

Exercise walk-through

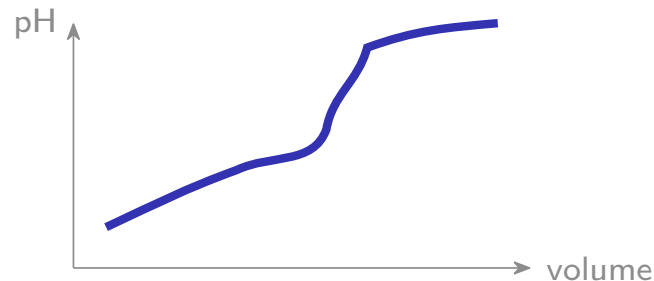
8.1

Introduction to Acids and Bases

AP Chemistry

What we will cover

- 1 Bronsted-Lowry and pH
- 2 Strong acids and bases
- 3 Weak acid and base equilibria
- 4 Buffers and Henderson-Hasselbalch
- 5 Acid-base titrations
- 6 Structure and pK_a



Structure and pK_a

Acid strength comes down to how easily the acidic H leaves, and how stable the

conjugate base is:

- **binary acids** : stronger *down* a group (weaker bond)
- **oxyacids** : more oxygens $\Rightarrow$ stronger

$$\text{p}K_a = -\log K_a$$

Smaller $\text{p}K_a$ = stronger acid.

$\text{pH} < \text{p}K_a$: the acid form dominates; $\text{pH} > \text{p}K_a$: the conjugate base dominates.

Why one acid is stronger than another

the principle

an acid is stronger when its **conjugate base is more stable**

electronegativity

more electronegative atoms nearby pull electron density away and stabilise the negative charge

resonance

a charge spread over several atoms is far more stable – why carboxylic acids beat alcohols

atomic size

down a group, a larger atom spreads the charge better – HI is stronger than HF

an indicator

itself a weak acid whose protonated and deprotonated forms have **different colours**, so it changes colour over its own pK_a range

Never argue from the acid; argue from the **anion left behind**. Every structural rule here is about stabilising that charge.

Exercises 2.1-2.3

2.1 Define a Brønsted-Lowry base.

[1]

2.2 Write the ionization of the strong acid HNO_3 in water.

[1]

2.3 Why is a weak acid written with an equilibrium arrow?

[1]

Exercises 2.1-2.3

2.1 Define a Brønsted-Lowry base. [1]

2.1

- A proton (H^+) acceptor
-

2.2 Write the ionization of the strong acid HNO_3 in water. [1]

2.2

- $\text{HNO}_3 \rightarrow \text{H}^+ + \text{NO}_3^-$
-

2.3 Why is a weak acid written with an equilibrium arrow? [1]

2.3

- It only ionizes partially, so an equilibrium exists between the molecule and its ions

Exercise 3.1

3.1 A strong acid in water

[1]

☐

A ionizes completely

B ionizes partially

C does not ionize

D forms OH^-

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☐

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3.1 A

- ionizes completely

Exercise 3.2 (a)

3.2 Compare HCl and CH₃COOH (acetic acid) at the same concentration.

(a) Which ionizes more?

[1]

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[1]

(a)

- HCl

Exercise 3.2 (b)

3.2 Compare HCl and CH₃COOH (acetic acid) at the same concentration.

(b) Which has the higher [H⁺]? Explain.

[2]

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[2]

(b)

- HCl – it is strong and ionizes completely, giving a higher [H⁺] than the partially-ionized weak acetic acid

Exercise 3.3

3.3 Write the equilibrium for the weak base ammonia NH_3 reacting with water. [3]

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