

Teacher's Guide For

Glaciers

For grade 7 - College

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Table of Contents	Page
Table of Contents and Rights.....	2
Materials in the Programs.....	3
Instructional Notes.....	3
Introduction and Summary of the Program.....	3
Links to Curriculum Standards.....	4
Summary of Program <i>Glaciers</i>	4
(The program can be divided into chapters accessed through the DVD's Menu Screen under Chapter Selects)	
Introduction.....	4
Glaciers Past and Present.....	5
Glacier Dynamics.....	5
Mountain Glacier Formations.....	6
Continental Glacier Formations.....	6
Glaciers and Climate Change.....	6
Answers to Blackline Master 1A Quiz.....	7

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MATERIALS IN THE PROGRAM

Teacher's Guide -This Teacher's Guide has been prepared to aid the teacher in utilizing materials contained within this program. In addition to this introductory material, the guide contains the following:

- Suggested Instructional Notes
- Student Learning Goals
- Test Questions on Blackline Masters Quiz 1A for duplication and handout to students

INSTRUCTIONAL NOTES

It is suggested that you preview the program and read the related Student Goals and Teacher Points. By doing so, you will become familiar with the materials and be better prepared to adapt the program to the needs of your class. You will probably find it best to follow the program in the order in which it is presented in this Teacher's Guide, but this is not necessary. The program can be divided into chapters accessed through the DVD's Menu Screen under Chapter Selects. It is also suggested that the program presentation take place before the entire class and under your direction. As you review the instructional program outlined in this Teacher's Guide, you may find it necessary to make some changes, deletions, or additions to fit the specific needs of your students. After viewing the program you may wish to copy the Test Questions on Blackline Master 1A and distribute to your class to measure their comprehension of the events.

INTRODUCTION AND SUMMARY OF PROGRAM

Glaciers are among the most powerful geologic forces on the planet. This program, *Glaciers*, examines their uniqueness and discusses the scientific study of glaciers, their different forms, the Earth's many postglacial landforms and how glaciers are affected by climate change. Presented in an effective format designed to promote successful student learning, *Glaciers* examines the key elements of mountain and continental glaciers, the importance of glaciers in the past and the present, and the effect of climate change on glaciers. In addition, the program presents interviews with leading experts on glaciers.

Below is a list of the program and its chapters. Using this program, teachers can create a lesson plan to cover the specific concepts and themes discussed.

Glaciers

- Introduction
- Glaciers Past and Present
- Glacier Dynamics
- Mountain Glacier Formations
- Continental Glacier Formations
- Glaciers and Climate Change

LINKS TO CURRICULUM STANDARDS

The design for this program includes the following curriculum correlations: National Science Educations Standards, Content Standard Grades (6-12) California State Board of Education Content Standards for Earth Sciences (Grades 6-12); and the State of New Jersey Department of Education Core Curriculum Content Standards for 5.8 Earth Science, section B, (Grades 7 – 12); and 5.10, Environmental Studies, Sections A and B, (Grades 7 – 12). In addition, the National Science Educations Standards, Content Standard B - Properties and changes of properties in matter, motions and forces, transfer of energy: Content Standard D – Structure of the Earth system, Earth’s history, Earth in the solar system and the McRel K-12 Science Standards and Benchmarks, Level III (Grades 6-8) and Level IV (Grades 9-12.)

SUMMARY OF PROGRAM

Glaciers

This program on *Glaciers* presents the key concepts of glaciers and their importance to the Earth.

Chapter one describes how glaciers can dominate entire continents, reshaping features.

Chapter two introduces the different forms of frozen water in the Earth’s cryosphere – sea ice, permafrost, glaciers and snow. At the same time it discusses the different ice ages that have occurred in Earth’s history.

Chapter three discusses how glaciers form and how they move.

How mountain glaciers form and their role in reshaping mountains are described in chapter four.

Chapter five describes the important features of continental glaciers, known as ice sheets, including how they work. It also presents how ice sheets change the landscape, creating such postglacial landforms as eskers, kettle lakes, kames, drumlins and moraines.

Chapter six explains that glaciers and ice sheets are totally intertwined with changing climates and rising sea levels, and how understanding climate change’s impact on glaciers is one of the most important challenges facing scientists today.

Chapter 1 *Glaciers: Introduction*

Student Goals - In this *Glaciers* chapter the students will learn:

- Glaciers are one of the most powerful geologic forces on the planet
 - Wind and water erosion can produce dramatic landscape features
 - The results of slow tectonic plate movements are spectacular
- But only glaciers can dominate an entire continent

- They can shape mountain peaks
- The waxing and waning of glaciers can change the world's climates
- Changes in Earth's ice budget affect the entire planet

Chapter 2 *Glaciers: Glaciers Past and Present*

Student Goals - In this *Glaciers* chapter the students will learn:

- There are four types of frozen water
 - Snow
 - Surface freezing of lakes and oceans
 - Permafrost
 - Glaciers
- There are two types of glaciers
 - Mountain glaciers
 - Continental glaciers or ice sheets
- Present day distribution of glaciers and ice sheets
 - In the southern hemisphere they are found in New Zealand, the Andes and the Antarctic
 - In the Northern hemisphere they are found in the Himalayas, the European Alps, North America's Rockies and Cascade Ranges, and Alaska
- The final great accumulation of land ice in the Northern hemisphere is the Greenland ice sheet, the remnant of the last great ice age
- At one time the Earth was covered completely in ice
- The Earth has also been ice free, such as when the dinosaurs existed
- Since the dinosaurs, Earth has been cooling, leading to an Ice Age, beginning 3 million years ago
- This waxing and waning of continental ice sheets during the last 1.8 million years is called the Pleistocene

Chapter 3 *Glaciers: Glacier Dynamics*

Student Goals - In this *Glaciers* chapter the students will learn:

- How glaciers work
 - Ice is brittle and can break under pressure
 - Glaciers are not formed from ice but from compressed snow
 - The process of compressed snow begins when snow lasts through the summer and does not melt
 - Glacial ice becomes plastic and begins to flow much like Silly Putty, spreading out in all directions
- When ice sheets spread out, they pick up rocks along the way and transport them long distances
- Glaciers can move as a result of weight and pressure, called deformation
- Glaciers can also move when ice at the bottom of glacier melts and creates a thin film of water that lubricates the surface for the glacier to slide over the ground
 - When glaciers calve into their melt water lakes or the ocean, that is primarily the result of ice slipping
- Most glaciers today are not growing but retreating

- When glaciers retreat, the ice is still moving forward by the process of deformation

Chapter 4 *Glaciers: Mountain Glacier Formations*

Student Goals - In this *Glaciers* chapter the students will learn:

- The most dramatic landforms produced by glaciers are pointed mountain peaks, known as horns
- At the highest coldest parts of the mountain, snow survives the annual weather cycle and compresses into ice
- This is done in a basin where the glacier scours into the rock creating a semicircular shape, called a cirque
- As the ice grows, it flows downhill, carving out a valley glacier
- In some cases, valley glaciers grow into ice fields that gather up rocks and boulders
- At the terminus of the ice field, these boulders and rocks, called glacial till, are deposited in what are called terminal moraines
- When mountain glaciers retreat, they can also leave behind postglacial features such as u-shaped valleys, hanging valleys, and, fjords

Chapter 5 *Glaciers: Continental Glacier Formations*

Student Goals - In this *Glaciers* chapter the students will learn:

- Continental glaciers, or ice sheets, have their own postglacial features and impacts on the landscape
- The last Continental glacier to push south was the Laurentide Ice Sheet
 - At that time, ice extended into the northern United States, Europe and Asia
 - Today, all that remains of that glacial epoch is the Greenland ice sheet
- When a continental ice sheet advances and retreats it reshapes the landscape by abrasion and deposition
 - Abrasion flattens out everything
 - An example is America's Great Plains with its lake rich landscape
 - Also drumlins an elongated hill of glacial till
- With deposition, ice sheets create different landforms
 - Long irregularly shaped hills called moraines
 - Eskers – layers of sand and gravel
 - Kames which are conical hills
 - Kettle lakes

Chapter 6 *Glaciers: Glaciers and Climate Change*

Student Goals - In this *Glaciers* chapter the students will learn:

- In the last few hundred years, scientists have learned much about glaciers
- Glaciers and ice sheets are totally intertwined with changing climates and rising sea levels
- No major change in the climate can occur without the Earth's ice budget changing
- In this era of climate change, understanding the dynamics of glacier growth and wasting has become one of the greatest scientific challenges of our time

Answers to Blackline Master 1A Quiz

1-a; 2-b; 3-c; 4-c; 5-d; 6-b; 7-b; 8-a; 9-d; 10-a,b,c; 11-b