

Training module # WQ -07

How to measure pH

New Delhi, May 1999

CSMRS Building, 4th Floor, Olof Palme Marg, Hauz Khas,
New Delhi – 11 00 16 India
Tel: 68 61 681 / 84 Fax: (+ 91 11) 68 61 685
E-Mail: dhvdelft@del2.vsnl.net.in

DHV Consultants BV & DELFT HYDRAULICS

with
HALCROW, TAHAL, CES, ORG & JPS

Table of contents

	Page
1 Module context	2
2 Module profile	3
3 Session plan	4
4 Overhead/flipchart masters	5
5 Evaluation	14
6 Handouts	16
7 Additional handouts	20
8 Main text	21

1. Module context

This module covers a practical exercise on the procedure of pH measurement. To complete this module successfully, the participants must be familiar with the module on the *preparation of standard solutions* and understand the *concept of ion concentration (pH)*. These and other related modules are listed in the table below.

While designing a training course, the relationship between this module and the others, would be maintained by keeping them close together in the syllabus and place them in a logical sequence. The actual selection of the topics and the depth of training would, of course, depend on the training needs of the participants, i.e. their knowledge level and skills performance upon the start of the course.

No.	Module title	Code	Objectives
1	<i>Basic water quality concepts</i>	WQ -01	<ul style="list-style-type: none">• Discuss the common water quality parameters• List important water quality issues
2	<i>Basic chemistry concepts</i>	WQ -02	<ul style="list-style-type: none">• Convert units from one to another• Discuss the basic concepts of quantitative chemistry• Report analytical results with the correct number of significant digits.
3	<i>How to prepare standard solutions</i>	WQ -04	<ul style="list-style-type: none">• Select different types of glassware• Use an analytical balance and maintain it.• Prepare standard solutions.
4	<i>Understanding the hydrogen ion concentration (pH)</i>	WQ -06	<ul style="list-style-type: none">• Discuss about the concept of pH• Calculate pH

2. Module profile

Title	:	How to measure the pH of a water sample
Target group	:	HIS function(s): Q1, Q2, Q3, Q5
Duration	:	One session of 150 min
Objectives	:	After the training the participants will be able to: <ul style="list-style-type: none">• Measure the pH of a water sample• Observe the effect of dissolved gases on pH
Key concepts	:	<ul style="list-style-type: none">• pH meter & electrodes• Precautions
Training methods	:	Explanations, demonstration of equipment and practical exercises
Training tools required	:	<ul style="list-style-type: none">• pH meter, with electrodes and operation manual• two bottles of carbonated water• flip chart or writing board• venue: basic chemical laboratory
Handouts	:	As provided in this module, including standard analytical procedure
Further reading and references	:	<ul style="list-style-type: none">• Standard Methods: for the Examination of Water and Wastewater, APHA, AWWA, WEF/1995. APHA Publication• Chemistry for Environmental Engineering, C.N. Sawyer, P.L. McCarty and C.F. Parkin. McGraw-Hill, 1994

3. Session plan

No	Activities	Time	Tools
1	<p>Preparations</p> <ol style="list-style-type: none"> 1. Make sufficient copies of the relevant portion of the user's manual for the pH meter 2. Check the pH meter(s) for demonstration and exercises 3. Prepare samples for exercises: <ul style="list-style-type: none"> • Sample A: carbonated drink freshly opened • Sample B: carbonated drink opened and stored in a beaker for an hour • Sample C: tap water • Sample D: diluted portion of buffer to be prepared by the participant 4. Obtain chemicals for preparation of buffers as detailed in SAP for pH measurement. 		
2	<p>Introduction:</p> <ul style="list-style-type: none"> • Ask the participants to state the importance of pH • Explain/summarize the importance • Enumerate methods to determine pH 	10 min	
3	<p>The pH meter</p> <ul style="list-style-type: none"> • Ask participants to read SAP for pH measurement and users manual for the available pH meter • Demonstrate the operation of a pH meter • Explain type of electrodes and temperature compensation arrangement 	20 min	
4	<p>Preparation of buffer solutions</p> <ul style="list-style-type: none"> • Explain the steps involved 	10 min	
5.	<p>Practice</p> <p>Divide the class in working groups of two persons each</p> <ul style="list-style-type: none"> • Describe the exercise • Let all participants prepare the buffer. • Measure pH of the samples, the buffer and diluted buffer. 	60 min	
6	<p>Wrap up</p> <ul style="list-style-type: none"> • Ask participants to write their report • Discuss the effect of dilution and storage on pH value • Summarize main points of pH measurement • Clarify doubts 	20 min	

4. Overhead/flipchart masters

OHS format guidelines

Type of text	Style	Setting
Headings:	OHS-Title	Arial 30-36, Bold with bottom border line (not: underline)
Text:	OHS-lev1 OHS-lev2	Arial 26, Arial 24, with indent maximum two levels only
Case:		Sentence case. Avoid full text in UPPERCASE.
Italics:		Use occasionally and in a consistent way
Listings:	OHS-lev1 OHS-lev1-Numbered	Big bullets. Numbers for definite series of steps. Avoid roman numbers and letters.
Colours:		None, as these get lost in photocopying and some colours do not reproduce at all.
Formulas/ Equations	OHS-Equation	Use of a table will ease alignment over more lines (rows and columns) Use equation editor for advanced formatting only

pH determination: methods

By

- pH meter
- indicators

pH meter: familiarising

- Read manufacturer's instructions
- Note type of electrodes
- Verify built-in temperature compensation

pH measurement: Standard Analytical Procedure (SAP)

See your handouts

pH measurement procedure: calibration

See SAP procedure steps a to e

Recording measurements

Sample	Sample source	pH value
Diluted Buffer		
Sample A		
Sample B		
Sample C		
Sample D		

Practice

- Individually or in pairs
 1. Prepare buffers of known pH
 2. Measure pH of various samples
 3. Study change of pH in stored samples
 4. Study effect of dilution in buffers

Report

- Effect of storage on pH
- pH of surface water and ground water
- Properties of buffer

5. Evaluation

6. Handouts

pH determination: methods

By

- pH meter
- indicators

pH meter: familiarising

- Read manufacturer's instructions
- Note type of electrodes
- Verify built-in temperature compensation

Buffer solution: different pH values

0.05M potassium hydrogen phthalate	pH = 4.00
0.025M potassium di-hydrogen phosphate + 0.025M di-sodium hydrogen phosphate	pH = 6.86
0.01M sodium borate decahydrate	pH = 9.18

- *Store all buffer solutions in polyethylene bottles.*
- *Replace buffer solutions every 4 weeks.*

Recording measurements

Sample	Sample source	pH value
Buffer solution		
Diluted Buffer		
Sample A		
Sample B		
Sample C		
Sample D		

Practice

- Individually or in pairs
1. Prepare buffers of known pH
 2. Measure pH of various samples
 3. Study change of pH in stored samples
 4. Study effect of dilution in buffers

Report

- Effect of storage on pH
- pH of surface water and groundwater
- properties of buffer

Add copy of Main text in chapter 8, for all participants.

7. Additional handouts

These handouts are distributed during delivery and contain test questions, answers to questions, special worksheets, optional information, and other matters you would not like to be seen in the regular handouts.

It is a good practice to pre-punch these additional handouts, so the participants can easily insert them in the main handout folder.

8. Main text

	Page
1. Aim	1
2. Method	1
3. Observations	1
4. Report	1
SAP for pH	2

How to measure the pH of a water sample

1. Aim

- 1.To prepare a buffer of known pH
- 2.To determine the pH of tap water
- 3.To study the effect of storage on the pH of a freshsample of water
- 4.To study the effect of dilution of a buffer on its pH

2. Method

- a. Prepare any one of the buffer solutions listed in the Standard Analytical Procedure for pH.
- b. Dilute 20 mL of the buffer prepared by you with 20 mL distilled water.
- c. Familiarise yourself with the operation of the pH meter available in the laboratory. The instructor will demonstrate the operation first. Note the type of electrodes and if the instrument has built in temperature compensation adjustment.
- d. Measure the pH of the buffer solution prepared by you and its diluted solution, and samples A, B, C and D according to the Standard Analytical Procedure for pH measurement.
- e. Find out from the instructor the sources of various samples.

3. Observations

<i>Sample</i>	<i>Source of sample</i>	<i>pH value</i>
Buffer		
Diluted buffer		
Sample A		
Sample B		
Sample C		
Sample D		

4. Report

Write your report in which the following aspects should be addressed:

Effect of storage on pH of samples containing dissolved gases, pH of ground water as compared to surface water, properties of buffer solutions.

