 2014]	1	R
Q.2	What is meant by term pH of solution? The pH of rain water collected from two cities A' and 'B' werefound to be 6.0 and 5.0 respectively. The water of which city will be more acidic? [CBSE 2011]	1	u
Q.3	The pH of soil 'A' is 7.5, while that of soil "B is 4.5. Which of the two soils A or B should be treated with powdered chalk to adjust the pH and why? [CBSE 2016]	3	R+A
Q.4	a.Define a universal indicator. Mention its one use. b. Solution 'A' gives pink colour when a drop ofphenolphthalein indicator is added to it. Solution 'B' gives a red colour when a drop of methyl orange is added to it. What type of solutions are 'A' and 'B' and which of these will have higher pH? [CBSE 2016]	3	U+A
Q.5	(a) Why does aqueous solution of an acid conduct electricity? (b) How does the concentration of H3O+ ions change when a solution of an acid is diluted? (c) Which one has a higher pH, a concentrated or a dilute solution of hydrochloric acid? (d)What would to be the gas evolved on adding dilute to hydrochloric acid to (i) Solid sodium carbonate placed in a test tube? (ii) Zinc metal in a test tube? [CBSE 2018(C)]	5	HOT