Mohamed Khider University of Biskra
Faculty of Exact Sciences and Natural and Life Sciences

1st year LMD – SNV Biology **Academic year: 2024/2025**
Subject: Chemistry 2

Applied exercises series No. 1

(Acid-base equilibrium)

Exercise 1:

1. Indicate among the following species, acids, bases and ampholytes: CH_3COOH, NH_4^+, $H_2PO_4^-$, CH_3CH_2OH, S^{2-}, Al^{3+}.

2. Name the conjugated acid/base pairs corresponding to each case.

Exercise 2:

- Knowing that the ionic product of water at 100 ºC is equal to 6.10^{-13}.

1. Calculate the pH of the following solutions at this temperature:

a) Pure H_2O, **b)** HCl at 0.1 mol/l, **c)** NaOH at 0.2 mol/l.

2. Compare these pH values with those obtained at 25 ºC.

Exercise 3:

- In an aqueous solution of formic acid HCOOH (0.2 M), the acid is dissociated to 3%.

1. Calculate the equilibrium concentrations of the species present in aqueous solution.

2. Deduce the pKa of this acid.

Exercise 4:

- Three solutions, sulfuric acid, hydrochloric acid and propanoic acid CH_3CH_2COOH (considered a weak acid) have the same pH. 15 Cm^3 of a 10^{-2} M NaOH sodium hydroxide solution are needed to neutralize 200 Cm^3 of the hydrochloric acid solution, while 40 Cm^3 of the sodium hydroxide solution is required to neutralize 10 Cm^3 of the propanoic acid solution.

Calculate:

1. The pH common to the three solutions.

2. The molarity of each solution.

3. The acid constant of propanoic acid.

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(Acid-base equilibrium)

Exercise 1:

26.75 g of ammonium chloride NH_4Cl are dissolved in 1 *l* of water.

1. Calculate the pH of NH_4Cl knowing that the Ka of the NH_4^+/NH_3 couple is equal to $5.6*10^{-10}$.

2. How many moles of NH_3 must be added to the previous solution to obtain a buffer solution of pH = 9.07?

We give: the molar mass (g/mol) of the atoms: H(1), N(14), Cl(35.5).

Exercise 2:

The pH of a saturated solution of H_2S is maintained equal to 3.7.

- What are the concentrations of SH^- and S^{2-} species in this solution, knowing that in a solution saturated with H_2S.

We have: $[H_2S] = 0.1$ mol/l

H_2S/HS^- ($Ka_1=10^{-7}$), HS^-/S^{2-} ($Ka_2= 1.2 * 10^{-13}$).

Exercise 3:

- We have the following solutions:

1. CH_3COOH at 0.5 mol/l and CH_3COONa at 0.5 mol/l (pKa=4.75)

2. How to prepare 1 liter of a buffer solution of pH = 4.9