

SAI International School
Lesson Notes
Subject - Chemistry
Ch-Acids, Bases & Salts
Topic-Concept of Acids & Bases
Module -8 Dt_/04/2020

Suggested Videos-1. <https://youtu.be/1X7C7a1ySoU>

- Arrhenius concept of acids & Base (Lesson Delivery)

2. <https://youtu.be/Jfa2wxpJJBA>

- Concepts of acids and bases

3. <https://youtu.be/DupXDD87oHc>

- Difference b/w acids & bases (cartoon)

4. <https://youtu.be/QZfgg4MrnRw>

- Physical properties, Strong & weak acids & bases.

5. <https://youtu.be/V6-mlh9xRjg>

- Dilute & Concentrated solutions

6. <https://youtu.be/d-1NfYDQwyk>

- Basicity of Acids

To be done in CW Copy-

A. Common Man's concept of Acids & Bases-

- **ACIDS-** Acids are substances that are **sour to taste** and **corrosive** in nature.
- **Bases-** Bases are substances that are **bitter to taste** and **slippery to touch**.

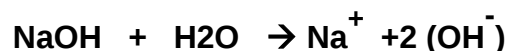
B. Arrhenius concept of acids and bases-

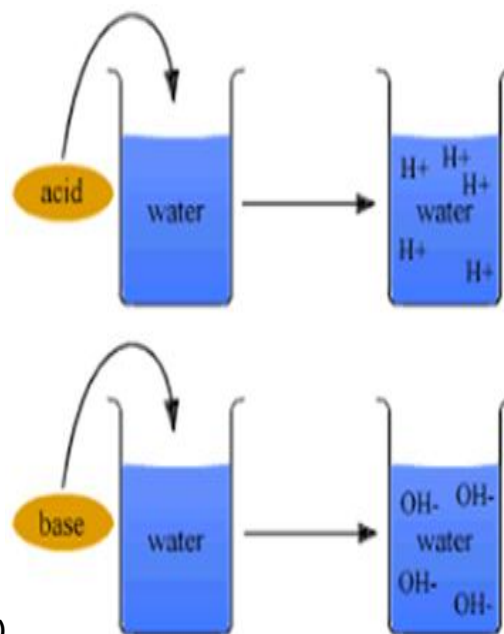
- **ACIDS-** Acids are those substances which **liberate H⁺ (hydronium) ions** in their **aqueous medium**.



(Hydronium ion)

- **BASES-** Bases are those substances which **liberate OH⁻ (hydroxyl) ion** in their **aqueous medium**.



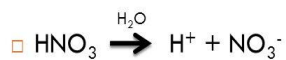


(hydroxyl ion)

Arrhenius Acids & Bases

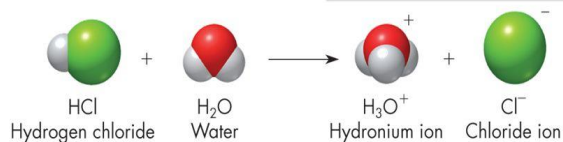
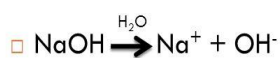
Arrhenius Acids

- Donate H⁺ to the solution



Arrhenius Bases

- Donate OH⁻ to the solution



(Arrhenius Concept of Acids & Bases)

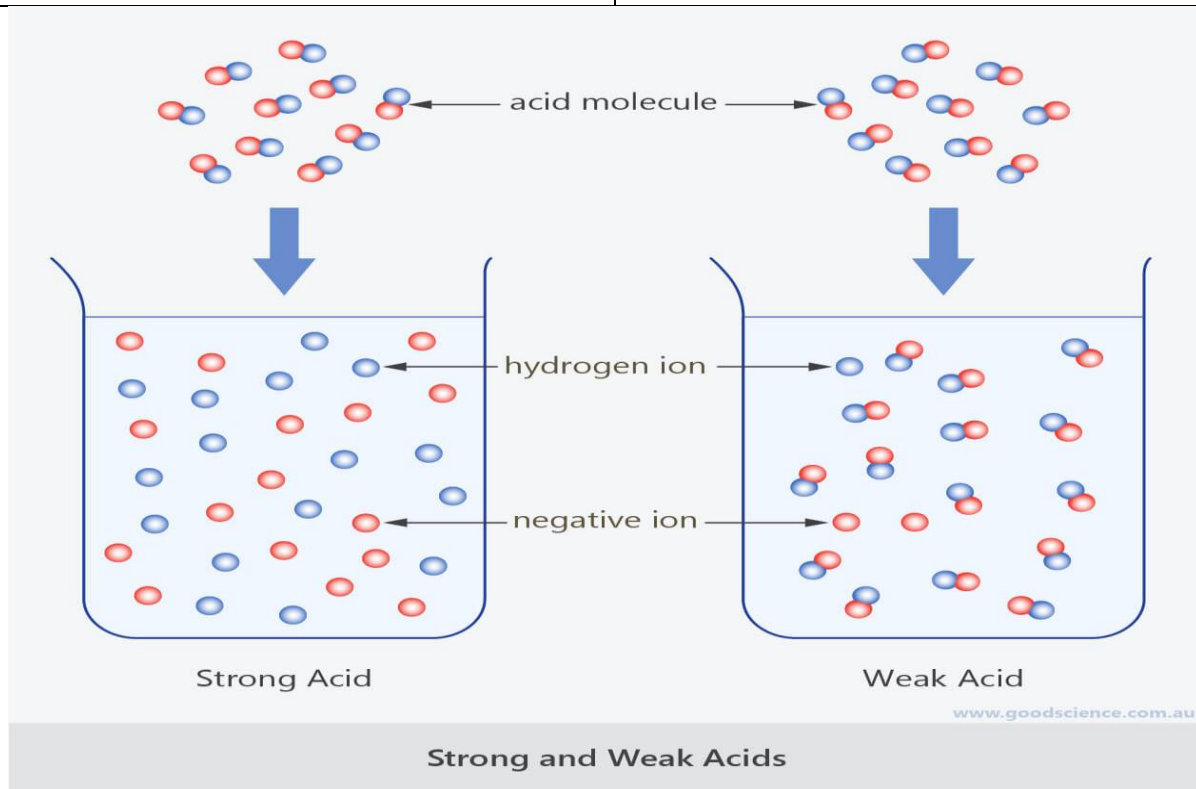
ACIDS & BASES may be Classified as-

Strong and Weak Diluted and concentrated Basicity & acidity

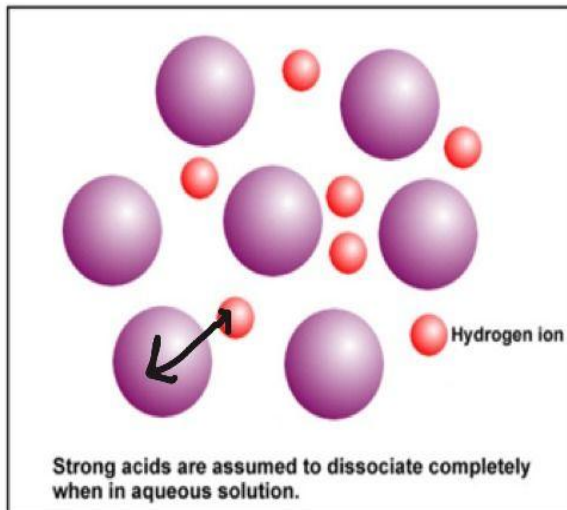
1. Strong and Weak-

<u>Strong Acid/Base</u>	<u>Weak Acid/Base</u>
Strong acids and bases are those acids or bases that <u>completely dissociate to form ions</u> in aqueous solution.	Weak acids and bases are those acids or bases that <u>ionize only partially</u> , and the ionization reaction is reversible .

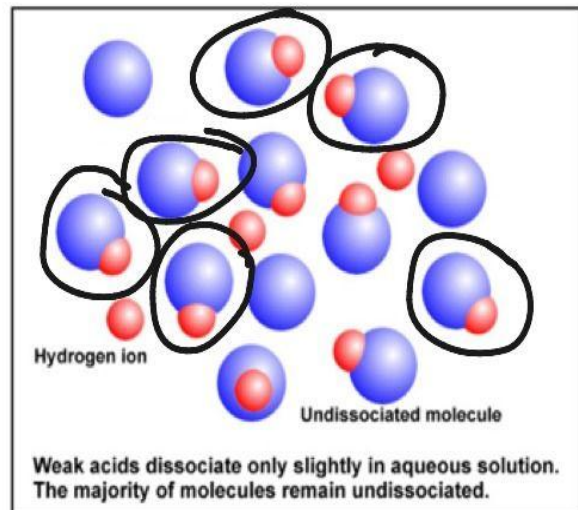
So, strong acids and bases ionise completely to form the corresponding positive and negative ions .	So, weak acid and base solutions contain multiple charged and uncharged species
Example- $\text{HCl(aq)} \rightarrow \text{H}^+(\text{aq}) + \text{Cl}^-(\text{aq})$ $\text{NaOH(aq)} \rightarrow \text{Na}^+(\text{aq}) + (\text{OH})^-(\text{aq})$	$\text{CH}_3\text{COOH(aq)} \rightarrow (\text{CH}_3\text{COO})^-(\text{aq}) + \text{H}^+(\text{aq})$ $\text{NH}_4\text{OH(aq)} \rightarrow \text{NH}_4^+(\text{aq}) + \text{OH}^-(\text{aq})$



Strong and Weak Acids & Bases



STRONG



Images from The University of British Columbia

WEAK

Strong and Weak Acids and Bases

Table 19.6

Relative Strengths of Common Acids and Bases		
Substance	Formula	Relative Strength
Hydrochloric acid	HCl	$\left. \begin{array}{l} \text{HCl} \\ \text{HNO}_3 \\ \text{H}_2\text{SO}_4 \end{array} \right\}$ Strong Acid ↑ Increasing strength of acid ↓ Neutral Solution ↓ Increasing strength of base Strong Base
Nitric acid	HNO ₃	
Sulfuric acid	H ₂ SO ₄	
Phosphoric acid	H ₃ PO ₄	
Ethanoic acid	CH ₃ COOH	
Carbonic acid	H ₂ CO ₃	
Hypochlorous acid	HClO	
Ammonia	NH ₃	
Sodium silicate	Na ₂ SiO ₃	
Calcium hydroxide	Ca(OH) ₂	
Sodium hydroxide	NaOH	
Potassium hydroxide	KOH	

Common Strong and Weak Acids and Bases

	Acid		Base	
common examples of strong forms	HCl	hydrochloric acid	LiOH	lithium hydroxide
	HNO ₃	nitric acid	NaOH	sodium hydroxide
	H ₂ SO ₄	sulfuric acid	KOH	potassium hydroxide
			Ba(OH) ₂	barium hydroxide
some examples of weak forms	CH ₃ COOH and other organic acids	ethanoic acid	NH ₃	ammonia
	H ₂ CO ₃	carbonic acid	C ₂ H ₅ NH ₂ and other amines	ethylamine
	H ₃ PO ₄	phosphoric acid		

2. Dilute and concentrated-

<u>Concentrated acid/Base</u>	<u>Dilute acid/Base</u>
Either acid/base is in pure form or has a high concentration	Percentage of water mixed in acid/base , is higher than the percentage of acid/base itself.
[02-04% water, with 96-98% of acid/base]	[80 or 90% water, with 10-20% of acid/base.]
Example - Concentrated sulfuric acid (about 98% by weight)	Example - 5% sulfuric acid is a dilute acid.

➤ **Method of diluting a concentrated Acid-**

Reaction of -

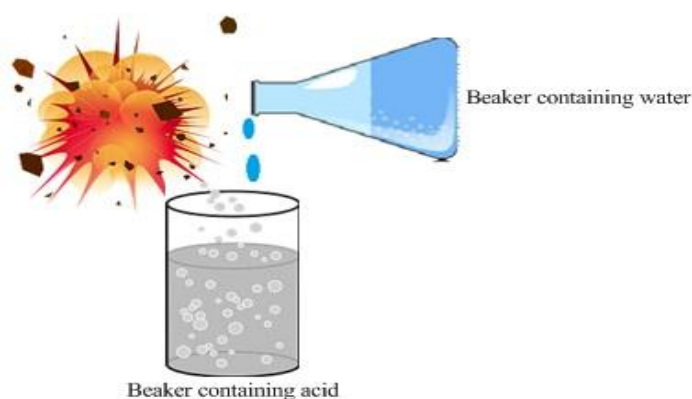
Water + Strong acid → highly Exothermic.

With sudden **rise in temperature**, the **acid fumes, boils and splashes out almost instantly**, creating a **hazardous** situation for anyone nearby.

So, when we **add water to strong acid**, the **acid splashes out** causing **damage**, or the **glass beaker might break**.

Hence the correct method of diluting a **concentrated acid** is to **add concentrated acid** to a **larger volume of water**, with **continuous stirring**.

Here water acts as a cooling agent and absorbs the heat produced.



Adding water to acid is Highly Dangerous.



Adding acid to water is Safe

3. Basicity and acidity-

Basicity of an acid is defined as the number of replaceable hydrogen atoms present in one molecule of an acid.

Acidity of base is defined as the number of ionizable hydroxyl ions (OH^-) present in one molecule of a base.

Basicity of Acid

Acid	Basicity
HCl	1
HNO_3	1
H_2SO_4	2
H_3PO_4	3

Acidity Of Base

The number of ionisable hydroxyl radicals (OH^- ion) present in a molecule of a base is known as acidity of base.

Example:-

1. NaOH, KOH are monoacidic bases.

(Acidity = 1)

2. $\text{Ca}(\text{OH})_2$, $\text{Ba}(\text{OH})_2$ are diacidic bases.

(Acidity = 2)

3. $\text{Al}(\text{OH})_3$, $\text{Fe}(\text{OH})_3$ are triacidic bases.

(Acidity = 3)

Assessment

MCQs

Q.1	An aqueous solution turns red litmus solution blue. Excess addition of which of the following solution would reverse the change? (a) Baking powder (b) Lime (c) Ammonium hydroxide solution (d) Hydrochloric acid
Q.2	Which among the following is not a base? (a) NaOH (b) KOH (c) NH_4OH (d) $\text{C}_2\text{H}_5\text{OH}$
Q.3	Which of the following are present in a dilute aqueous solution of hydrochloric acid? (a) $\text{H}_3\text{O}^+ + \text{Cl}^-$ (b) $\text{H}_3\text{O}^+ + \text{OH}^-$ (c) $\text{Cl}^- + \text{OH}^-$ (d) unionised HCl
➤ 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: H_2CO_3 is a strong acid. Reason: A strong acid dissociates completely or almost completely in water.
Q.5	Assertion: Weak acids have low electrical conductivity. Reason: Strong acids and weak acids have equal concentration of hydrogen ions in their solutions.

Home assignment

S.LNo.	Questions	Mark	Skill																				
Q.1	Column II gives nature of acids and bases mention in column I, match them correctly. <table border="1"> <thead> <tr> <th colspan="2">Cloumn I</th><th colspan="2">Cloumn II</th></tr> </thead> <tbody> <tr> <td>(A)</td><td>HCl</td><td>(p)</td><td>strong acid</td></tr> <tr> <td>(B)</td><td>HCN</td><td>(q)</td><td>weak acid</td></tr> <tr> <td>(C)</td><td>NaOH</td><td>(r)</td><td>weak base</td></tr> <tr> <td>(D)</td><td>NH₄OH</td><td>(s)</td><td>strong base</td></tr> </tbody> </table>	Cloumn I		Cloumn II		(A)	HCl	(p)	strong acid	(B)	HCN	(q)	weak acid	(C)	NaOH	(r)	weak base	(D)	NH ₄ OH	(s)	strong base	1	R
Cloumn I		Cloumn II																					
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(C)	NaOH	(r)	weak base																				
(D)	NH ₄ OH	(s)	strong base																				
Q.2	True/False: There are a variety of strengths when you study acids and bases.	1	u																				
Q.3	What are strong and weak acids? In the following list of acids, separate strong acids from weak acids. Hydrochloric acid, citric acid, acetic acid, nitric acid, formic acid, sulphuric acid.	3	R+A																				
Q.4	(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?	3	U+A																				
Q.5	a. Define indicator. Name two indicators obtained from plants. b. Write a balanced chemical equation for the reaction taking place when sodium oxide reacts with water. How will this solution behave towards phenolphthalein and red litmus paper? c. State what happens when sodium hydroxide solution reacts with hydrochloric acid. [CBSE 2016]	5	HOT																				