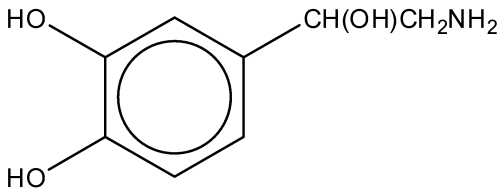
St. Andrew's Junior College
H1 Chemistry 2022
Assignment
Theory of Acids and Bases

1. Norepinephrine is an organic chemical that functions in the brain and body as a hormone and neutrotransmitter. Norepinephrine has the structural formula shown below:



Norepinephrine, abbreviated as BNH_2, undergoes partial dissociation as follows:

$$BNH_2 + H_2O \rightleftharpoons BNH_3^+ + OH^-$$

(a) Define pOH.

$pOH = -\log_{10}[OH^-]$

(b) Calculate the $[OH^-]$ that has dissociated from Norepinephrine given that the degree of dissociation is 0.0450 for 0.05 mol dm^{-3} of Norepinephrine at 25 °C. Hence, calculate the pH of the solution.

$[OH^-]$ /0.05 = 0.045

$[OH^-] = 2.25 \times 10^{-3}$ mol dm^{-3}.

pOH = 2.65

pH = 14 – 2.65 = 11.4

(c) Write an expression for K_b and calculate its value given that $[BNH_3^+] = [OH^-]$.

$K_b = [BNH_3^+][OH^-]/[BNH_2]$

$K_b = 1.01 \times 10^{-4}$ mol dm^{-3}

(d) When hydrochloric is reacted with excess Norepinephrine, a buffer solution is formed. Explain with the aid of two equations to explain how the solution can control pH.

$OH^- + BNH_3^+ \longrightarrow BNH_2 + H_2O$

The **small amount of OH^- ions** are removed by the **large amount of BNH_3^+** in

the buffer.

$H^+ + BNH_2 \longrightarrow BNH_3^+$

The **small amount of H^+ ions** removed by the **large amount of BNH_2** in the buffer.

Therefore pH remains almost unchanged.

(e) Suggest a suitable indicator for the titration of Norepinephrine and hydrochloric acid and explain the reason.

Methyl orange.

Titration of weak base with strong acid will result in acidic salt formed and the working range of the indicator lies within the rapid pH change of the titration curve.

(f)* Explain with the aid of an equation how BNH_3^+ undergoes partial hydrolysis in water.

$BNH_3^+ + H_2O \rightleftharpoons BNH_2 + H_3O^+$