

# GLACIERS

## Rivers of Ice

Glaciers are relatively recent phenomena as they appear to have existed only since the last ice age when cooler conditions began locking up large amounts of water into both continental and alpine glaciers. This uptake of water lowered sea levels around the world allowing humans to populate the continents. When these humans reached areas that had been under glaciation, they found fertile soils where plant and animal life abounded.

In this way glaciers have influenced human development in the past, as well as the landscapes we find in North America and Europe today.

The intricacies of glaciers are examined in some detail by this program. It looks at how glaciers form, the different types of glaciers that exist around the world and the distinctive landscape features created by present (or past) glaciers. Cirques, moraines and U-shaped valleys are among many that remind us of the awesome power of these slow-moving giants.

Although under threat today from global warming, the short history of glaciers makes it hard to generalise about the fate of today's glaciers. However what is certain is that if the glaciers do melt then many of our coastal cities will resemble classical Atlantis as rising sea levels envelope them.



### Word Check:

Moraine, Cirque, Piedmont, U-shaped Valley, Hanging Valley.

### Pre-viewing Questions:

1. How will global warming affect the world's glaciers? What consequences could this have?
2. Are there any areas of Australia that are cold enough to maintain glaciers? What about New Zealand?

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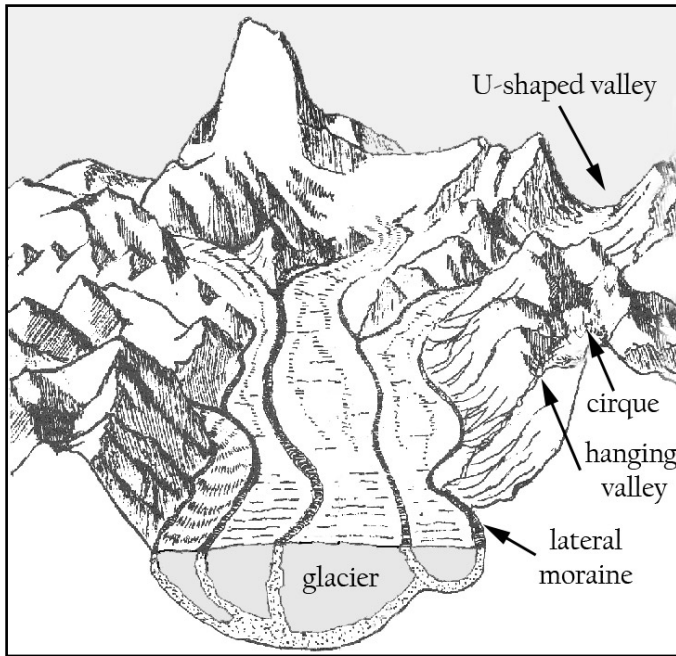
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## Glaciers: QUESTIONS

### Chapter 1: What is a Glacier?

1. What is a large sheet of ice that covers a mountainous region called?
2. Do all glaciers form over land?
3. What is at the foundation of all glaciers?
4. Why does glacier ice look blue?
5. What is meant when a glacier 'calves'?
6. How much of an iceberg's mass is below the water?
7. How does gravity affect glaciers?

### Chapter 2: Types of Glaciers

8. What are the characteristics of a continental glacier?
9. Where are the world's two continental glaciers found?
10. Compared to the United States, how large is the glacier at the south pole?
11. How can scientists study ice that is thousands of years old?
12. What information do these ice samples reveal?
13. Where are mountain or alpine glaciers found?
14. What is a tidewater glacier?
15. What is a piedmont glacier?
16. What is the only permanent animal inhabitant of glaciers?

### Chapter 3: Zones of a Glacier

17. How does a glacier move?
18. Which moves faster; the top of the glacier, or the bottom?
19. What is a moraine?
20. What is rock flour?

### Chapter 4: How a Glacier Forms

21. What forms a deep U-shaped valley?
22. What is a hanging valley?
23. What is a cirque?
24. What is a terminal moraine?
25. Where do lateral moraines form?
26. How were the Great Lakes of America formed?

## FURTHER INFORMATION

### On the glaciers of Glacier Bay, Alaska:

[www.isset.org/site\\_of\\_the\\_month/glacier\\_bay/glacierbay.script.html](http://www.isset.org/site_of_the_month/glacier_bay/glacierbay.script.html)

### For many glacier related links:

[http://wps.prenhall.com/esm\\_tarbuck\\_earth\\_7/0,6431,504083-,00.html](http://wps.prenhall.com/esm_tarbuck_earth_7/0,6431,504083-,00.html)

### Some good glacier images:

[http://www.geo.cornell.edu/geology/classes/Geo101/101images\\_fall.html](http://www.geo.cornell.edu/geology/classes/Geo101/101images_fall.html)

### All about glaciers:

<http://nsidc.org/glaciers/>

### For images of glaciers, moraines etc:

<http://www.geography-site.co.uk/pages/album/Glaciation/index.html>

### Lots of information and photos about New Zealand's glaciers:

<http://members.tripod.com/NZPhoto/glaciers/>

# Glaciers: ANSWERS

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## Chapter 1: What is a Glacier?

1. A glacier.
2. Yes, all glaciers form over land.
3. Snow and ice that does not melt from year to year.
4. Because the dense ice absorbs all but the blue band of the light spectrum.
5. Calving is when pieces of a glacier break off into the sea.
6. Icebergs have 85% of their mass beneath the water.
7. Gravity compresses the ice in the glacier and also forces it to move slowly downhill.

## Chapter 2: Types of Glaciers

8. A continental glacier covers a large area.
9. They are located in Antarctica and in Greenland.
10. The glacier is larger than the United States.
11. By drilling into glaciers several kilometres thick.
12. The deep ice cores can build up a picture of past climate conditions.
13. They are found all around the world where temperatures remain too low for snow to melt.
14. A tidewater glacier is one that flows into the sea.
15. A piedmont glacier is a glacier that has spread out at the foot of the mountain.
16. The Ice Worm is the only full-time animal inhabitant of glaciers.

## Chapter 3: Zones of a Glacier

17. Glacier movement is assisted by meltwater running at the glacier's base and the enormous weight of the ice itself.
18. The top of a glacier moves faster than the bottom.
19. A moraine is comprised of sediments deposited by a glacier.
20. Rock flour is finely ground rock contained in a glacier's meltwater.

## Chapter 4: How a Glacier Forms

21. An alpine glacier creates a deep U-shaped valley.
  22. A hanging valley is a valley carved by a glacier that is isolated up the side of the main valley after the glacier melts.
  23. A cirque is a bowl-shaped depression at the top of a mountain formed by alpine glaciers.
  24. A terminal moraine is the pile of sediment left at the end of a glacier.
  25. Lateral moraines form along the sides of glaciers where the movement is slower.
  26. The Great Lakes are ice-carved lakes exposed by the retreat of ice after the last ice age.
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## HOW SOIL IS FORMED

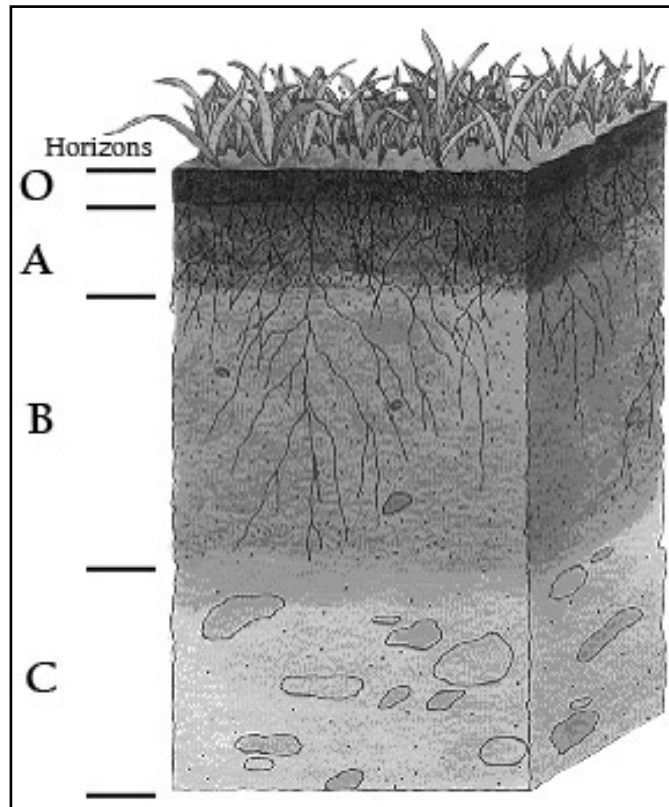
### From Rocks to Riches

Soils are the final result of the long and slow processes that weather the exposed rocks in our landscape. As far as the transformation of rock into soil is concerned, it's all down-hill as the agents of erosion and gravity take their toll.

The various forms of weathering that can lead to the formation of soils are broken down into three main areas: Physical Weathering; Chemical Weathering and Mass Movement.

Physical Weathering includes frost action, the pressure of tree roots and the buckling and cracking of rocks that have had pressure removed from them. As the name suggests, Chemical Weathering involves the mixing of chemicals to produce compounds that accelerate the weathering process. A good example of this is the weak Carbonic Acid in rainwater that causes damage to many of the stones, not only in our landscape, but also in our public buildings as well. Finally through the process of Mass Movement rocks and soil are moved from higher altitudes to lower altitudes, also accelerating the transformation of rock into soil.

This program finally examines why different types of soil form and why soil formation occurs at different rates around the world.



#### Word Check:

Physical Weathering, Chemical Weathering, Exfoliation, Hydration, Oxidation, Mass Movement, Differential Weathering, Humus, Leaching.

#### Pre-viewing Questions:

1. Where does soil come from? How do we have so many different types of soils?
2. Why do you think soil erosion one of the greatest threats we have to agricultural land in Australia?

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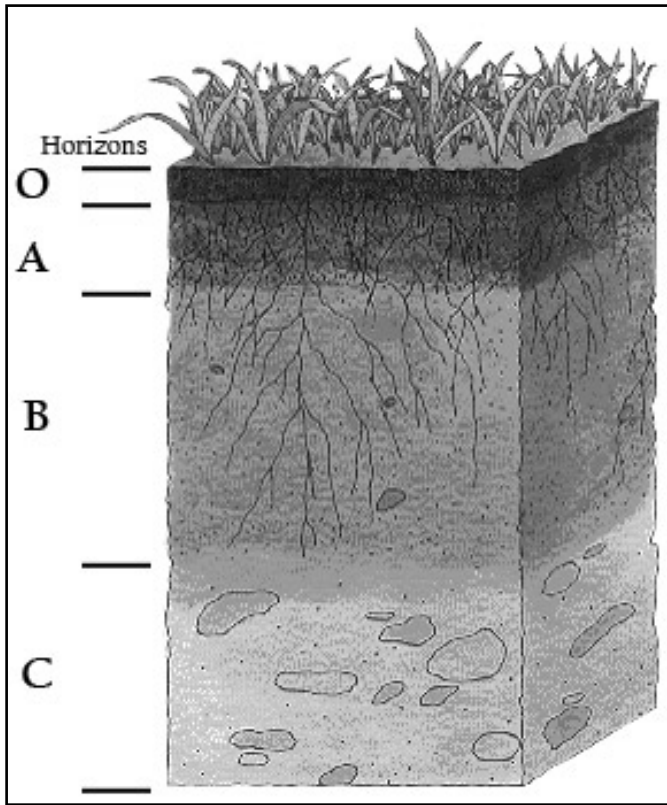
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## How Soil is Formed: QUESTIONS

1. What is soil?
2. What are the agents of weathering?
3. What is physical weathering?
4. What is chemical weathering?

### Chapter 1: Physical Weathering

5. What are the four methods of physical weathering?
6. What can cause igneous rocks to buckle and crack?
7. What is exfoliation?
8. How do cycles of freezing and thawing erode rocks?
9. What is root pry?
10. In what circumstances does abrasion of rocks take place?

### Chapter 2: Chemical Erosion

11. Why is water important in the process of chemical weathering?
12. What is hydration?
13. What is oxidation?
14. How does Acid Rain form?
15. What is carbonation?

### Chapter 3: Mass Movement

16. What are the four types of mass movement?
17. Under what circumstances does soil creep occur?

18. What are earth- and mud-flows?
19. What is the difference between an earth-flow and a landslide?
20. What is subsidence?
21. How does a sink-hole form?
22. What is differential weathering?

### Chapter 4: Formation of Different Soil Types

23. How does the type of rock determine different types of soils?
24. How does climate influence soil formation?
25. How do plant and animal life influence soil formation?
26. What is humus?
27. What are soil horizons?
28. What is leaching?
29. Why do temperate areas produce good soils?

## FURTHER INFORMATION

### An examination of Australia's poor soils:

[http://hsc.csu.edu.au/earth\\_environmental/core/caring/9\\_4\\_1/941net.html](http://hsc.csu.edu.au/earth_environmental/core/caring/9_4_1/941net.html)

### Test yourself with this About Soils test:

[http://www.beenleigss.eq.edu.au/requested\\_sites/soil/soilc.htm](http://www.beenleigss.eq.edu.au/requested_sites/soil/soilc.htm)

# How Soil is Formed: ANSWERS

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1. Soil is a combination of small rock fragments and organic matter.
2. The main agents of erosion are the sun, wind and water.
3. Physical weathering occurs when rocks are directly impacted by wind and rain.
4. Chemical weathering occurs when rocks are eroded by chemical compounds such as acid in rain.

## Chapter 1: Physical Weathering

5. The main methods of physical weathering are; pressure, freeze-thaw, plant growth and abrasion.
6. Rocks can buckle and crack when pressure is relieved due to overlying rock levels being eroded away.
7. Exfoliation occurs when rock weathers off in sheets. This is very common in granites.
8. Freeze-thaw occurs when frozen water in cracks expands creating pressure for the rock to split.
9. Root pry is erosion caused by the pressure exerted from growing plant roots.
10. Abrasion can occur in streams, rivers, oceans and glaciers.

## Chapter 2: Chemical Erosion

11. Water is important in chemical weathering because of its ability to carry dissolved minerals and chemicals.
12. Hydration occurs when water and other minerals mix to form a new compound such as clay (a mixture of water, mica and feldspar).
13. Oxidation occurs when oxygen combines with other materials to form a new compound.
14. Acid Rain occurs when carbon dioxide in the air combines with the water of rain to form a weak Carbonic Acid.
15. Carbonation is the weathering action of Acid Rain on rocks.

## Chapter 3: Mass Movement

16. Creep, flow, landslide and subsidence are the main forms of Mass Movement.
17. Soil Creep occurs when the soil is saturated with water and it slips on underlying rock levels.
18. When earth or mud cuts a gully as it flows downhill.
19. A landslide occurs under dry conditions.
20. Subsidence occurs when rocks and earth sink, rather than slide downhill.

21. A sink-hole forms when weaker underlying rocks erode away forcing the upper layers of rocks to collapse downwards.
22. Differential weathering occurs when different rocks in a landscape weather at different rates.

## Chapter 4: Formation of Different Soil Types

23. All soil comes from rocks, so different rocks form different soils.
  24. More soil forms in moist climates and areas with big changes in temperature may also have increased soil formation.
  25. Passages created by animals such as worms and the roots of trees help break down soils and mix them up.
  26. Humus is the organic element in soil.
  27. Layers in the soil such as topsoil and bedrock.
  28. When water moves humus and other minerals from the top layers of soil to lower layers.
  29. Good rainfall creates the right conditions for soil formation, but the rain is not enough to leach the soil.
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