Scope and Sequence



BioTechBuilder LAB SKILLS

TOPIC: BUILDING A SOLID FOUNDATION
TOPIC: MAKING SOLUTIONS
TOPIC: GROWING CELLS

This module introduces students to fundamental concepts, math, and techniques needed to operate in any laboratory environment.



TOPIC: BUILDING A SOLID FOUNDATION

Students build a solid foundation in core laboratory skills by mastering laboratory safety, chemical handling, metric measurements, and laboratory documentation.

LESSON	LAB ACTIVITY	ADDITIONAL RESOURCES
1. Safety First!	Lab Safety Equipment Scavenger Hunt	Slides, Wrap Up, Homework
Students are introduced to key safety equipment in the lab through a scavenger hunt that culminates in creation of a map of their lab space.		
2. Handling Hazards	Case Study: Responding to a Chemical Spill	Slides, Pre-lab Quiz
Students learn how to assess and manage hazards posed by chemicals used in the lab and show their understanding through a role playing activity.		
3. Measuring in Metric	Weighing Solids	Slides, Pre- and Post-lab Quiz
Students learn to collect and record accurate measurements with an electronic balance by weighing solids using different metric units.		
4. Keeping a Lab Notebook	Weighing Solids for Solutions	Slides, Pre-lab Quiz, Rubric, Homework
Students begin to take ownership of their experiments by creating their first protocol and lab notebook entry as they weigh solid chemicals.		
5. Lab Practical	Assessment	Slides, Answer Key
Students demonstrate their understanding of lab safety, safe handling of hazardous chemicals, and keeping of a lab notebook.		

TOPIC: MAKING SOLUTIONS

Students learn the math and procedures used to prepare and dilute solutions, measure and adjust pH, and use heat and aseptic techniques where needed.

LESSON	LAB ACTIVITY	ADDITIONAL RESOURCES
1. Getting to Know Glassware	Glassware Scavenger Hunt	Slides, Wrap Up
Students become familiar with the glassware used to make solutions, as well as how to estimate and read volumes.		
2. Making Stock Solutions	Prepare a Kool-Aid® Stock Solution	Slides, Pre-lab Quiz, Wrap Up, Homework
Students practice molarity calculations and prepare a single-solute stock solution.		
3. Diluting Solutions	Serial Dilutions	Slides, Pre-lab Quiz, Wrap Up, Homework
Students are introduced to serological pipettes and how to prepare serial dilutions and notebook self evaluations.		
4. Micropipetting	Micropipetting Practice	Slides, Pre-lab Quiz, Wrap Up
Students are introduced to micropipettes and use them to practice transferring liquids.		
5. Lab Practical I	Assessment	Slides, Rubric
Students exchange mystery solutions and use spectrophotometry to prepare a standard curve and measure the mystery solution concentration.		
6. Making Multi-Solute Solutions	Making 1X PBS	Slides, Pre-lab Quiz, Wrap Up, Rubric
Students review solution calculations and prepare solutions with multiple solutes.		
7. Perfecting pH	Measuring and adjusting pH of 1XPBS	Slides, Pre-lab Quiz, Optional Activity, Homework
Students learn how to measure and adjust the pH of a solution.		
8. Saturating Solutions	Making a Supersaturated Solution	Slides, Pre-lab Quiz, Optional Activity
Students learn how to prepare a saturated solution while practicing %w/v and %v/v calculations and safe operation of a hot plate.		
9. Preventing Bacterial Contamination	Pipetting Using Aseptic Technique	Slides, Rubric, Optional Activity, Homework
Students learn about and practice aseptic technique while pipetting solutions.		
10. Lab Practical II	Assessment	Slides, Set Up, Rubric
Students demonstrate mastery by writing their own lab protocol and preparing solutions.		

TOPIC: GROWING CELLS

This topic introduces students to methods for culturing bacteria on solid and liquid media and the use of a spectrophotometer and plating to measure viability.

LESSON	LAB ACTIVITY	ADDITIONAL RESOURCES
1. Pouring Plates	Pouring Plates	Slides
Students pour agar plates while learning the fundamentals of bacterial cell structure and culturing methods.		
2. Streaking for Single Colonies	Streaking for Colony Isolation	Slides, Pre-lab Quiz, Rubric
Students streak for single colonies from a bacterial slant while learning about phases of a growth curve.		
3. Culturing a Colony	Preparing Overnight Cultures	Slides, Pre-lab Quiz, Optional Activity
Students learn about selective media, then use aseptic technique to prepare liquid selective media and transfer a single colony into the media for growth overnight.		
4. Measuring Cell Concentration	OD600 vs Counting Colonies	Slides, Pre-lab Quiz, Homework
Students measure OD600 of their overnight culture and prepare a serial dilution of for viability assay plating.		
5. Lab Practical part 1	Assessment	Slides, Rubric
Students learn how cell concentration and viable cells differ, then count the colonies on their plates to calculate the viability of their bacterial cells. Each student repeats the viability assay experiment for skills assessment.		
6. Lab Practical part 2	Assessment	Slides
Students repeat the analysis and calculation of the bacterial cell viability using their plates from Lab Practical part I, and submit their lab notebook for assessment.		