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INTEGRATED
CHEMISTRY AND PHYSICS

Lab Manual

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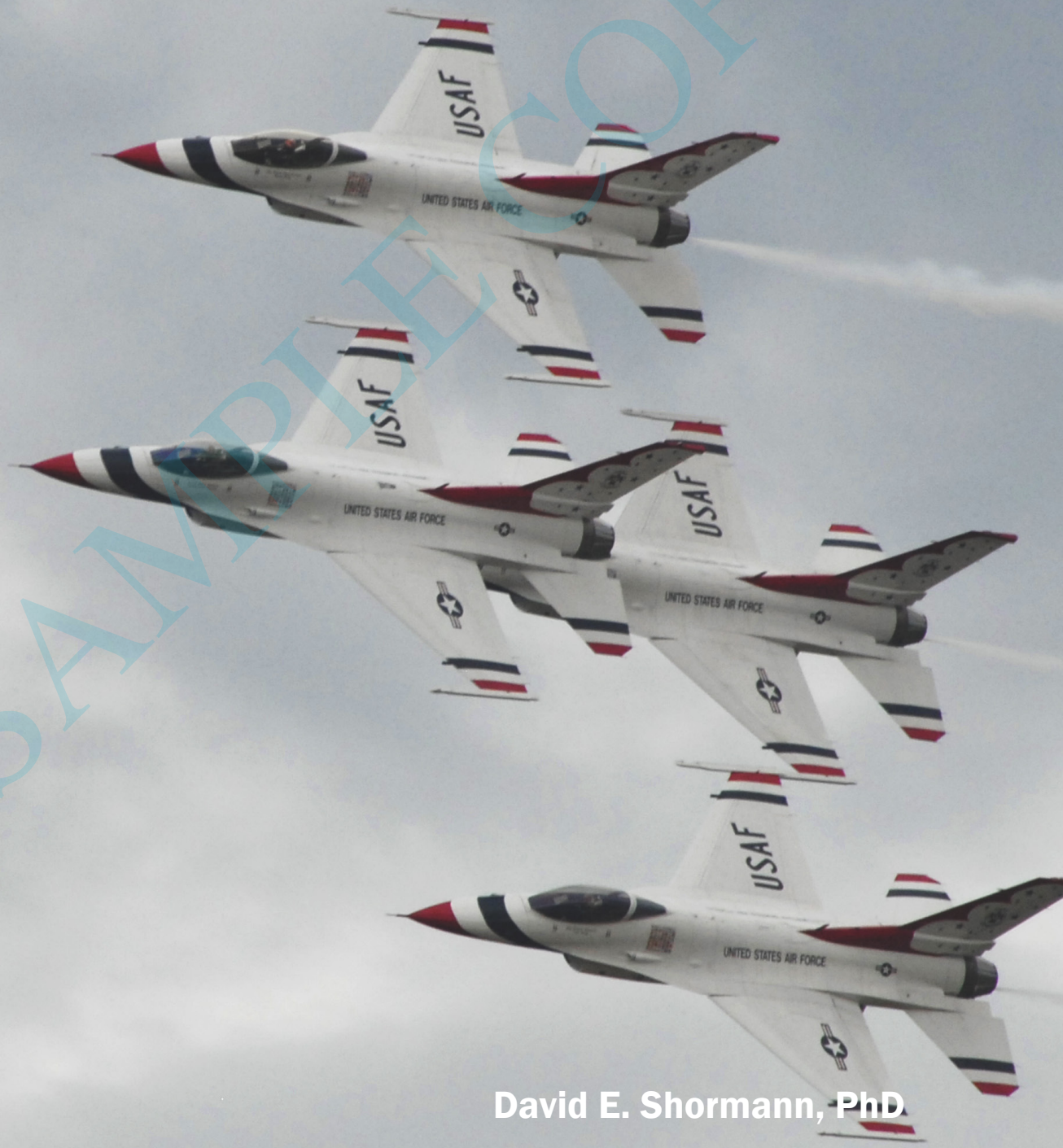

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DIVE Integrated Chemistry & Physics

Laboratory Manual

All Formats

by David E. Shormann, PhD

Digital Interactive Video Education

P.O. Box 447 Hockley, TX 77447

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Permissions: You are allowed to print 1 copy for each student currently enrolled in DIVE Integrated Chemistry and Physics.

DIVE Integrated Chemistry & Physics

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 **Integrated Chemistry & Physics.**
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

Introduction to ICP Laboratory

Introduction

Welcome to Integrated Chemistry and Physics (ICP) Laboratory! Reading about science and watching lectures are important parts of any science course, but no science course is complete unless many hours are spent engaged in detailed observation of God's creation through scientific investigations.

ICP Laboratory Activities will provide you with an opportunity to test and observe many of the topics covered in the lectures. DIVE ICP Labs will also contain an added emphasis on energy and energy conversion, and we will take a closer look at some of the Christians who discovered important scientific principles, repeating some of the experiments they taught their own students. The laboratory activities in this workbook will be one of two types: observations with data collection, or experiments following the scientific method.

In Laboratory Activity 1, you will become familiar with some of the items we will use frequently, including a laboratory burner, a digital balance, and a data logger. We will also discuss some basic laboratory safety.

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

Equipment: Laboratory burner, striker, Ohaus digital balance, Xplorer GLX datalogger, weighing dish, sugar.

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

Using a Bunsen burner: Observe the laboratory burner being lit, and answer the following questions.

How high above the burner top should you hold the striker?

List three things you should never do when lighting a laboratory burner.

Using a Digital Balance:

What is the purpose of the "zero" button?

Weigh 3.00 g of sugar in a weighing dish. What is the weighing dish for?

What are some things you should not do with a balance?

Using a Datalogger:

What is the purpose of a data logger?

Observe the Xplorer GLX datalogger in use.

What is the rate of temperature change at t=10s? _____

What is the rate of temperature change at t=20s? _____

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?_____
_____

How do you mix acid and water?_____

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

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 ICP Laboratory Activity:

Introduction

Hypothesis

Methods

Results

Discussion

The purpose of Laboratory Activity 2 is to use the Scientific Method to answer two different questions. Many of the Laboratory Activities in your DIVE ICP Workbook follow the Scientific Method, and Laboratory Activity 2 is designed to introduce the method to you. You will also become familiar with using Microsoft Excel to organize data, create graphs, and perform statistical analyses.

Part 1: Has the color distribution changed for plain M&Ms?

Introduction:

You may be surprised, but M&M candies make excellent tools for learning to organize data and analyze it statistically. M&Ms plain candies have 6 color coatings, and these coatings follow the distribution shown

Color	Frequency (%)
red	13
brown	13
yellow	14
green	16
orange	20
blue	24

The "frequency" means that, for example, if you had 100 M&Ms, you would expect 13 of them to be red, 13 brown, 14 yellow, and so on. But is this still the case, or have the manufacturers changed the color frequencies?

Hypothesis:

Conduct some research online, or contact the makers of M&Ms directly and ask for "color frequency data" for their plain M&Ms candies (www.mms.com).

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

Materials: 100 M&Ms

Procedure: Please refer to video lab. Record your data on the following page.

Degrees of Freedom =					
Color	% observed	% expected	difference (o-e)	$(o-e)^2$	$(o-e)^2/e$
Red		13			
Brown		13			
Yellow		14			
Green		16			
Orange		20			
Blue		24			
				Σ=	

Results:

Use the following Chi-Square distribution table to determine whether there was a difference in the expected and observed results.

Chi-square Distribution Table					
Probability	Degrees of Freedom (df)				
p=	1	2	3	4	5
0.05	3.84	5.99	7.82	9.49	11.1

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.

Part 2: Does a thermometer's rate of cooling follow a predictable pattern?

Introduction:

In Laboratory Activity 1, you observed how temperature changed with time for the temperature sensor on the Xplorer GLX datalogger. We will use the same temperature sensor to answer the question shown.

Hypothesis:

Observe the mathematical patterns that Microsoft Excel can predict, and pick one of those.

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

Materials: Xplorer GLX Datalogger, temperature sensor, Microsoft Excel.

Procedure: Please refer to video lab. Record your data in the following table.

Observation #	Time	Temperature
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		

Results:

Use Microsoft Excel to create a trendline for the graph of Temperature (y-axis) versus Time (x-axis)

Equation = _____

R^2 = _____

What does R^2 tell you?

What is the highest value R^2 can attain?

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.

Table of equivalent measures
(memorize these conversions)

Length

12 inches = 1 foot
3 ft. = 1yard
5280 ft. = 1 mile
2.54 cm. = 1 inch
10 mm. = 1 cm.
100 cm. = 1 m.
1000 m. = 1 km.
1.61 km. = 1 mi.

Volume

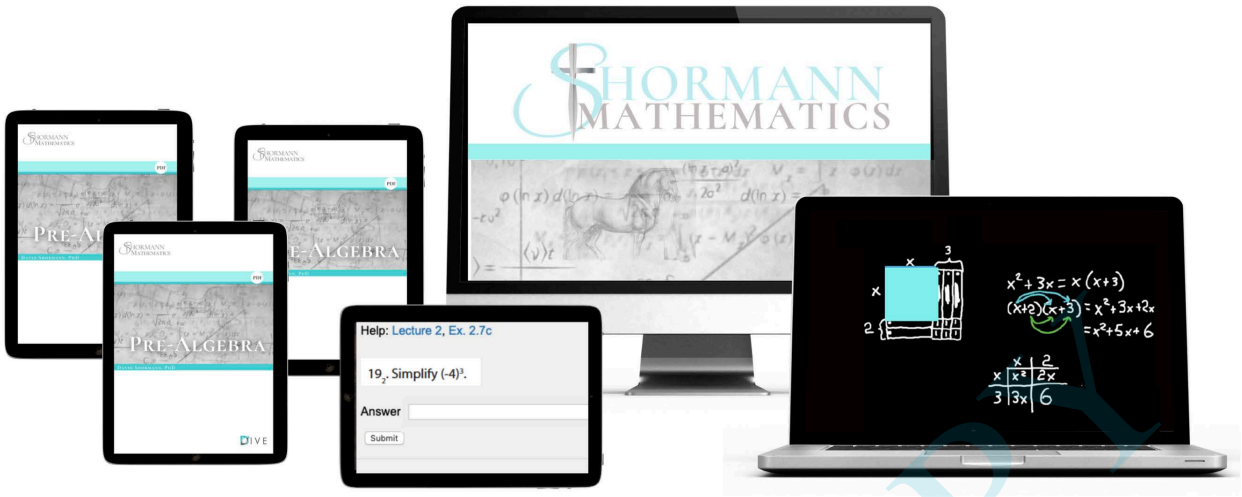
8 oz. = 1 cup
2 cups = 1 pint.
2 pints = 1 quart
4 quarts = 1 gallon
1.057 quarts = 1 liter
1000 ml. = 1 liter
1 cm^3 = 1 ml.

Mass/ Weight

16 oz. = 1 lb.
2000 lb. = 1 ton
2.2 lb. = 1 kg.
1000g = 1 kg.

Temperature

F = 1.8 C° + 32
K= 273 + C°



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Course	Credits	Test Prep
Pre-Algebra	1 Pre-algebra	-
Algebra 1 with Integrated Geometry	1 Algebra 1 1/2 Geometry	First part of prep for: PSAT, SAT, ACT, CLEP College Algebra, CLEP College Math
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
Calculus 2	1 Calculus 2	AP Calculus AB and BC

*If Saxon Algebra 1, 3rd Edition (1/3 credit of Geometry) was taken, completion of Shormann Algebra 2 earns 1 full credit of Geometry and 1 full credit of Algebra 2. Learn More

**If Saxon Algebra 2, 2nd or 3rd Edition (1/2 credit of Geometry) was taken, 1/2 credit of Geometry and 1 full credit of Precalculus is earned in Shormann Precalculus. Learn More

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