

# Science with TI-Nspire™ Technology



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# **Science with TI-Nspire™ Technology**

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This book is a compilation of experiments that have previously appeared in various Vernier lab books. Many thanks to the authors who originally wrote these experiments and the editors who put all of this together.

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Proper safety precautions must be taken to protect teachers and students during experiments described herein. Neither the authors nor the publisher assumes responsibility or liability for the use of material described in this publication. It cannot be assumed that all safety warnings and precautions are included. Teachers must follow local regulations concerning safe handling, use, and disposal of the chemicals associated with the experiments included in this manual.

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\* Experiments denoted with an asterisk are appropriate as written for middle school science.



## Sensors Used in Experiments

		Temperature	Magnetic Field Sensor	pH	Conductivity	Dissolved Oxygen	Light	Gas Pressure	CO <sub>2</sub>	Heart Rate	Colorimeter	Motion	Force	Acceleration	Voltage	Microphone
1	Intro to Data Collection	1														
2	Exploring Magnetism		1													
3	Where IS North?		1													
4	Soil Temperature	3														
5	Watershed Testing	1		1	1	1										
6	Reflection and Absorption of Light	1					1									
7	Dew Point	1														
8	Seasons and Angle of Insolation	1														
9	Acids and Bases			1												
10	Diffusion through Membranes				1											
11	Conducting Solutions				1											
12	Enzyme Action							1								
13	Transpiration							1								
14	Cell Respiration								1							
15	Interdependence of Plants and Animals			1		1										
16	Heart Rate and Physical Fitness									1						
17	Ventilation and Heart Rate									1						
18	Freezing and Melting of Water	1														
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23	Conductivity of Solutions: The Effect of Concentration				1											
24	Additivity of Heats of Reaction: Hess's Law	1														
25	Acid Rain			1												
26	Graph Matching											1				
27	Ball Toss											1				
28	Newton's Second Law												1	1		
29	Static and Kinetic Friction											1	1			
30	Simple Harmonic Motion											1				
31	Capacitors														1	
32	Sound Waves and Beats															1
33	Speed of Sound															1



## Preface

This book contains thirty-three experiments using Vernier probeware with the Texas Instruments TI-Nspire™ handhelds and computer software for collecting, displaying, printing, graphing, and analyzing data. These can comprise a high percentage of the experiments included in any science course. We are convinced of the importance of *hands-on* experiments. Data collection technologies are an integral and indispensable equipment component in a science classroom.

Data-collection technologies not only enable students to experience new experiments with measurements not previously obtainable in the classroom, but they also enhance experiments and demonstrations formerly done with devices such as thermometers, pH strips, and stopwatches. Data-collection technologies can give more accurate measurements, they can allow an experiment to be continuously monitored without close attention, and they can save, display, graph, and analyze data. Temperature probes interfaced with TI-Nspire technology can eliminate student use of mercury thermometers.

Vernier Software & Technology, with its high quality and comparatively inexpensive hardware, supported with well-written, thorough, and easy-to-use software, has made it possible and relatively simple for science teachers to completely integrate data collection with TI-Nspire technology into their classrooms. This book helps in the task.

This book is not intended as a stand-alone laboratory manual. It is intended to supplement the science-teaching materials adopted for use in your school. Experiments in this book can be used unchanged or they can be modified using the word-processing files provided on the accompanying electronic resources. Here are some ways to use the experiments in this book:

- Unchanged. You can photocopy the student sheets, distribute them, and students can do the experiments following the procedures as they are written. Many students will be more comfortable if most of the steps used in data collection and analysis are included in each experiment.
- Slightly modified. The electronic resources accompanying the book are for this purpose. Before producing student copies, you can change the directions to make them better fit your teaching circumstances. See Appendix A.
- Extensively modified. Some teachers will want to decrease the degree of detail in student instructions to allow for more inquiry-driven experimentation.

We hope and expect that experienced science teachers will significantly modify the procedures provided in this book. The *Teacher Information* section that follows each experiment has sample results, answers to questions, directions for preparing solutions, and other helpful hints regarding the planning and implementation of a particular experiment.

For students and teachers that are new to data collection with the TI-Nspire technology, we **strongly** recommend that you start with the first activity, *Introduction to Data Collection*. This activity is designed to introduce students and teachers to the features of the DataQuest application that are used throughout the book. We also recommend reviewing the information in *Appendix B* and *Appendix C* for instructions on the common tasks used when collecting and analyzing data with the Vernier DataQuest™ application.

It is **important** for teachers to read the information presented in the appendices. They include valuable information that can help make you more comfortable with your initial use of the DataQuest application, TI-Nspire technology, and Vernier sensors. Here is a short summary of the information available in each appendix:

- *Appendix A* includes information about the electronic resources that accompany this book.
- *Appendix B* tells you how to use the DataQuest application on a handheld.
- *Appendix C* tells you how to use the DataQuest application on a computer.
- *Appendix D* provides information on Vernier products.
- *Appendix E* provides a list of equipment and supplies used in these experiments.
- *Appendix F* provides safety information.