



evropský  
sociální  
fond v ČR



EVROPSKÁ UNIE



MINISTERSTVO ŠKOLSTVÍ,  
MLÁDEŽE A TĚLOVÝCHOVY



OP Vzdělávání  
pro konkurenceschopnost

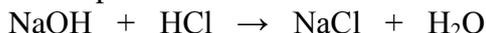


INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

## LABORATORY WORK NO. 10

# ACIDITY AND BASITY OF AQUEOUS SOLUTIONS

- **PRINCIPLE:** Mutual reaction of acid with base (alkali) is called neutralization. Water and salt of given acid are the products of the reaction.



Neutralization reaction belongs to the group of protolytic reactions.



Neutralization is the reaction of oxonium cations and hydroxide anions during formation of water molecules. Basic equation of neutralization can be described in ion form:



### TASK NO.1: PREPARATION OF SODIUM CHLORIDE BY NEUTRALIZATION OF WATER SOLUTIONS OF SODIUM HYDROXIDE BY HYDROCHLORIDE ACID

- **CHEMICALS:** solid NaOH, HCl 35%, distilled H<sub>2</sub>O, phenolphthalein
- **AIDS:** scales, spoon, weighing boat, volumetric flask 100 ml, pipette, graduated cylinder 50 ml, beaker 50 ml, stirring rod, titration flask, burette 50ml, evaporating dish
- **PROCEDURE:**  
**A. Preparation of 100 ml solution of NaOH in concentration  $c = 1 \text{ mol/l}$**   
Weigh out the calculated weight of NaOH on scales. Dissolve the measured quantity in distilled water in the beaker. Subsequently pour the solution into the 100 ml volumetric flask and add distilled water up to the index line.
- **CALCULATIONS :** 
$$m_{\text{NaOH}} = c_{\text{NaOH}} \cdot M_{\text{NaOH}} \cdot V_{\text{R}}$$
  
where  $m_{\text{NaOH}}$  is the weight of NaOH (g),  $c_{\text{NaOH}}$  is the molar concentration of NaOH (g/mol),  $M_{\text{NaOH}}$  is the molecular weight on NaOH (mol/l) and  $V_{\text{R}}$  is the volume of the solution (l).
- **SAFETY:** Sodium hydroxide belongs among caustic substances.

### **B. Preparation of 100ml solution of HCL in concentration $c=1\text{mol/l}$**

Fill in the 100ml volumetric flask with distilled water approximately into the half of its capacity. The teacher will carefully add the calculated quantity of concentrated hydrochloride acid from the graduated cylinder and you will add distilled water up to the index line. Plug and stir.



■ **CALCULATIONS:**

$$m_{\text{HCl}} = c_{\text{HCl}} \cdot M_{\text{HCl}} \cdot V_{\text{R}} ,$$

where  $m_{\text{HCl}}$  is the weight of HCl (g),  $c_{\text{HCl}}$  is the substance concentration of HCl (mol/l),  $M_{\text{HCl}}$  is the molecular weight of HCl (g/mol) and  $V_{\text{R}}$  is the volume of the solution (l).

$$m_{\text{HCl}} = 100\% \text{ HCl, we have } 35\% \text{ HCl}$$

↑ x g .....	100% HCl
y g.....	35% HCl ↓
y = .....	g 35% HCl

$$V = m / \rho ,$$

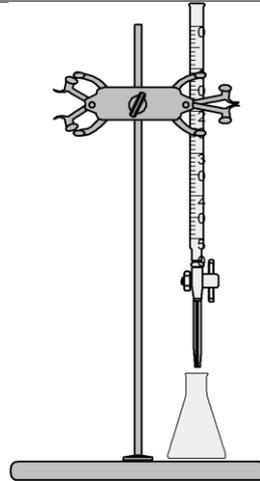
where V is the volume of acid (ml), m is the weight of 35% HC and  $\rho$  is the density of 35% HCl (1,18 g/ml).

**C. Neutralization of NaOH by HCl acid by means of titration**

- **PROCEDURE:** We pipette 25ml of the prepared solution of NaOH ( $c = 1\text{mol/l}$ ) and about 3 drops of phenolphthamin into the titration flask. We titrate from the burette with the prepared solution of HCl ( $c=1\text{mol/l}$ ) up to discolouration of the titrated solution. We write down the consumption of HCl ( $V_{\text{HCl}}$ ) .

■ **CALCULATIONS / ECQUATION :**





Titration

**D. Crystallization of prepared solution of NaCl**

- **PROCEDURE:** Weight the empty, clean evaporating dish . Pour the prepared solution of NaCl from the titration flask into the evaporating dish, let water evaporate partially and let the saturated solution crystallize freely. The real yield is the correct result (RealY).

- **CALCULATIONS:**  $m_{\text{NaOH}} = c_{\text{HCl}} \cdot M_{\text{NaOH}} \cdot V_{\text{HCl}} = 1.39,99 \cdot V_{\text{HCl}} = \dots\dots \text{ g}$

where  $m_{\text{NaOH}}$ .is the weight of NaOH (g),  $M_{\text{NaOH}}$  is the molecular weight of NaOH (g/mol),  $c_{\text{HCl}}$  is the concentration of HCl (mol/l),  $V_{\text{HCl}}$  is the volume of the HCl solution (l).

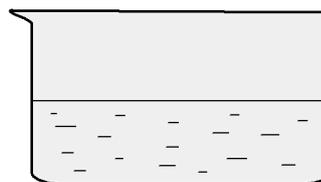
39,999 g NaOH.....58,443 g NaCl  
 g NaOH.....x g NaCl

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$$x = \dots\dots \text{ g NaCl} = \text{theoretical yield TY}$$

Calculate relative yield (RY):

$$\text{RelativeY} = \text{RealY} / \text{TY} \cdot 100 \quad (\%)$$



Evaporation



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■ CONCLUSION:

- a.) Write down how many grams of NaOH do you need for the preparation of 100ml of solution in concentration 1mol/l ?
- b.) Write down how many ml of 35% HCl do you need for the preparation of 100ml of solution in concentration 1mol/l?
- c.) Write down the consumption of HCl acid for the titration of NaOH ( $V_{\text{HCl}}$ )
- d.) Mention the theoretical, real and relative yield of NaCl (TY, ReaY, RY)



## STUDENT'S SHEET No. 10

### ACIDITY AND BASITY OF AQUEOUS SOLUTIONS

#### 1. Vocabulary:

Match the Czech words with their English equivalents:

1. váhy	A. graduated cylinder	1.....
2. navažovací lodička	B. evaporating dish	2.....
3. filtrační baňka	C. dissolve	3.....
4. byreta	D. solution	4.....
5. odpařovací miska	E. volumetric flask	5.....,
6. roztok	F. burette	6.....
7. neutralizace	G. weighing boat	7.....
8. odměrný válec	H. scales	8.....
9. rozpustit	I. filtration flask	9.....
10. odměrná baňka	J. neutralization	10.....

#### 2. Translate words from the text into Czech:

sodium hydroxide	.....
water solution	.....
weight	.....
overpour	.....
anion	.....
stirring rod	.....
calculation	.....
ion	.....
substance	.....
solid	.....
equation	.....

#### 3. Answer following questions according to the text:

a) What is the name for mutual reaction of acid with base(alkali)?

.....

b) What is the result of this reaction?

.....

c) Can you define the basic equation for neutralisation in ion form?

.....

d) What chemicals do you need for task 1?

.....

e) What is an evaporating dish used for?

.....



**4. Choose the correct spelling of the words bellow:**

- a) consomption
- b) consamption
- c) consumption
- d) comsumption

- a) volumetric flesk
- b) volumetric flask
- c) volumetrik flask
- d) volumetrick flask

- a) satureted solution
- b) saturated solution
- c) saturate solution
- d) seturated sulution

- a) beeker
- b) beacker
- c) beaker
- d) biker

**5. Complete the missing letters:**

\_i\_r\_a\_\_o\_n  
\_\_l\_u\_\_o\_  
w\_\_g\_h\_\_n\_\_b\_\_t  
c\_\_s\_t\_\_i\_s\_\_t\_\_n  
\_t\_\_r\_\_n\_\_r\_o\_\_  
\_a\_\_c\_\_a\_t\_\_o\_\_  
l\_\_b\_\_a\_\_o\_\_w\_\_r\_\_  
\_e\_n\_\_t\_\_

**6. Translate into Czech**

kyselina .....  
zásada .....  
míchat .....  
příprava .....  
výpočet .....  
pomůcka .....  
hmotnost (váha) .....  
výtěžek .....  
nasycený .....  
spotřeba .....