Module
W03

Wet-lab Foundational Course

Introduction to Fundamental Laboratory Skills and Calculations

NGS Academy for the Africa CDC

Module
W03

Introduction to Fundamental Laboratory Skills and Calculations

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Module last updated:
December 2024

Number of sessions	4–5
Total learning time	15–20 hours
Target audience	Wet laboratory personnel (i.e., scientists, laboratory technicians, etc.)
Format	Lectures, videos, practicals/tutorials
Level of the module	Introductory

Contributors

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Module description

This module provides a basic introduction to essential laboratory methods and instrumentation, equipping participants with the necessary skills to conduct basic laboratory procedures and apply essential calculations critical for next-generation sequencing (NGS) applications and pathogen genomic surveillance workflows. Through a combination of theoretical instruction and hands-on practice, participants will gain practical experience with modern analytical instruments and develop technical competencies in solution preparation, measurement techniques, pipetting, instrument calibration, and maintenance, with particular emphasis on nucleic acid analysis and quality control procedures essential for successful NGS library preparation. The proper execution of these essential lab techniques is critical for successful experiments and the generation of high-quality sequencing data used in genomic surveillance programs. In this module, participants are also introduced to the following topics and/or concepts:

- Calculating molar and percentage concentrations
- Dilutions and dilution factors
- Preparing dilutions from stock solutions
- Preparing a serial dilution
- Preparation of solutions and reagents
- Weighing and measurement techniques
- Appropriate pipetting techniques
- Pipette calibration and maintenance
- How to use a pH meter

Module learning outcomes

On completion of this module, the participants will have a basic knowledge of, or will be able to:
- Apply essential mathematical concepts and calculate molar and percentage concentrations of solutions
- Explain the importance of dilutions and dilution factors in various laboratory procedures and experiments
- Demonstrate the ability to perform accurate dilutions
- Prepare accurate dilutions from stock solutions for use in experiments or analyses
- Apply the necessary techniques to perform a serial dilution
- Demonstrate the ability to safely and effectively prepare laboratory solutions and reagents
- Demonstrate competence in laboratory weighing and measurement techniques
- Master pipetting techniques to ensure accurate and consistent liquid handling
- Explain the significance of pipette calibration and maintenance
- Demonstrate the skills to correctly operate and interpret results from a pH meter

Module assessments

Module practical: Practical assessment available
Module quiz: Assessment questions available on the ASLM platform

Module resources

- Academia | A Laboratory Manual for the Preparation of Chemical Reagents, Solutions and Special Indicators
- Bio Technology | Preparation of Buffers and Solutions
- University of Glasgow | Molecular Biology Explained
  - Calculating Molar Concentrations
  - Calculating % Concentrations
  - Dilutions from stock solutions
- Biologyexams4u | Video: Dilution and Dilution Factor in Microbiology - How to Calculate Dilution Factor in Serial Dilution?
- Henrik's Lab | How to prepare a Serial Dilution
- Mettler Toledo Videos | Laboratory Solutions
  - Lab Weighing Tutorials, Tips and Tricks
  - Weighing in the laboratory
  - Lab Education and Training
- Bio-Rad Laboratories Video - Using an Electronic Balance
- Mettler Toledo Videos | Good Pipetting Techniques Tutorials
- Addgene Video - Multichannel Pipetting Technique
- Eppendorf | Video: How to pipette correctly – a short step-by-step introduction into proper pipetting

- [Eppendorf | Videos - Pipetting Tutorials](#)
- [Arizona Department of Health Services | Video - Pipette Calibration and Cleaning](#)
- [Bio-Rad Laboratories | Video - Using a pH Meter](#)

📋 References

- OpenAI. (2024). Gemini response on learning objectives for an introduction to fundamental laboratory skills and calculations module. Retrieved July 29, 2024, from https://gemini.google.com/
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