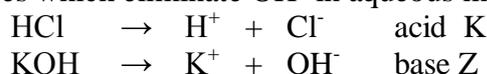


LABORATORY WORK NO. 9

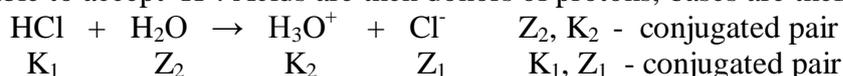
ACIDITY AND BASITY OF AQUEOUS SOLUTIONS

■ PRINCIPLE: Characteristics of acids and bases

Arrhenius theory: Acids are substances which eliminate H^+ in aqueous medium, bases are substances which eliminate OH^- in aqueous medium.



Brönsted-Lowry theory: Acids are substances which are able to eliminate H^+ (proton), bases are able to accept H^+ . Acids are then donors of protons, bases are their acceptors.



A special scale for determination of acidity rate of aqueous solutions is used, it's so called. *pH scale*.

The pH of aqueous solutions is defined as the negative decadic logarithm of equilibrium amount-of-substance concentration of oxonium cations H_3O^+ :

$$pH = -\log [H_3O^+]$$

The pH takes values from 0 to 14 for common aqueous solutions.

Acid solution : $pH < 7$

Neutral solution: $pH = 7$

Basic solution: $pH > 7$

It is possible to diagnose the pH value either visually (universal pH paper, acidobasic indicators) or by means of apparatus (pH – meters).

TASK NO. 1 ACIDOBASIC INDICATORS

Find out the colouring of common acidobasic indicators in aqueous solutions of HCl, NaCl and NaOH.

■ **CHEMICALS:** HCl ($c = 1\text{mol/l}$), NaCl ($c = 1\text{mol/l}$), NaOH ($c = 0,5\text{ mol/l}$), phenolphthalein, methyl orange, methyl red, congo red, bromophenol red, malachite green, methyl blue, litmus, bromothymol blue

■ **AIDS:** test tubes, dropper, pipette

■ **PROCEDURE:** Pour about 1 ml of appropriate solution into the test tube. Add a few drops of indicator. Shake and write down the resultant colour into the prepared table.

Indicator	Solution of HCl	Solution of NaCl	Solution of NaOH
phenolphthalein			
methyl orange			
methyl red			
congo red			
malachite green			
methyl blue			
litmus			
bromothymol blue			

complete the table.

TASK No. 2 pH OF SOLUTIONS

Find out the pH of following solutions :

HCl, H₂SO₄, CH₃COOH, NaOH, NH₃, Ba(OH)₂, NaCl, NH₄Cl, BaCl₂, (NH₄)₂CO₃.

- **CHEMICALS:** HCl (c = 1 mol/l), H₂SO₄ (c = 1 mol/l), CH₃COOH (c = 1 mol/l), NaOH (c = 0,5 mol/l), NH₃ 25%, Ba(OH)₂ saturated solution, NaCl 5%, NH₄Cl 10%, BaCl₂ 5%, (NH₄)₂CO₃ 10%
- **AIDS:** universal pH papers, rod, manual pH- meter
- **PROCEDURE:** Apply by the rod a drop of the examined solution on pH paper. Compare the colouring of the paper with the appropriate colour on the scale. Use also manual pH-meter to determinate the pH value of the solutions. Write down in the table.

Solution	pH - paper	Colour	pH – pH-meter
HCl 1 mol/l			
H ₂ SO ₄ 1 mol/l			
CH ₃ COOH 1 mol/l			
NaOH 0,5 mol/l			
NH ₃ 25% solution			
Ba(OH) ₂ sat. solut.			
NaCl 5% solution			
NH ₄ Cl 10%			
BaCl ₂ 5% solution			
(NH ₄) ₂ CO ₃ 10%			

- **CONCLUSION:** Complete the table. Compare the pH found out by both pH paper and pH- meter.



STUDENT'S SHEET No.9

ACIDITY AND BASITY OF AQUEOUS SOLUTIONS

1. Vocabulary:

Match the Czech names with their English equivalents:

acidity	konjugovaný pár	1....
pH scale	příjemce	2....
eliminate	rovnovážný	3....
colouring	vodný roztok	4....
indicator	pH stupnice	5....
acceptor	kyselost	6....
basity	zabarvení	7....
aqueous solution	indikátor	8....
equilibrium	zásaditost	9....
conjugated pair	odštěpovat se	10...

2. Complete the colour(s) for the following chemicals:

methyl

malachite

congo

bromothymol

bromophenol

3. Translate words from the text into Czech:

aqueous medium

amount-of-substance concentration

decadic logarithm

appropriate solution

acid solution

appropriate value of pH

to diagnose visually

find out

by the means of

resultant colour



4. Answer the following questions:

1. What aids do you need if you want to diagnose the pH value visually?

.....

2. What special aids do you need for task one?

.....

3. Which theory says that acids are donors of protons and bases are their acceptors?

.....

4. What is the pH scale used for?

.....

5. What should be the pH value for acid solution?

.....

5. Choose the correct spelling of the words bellow:

- a)pH metr
- b)Ph meter
- c)pH metre
- d)pH – meter

- a)aqueous solution
- b)aqueros solution
- c)aqueous solutian
- d)acqueros solotiom

- a)substence concentration
- b)substancy concentratiom
- c)substance concentration
- d)substance koncentration

- a)oxonion cations
- b)oxonion cationts
- c)oxoniont cationts
- d)oxonio cations

6. Complete the missing letters of the verbs:

e _ m i a _ _
d f _ _ e
_ i a _ o s _
c _ p _ r e
f _ n _ o _ _

d t _ _ m n _ _ _
w i _ _ d w _
c m p _ t _