



SNS COLLEGE OF ALLIED HEALTH SCIENCES

SNS Kalvi Nagar, Coimbatore - 35

Affiliated to Dr MGR Medical University, Chennai



DEPARTMENT OF CARDIAC TECHNOLOGY

COURSE NAME : BIOCHEMISTRY

TOPIC : ACIDS AND BASES



ACID



- An acid is any hydrogen-containing substance that is capable of donating a proton (hydrogen ion) to another substance.
- An acid is a substance that produces hydrogen (H^+) ions when it is added to water. A hydrogen ion is just the proton and no electron.

For example:

- HCl – hydrochloric acid
- H_2SO_4 – sulfuric acid
- HNO_3 – nitric acid.
- When we put a molecule of acid into water, it breaks apart – means it dissociates.
- For example hydrochloric acid (HCl) dissociates into hydrogen ions (H^+) and chloride anions (Cl^-).



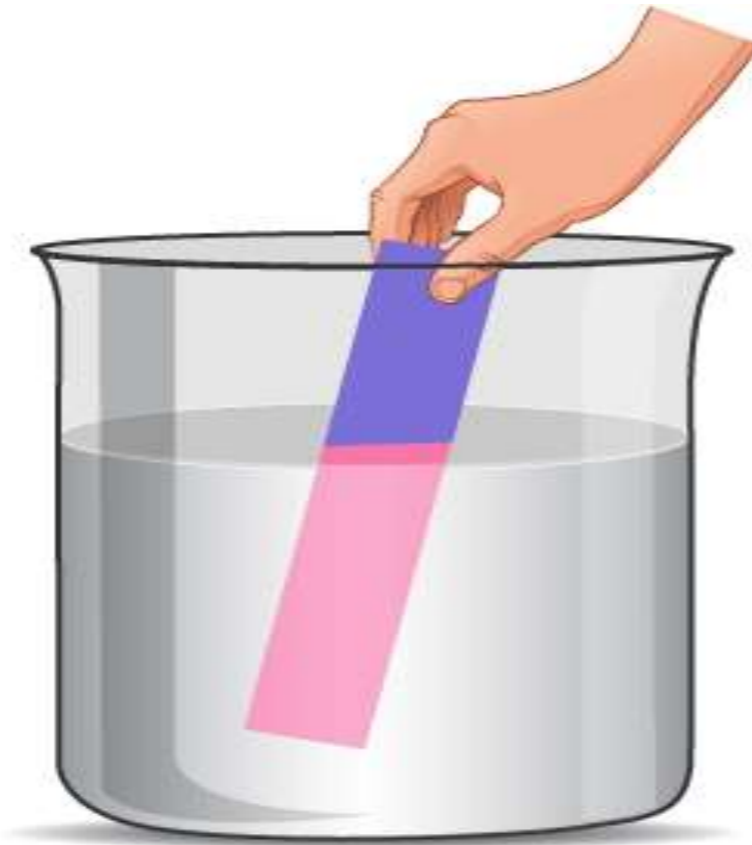
BASES



- Bases – A base is a molecule or ion able to accept a hydrogen ion from an acid.
- A base is a substance that neutralises acids. When bases are added to water, they split to form hydroxide ions, written as OH^- .

For example:

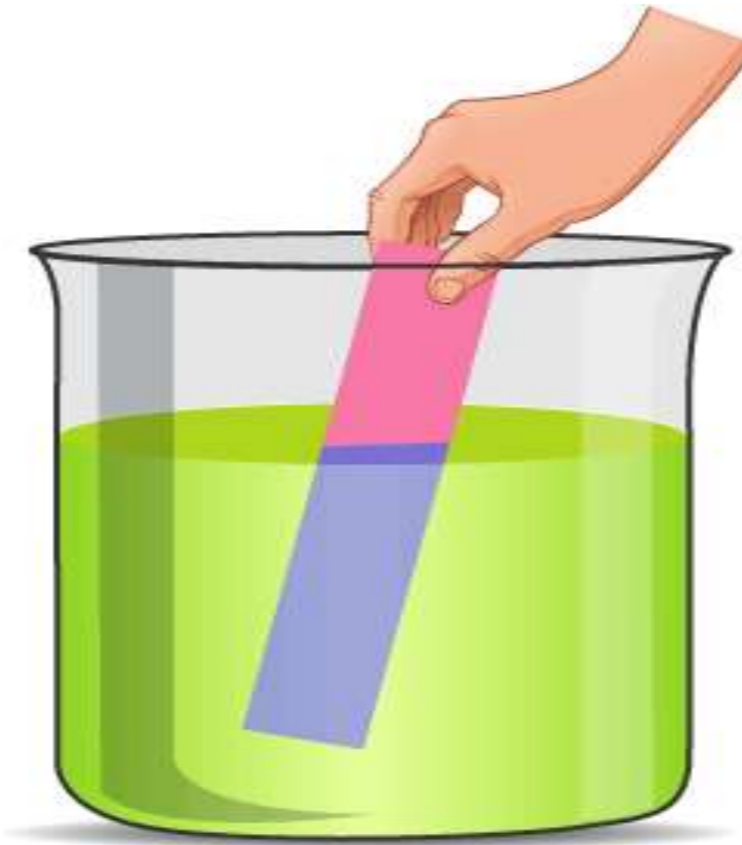
- NaOH – sodium hydroxide (caustic soda)
- NH_4OH – solution of ammonia in water
- $\text{Ca}(\text{OH})_2$ – calcium hydroxide (builders' lime)
- An example – Brushing teeth. The acid created from the bacteria on your teeth reacts with the base in your toothpaste. This reaction is called neutralisation.



Acid

Blue litmus turns red

Acids are known to turn blue litmus red.



Base

Red litmus turns blue

Bases are known to turn red litmus blue

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Common acids and bases



- Citrus fruits contain citric acid.
- Stomach needs a special lining to protect it from the hydrochloric acid used to [digest our food](#).
- Citrus fruits, tomatoes and vinegar are acidic.
- Toothpaste is a weak base - neutralises the acids in foods and protects tooth enamel.
- The manufacturing of soap and paper involves the use of sodium hydroxide.
- NaOH is also used in the manufacture of rayon.
- $\text{Ca}(\text{OH})_2$, also known as slaked lime or [calcium hydroxide](#), is used to manufacture bleaching powder.



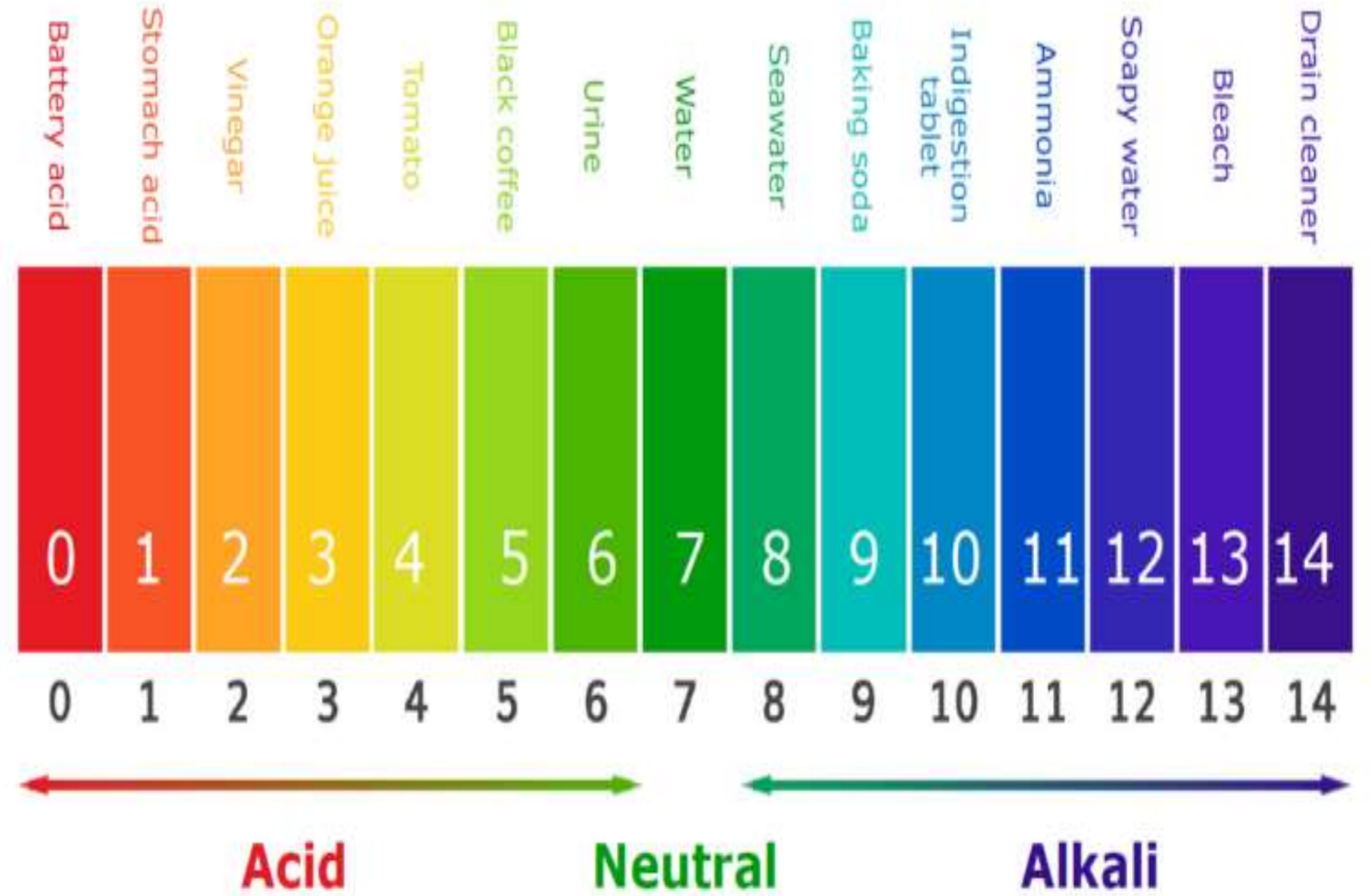
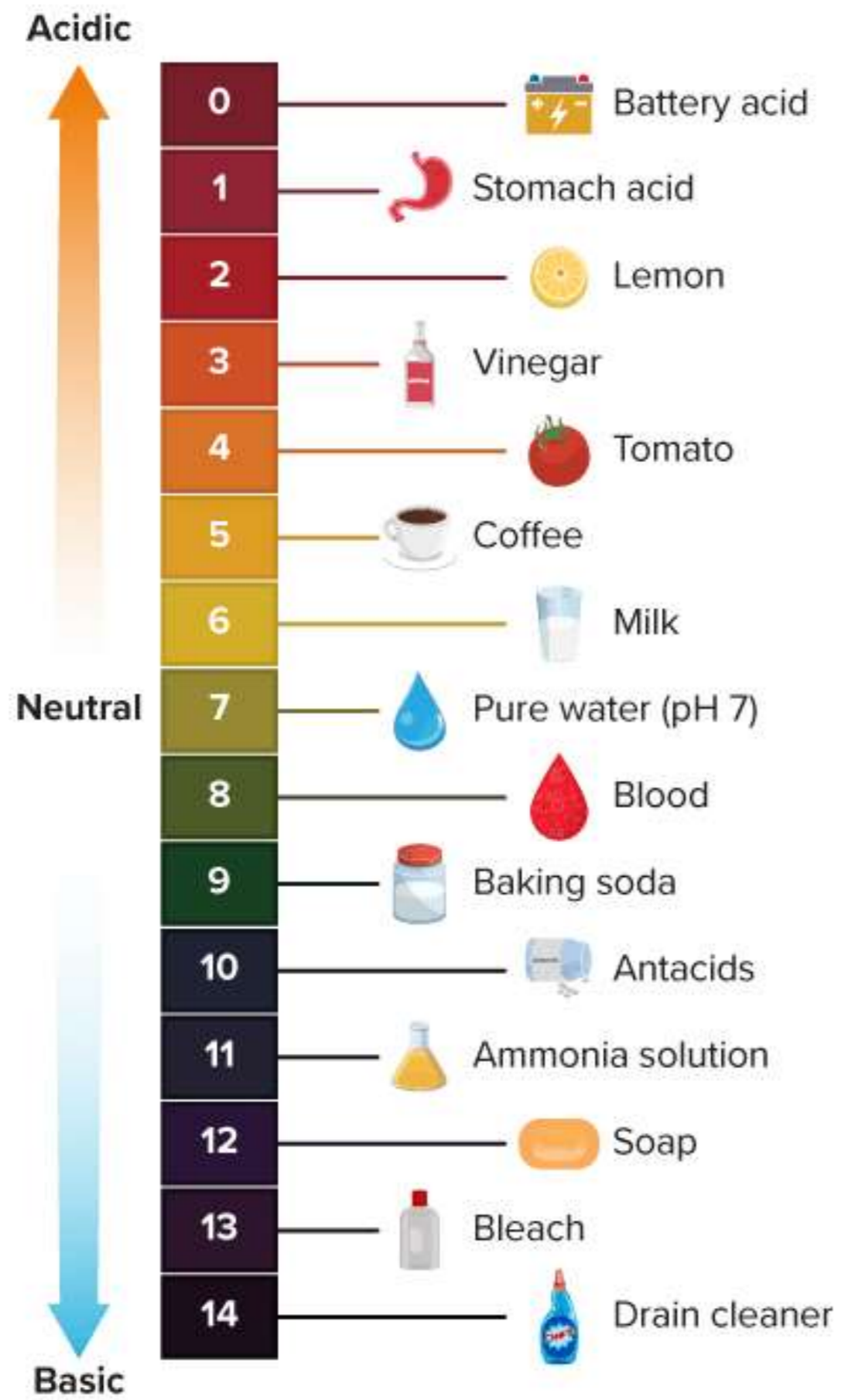
Identifying and measuring acids and bases



- A pH meter measures how acidic or basic a solution is.
- **pH** is defined as the negative logarithm of H⁺ ion concentration. Hence the meaning of the name pH is justified as the power of hydrogen.

$$\text{pH} = -\log [\text{H}^+]$$

- Acids have a pH below 7. The more H⁺ ions, the more acidic it is and the lower the pH will be.
- Bases have a pH above 7.
- pH 7 is said to be neutral – this means there is a balance of H⁺ and OH⁻ ions. Sometimes, the pH value can be less than 0 for very strong acids or greater than 14 for very strong bases.





Assessment



1. Acid?
2. Base?
3. pH?
4. Acid - litmus paper colour change?
5. Base - litmus paper colour change?



Difference between Acids and Bases



Acids	Bases
Acid gives off hydrogen ions when dissolved in water.	Bases give off hydroxyl ion when dissolved in water.
It turns blue colour litmus paper into red.	It turns red colour litmus paper into blue.
It has a sour taste.	It has bitter taste and soapy to touch.
Its pH value ranges from 1 to 7.	Its pH value ranges from 7 to 14.
Example: HCl, H ₂ SO ₄ etc.	Example: NaOH, KOH etc.



Theories of Acids and Bases



- Three different theories have been put forth in order to define acids and bases.
- These theories include the Arrhenius theory, the Bronsted-Lowry theory, and the Lewis theory of acids and bases.
- The ***Arrhenius theory*** of acids and bases states that “an acid generates H^+ ions in a solution whereas a base produces an OH^- ion in its solution”.
- The ***Bronsted-Lowry theory*** defines “an acid as a proton donor and a base as a proton acceptor”.
- Finally, the ***Lewis definition*** of acids and bases describes “acids as electron-pair acceptors and bases as electron-pair donors”.



Arrhenius Acids and Bases

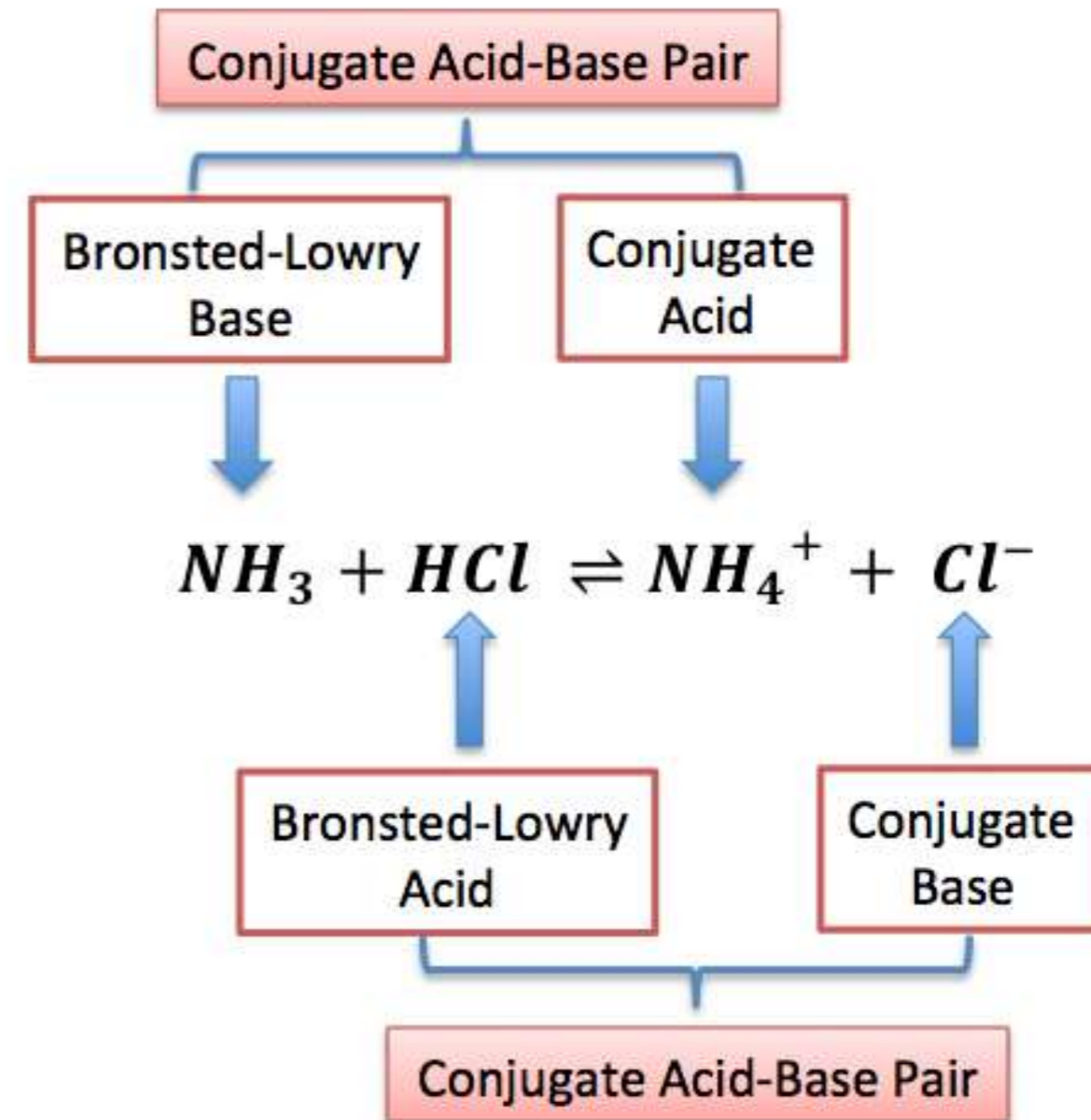
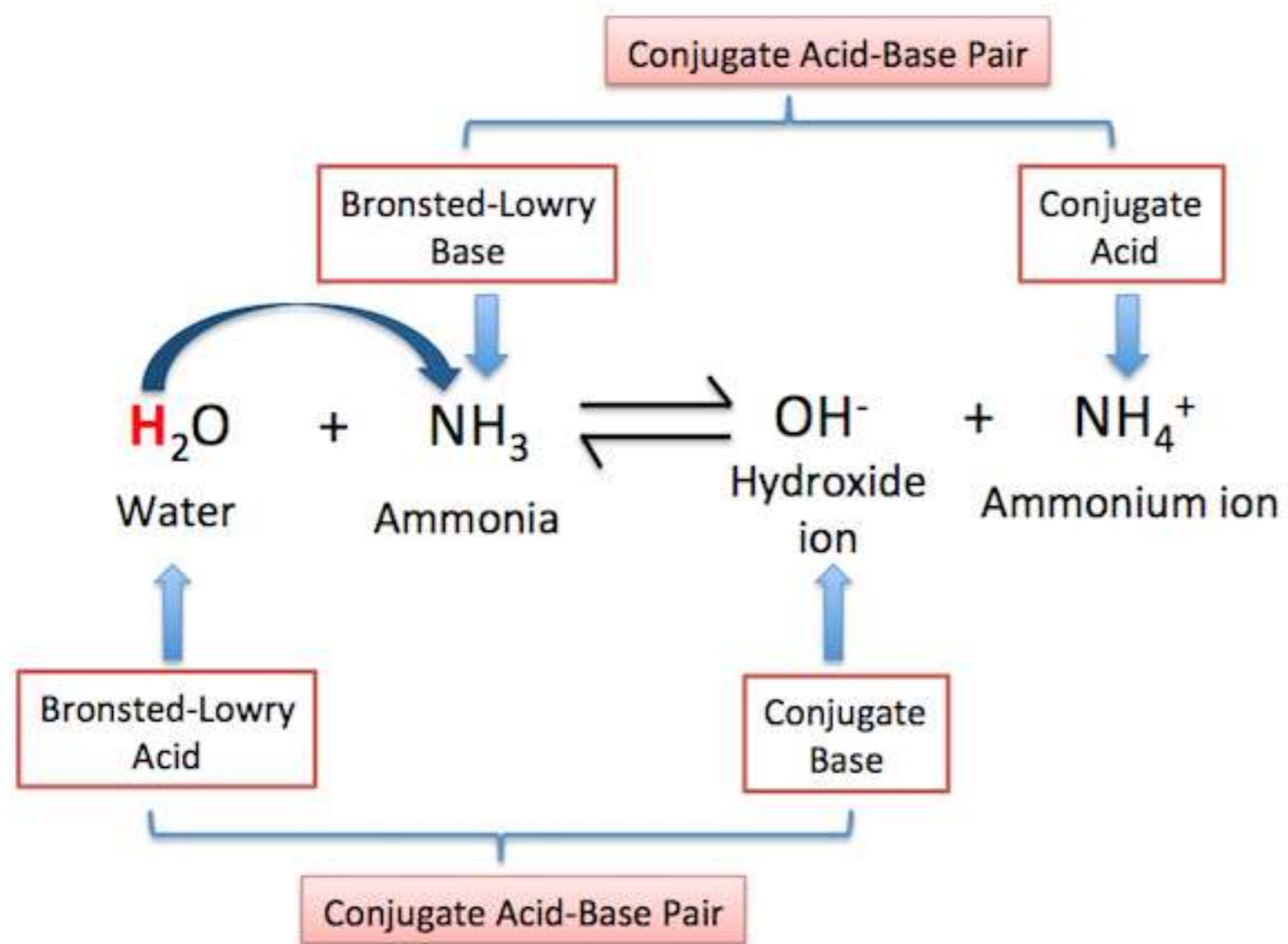


Acid - forms H^+ in water



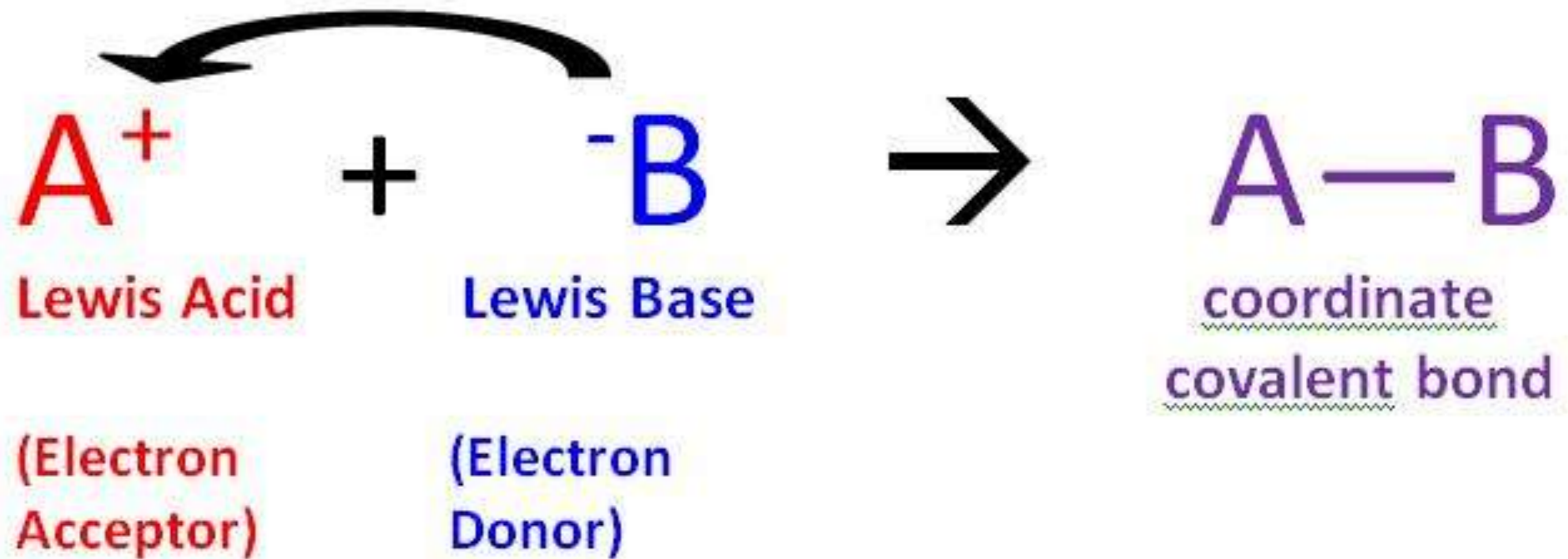
Base - forms $\text{}^-\text{OH}$ in water

Bronsted-Lowry theory





Lewis definition





Uses of Acids



- Vinegar, a diluted solution of [acetic acid](#) - used as a food preservative.
- Citric acid is an integral part of lemon juice and orange juice - preservation of food.
- Sulphuric acid - widely used in batteries. The batteries used to start the engines of automobiles
- The industrial production of explosives, dyes, paints, and fertilizers involves the use of sulphuric acid and nitric acid.
- Phosphoric acid is a key ingredient in many soft drinks.



Uses of Bases



- The manufacturing of soap and paper involves the use of sodium hydroxide. NaOH is also used in the manufacture of rayon.
- $\text{Ca}(\text{OH})_2$, also known as slaked lime or [calcium hydroxide](#), is used to manufacture bleaching powder.
- Dry mixes used in painting or decoration are made with the help of calcium hydroxide.
- Magnesium hydroxide, also known as milk of magnesia, is commonly used as a laxative.
- Ammonium hydroxide is a very important reagent used in laboratories.



Properties of Acids



- Acids are corrosive in nature.
- Good conductors of electricity.
- When reacted with metals, these substances produce hydrogen gas.
- Acids are sour in taste.
- Examples: Sulfuric acid [H_2SO_4], [Hydrochloric acid](#) [HCl], Acetic acid [CH_3COOH].



Properties of Bases



- Some properties, like a bitter taste, feel slippery, soapy texture
- These substances release hydroxide ions (OH^- ions) when dissolved in water.
- In their aqueous solutions, bases act as good conductors of electricity.
- The pH values corresponding to bases are always greater than 7.
- Bases are bitter-tasting substances which have the ability to turn red litmus paper blue.
- Examples: Sodium hydroxide $[\text{NaOH}]$, [milk of magnesia \$\[\text{Mg}\(\text{OH}\)_2\]\$](#) , calcium hydroxide $[\text{Ca}(\text{OH})_2]$.



Assessment



1. Any 2 properties of acid?
2. Any 2 properties of base?
3. 3 Theories?



THANK YOU