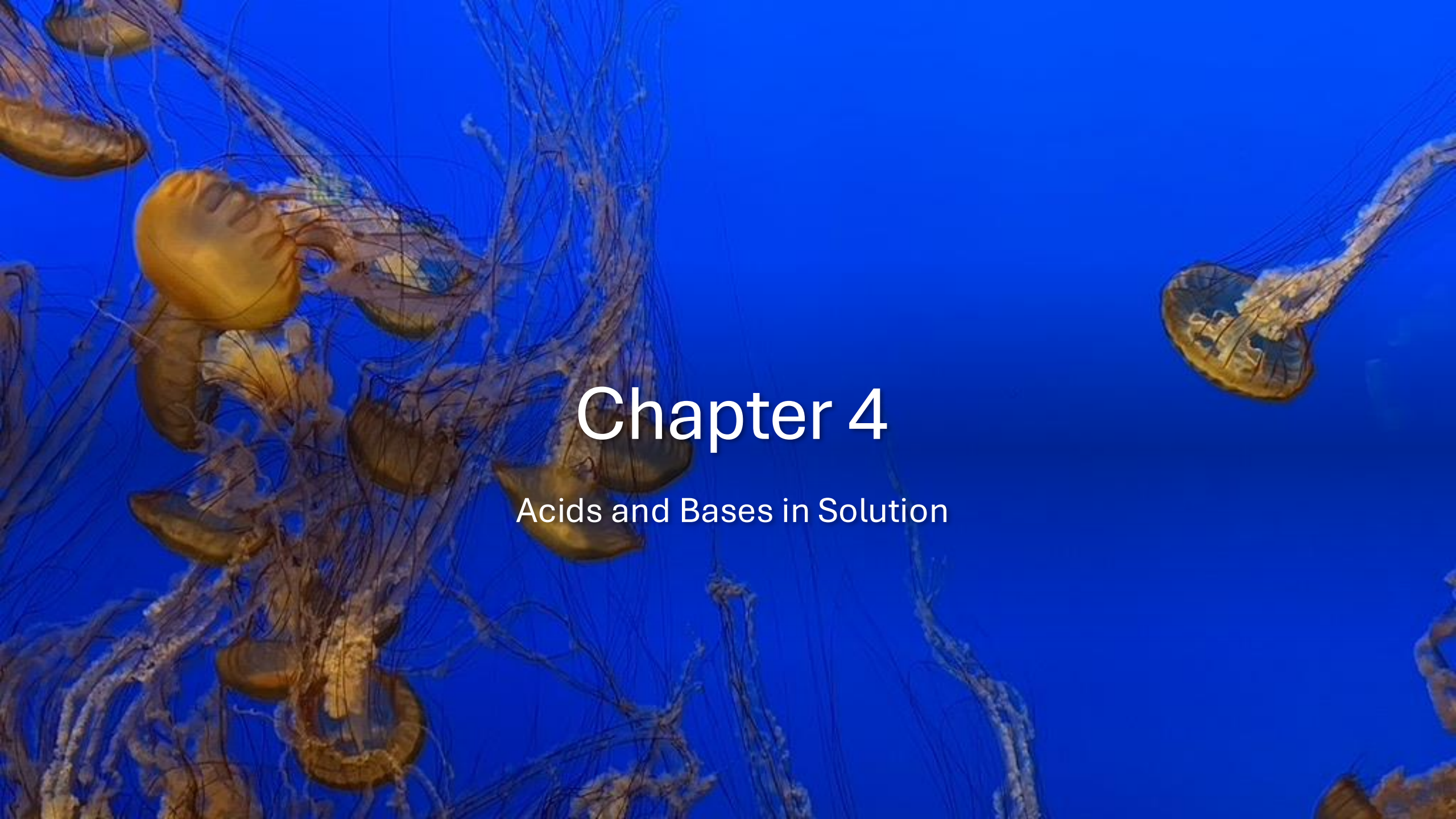

Chapter 4

Acids and Bases in Solution

Solutions

- Solute = smaller amount of something that is dissolved in a solution
- Solvent = larger amount of something in the solution
- Water is a common solvent

- % solutions can be
  - w/w (g solute/100 g solution)
  - w/v (g solute/100 mL solution)
  - v/v (mL solute/100 mL solution)
-
- Molarity = moles solute/L solution

Solutions

Parts per million = 1 g in 1 x 10^6 g of water

1 x 10^6 g of water = 1 x 10^6 mL of water (Density of water = 1g/mL)

1 x 10^6 mL = 1000 L

$$\frac{1\text{g}}{1000\text{ L}} \times \frac{1000\text{ mg}}{\text{g}} = \frac{1\text{ mg}}{\text{L}}$$

Parts per billion = 1 g in 1 x 10^9 g of water

1 x 10^9 g of water = 1 x 10^9 mL of water

1 x 10^9 mL = 1 x 10^6 L

$$\frac{1\text{g}}{1 \times 10^6\text{ L}} \times \frac{1 \times 10^6\text{ ug}}{\text{g}} = \frac{1\text{ ug}}{\text{L}}$$

Dilution of Solutions

Adding solvent decreases the concentration of the solution. The moles stay the same, but the molarity decreases.

Molarity = moles/volume(L)

Same moles, more volume = less molarity

1. Find the moles: Molarity x volume(L) = moles

2. Divide the moles by the new volume(L) = new Molarity

What is the molarity of a solution that is made by diluting 10.0 mL of 0.2M sodium hydroxide to a total volume of 50 mL?

1. $10\ mL \times \frac{1\ L}{1000 mL} \times 0.2\ M = 2 \times 10^{-3}$ moles
2. $\frac{2 \times 10^{-3}\ moles}{50\ mL} \times \frac{1000\ mL}{L} = 4 \times 10^{-2}\ M$

Dilutions

What is the molarity of a solution that is made by diluting 25.00 mL of 3.00M hydrochloric acid (HCl) to 500.0 mL?

A. 1.5×10^{-1}M

B. 6.66 M

C. 6×10^{1}M

D. 4.16×10^{3}M

E. None of these

Dilutions

What is the molarity of a solution that is made by diluting 25.00 mL of 3.00M hydrochloric acid (HCl) to 500.0 mL?

A. 1.50×10^{-1}M

B. 6.66 M

C. 6×10^{1}M

D. 4.16×10^{3}M

E. None of these

$$\frac{25.00\ \text{mL}}{500\ \text{mL}} \times 3.00\ \text{mole/L} = 1.5 \times 10^{-1}\ \text{mole/L}$$

All acids donate protons to water

All bases accept protons or increase OH^- concentration

Hydrochloric acid = HCl

Hydrobromic acid = HBr

Hydrofluoric acid = _____

Oxyacids are based on oxyanions:

Carbonic acid = H_2CO_3

Sulfuric acid = H_2SO_4 sulfurous acid = H_2SO_3

Nitric acid = HNO_3 nitrous acid = HNO_2

Hypochlorous acid = _____ Chlorous acid =_____

Chloric acid = _____. Perchloric acid = _____

Salt Water

Acid + Base → _____ + _____

6. What is the molarity of a sodium hydroxide solution, if **22.34** mL was needed to titrate **20.00 mL** of a 0.**1221 M** solution of hydrochloric acid?

a. 3.659×10^{3}M b. 1.364×10^{-1}M c. 1.093×10^{-1}M d. 2.884×10^{-3}M e. none of these

$HCl + NaOH \rightarrow NaCl + H_2O$

Moles of HCl = moles of NaOH at the endpoint

Find moles of HCl:

20.00 mL x 0.1221mole/L x 1L/1000mL = 2.442×10^{-3} moles HCl

At endpoint: NaOH **=** 2.442×10^{-3} moles

Molarity of NaOH = moles/L= moles/volume

2.442×10^{-3} moles/22.34 mL. x 1000mL/L = 1.093×10^{-1} M