UNIVERSITY of LIFE SCIENCES in Lublin

FACULTY OF VETERINARY MEDICINE

Solutions, buffers

Practical preparation of a solution of known concentration, preparations of buffers, the influence of the dilution on the pH of the buffer, determination of buffer capacity

Task 1

The purpose of this activity is to prepare and to calculate the percentage and molar concentration of the copper sulfate solutions.

Procedure

Add the following volume of the $CuSO_4$ solution and distilled water to 5 tubes (I, II, III, IV, V):

Tube No.	$CuSO_4$ cm^3	H_2O cm^3	Concentration	
			%	mol/dm^3
I	2	1		
II	1	1		
III	1	2		
IV	0.5	4.5		
V	0.1	0.9		

Calculate the final concentration (percentage and molar) of the copper sulfate solutions, using the information that the initial concentration of the solution was 1%.
Molar mass of $CuSO_4$ = 159.61 g/mol

Task 2

The purpose of this activity is to prepare the buffer solutions of a selected pH.

Procedure

Add the 0.1 mol/dm^3 acetic acid and 0.1 mol/dm^3 sodium acetate in appropriate volume to 5 tubes, as shown in the table below. Thoroughly mix the tubes. Calculate the pH of the buffer solutions from each tube using the Henderson-Hasselbalch equation. Measure the pH by the potentiometric method to confirm the accuracy of the calculations,

Tube No.	CH_3COOH 0.1 mol/dm^3 cm^3	CH_3COONa 0.1 mol/dm^3 cm^3	Calculated pH value (for 18°C)	pH value measured potentiometrically
1	9	1		
2	7	3		
3	5	5		
4	3	7		
5	1	9		

Task 3
The purpose of this activity is to observe the effect of the dilution of buffer solution on its pH.

Procedure
Add the 0.1 mol/dm^3 acetate buffer (pH=4.7)and distilled water in appropriate volume to 5 tubes, as shown in the table below. Calculate the dilution and molarity of the buffer solutions deriving from each tube. Add 5 drops of bromocresol green to each tube.

What is the color of the indicator at various dilutions of the buffer solution? What does it mean?

Tube No.	Buffer cm^3	H_2O cm^3	Dilution	Molarity	Color of the indicator
1	2	0			
2	0.5	1.5			
3	0.2	1.8			
4	0.02	1.98			
5	0	2			

* The color of bromocresol green changes between pH 3.8 and pH 5.4 from yellow toward blue. Green is the intermediate color.

Task 4
The purpose of this activity is to evaluate the capacity of the acetate buffer.

Procedure
Add the 0.1 mol/dm^3 sodium acetate, 0.1 mol/dm^3 acetic acid and distilled water in appropriate volume to 4 tubes, as shown in the table below.

Calculate the dilution of the buffer solution. Add 5 drops of bromocresol green to each tube. Add 0.1 cm^3 of 0.1 mol/dm^3 NaOH to tube No. 4. Add drop by drop 0.1 mol/dm^3 NaOH to other tubes,

until the color has become the same as in the tube No. 4. Note the volume of the consumed NaOH in each tube. Does the dilution has an influence on the buffer capacity?

Tube No.	CH_3COOH 0.1 mol/dm^3 cm^3	CH_3COONa 0.1 mol/dm^3 cm^3	H_2O cm^3	Dilution	The volume of consumed NaOH (drops)
1	2	2	0		
2	1	1	2		
3	0.5	0.5	3		
4	0	0	4		