PHARM.D • YEAR 1

Pharmaceutical Inorganic Chemistry

CHAPTER 5

# Non-Aqueous Titrations

PPT CHAPTER COVER



DOCTOR OF PHARMACY

# Why Use a Non-Aqueous Titration?

## ① Solubility

Many analytes or titrants are poorly soluble in water but dissolve well in non-aqueous solvents, enabling accurate titration.

## ② Acid-Base Properties

Acid-base behavior can differ in non-aqueous solvents, allowing proper neutralization and reliable results.

## ③ Reaction Kinetics

Non-aqueous solvents can speed up the reaction between analyte and titrant, giving a faster and more efficient titration.

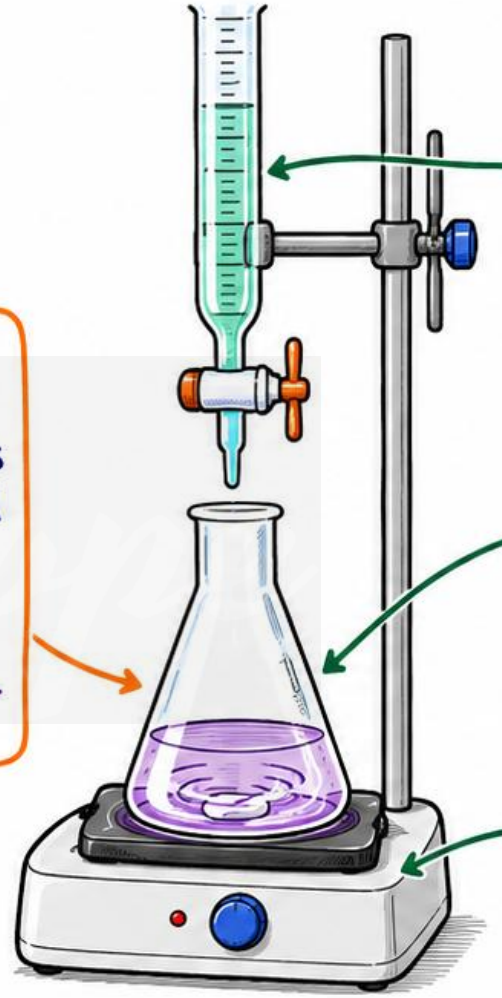
## ④ Autoproteolysis

These solvents have much lower autoproteolysis constants than water, contributing fewer $H^+$ and $OH^-$ ions to the solution.

**Principle:**

Neutralization occurs between titrant and analyte in a non-aqueous medium.

$HA + B \rightarrow A^- + BH^+$

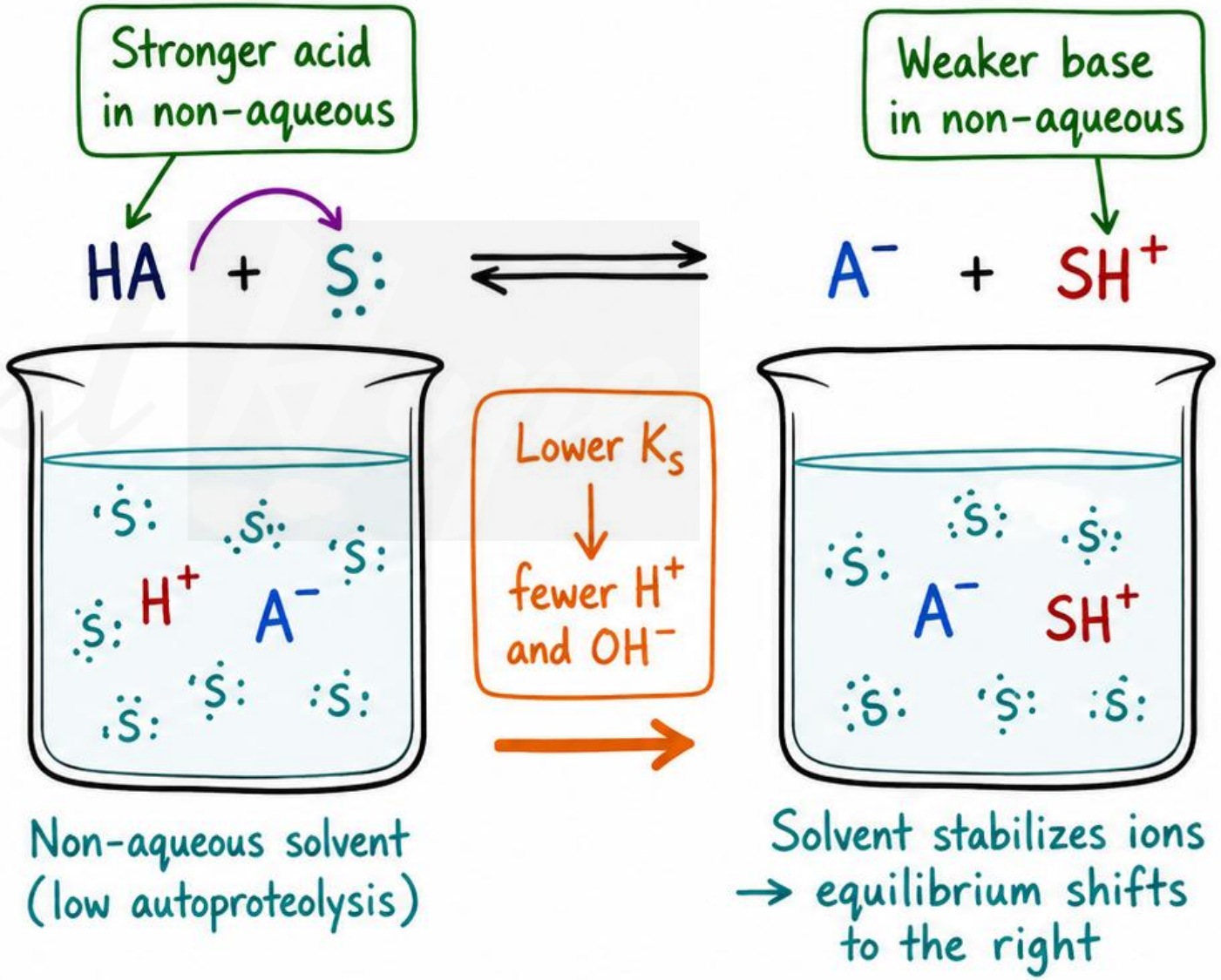



**Takeaway:** ★ Non-aqueous titration is used when water is unsuitable—improving solubility, ensuring proper acid-base behavior, enhancing reaction rate, and minimizing background $H^+$ and $OH^-$ for accurate, reliable results.

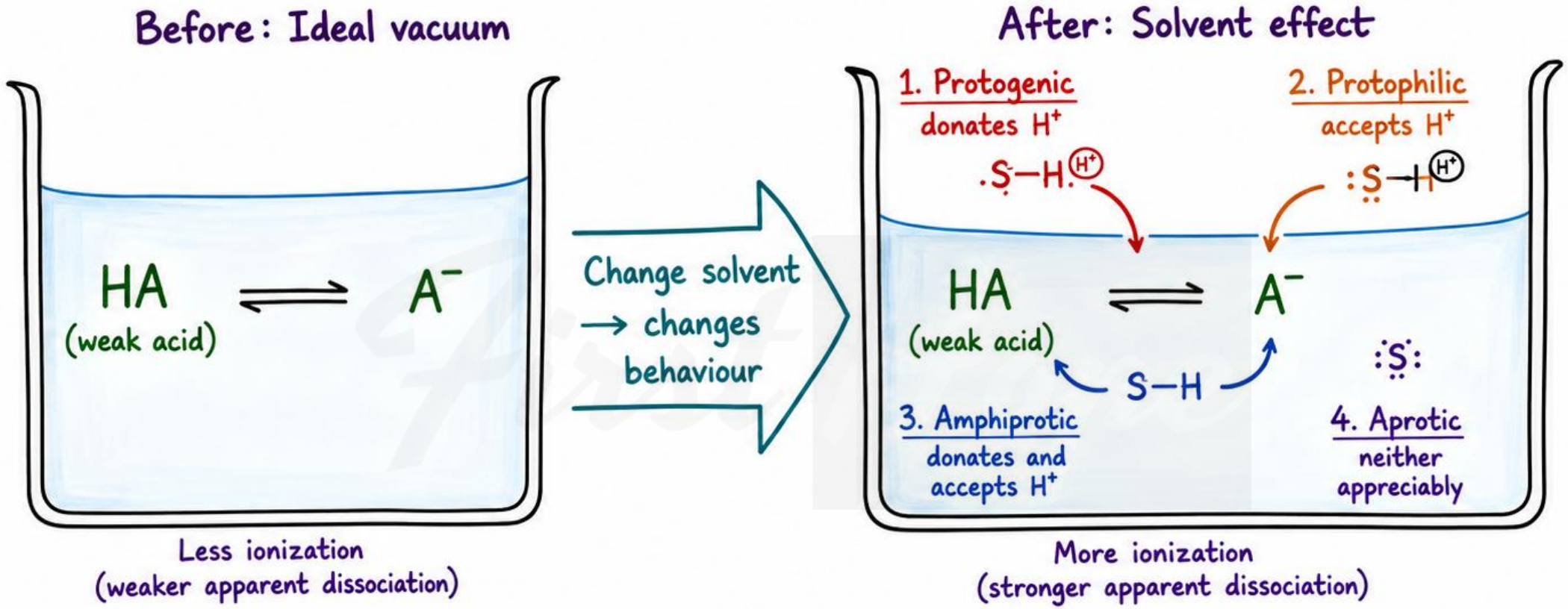
# How the Solvent Changes Acid-Base Strength

Principle: Acid-base strength depends on solvent because the solvent's ability to donate or accept protons and stabilize ions changes. This shifts the position of acid-base equilibria.

- Lower autoproteolysis ($K_s$) means fewer $H^+$ and $OH^-$ from solvent, so acids are stronger and bases are weaker.
- Solvent polarity and basicity control ion stabilization and solvation, further shifting acid-base strength.

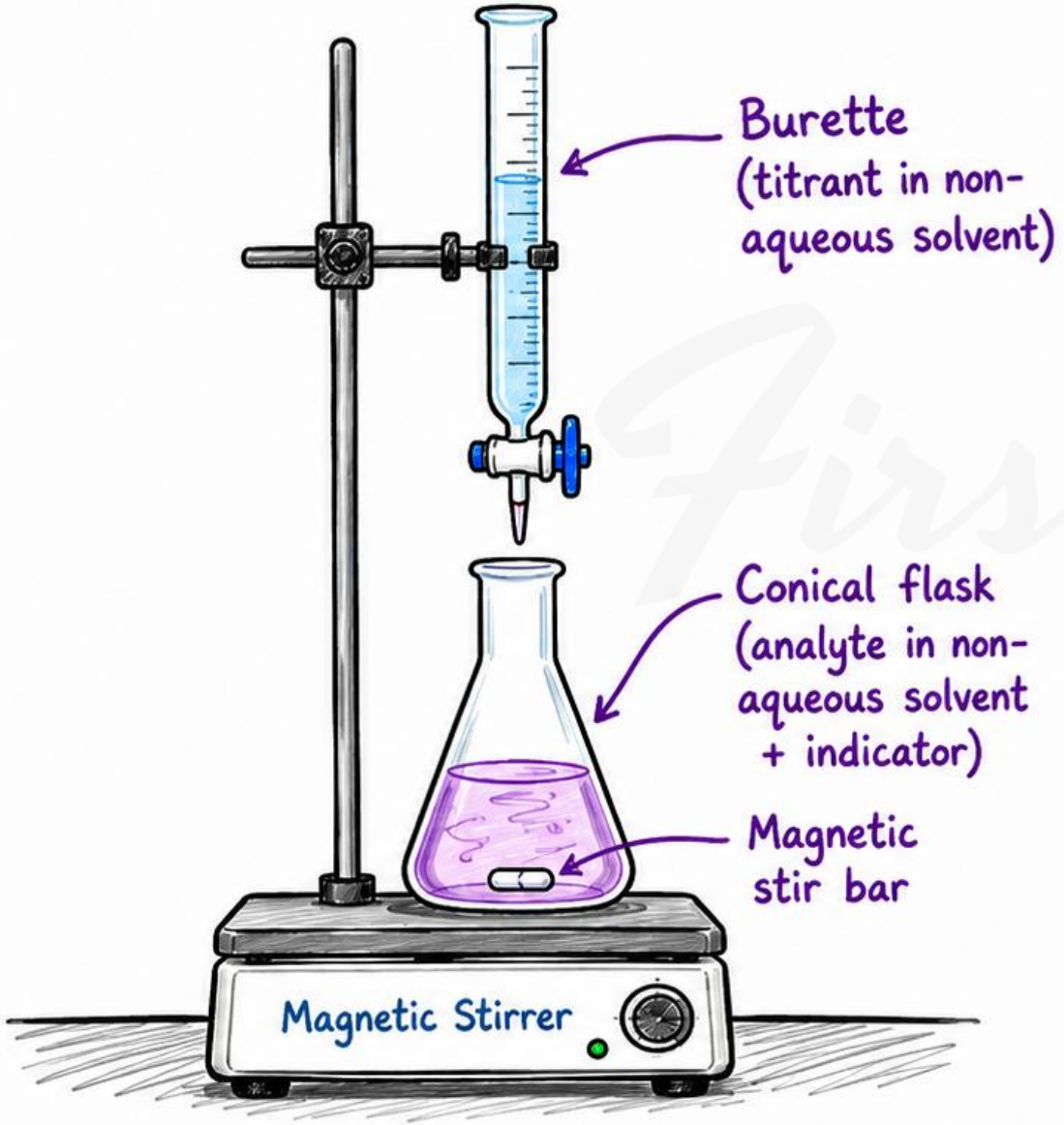


# Four Solvent Behaviours




- Protogenic solvents donate protons; protophilic solvents accept protons.
- Amphiprotic solvents can both donate and accept protons, while aprotic solvents do neither appreciably.
- Solvent behaviour changes the apparent strength and solubility of weak acids or bases and therefore affects endpoint sharpness.

# Protic and Aprotic Solvents




## 1 Protic solvents:

Have acidic hydrogen; can donate $H^+$ and form hydrogen bonds.

- Examples: Acetic acid, Methanol, Ethanol, Glycerol.

## 2 Aprotic solvents:

Lack acidic hydrogen; cannot donate protons.

- Examples: Dimethyl sulfoxide (DMSO), Acetonitrile, Dimethylformamide (DMF).

## 3 Polar solvents:

Have a dipole moment; dissolve a wide range of polar and ionic compounds.

- Examples: Acetic acid, Methanol, Ethanol, Dimethyl sulfoxide (DMSO), Acetonitrile.

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