Biotechnology I Syllabus

### Instructors

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### Course Philosophy

We believe learning is best done in a variety of ways: reading and writing, seeing, and doing. In this shop, you will gain a basic understanding of the field of biotechnology and develop quite a few skills. Besides the technical skills, you will be challenged to develop skills necessary for every scientist: problem solving, data analysis, experimental design, accurate recording, detailed observation, and data interpretation. One of the many goals we have for you is to become a more critical and logical thinker. Each shop week will be a different unit based on a theme. There will be similar assignments in each unit, such as quizzes, discussion-based lectures, problem sets, independent research, student lead lectures and labs with reports. The field of biotechnology is constantly changing but with this program you will have the basic skills and knowledge to be very marketable. On top of that, we will help you develop your reading, writing, and vocabulary skills to help with the MCAS ELA test. Math is a major part of science so you will also develop your math skills to help your MCAS Math scores.

### Course Description

Biotechnology Freshman Shop is a 45 day, full day course. You will learn safety in the lab, orientation to the biotechnology fields, career exploration, basic lab skills development, basic microscopy, solution preparation, and microbiology. You will learn how to create and execute an emergency plan for the biotechnology lab, comply with state and federal regulations, and respond to basic medical emergencies with First Aid and CPR training. You will explore career possibilities within the field of biotechnology in this course through lecture, research, field trips to lab facilities, and guest speakers from the field. You will develop basic skills in the use of laboratory equipment along with calibration and maintenance protocols. Microscopy techniques will be explored to deepen an understanding of cell theory. Proficiency in the preparation of solutions will be attained while examining the related theories of biochemistry. You will learn about micro-organisms such as bacteria and viruses while developing the skills to grow, maintain, and identify colonies of bacteria. Technical terminology and technical writing will be taught and used to develop your professional rapport. You will also be expected to be able to present material and lead classroom discussions in a professional manner.

### Organization

For this shop, you will need to bring with you the following materials **every day**:

1. Lab coat
2. Safety goggles
3. Clear metric ruler
4. Scissors
5. Sharpies (black, industrial strength, fine-tipped)
6. Lab notebook (bound notebook with graph paper)
7. Headphones that can be inserted into laptops
8. Two 3-ring binders with dividers, one 1”, one 2”
9. Colored pencils
10. Black or blue pens
11. Highlighter
12. Eraser
13. #2 pencils
14. All textbooks and lab manuals, covered and in good condition

You will keep your class materials in the 2”binder. Please have a tab for general course information, a tab for each unit (1-8), and a tab for review.

The 1” binder will be used for your portfolio. This will be submitted at the end of the year as a mark of your progress. It will be divided into the following sections: SOP, lab reports, emergency plan, certifications, and maintenance checklist. Put your lab notebook inside of your portfolio. You will add to your portfolio over the four years in the program so when you leave, you will have a wonderful document of all of the work you did!

### Shop Rules and Expectations

We expect you to:

1. Come to shop every day, on time, and ready to work for the entire time. This includes wearing appropriate attire and bringing all materials required. Please do not leave materials in your locker that you require for shop. They don’t help out anyone over there.
2. Follow all directions, both spoken and written. From us.
3. Give us your best effort all day, every day. We will do the same for you.
4. Follow all safety rules. They, ya know, keep you safe.
5. Use language that is respectful to yourself and others. Bullying and harassment will be taken seriously and immediately reported to the disciplinarian. Think about your grandma or mother or grandpa or father or someone else you greatly respect and admire. Would you say what you are about to say in front of her?
6. Conduct yourself as a professional, meaning no playing around or distracting behavior. This equipment is pretty nice stuff and as the saying goes, you break it, you buy it.
7. You are expected to complete all assignments in the time frame given, pay attention during lectures and instructions, and be a participating member of any lab group. Sleeping and other forms of non-participation are not acceptable. No one likes dead weight.

Consequences:

1. For the first incident, we will subtly remind you of our expectations. This step may be bypassed if the behavior is considered extreme.
2. The next incident, we will have a private discussion with you after school. Some may call this detention. We call it a discussion.
3. If the issue still occurs, we will discuss the situation with your parent(s)/guardian(s) and the disciplinarian. This is not fun for anyone. Let’s not go here, okay?

In return, we will:

1. Treat you with respect and understanding.
2. Prepare interesting, hands-on activities that will help you learn best.
3. Keep you safe.
4. Provide feedback on all work in a timely manner.
5. Conduct ourselves as professionals.
6. Smile. And make you smile.

### Grading Policy

|  |  |
| --- | --- |
| **Category** | **Weight** |
| Practical & Unit Exams | 20% |
| Lab Reports & Projects | 20% |
| Quizzes | 20% |
| Homework & Classwork | 20% |
| Final Practical & Exam | 10% |
| Daily Grade | 10% |

* **Practical and Unit Exams** – 20%
  + Unit assessments are based upon a combination of a written exam and a practical, or performance exam. Written exams are a combination of short answer, open response, problem, case study, multiple choice, and matching. Your technical skills will be graded using rubrics that will be handed out at the beginning of each unit.
* **Lab Reports and Projects** – 20%
  + The final drafts of your lab reports will be graded using the lab report rubric. Projects will be graded using rubrics tailored to the assignment and will be handed out when the project is assigned.
* **Quizzes** – 20%
  + Frequent quizzes will be given help figure out what you know before the unit exam. Quizzes will be multiple choice, matching, completion, short answer, and case study questions.
* **Homework and Classwork** – 20%
  + Homework and classwork will be assigned daily.
* **Final Practical and Exam** – 10%
  + A cumulative assessment will be given at the end of the course to measure both skills and knowledge.
* **Daily Grade** – 10%
  + Your daily grade is based on employability skills, preparation, motivation, communication skills, and professionalism. Please see rubric.

### Timeline (subject to change)

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| --- | --- | --- | --- |
| Week | Unit | Topics Covered | Sample Activities |
| 1 | Introduction to Safety in the Lab | Conduct in the lab  Emergency preparedness  First Aid certification  CPR certification  OSHA10 certification  Chemical handling | Create an emergency plan  Emergency drill  Create an MSDS sheet  Practical  Unit exam |
| 2 | Career Exploration | Biotechnology careers  Career Cruising  Different types of labs  Finding information | Field trip to lab  Guest speaker from field  Power point on career path |
| 3 | Introduction to Lab Skills Part I | Metric system conversions  Scientific notation  Measuring volume  Measuring mass  Measuring pH  Calibrating equipment | Metric system lab  Micropipette challenge  Volume lab  pH lab  Mass lab  Practical  Unit exam |
| 4 | Introduction to Lab Skills Part II | Measuring temperature  Measuring optical density and wavelength  Using a centrifuge | Temperature lab  Temperature and density lab  Optical density lab  Centrifugation lab  Create a maintenance schedule and checklist  Practical  Unit exam |
| 5 | Preparing Solutions | Atomic theory  Carbon compounds  Moles (stoichiometry)  Solutions | Build an atom  Carbon compound lab  Carbon compound model building  Mole map  Preparing solutions lab  Dilutions lab  Practical  Unit exam |
| 6 | Basic Microscopy | Cell theory  Organelles  Plant vs. animal vs. bacteria cell  Different types of microscopes  Structure and function of a microscope | Cell lab  Build a cell  Microscope lab  Practical  Unit exam  Lab report |
| 7 | Microbiology Part I | Sterile and aseptic technique  Different types of bacteria  How to identify bacteria  Viruses | Aseptic technique lab  Aseptic technique case study  Intro to bacteria lab  Growing bacteria lab  Identifying bacteria lab  Build a bacteria  Virus case study  Practical  Unit exam  Lab report |
| 8 | Microbiology Part II | Population growth and bacteria  Bacteria and disease  Contamination and microbiology troubleshooting  Viruses vs. bacteria | Bacteria presentations  Contamination lab  Bacteria and disease case study  Essay on viruses vs. bacteria  Practical  Unit exam |
| 9 | Review and Final | Review units 1-8  Portfolios | Practice exams  Practice skills  Portfolio and SOP organization  Self-assessment  Written and practical final exam |