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LAB MANUAL

ALL FORMATS

DIVE Biology

Laboratory Manual

All Formats

by David E. Shormann, PhD

Digital Interactive Video Education

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DIVE Biology

Parents: Important Instructions

Self-Paced eLearning Course Setup

1. Parents: Login to the eLearning Course using the student login credentials emailed two business days after purchase.
2. Follow the **Parent Setup Instructions** on the Course Home page.

CD, Stream, & Download Course Setup

1. Parents: Go to www.DIVEintoMath.com/science-tg
2. Select your format, then **Biology**.
3. Follow the setup instructions on page 2.

Hands-On Lab Instructions

Important: If you are completing the labs with your equipment or a lab kit, you must use the Lab Instructions linked in the Labs section of the Teacher's Guide.

Laboratory Activity 1

If completing the labs hands-on, you must use the Lab Instructions on page i.

Introduction to Biology Laboratory

Introduction

Welcome to Biology Laboratory! Biology laboratory is one of the most important parts of a high school education, because for most students, there will probably be no other time when they investigate God's creation in such detail. This is especially important for Christians, because it is good to know as much as possible about what He said (Holy Bible) and what He made.

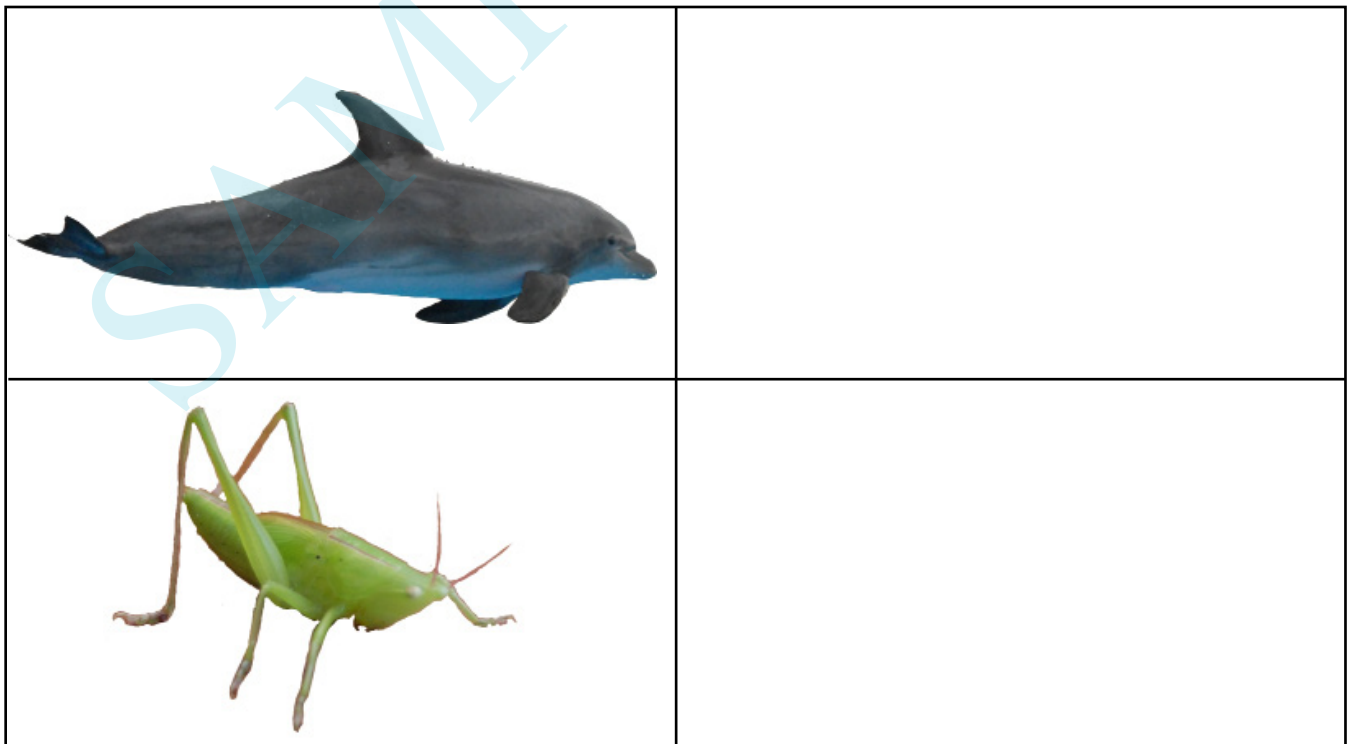
The laboratory activities in this workbook will be one of three types: observations with data collection, experiments following the scientific method, and dissections. Two important skills for biology laboratory are microscope use and sketching. Laboratory Activity 1 is designed to help you become familiar with and practice these skills. We will also discuss some basic laboratory safety.

Methods **Lab Kit Users: Read the Instructions for Lab Kits (see page i)**

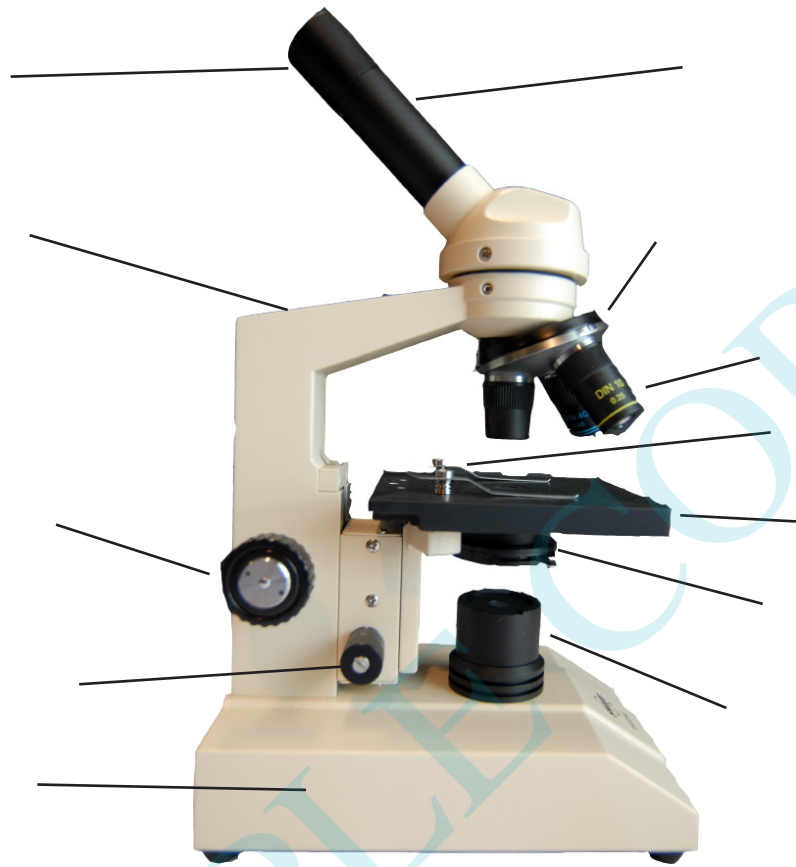
Equipment: Microscope with 40, 100, and 400x magnification, preserved slides of desmids (algae) and crossed threads, two hand magnifying lenses

Procedure: For a detailed explanation of procedure, please watch video lab. Record all observations in this workbook.

Sketching: Practice sketching in the space provided. Try to make your sketch the same size and proportions as the picture shown.



Parts of a Microscope: Label the following diagram.



How a Microscope Works

Most microscopes are compound microscopes, and they use two or more lenses to magnify an object. What are these lenses called?

Describe the image resulting from overlapping two hand lenses, which simulates the two lenses in a compound microscope.

The microscope shown above has a 10x eyepiece lens, and three objective lenses of 4, 10, and 40x magnification. Calculate the three magnifications available with this microscope.

Using the Microscope

BEFORE placing a slide on the stage, where should the stage be?

BEFORE placing a slide on the stage, what should the objective lens be set on?

With the objective on its lowest setting, place the Crossed Thread slide on the stage. Move the stage towards the lens until the threads come into focus. Observe the threads. Why is the intersection of the threads black?

Next, move the objective lens to the next highest magnification, refocus and observe. If you have a higher setting on your microscope, go to it next.

Describe some advantages and disadvantages of higher magnifications.

Describe some advantages and disadvantages of lower magnifications.

Sketch what you see: Observe the preserved slide of desmids on at least two different magnifications.

On a lower magnification, sketch a group of cells below.	On a higher magnification, sketch one or two cells, and include internal structures.

Laboratory Safety

Material Safety Data Sheets (MSDS)

What is the most important section # on the MSDS for you to be familiar with?

Basic Laboratory Safety

When should goggles be worn?

When should gloves be worn?

Don't ever _____ anything, or eat during lab!

Your clothes and shoes should

A very effective method for preventing accidents during lab is to _____ the experiment before performing it.

Laboratory Activity 2

The Scientific Method

If completing the labs hands-on, you must use the Lab Instructions on page i.

Introduction

In the early 1600's, Francis Bacon, considered the founder of the Scientific Method, wrote a two-volume work titled *The Advancement of Learning*. In order to truly advance learning, Francis believed that "A man cannot be too well studied in the book of God's word or in the book of God's works". He based this idea on Matthew 22:29 when Jesus rebuked the Pharisees because they did not "know the Scriptures or the power of God".

God has commanded us to rule over His creation (Genesis 1:28), but to rule well we need good rules. The scientific method is an excellent tool we can use to reason inductively about His creation. It consists of 5 main parts, which are:

Describe each part of the typical DIVE Biology Laboratory Activity:

Introduction

Hypothesis

Methods

Results

Discussion

The purpose of Laboratory Activity 2 is to use the Scientific Method to answer a question. Many of the Laboratory Activities in your DIVE Biology Workbook follow the Scientific Method, and Laboratory Activity 2 is designed to introduce the method to you.

Introduction-Nitrification in the Gulf of Mexico

Nitrification is an important process in aquatic ecosystems. Bacteria in the water and sediments convert ammonia (NH_3) to nitrite (NO_2) and nitrate (NO_3). *Nitrosomonas* species are primarily responsible for converting ammonia to nitrite, while *Nitrobacter* species convert the nitrite to nitrate. Nitrification occurs in all aquatic systems, but in some places it is more pronounced. For example, consider the Mississippi River plume, where the Mississippi River enters the Gulf of Mexico. The Mississippi River flows through many urban and agricultural regions, and contains a rather high concentration of nitrogen compounds when it reaches the Gulf. When the muddy Mississippi River waters hit the clear Gulf of Mexico waters, the mixture of nutrients and sunlight creates algae blooms, providing abundant food for a variety of aquatic organisms. Waste products and dead organisms sink to the bottom, and nitrification occurs as long as oxygen levels are adequate.

The purpose of this Laboratory Activity is to answer the following question.

Does nitrification occur in the Mississippi River Plume?

Hypothesis

Yes, if the mean nitrate concentrations are higher near the bottom than the surface of the Gulf, and the ammonia concentrations are lower near the bottom than the surface ($p \leq 0.05$).

Methods **Lab Kit Users: Read the Instructions for Lab Kits (see page i)**

Materials: Microsoft Excel or similar spreadsheet. **Important:** You DO NOT need the website discussed in the video lab. All the data you need is provided in the table on page 7.

Procedure: Please refer to video lab. Use the data on the following page for your calculations.

The following data was collected by research scientists (myself included) in May 1992 in the Mississippi River Plume. Units used are concentration in micromoles N per liter. The data is part of the Nutrient Enhanced Coastal Ocean Productivity (NECOP) study. **Important:** You DO NOT need the website discussed in the video lab. All the data you need is provided in the table below. Surface data is from samples collected at 10 m depth.

Station	Nitrate+Nitrite Surface	Nitrate +Nitrite Bottom	Ammonium Surface	Ammonium Bottom
H1033	2.99	9.82	0.24	0.32
H1034	2.80	7.00	0.24	0.24
H1035	3.11	8.07	0.65	0.33
H1036	3.56	7.86	0.33	0.33
H1037	3.52	6.28	0.46	0.38
H1038	2.46	9.79	0.53	0.46
H1039	9.37	5.75	0.76	0.46
H1040	7.44	6.31	1.2	0.46
H1041	2.98	3.67	0.23	0.99
H1042	3.37	4.32	0.38	0.53
H1043	0.46	9.58	0.57	0.57
H1044	0.47	4.08	0.29	0.41
H1045	0.25	1.17	0.57	0.38
H1046	0.46	2.21	0.76	0.19
H1047	0.88	2.1	0.19	0.19

Results:

Was there more nitrate+nitrite at the bottom?

p-value = _____

Was there less ammonium at the bottom?

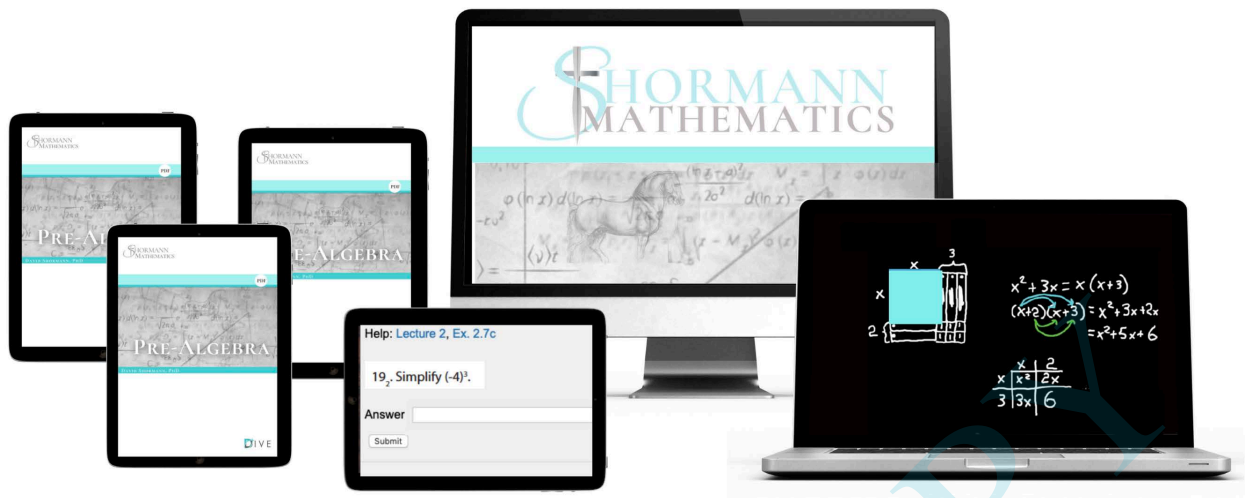
p-value = _____

Discussion

1. Was your hypothesis correct? Why or why not?

2. List at least three sources of error.

3. Considering the question answered in this experiment, list some similar questions that could be answered by conducting a science experiment.



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Algebra 2 with Integrated Geometry	1 Algebra 2 1/2 Geometry*	Prep for: PSAT, SAT, ACT, CLEP College Algebra, CLEP College Math
Precalculus with Trigonometry	1 Precalculus with Geometry 1/2 Geometry**	CLEP Precalculus Review prep for: PSAT, SAT, ACT, CLEP College Algebra and CLEP College Math
Calculus 1	1 Calculus 1	CLEP Calculus, AP Calculus AB Review prep for: PSAT, SAT, ACT, and CLEP Precalculus
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