

Biotechnology Laboratory Skills

Course Outcome Summary

Course Information

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| Organization | Madison Area Technical College |
| Developers | Lisa Seidman |
| Development Date | 12/1/1994 |
| Revised By | Lisa Seidman |
| Revised Date | 4/24/2002 |
| Course Number | 10-007-103 |
| Instructional Level | Two-Year Technical Diploma |
| Instructional Area | Biotechnology |
| Division | Agriscience, Apprenticeship, Technical, Industrial |
| Department | Biotechnology Laboratory Technician |
| Potential Hours of Instruction | 126 |
| Total Credits | 3 |

Description

Covers basic concepts and techniques necessary to work effectively in a biotechnology lab. The importance of quality regulations and standards and the role of the technician in producing quality results is emphasized. Laboratory math is introduced and applied. Students learn basic techniques including: measuring, weighing, mixing solutions, following and writing procedures, keeping records, making observations, and using instrument manuals and catalogues. Principles of metrology (measurement) are introduced and students practice using, calibrating, and verifying the performance of instruments.

Types of Instruction

| Instruction Type | Contact Hours | Credits |
|---------------------------------------|---------------|---------|
| A. Classroom Presentation | 18 | 3 |
| B. On Campus Laboratory and Clinicals | 108 | |

Textbooks

Bender. *Chemical Instrumentation*.

Ambrose and Ambrose. *A Handbook of Biological Investigation*.

Seidman. *Lab manual*.

Assorted authors. *Resource package with assorted articles*.

Seidman. *Introduction to Basic Lab Methods and Instrumentation for Biotechnology Laboratory Technicians*.

Learner Supplies

lab coat.

calculator.

safety glasses.

locker.

bound lab notebook.

Prerequisites

Corequisite: Chemistry 1 (10-806-111)

OR consent of instructor

Competencies

A. Apply knowledge of science

Competence will be demonstrated:

1. through the completion of laboratory assignments.
2. through the completion of written documentation and explanation of laboratory work.
3. through the completion of written explanations of laboratory data.
4. through completion of an oral report to class.

Criteria - Performance will be satisfactory when:

1. learner identifies variables, hypothesis and procedure correctly in a simulated experiment.
2. learner designs a simple experiment to test a hypothesis.
3. learner establishes an hypothesis, theory, variables, experiment, protocol, technology, data, measurement and fact.
4. learner examines theories
5. learner examines variables
6. learner examines experiments
7. learner examines protocol
8. learner examines technology
9. learner examines data
10. learner examines measurements
11. learner examines facts

B. Use basic arithmetic

Competence will be demonstrated:

1. through the completion of written assignments
2. through written examinations

Criteria - Performance will be satisfactory when:

1. learner explains independent and dependent variables
2. learner graphs simulated data
3. learner interprets graph
4. learner adds using scientific notation
5. learner subtracts using scientific notation
6. learner multiplies using scientific notation
7. learner divides using scientific notation
8. learner converts scientific notation to regular form and vice versa
9. learner states log of 10, 100, 1,000 and 10,000
10. learner solves word problems with ratios and proportions
11. learner solves conversion problems with mass and volume units.
12. learner uses percents

C. Examine measurements as an introduction to quality control

Competence will be demonstrated:

1. through the completion of laboratory activities.
2. through the completion of written documentation and explanation of laboratory work.
3. through the completion of written explanations of laboratory data.
4. by completing proficiency examinations.

5. by completing standard operating procedures report

Criteria - Performance will be satisfactory when:

1. learner performs a series of measurements in the lab
2. learner properly calibrates instruments
3. learner calculates the standard deviation of the measurements and their standard error
4. learner uses vocabulary terms appropriately
5. learner follows the standards operating procedures in the lab
6. standard operating procedures report includes calibration instructions
7. standard operating procedures report includes maintenance instructions
8. standard operating procedures report includes documentation instructions
9. standard operating procedures report includes steps to perform

D. Keep records to write lab reports following lab protocols

Competence will be demonstrated:

1. through the completion of laboratory activities
2. through the completion of written explanations of laboratory data
3. through the completion of written documentation and explanation of laboratory work
4. by submitting laboratory report

Criteria - Performance will be satisfactory when:

1. learner applies principles of documentation
2. learner writes simple protocol
3. learner records observations in lab notebook
4. laboratory report includes all sections
5. laboratory report is written in standard format for scientific reports
6. laboratory report is word processed
7. laboratory report includes graphs
8. laboratory report includes figures or tables

E. Examine electricity

Competence will be demonstrated:

1. through the completion of written assignments
2. through written examinations

Criteria - Performance will be satisfactory when:

1. learner uses electrical terms (voltage, current, resistance, alternating and direct current)
2. learner solves problems using $V = IR$ equation
3. learner draws a complete circuit
4. learner diagrams a short circuit.
5. learner summarizes safety rules for working with electricity

F. Examine weighing and measuring

Competence will be demonstrated:

1. through the completion of laboratory activities
2. by completing proficiency examinations
3. through the completion of written documentation and explanation of laboratory work

Criteria - Performance will be satisfactory when:

1. learner accurately measures three volumes
2. learner uses correct measuring instrument
3. learner checks calibration of pipettor
4. learner accurately weighs three solids
5. learner uses correct balance
6. learner properly calibrates and operates balances

G. Prepare solutions**Competence will be demonstrated:**

1. through the completion of written assignments
2. through written examinations
3. through the completion of laboratory activities
4. by competing proficiency examinations

Criteria - Performance will be satisfactory when:

1. learner computes components of given percentage solutions
2. learner computes components of given molarity solutions
3. learner computes components of given ppm, ppb solutions
4. learner computes components of stock solutions
5. solutions have correct conductivity
6. the solution's volume is correct
7. the solution's pH is correct

H. Analyze pH**Competence will be demonstrated:**

1. through the completion of written assignments
2. through written examinations
3. through the completion of laboratory activities
4. through the completion of written documentation and explanation of laboratory work

Criteria - Performance will be satisfactory when:

1. learner examines uses of pH measurements
2. learner diagrams an electrode
3. learner finds the correct pH solution
4. learner troubleshoots a problem
5. learner demonstrates effect of temperature and proper operation of meters and use of electrodes
6. learner prepares solutions using pH meters
7. report includes calculations
8. report includes tables with data
9. report includes graph showing the effect of pH on temperature

I. Examine spectroscopy**Competence will be demonstrated:**

1. through the completion of written assignments.
2. through written examinations.
3. through the completion of laboratory activities.
4. through the completion of written documentation and explanation of laboratory work.
5. through the completion of written explanations of laboratory data.
6. by completing proficiency examinations.

Criteria - Performance will be satisfactory when:

1. learner explains Beer's Law
2. learner solves problems using Beer's Law
3. learner prepares standard curve in lab
4. learner performs colorimetric assays
5. learner performs UV spectrophotometry
6. learner explains fluorescence and atomic absorption spectroscopy
7. learner determines DNA concentration
8. learner uses microprocessor programs to perform spectrophotometry

J. Use a centrifuge

Competence will be demonstrated:

1. through the completion of written assignments
2. through written examinations
3. through the completion of laboratory activities
4. through the completion of written documentation and explanation of laboratory work
5. through the completion of written explanations of laboratory data

Criteria - Performance will be satisfactory when:

1. learner explains centrifugal force, differential centrifugation, and density gradient centrifugation
2. learner obtains samples using a Sorval high speed centrifuge
3. learner obtains samples using a Sorvall ultracentrifuge
4. learner separates materials by gradient centrifugation
5. learner separates cell components by centrifugation

K. Analyze filtration**Competence will be demonstrated:**

1. through the completion of written assignments.
2. through written examinations.
3. through the completion of laboratory activities.
4. through the completion of written documentation and explanation of laboratory work.
5. through the completion of written explanations of laboratory data.
- 6.

Criteria - Performance will be satisfactory when:

1. learner uses filtration vocabulary words (macrofiltration, microfiltration, ultrafiltration, depth filter, membrane filter and tangential filtration)
2. learner filters a sterilized solution
3. learner filters solutions using depth and membrane filters
4. learner chooses proper filter for an application.
5. learner summarizes ultrafiltration

L. Analyze microscopy**Competence will be demonstrated:**

1. through the completion of written assignments
2. through written examinations
3. by completing proficiency examinations

Criteria - Performance will be satisfactory when:

1. learner examines parts of a microscope
2. learner differentiates between light and electron microscopes
3. learner identifies plant cell types
4. learner identifies animal cell types
5. learner explains dark field, polarized microscopy
6. learner explains scanning electron microscopy
7. learner explains high voltage electron microscopy
8. learner explains analytical microscopy
9. learner explains tunneling microscopy

M. Analyze cryopreservation**Competence will be demonstrated:**

1. through the completion of written assignments.
2. through written examinations.

Criteria - Performance will be satisfactory when:

1. learner summarizes cryopreservation correctly according to article in resource package.

2. learner summarizes types of tubing.
3. learner distinguishes between types of oil and waxes.
4. learner explains which types of oil or wax to use for a given application.

N. Use word processing software

Competence will be demonstrated:

1. through the completion of written assignments.
2. through written examinations.

Criteria - Performance will be satisfactory when:

1. learner summarizes ASCII
2. learner summarizes program
3. learner summarizes hardware
4. learner summarizes software
5. learner summarizes disk
6. learner summarizes word processing
7. learner summarizes BIT
8. learner summarizes BYTE
9. learner summarizes file
10. learner types page using word processing program