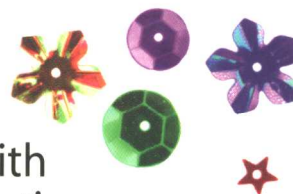


Terrific Science Press

Science Projects for **HOLIDAYS** Throughout the Year

- For Earth Day make recycled paper...that grows.
- For Easter, make geodes in plastic eggshells.
- For Kwanzaa, make ice candles for a kinara.
- For Mother's Day, make a sachet...using a marshmallow.

And many more!



Brought to you by Terrific Science Press, with
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**The year-round
teacher resource
for grades K-5**

Science Projects for Holidays throughout the Year



Complete Lessons for the Elementary Grades

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Terrific Science Press

Miami University Middletown

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• Foreword

Holidays and special events are times of excitement and energy. Children are quick to pick up on this excitement. One of our teachers has dubbed it the “holiday crazies.” If the “crazies” are viewed to be an obstacle, productive learning can be difficult, but if dealt with as a positive thing, this youthful enthusiasm can provide the motivation for otherwise untapped learning opportunities.

Science Projects for Holidays throughout the Year was developed to help teachers turn the “holiday crazies” into a fun and exciting time to learn about science. Holiday celebrations and science make a great team—because the crafts often associated with holidays are typically rooted in science, tying them to productive hands-on science lessons makes for good learning experiences.

This book unites holidays with fun crafts or experiments that teach important science skills and concepts. The 23 physical science lessons in this book are firmly grounded in the National Science Education Standards and are structured as meaningful investigations that help students make sense of science by drawing connections between scientific phenomena and their own world. Additionally, each lesson also includes ideas for writing, art and music, mathematics, and social studies extensions related to the holiday, the culture in which the holiday is celebrated, or the concept studied in the science activity.

Science Projects for Holidays throughout the Year is one of several books to result from the National Science Foundation-funded Teaching Science with TOYS program and the Ohio Board of Regents-funded Science-Literature Integration program, located at Miami University in Ohio. The goal of the TOYS program is to enhance teachers’ knowledge of chemistry and physics and to encourage the use of activity-based, discovery-oriented science instruction. The goal of the Science-Literature Integration project is to encourage the integration of science with language arts, a discipline that shares many of the process skills used in science.

I hope you and your students find that these activities make both holidays and science more interesting, relevant, and fun—both to learn and to teach.

Mickey Sarquis, Principal Investigator
Teaching Science with TOYS

● Introduction

Holidays and other special days are times of excitement and energy. Wouldn't it be wonderful if your students approached science with the same excitement? *Science for the Holidays* was developed to help you tap into the energy of such special celebrations and use it to teach science.

Science for the Holidays offers 23 complete lessons for teaching hands-on, discovery-oriented physical science in the elementary classroom. Each lesson is a tightly integrated learning episode with clearly defined objectives supported and enriched by all facets of the lesson, including historical and cultural backgrounds; reading of both fiction and nonfiction; writing; and, where appropriate, social studies, art, music, mathematics, and other subjects. Along with the science content objectives, many process objectives are woven into every lesson.

These lessons are intended to help you make the most of all of your classroom time. By converting class periods around holidays and other celebrations into rich educational opportunities, these lessons will complement and enrich your curriculum while providing fun for you and your students. We encourage you to use these lessons to meet the needs of your students and your district's science objectives. See *Getting the Most Out of This Book*, page 6, for suggestions on doing so.

Why Use Holiday-Based Integrated Science and Language Arts Lessons?

Many holidays and other special days are celebrated during the school year. Time close to these celebrations often includes a number of craft projects appropriate to the occasion. Certainly these activities are fun for students and help raise their awareness of the holidays being observed, but science and other subjects are often pushed aside to make room for these efforts. Elementary teachers feel the pressure of including more high-quality science instruction while being responsible for students' achievement in many subjects. Teachers face a frustrating dilemma: to choose between taking time for special activities and addressing instructional goals. However, incorporating holiday activities need not involve sacrifice. This multidisciplinary collection can help you resolve the "either/or" dilemma by blending science, social studies, history, arts and crafts, and children's literature into a fun yet educational experience.

Holiday-based integrated science lessons provide venues for students to actively investigate their world using process skills that span subject areas: observing, communicating, classifying, predicting outcomes, and drawing conclusions. "When we are confronted with a problem or puzzling situation in real life, we hardly stop to think, 'Which part is mathematics, which physical education, which science,...and so on?' Rather we...bring to bear whatever we need to know or do without regard for the source....Understood this way, knowledge and skills are organically integrated in real life." (Beane, 1995) Integrated learning enables children to build on this natural relationship between subjects.

The fun element in holiday science projects provides an extra boost to the learning process: "Increased motivation and conceptual understanding will occur if both the fun and mental aspects of scientific play are reunited." (O'Brien, 1993)

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O'Brien, T. "Teaching Fundamental Aspects of Science with Toys." *School Science and Mathematics*, 93(4), April 1993, 203–207.

Toward a Coherent Curriculum; Beane, J.A., Ed.; Association for Supervision and Curriculum Development: Alexandria, VA, 1995; pp 6–10.

Support for the Development of This Book

The lessons in this book were developed through the support of two professional development programs for teachers offered through Miami University's Center for Chemical Education: the Ohio Board of Regents-funded Science Integration in Today's Elementary Schools (SITES) project and the National Science Foundation-funded Teaching Science with TOYS program. These programs promote the creative integration of activity-based, discovery-oriented science instruction into the elementary school curriculum by addressing state and national standards for science education without overburdening the already busy elementary school teacher. Both programs share a common emphasis of preparing teachers to provide carefully constructed learning opportunities that are motivating, engaging, and intimately linked to the children's world.

The interdisciplinary lessons in this set have grown out of the SITES and TOYS programs with classroom teachers having contributed to the development, review, and classroom testing of these materials. These lessons are designed to engage children in multisensory experiences that sharpen both their process skills and content knowledge.

Through SITES, TOYS, and their affiliated programs, more than 1,500 teachers have brought literature- and toy-based science into their classrooms. Through written materials such as this book, it is our hope that even more teachers and students can share in the fun of doing and learning science.

To learn more about these and other professional development opportunities for teachers at Miami University, check out our World Wide Web site (<http://www.muohio.edu/~ccecwis/>) or write to

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● Organization of the Lessons

Each lesson in this book provides complete instructions for using the lesson in your classroom. These lessons have been classroom-tested by teachers like yourself and have been demonstrated to be effective, safe, and practical in elementary classrooms. Each lesson is organized into two main sections: an introduction to the holiday or season, and a guide for conducting the lesson. The guides are divided into five parts: Building Bridges, Science Activity, Integrating with Language Arts, Other Lesson Extensions, and National Science Education Standards. Each of these parts has several sections, which are described below.

Introduction to the Holiday

- This section contains the date and culture/religion (if appropriate) of the holiday or season and, if appropriate, descriptions of similar holidays and customs in other cultures. This information is written for the teacher and is intended to be adapted for presentation to students; it is not intended as a student handout.

First Page of the Lesson

- This page contains the name of the lesson and a brief description of the link between the holiday and the science activity.
- Key Science Topics—This list includes the specific science topics covered by the science activity.
- Time Required—This section lists the estimated time required for setup, performance, and cleanup for the science activity. (The setup time does not include the time necessary to assemble materials, since such times will vary widely. It also does not include time required for extensions.)
- Photograph—A photograph of the toy, key materials, or activity setup appears beside Key Science Topics and Time Required.

Part 1: Building Bridges

- Building Student Knowledge and Motivation—This section includes an idea for a science center activity that serves as an opening strategy for the lesson. These activities help students develop common background knowledge prior to studying the holiday and doing the science activity.
- Bridging to the Science Activity—This section includes ideas for activities and/or discussions. These activities and discussions draw upon the student experiences from Building Student Knowledge and Motivation and set the stage for doing the activity.

Part 2: Science Activity

- **Materials**—Materials are listed for Bridging to the Science Activity, Getting Ready, the Procedure, and the Extension(s) for Further Science Inquiry. Materials are divided into amounts per class, per group, and per student for each part. Most materials can be purchased from grocery, discount department, or hardware stores. Quantities or sizes may be listed in English measure, metric measure, or both, depending on what is clear and appropriate in each case. Sources are listed for unusual items.
- **Safety and Disposal**—Special safety and/or disposal procedures are listed if required.
- **Getting Ready**—Information is provided in Getting Ready when preparation is needed before beginning the activity with students.
- **Procedure**—The steps in the Procedure are directed toward you, the teacher, and include cautions and suggestions where appropriate. Each Procedure is divided into two or more parts. In most cases, parts should be done in the order indicated, but for some activities, parts are independent of each other and can be done in any order or combination.
- **Extension(s) for Further Science Inquiry**—Extensions are methods for furthering student understanding of the science topic. Each activity contains at least one Extension for Further Science Inquiry.
- **Science Explanation**—The Science Explanation explains the science covered in the activity and, where appropriate, contains historical information about how related technology was developed. This explanation is written to you, the teacher, and is intended to be modified for students.
- **References for the Science Activity**—This section cites reference materials used to develop the science activity and explanation.

Part 3: Integrating with Language Arts

This section contains ideas for integrating the rest of the lesson with children's literature and writing.

- **Featured Fiction and/or Nonfiction Book**—The Featured Fiction or Nonfiction Book is a children's book that links well with the science concept, the holiday or season, or the culture in which the holiday is celebrated. We have included books that represent as wide a variety of cultures as possible. In some cases, both fiction and nonfiction books are featured. A brief paragraph after each featured book provides ideas for reading and discussing the book.
- **Writing Extensions**—The suggested writing extensions are intended to give students different types of opportunities to communicate what they have learned about the holiday, the culture in which the holiday is celebrated, the science objective, or one of the books listed under Featured Books or Additional Books. As such, these extensions can serve as assessment tools. The writing extensions in these lessons span a range of levels, from emergent to fluent.
- **Additional Books**—This section lists fiction and nonfiction books related to the science activity, the holiday or season, or the culture in which the holiday is celebrated.

Part 4: Other Lesson Extensions

This section lists extensions for art and music, mathematics, and social studies, as well as activities to do just for fun. These extensions cover a range of grade levels; teachers can choose ones appropriate for their level and adapt others as necessary.

Part 5: National Science Education Standards

This section lists the National Science Education Standards addressed throughout the entire lesson, including the holiday introduction, the science activity, and all of the extensions. The standards are grouped in four categories used in the National Science Education Standards for grades K–3 and 4–6: Science as Inquiry, Physical Science, Science and Technology, and History and Nature of Science.

Notes and Icons

Icons appear throughout the book in the left-hand margins and are described below.



Notes are preceded by an arrow and appear in italics.



Cautions are preceded by an exclamation point and appear in italics.

● Getting the Most Out of This Book

We hope that you find this book helpful in preparing fun, exciting, and informative holiday-related scientific investigations for your classroom. However, each of the lessons in this book contains much more than just the instructions for a holiday craft or an isolated science activity—they are multidisciplinary, inquiry-based learning opportunities that will enhance an elementary school curriculum. This section reviews the pedagogical concepts behind the lessons as well as tips and suggestions to help you make the most out of instructional time. The seven topics covered in this section are as follows:

- Meeting the Needs of Your Students presents suggestions for adapting the lessons in this book for students of different grade levels and abilities.
- Integrating the Holidays, Science Activities, and Books describes the book's strategy for weaving these elements into a cohesive lesson.
- Standards for Science Education discusses published standards for science education and how this book relates to them.
- Assessment describes different approaches to assessing student performance throughout each lesson.
- Teaching with Classroom Centers explains the concept of centers as used in this book and presents suggestions for setting up and using centers in your classroom.
- Using Science Journals presents suggestions for integrating journal writing into your students' science investigations.

Meeting the Needs of Your Students

This book was written and classroom-tested with a focus on the needs and abilities of elementary school children. However, the science content is rich enough to enable you to easily adapt the lessons for upper grades as well. Additionally, whether you teach in a traditional or multi-age classroom, we understand that the individual needs of your students may span a wide range, mandating some modification or adaptation of even the best of lessons. To assist you in such efforts, the lessons in this book include an array of science, reading, writing, social studies, and art elements that span a variety of challenge levels and learning experiences. In our testing, teachers have reported that the format and information provided with these lessons made for fun, successful, and rewarding learning experiences for their classes.

Integrating Celebrations, Science, and Language Arts

The activities and books used in this module have been chosen to coordinate with holidays and special celebrations from a range of cultural traditions. Each science activity relates in some way to the celebration, and each accompanying book tells a story or provides information that relates to the celebration and/or the science activity. While many of the activities involve making a holiday craft, the procedures do so within a scientific context, with instructions for presenting the central science concept.

At the beginning of each lesson is a brief description of the holiday to which it is related. This information, intended for the teacher, can be adapted as necessary for the students.

Each lesson sets the stage for the science activity with a discussion, learning center, or other method for stimulating student interest in the science concept to be covered. Then the class conducts the science activity. Afterward, students listen to a featured fiction and/or nonfiction book that is related to the holiday/celebration, the science activity, or both.

Most of the lessons include suggestions for further reading on topics related to the holiday, the culture in which the holiday is celebrated, or the science concept. Appendix B contains an alphabetical listing of all featured books used in the lessons as well as all books listed as suggestions for further reading. Older students may also conduct independent research to find related reading materials.

Standards for Science Education

The science activities in this book have been designed to help elementary teachers meet standards for science education, most notably the National Science Education Standards compiled under the direction of the National Research Council. This book is organized around the National Science Education Standards for grades K–4 and 5–8. A list of the standards addressed by each lesson is included at the end of the lesson, in Part 5. The standards are grouped in four of the major categories set forth in the National Standards: Science As Inquiry, Physical Science, History and Nature of Science, and Science and Technology. Each of these categories contains one or more subcategories, which also correspond to the National Standards. A table of all lessons and the standards they address is included in Appendix B.

Understanding the Nature of Science

The National Science Education Standards states that as a result of activities in grades K–4, students should develop the abilities necessary to do scientific inquiry and to understand the process of scientific inquiry.

Science shares many of the same information-processing procedures and skills used in other subjects, including reading, mathematics, and social studies. This is why we believe that interdisciplinary lessons engage children in using process skills that are complemented and reinforced in multiple ways. Such lessons serve to provide rich learning experiences. For example, as students do science investigations, follow scientific procedures, analyze data, and think as scientists, they also develop effective reading skills by observing, communicating, classifying, predicting and verifying outcomes, and drawing conclusions. This provides for simultaneous improvement of science and reading skills.

Physical Science Content Standards

An understanding of the physical world is an essential component of scientific literacy. To help you teach physical science concepts, the lessons in this book are grouped into three sections based on the Physical Science Content Standard for Grades K–4 from the National Science Education Standards: Properties of Objects

and Materials; Position and Motion of Objects; and Light, Heat, Electricity, and Magnetism. An important idea to remember is that students are expected to develop an understanding of these concepts as a result of observation and manipulation of objects and materials in their environment. Every lesson in this book gives students the opportunity to develop their understanding through such experiences.

Science and Technology Standards

Most of the lessons in this book involve making holiday-related crafts. An integral part of many of these lessons is the process of design. Students are often required to propose modifications to a process, implement those modifications, evaluate the results, and communicate their results. Such projects help students to develop an understanding of the relationship between science and technology. Indeed, as the National Science Education Standards states, design is the technological parallel to inquiry in science.

History and Nature of Science

Understanding how people in the past approached science and technology can help motivate students and provide examples of scientific inquiry and technological design in action. It can also help them understand that science is something that people—people just like them—do. Many of the lessons involve technologies that have been developed gradually over hundreds, or even thousands, of years, with contributions by people of many cultures. These technologies include candle-making, paper-making, agriculture, and fragrance chemistry. In addition, the Birthday lesson includes a list of scientists, their birthdays, and their notable achievements, providing a jumping-off point for studying the history of science, a 5–8 content standard under History and Nature of Science.

The Particle Nature of Matter

An important issue that arises when teaching physical science content in the elementary grades is how to approach teaching about the particle nature of matter. To be able to explain the nature and interactions of matter, it is necessary to know about the nature of the particles that make it up. As adults, you have probably heard and used the terms atoms, molecules, and ions. Remember, however, that young children do not have the conceptual background to distinguish correctly between these three terms. In the primary grades, we strongly recommend that you use the general term “particles” with students to prevent creating misconceptions that will later be difficult to correct. Additionally, with elementary students, limit your discussion to the general idea that all matter is made up of particles that are too small to be seen by the human eye and that, in spite of our inability to see these particles, their existence accounts for matter as we know it. The discussion of the various types of particles (atoms, molecules, ions) should be held to later years in the curriculum when the students are conceptually ready for this level of detail. Our recommendations are consistent with those of the American Association for the Advancement of Science Benchmarks for Science Literacy and the National Science Foundation-funded S_2C_2 (School Science Curriculum Conference) report, a joint report of the American Chemical Society and the American Association of Physics Teachers.

Reference

National Research Council. *National Science Education Standards*; National Academy: Washington DC, 1996.

Assessment

Assessment and learning are two sides of the same coin. Assessments enable students to let teachers know what they are learning, and when students engage in an assessment exercise, they should learn from it. Paper-and-pencil tests are a familiar and ubiquitous form of assessment. But in light of what we are hoping to teach students about both the process and content of science, traditional tests requiring students to choose one of a few given answers or fill in the blank measure only a fraction of what we need to know about their science learning. The National Science Education Standards advocates using diverse assessment methods, including performances and portfolios as well as paper-and-pencil tests.

Emerging from among a host of terms describing current assessment options (for example, authentic, alternative, portfolio, and performance), the term active assessment has been proposed by George Hein and Sabra Price in their book *Active Assessment for Active Science*. They define "active assessment" as a whole family of assessment methods that actively engage the learner and can also be interpreted meaningfully by the teacher. Almost any of the experiences that make up the lessons in this book can also serve as active assessments. For example, brainstorming sessions, science journal entries, data and observations from science investigations, and writing extensions can all be part of developing a picture of what students are learning. For this reason, we have not identified any particular portion of the lessons in this book as assessments. We hope that as you use the lessons in this book, you will engage in many different forms of active assessment, thus maximizing the opportunity for all students to demonstrate their accomplishments and understanding.

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Teaching with Classroom Learning Centers

Most of the lessons in this book involve using classroom learning centers in Part 1, Building Bridges. Centers are small areas of a classroom set aside for independent learning. You also might call them stations or learning areas. Typically, they include a variety of materials for students to manipulate, read, and look at. Learning centers can be an integral part of everyday classroom instruction, or they can be used as temporary learning stations for a specific activity. A center is not just a physical space to work on tasks such as ditto sheets or workbooks. Rather, centers