Investigate the Possibilities

Elementary General Science

Water & Weather

From the Flood to Forecasts

Teacher's Guide

Tom DeRosa
Carolyn Reeves

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Unless otherwise noted, Scripture quotations are from the New International Version of the Bible.

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Table of Contents

Introduction

The overall goal for each book is to include three components: good science, creation apologetics, and Bible references. This goal underlines the rationale for the design of the workbooks.

Science is a great area to teach, because children have a natural curiosity about the world. They want to know why and how things work, what things are made of, and where they came from. The trick is to tap into their curiosity so they want to find answers.

Many elementary-level science lessons begin with definitions and scientific explanations, followed by an activity. A more effective method is to reverse this order and begin with an activity whenever possible. The lessons found in these workbooks begin with an investigation, followed by scientific explanations and opportunities to apply the knowledge to other situations.

In addition to the investigations, there are sections on creation apologetics, written mostly in narrative form; connections to Bible references; on-your-own challenges; pause and think questions; projects and contests; and historical stories about scientists and engineers. These sections encourage students to think more critically, to put scientific ideas into perspective, to learn more about how science works, to gain some expertise in a few areas, and to become more grounded in their faith in the Bible.

It is not expected that students will do everything suggested in the workbooks. The variety provides students with choices, both in selection of topics and in learning styles. Some students prefer hands-on activities and building things, while others prefer such things as writing, speaking, drama, or artistic expressions. Once some foundational ideas are in place, having choices is a highly motivating incentive for further learning.

Every effort has been made to provide a resource for good science that is accurate and engaging to young people. Most of the investigations were selected from lessons that have been tested and used in our Discovery classrooms. The science content meets and exceeds the recommendations of the National Science Education Standards.

Format for Individual Lessons:

1. Think about This

The purpose of this section is to introduce something that will spark an interest in the upcoming investigation. Lesson beginnings are a good time to let students make observations on their own; for a demonstration by the teacher; or to include any other kind of engaging introduction that causes the students to want to get answers. Teachers should wait until after students have had an opportunity to do the investigation before answering too many questions. Ideally, lesson beginnings should stimulate the students' curiosity and make them want to know more. Lesson beginnings are also a good time for students to recall what they already know about the lesson topic. Making a connection to prior knowledge makes learning new ideas easier.

2. The Investigative Problem

This section brings a focus to the activity students are about to investigate and states the objectives of the lesson. Students should be encouraged throughout the investigation to ask questions about the things they want to know. It is the students' questions that connect with the students' natural curiosity and makes them want to learn more. Teachers should stress to students at the start of each lesson that the goal is to find possible solutions for the investigative problem.

3. Gather These Materials

All the supplies and materials that are needed for the investigation are listed. The teacher's book may contain additional information about substituting more inexpensive or easier to find materials.

4. Procedures and Observations

Instructions are given about how to do the investigation. The teacher's book may contain more specifics about the investigations. Students will write their observations as they perform the activity.

5. The Science Stuff

It is much easier for students to add new ideas to a topic in which they already have some knowledge or experience than it is to start from scratch on a topic they know nothing about. This section builds on the experience of the investigation.

6. Making Connections

Lessons learned become more permanent when they are related to other situations and ideas in the world. This section reminds students of concepts and ideas they likely already know. The scientific explanation for what the students observed should be more meaningful if it can be connected to other experiences and/or prior knowledge. The more connections that are made, the greater the students' level of understanding will become.

7. Dig Deeper

This section provides ideas for additional things to do or look up at home. Students will often want to learn more than what was in the lesson. This will give them some choices for further study. Students who show an interest in their own unanswered questions should be allowed to pursue their interests, provided the teacher approves of an alternative project. Students should aim to do at least one project per week from Dig Deeper or other project choices. The minimum requirements from this section should correspond to each student's grade level. Students may want to do more than one project from a lesson and none from other lessons. Remember, this is an opportunity for students to choose topics that they find interesting.

8. What Did You Learn?

This section contains a brief assessment of the content of the lesson in the form of mostly short-answer questions.

9. The Stumpers Corner

The students may write two things they would like to learn more about or two "stumper" questions (with answers) pertaining to the lesson. Stumper questions are short-answer questions to ask to family or classmates, but they should be hard enough to be a challenge.

Note to the Teacher

The books in this series are designed to be applicable mainly for grades 3–8. The recommendations for K–4 were also considered, because basic content builds from one level to another. The built-in flexibility allows younger students to do many of the investigations, provided they have good reading and math skills. Middle school students will be presented the basic concepts for their level, but will benefit from doing more of the optional research and activities.

We feel it is best to leave grading up to the discretion of the teacher. However, for those who are not sure what would be a fair way to assess student work, the following is a suggestion.

1. Completion of 20 activities with write-up of observations — ⅓
2. Completion of What Did You Learn Questions + paper and pencil quizzes — ⅓
3. Projects, Contests, and Dig Deeper — ⅓

The teacher must set the standards for the amount of work to be completed. The basic lessons will provide a solid foundation for each unit, but additional research and activities are a part of the learning strategy. The number of required projects should depend on the age, maturity, and grade level of the students. All students should choose and complete at least one project each week or 20 per semester. 5th and 6th graders should complete 25 projects per semester. A minimum guide for 7th and 8th graders would be 30 projects. The projects can be chosen from "Dig Deeper" ideas or from any of the other projects and features. Additional projects would give extra credits. By all means, allow students to pursue their own interests and design their own research projects, as long as you approve first. Encourage older students to do the more difficult projects.

As students complete each investigation and other work, they should record what they did and the date completed in the student journal. You may or may not wish to assign a grade for total points. But a fair evaluation would be three levels, such as: minimum points, more than required, and super work. Remember, the teacher sets the standards for evaluating the work.

Ideally, if students miss one of the investigations, they should find time to make it up. When this is not practical, make sure they understand the questions at the end of the lesson and have them do one of the "Dig Deeper" projects or another project.

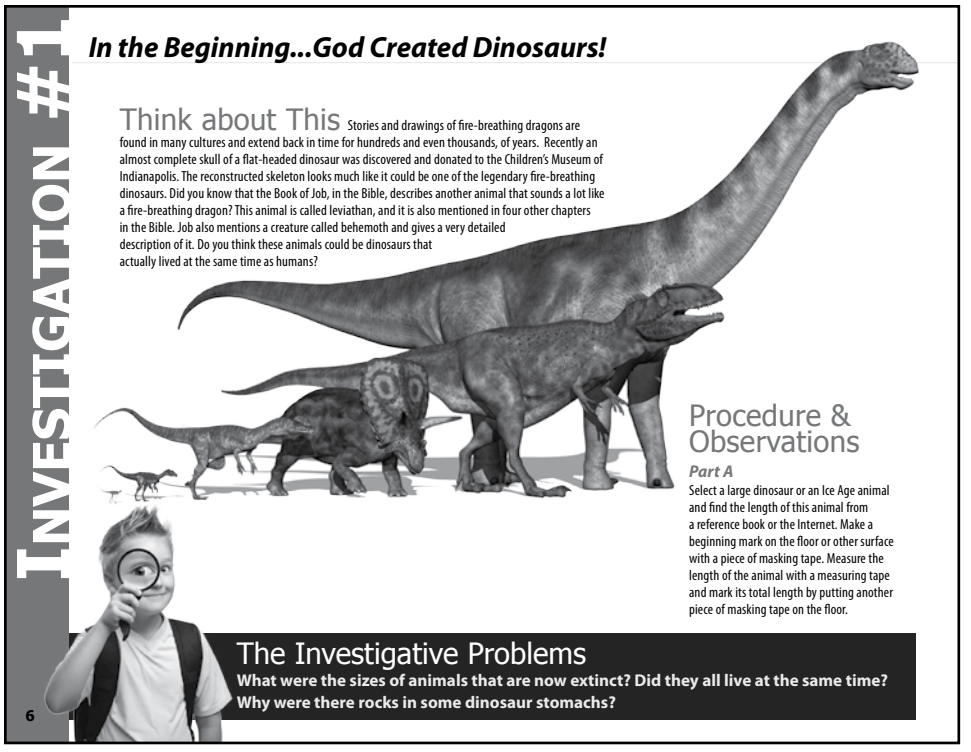
You should be able to complete most of the 20 activities in a semester. Suppose you are on an 18-week time frame with science labs held once a week for two or three hours. Most investigations can be completed in an hour or less. Some of the shorter activities can be done on the same day or you may choose to do a teacher demonstration of a couple of the labs.

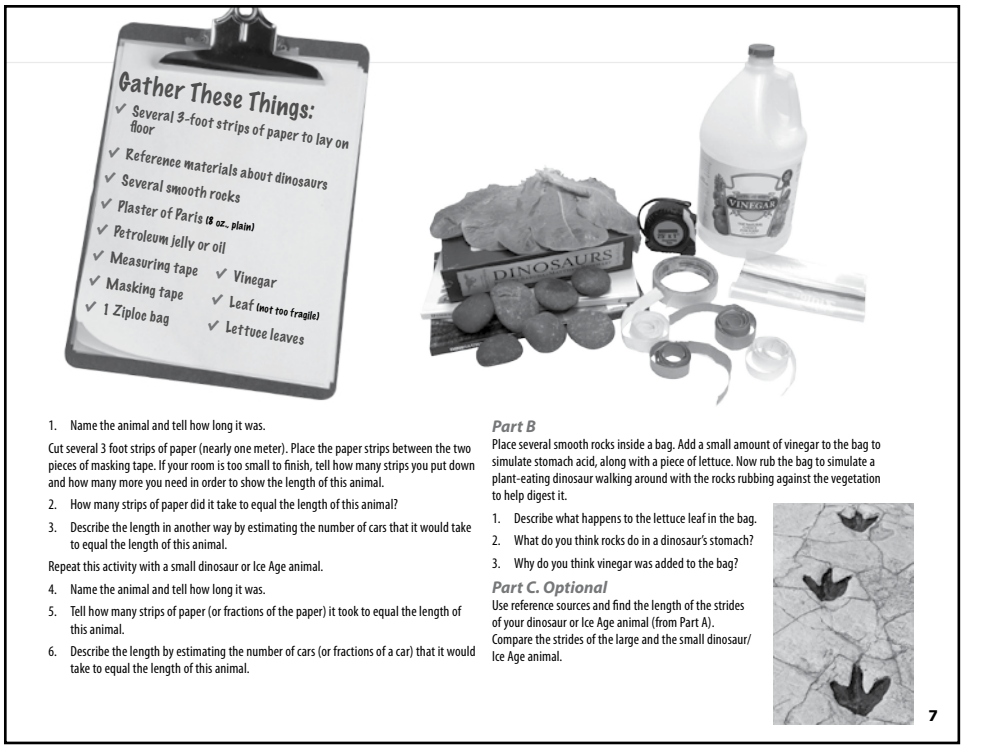
It is suggested that at least five hours a week be allotted to the investigations, contests, sharing of student projects, discussion of "What Have You Learned" questions, and research time. More time may be needed for some of the research and projects. Count projects, contests, and Dig Deeper activities equally. There are over 70 possible activities from which students may choose.

Any time chemicals are used that might irritate eyes, safety glasses should be required. This is also a requirement for being around flames and other devices used for heating water or other chemicals. They are as important as safety belts are for children in a moving vehicle. Some activities should be done only as demonstrations led by an adult, but a student helper can assist if the student is wearing safety glasses and covering to protect clothes.

Refer students to textbooks or other references to help them answer questions, but also encourage them to think of their own explanations. It is not too early to help students understand that science is mostly about finding explanations for things they have observed and about finding patterns in nature. When controlled experiments are done, help them identify the controls and the variable.

Most of the supplies and equipment can be obtained locally. However, these may also be ordered for convenience.





Objectives

1. In this activity, students will be able to visually evaluate and demonstrate the sizes of different dinosaurs and Ice Age animals.
2. Many dinosaurs and Ice Age animals were extremely large. However, some were quite small.
3. Many dinosaurs had rocks in their stomachs to aid in digestion.
4. Dinosaurs laid eggs, while most Ice Age animals gave birth to live offspring.
5. Ice Age animals flourished for almost 700 years after the Flood, while most dinosaurs died out much sooner.

Note

Most students are fascinated by dinosaurs, and there is an abundance of information about them. Most of the secular information routinely assumes that dinosaurs became extinct millions of years ago. The references at the beginning of this book are good sources of creation-based books and Internet information. You might want to show students some of these materials so they know that not all scientists agree that dinosaurs died out millions of year ago. Ice Age fossils are no less fascinating than dinosaurs. They are known to have lived a few thousand years ago. It may be a little more difficult to find grade-level information about Ice Age fossils, but good information can be found in the recommended references.

The Science Stuff

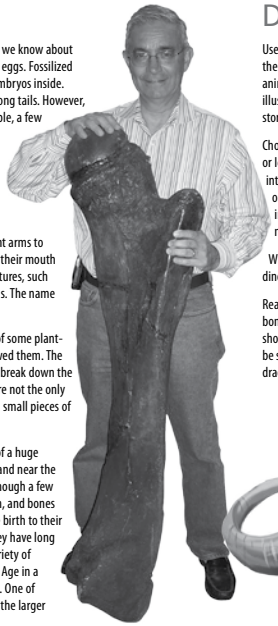
Dinosaurs are a fascinating group of animals, but most of what we know about them is from fossil remains. We know that many dinosaurs laid eggs. Fossilized dinosaur eggs have been discovered, some of which had tiny embryos inside. They generally had small brains, many teeth, long necks, and long tails. However, these characteristics were not found in all dinosaurs. For example, a few dinosaurs apparently did not have teeth.

Dinosaurs lived in great numbers before the Flood, and ranged from the size of a chicken to about 150 feet (almost 50 meters) in length. The sizes of most dinosaurs were somewhere in the middle.

Some dinosaurs walked on two legs and used their smaller front arms to hold things. Other dinosaurs walked on four legs and just used their mouth or teeth to hold objects. Dinosaurs had a variety of unusual features, such as armor plates that covered their backs or spikes on their heads. The name "dinosaur" means terrible lizard.

Gastroliths, or stones, have been found in the stomach region of some plant-eating dinosaur fossils. It is thought that the dinosaurs swallowed them. The grinding action of the stones on the plant material would help break down the food the dinosaurs had eaten and aid in digestion. Dinosaurs are not the only animals to make use of rocks to help digest food. Chickens hold small pieces of gravel in their gizzards that helps them digest their food.

Ice Age animals are as puzzling as the dinosaurs are. Remains of a huge number of woolly mammoths have been discovered in Siberia and near the Arctic Circle. Only bones and tusks remain of most of them, although a few have been found that are completely frozen with their fur, flesh, and bones intact. Woolly mammoths are warm-blooded animals that give birth to their young. They resemble modern elephants in many ways, but they have long curved tusks, a thick layer of hair, and smaller ears. Another variety of mammoth, the Columbian mammoth, also lived during the Ice Age in a region generally south of the territory of the woolly mammoth. One of the fascinating facts about mammoths is that fossil remains of the larger Columbian mammoths have been found in South Florida.



Tom DeRosa holding a large femur of a Columbian mammoth found in the Peace River, Florida.

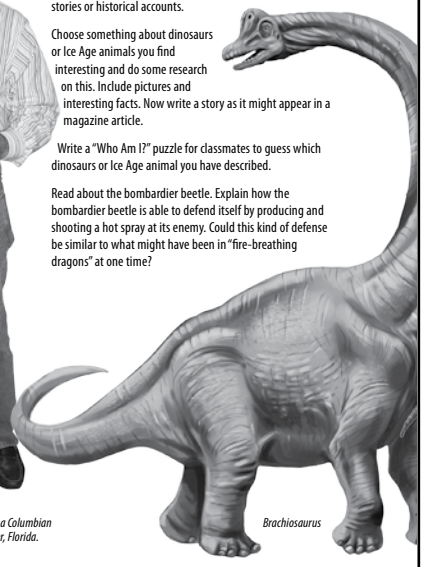
Dig Deeper

Use the descriptions of leviathan or behemoth found in the Bible and try to make a drawing of what one of these animals might look like. Compare your picture to descriptions, illustrations, and drawings of dragons found in literature stories or historical accounts.

Choose something about dinosaurs or Ice Age animals you find interesting and do some research on this. Include pictures and interesting facts. Now write a story as it might appear in a magazine article.

Write a "Who Am I?" puzzle for classmates to guess which dinosaurs or Ice Age animal you have described.

Read about the bombardier beetle. Explain how the bombardier beetle is able to defend itself by producing and shooting a hot spray at its enemy. Could this kind of defense be similar to what might have been in "fire-breathing dragons" at one time?

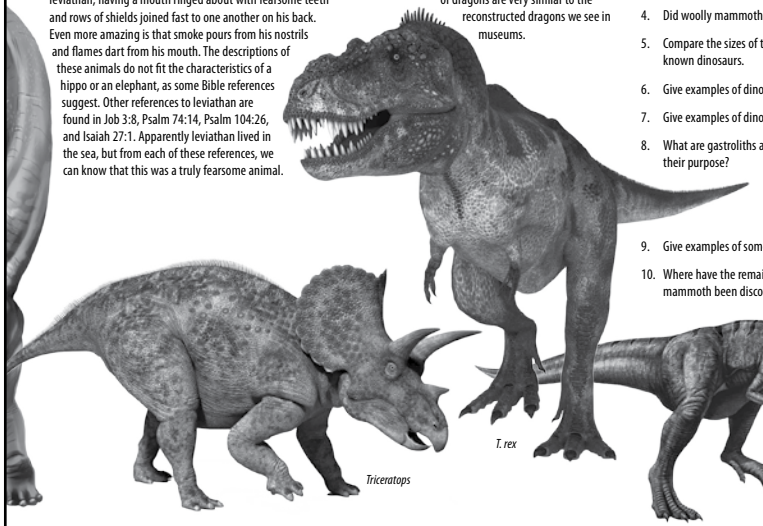


Brachiosaurus

Making Connections

There are fascinating references of animals in the Book of Job that sound like accurate descriptions of dinosaurs. Certainly Job would have been familiar with the animals that were being discussed. The 40th chapter of Job describes the powerful behemoth with a tail that sways like a cedar tree. The 41st chapter of Job refers to a fierce animal known as leviathan, having a mouth ringed about with fearsome teeth and rows of shields joined fast to one another on his back. Even more amazing is that smoke pours from his nostrils and flames dart from his mouth. The descriptions of these animals do not fit the characteristics of a hippo or an elephant, as some Bible references suggest. Other references to leviathan are found in Job 3:8, Psalm 74:14, Psalm 104:26, and Isaiah 27:1. Apparently leviathan lived in the sea, but from each of these references, we can know that this was a truly fearsome animal.

Stories and references to dragons are found in nearly every civilization. Ancient books tell of using dragon parts for medicine. Many pictures of dragons are found in Oriental arts and books. Ancient Chinese stories tell of dragons being used to pull the emperor's chariot. Dragon slayers, such as Beowulf, are among the early heroes. The descriptions of dragons are very similar to the reconstructed dragons we see in museums.



T. rex

Triceratops

Allosaurus

What Did You Learn?

1. Are dinosaurs classified as reptiles, amphibians, or mammals?
2. Did dinosaurs lay eggs?
3. Are woolly mammoths classified as reptiles, amphibians, or mammals?
4. Did woolly mammoths lay eggs?
5. Compare the sizes of the smallest and the largest known dinosaurs.
6. Give examples of dinosaurs that walked on two legs.
7. Give examples of dinosaurs that walked on four legs.
8. What are gastroliths and what seemed to have been their purpose?
9. Give examples of some Ice Age animals.
10. Where have the remains of huge numbers of woolly mammoth been discovered?

What Did You Learn?

1. Are dinosaurs classified as reptiles, amphibians, or mammals? *Reptiles*
2. Did dinosaurs lay eggs? *Yes*
3. Are woolly mammoths classified as reptiles, amphibians, or mammals? *Mammals*
4. Did woolly mammoths lay eggs? *No, they gave birth to their young.*
5. Compare the sizes of the smallest and the largest known dinosaurs. *The smallest were about the size of chickens, and the largest were almost 150 feet (about 50 meters) long*
6. Give examples of dinosaurs that walked on two legs. *T. rex and Allosaurus*
7. Give examples of dinosaurs that walked on four legs. *Triceratops and Apatosaurus*
8. What are gastroliths and what seemed to have been their purpose? *Rocks that seem to have been in the stomach region of some dinosaurs. They were probably used to help digest food.*
9. Give examples of some Ice Age animals. *Woolly mammoths and Columbian mammoths.*
10. Where have the remains of huge numbers of woolly mammoth been discovered? *In Siberia and other regions near the Arctic Circle.*