

**Reading Guide for
Chapter 17: Glaciers and Ice Ages (p. 538)**

As residents of western Washington, our everyday lives are impacted by the glacial history of this region. As we struggle to drive or bike up and down our steep hills, we can thank the glaciers that shaped the Puget lowlands. Puget Sound itself is a product of this glacial age. Evidence of this glaciation is all around. I hope that you enjoy reading and learning about glaciers.

Glacier Formation and Growth (p. 541)

Glaciers form and grow when the snow accumulation is greater than ablation due to summer melting and sublimation.

As snow transforms from flakes to firn and eventually into ice, it _____ (increases/decreases) in density. This transformation is primarily due to _____ that creates water vapor that recrystallizes into more spherical grains.

Describe what is meant by the snowline (sometimes referred to as the annual snowline):

An aside: there is a slight difference in the level of the annual snowline on the higher Cascade peaks. There is more ice on the north and east sides of the peaks in the Cascade and Olympic Mountains than on the south and west sides of the same peaks. An example is Mt. Rainier-- much greater ice volume on the north and east sides than on the west and south sides. In the summer you may notice that the north side of your house is cooler. In the northern hemisphere, the sun is in the southern sky, so shadows during midday are on the north sides of objects. The north sides of the major volcanoes receive less solar energy, so the glaciers are larger!

Classifying Glaciers (p.542)

Although the author of your text subdivides glaciers into several different types, we will use the terms alpine and ice sheet (or continental glacier). There is nothing incorrect about the other terms, but I will not expect you to know them.

The Budget of a Glacier (p. 542)

► The budget of a glacier is the difference between a glacier's _____ of snow and ice and its _____. The glacier's terminus will extend farther down the valley if:

(This is sometimes termed an advancing glacier)

Whereas, the terminus of the glacier will be higher in elevation (up the valley) if:

► (This is sometimes termed a retreating glacier. Note: the position of the terminus of the glacier is the not the same as the movement of the glacier ice. That is, the terminus of a glacier can retreat, but the ice in that glacier will still be moving downhill!)

The equilibrium line is the line that separates the zone of _____ from the zone of _____. Usually the equilibrium line and the snowline are very close and for our purposes we can refer to them as the same in this course.

Glacial Flow (p. 542)

► Glaciers move by a combination of _____ and _____. In very cold climates glaciers may freeze to the bedrock under the glacier, but they do move due to _____.

In what way is a glacial surge different than normal glacial movement? What causes a glacial surge?

The Work of Glaciers (p. 546)

Glacial Erosion (p. 546) and *Glacial Transport and Deposition* (p. 549)

Complete the following matching list:

- | | |
|--|---------------|
| _____ 1. When three or more cirque glaciers erode a mountain, a steep peak is formed | A. striations |
| _____ 2. Drift that is deposited directly from the glacier. | B. cirque |
| _____ 3. Meltwater deposits of sand and gravel that accumulated under the ice forming a sinuous ridge. | C. arete |
| _____ 4. A scratch formed by the movement of ice carrying rocks. | D. horn |
| _____ 5. Deep horseshoe-shaped basins that develop above the snowline. | E. erratic |
| _____ 6. Gently rounded, elongated hills that are streamlined in the direction of the movement of the ice sheet. | F. till |
| _____ 7. Sand and gravel deposited by the meltwater of a glacier. | G. moraine |
| _____ 8. A sharp ridge formed by the headward erosion of two alpine glaciers. | H. drumlin |
| _____ 9. A very large rock that has been eroded from one type of bedrock and then deposited on another. | I. outwash |
| _____ 10. A mass of drift that accumulates at the terminus of a glacier. | J. esker |

Match the correct process of formation (the numbered items) with the glacial features on the left.

- | | |
|---------------------|--|
| _____ A. striations | 1. Eroded by the ice |
| _____ B. cirque | 2. Deposited directly by the ice |
| _____ C. arête | 3. Deposited by the meltwater from the ice |
| _____ D. horn | |
| _____ E. erratic | |
| _____ F. till | |
| _____ G. moraine | |
| _____ H. drumlin | |
| _____ I. Outwash | |
| _____ J. esker | |

Other Effects of Glaciation (p. 555) The information on the changes in drainage patterns and the formation of the Channeled Scablands of Eastern Washington (Highlight 17-1) is interesting and you should read them, but you will not be tested directly over this material.

In the hills east of Bellingham is a deposit of sediment that indicates that the ocean was about 300 feet higher than the present level immediately after the last glacial advance into the Puget lowlands. Use Figure 17-24 and the discussion on page 558 to explain why the land was 300 feet lower immediately after the last glaciation compared to the present.

In some places outside of the area covered by ice, there was more rainfall during the last glaciation. Lakes developed in these places. We call these lakes _____.
_____ is an example.

Since the amount of water on Earth is relatively fixed, if there is more water in ice during a glacial period, the level of the oceans must have _____.

Reconstructing Ice-Age Climates (p. 562)

Please read, but you will not be tested of this information directly.

The Causes of Glaciation (p. 566)

Please read this section, but I will not test you over the various ideas about what caused the glaciations.

The Earth's Glacial Past (p. 569)

Glaciation in the Pleistocene (p. 571) and *Recent Glacial Events* (p. 572)

The most important idea in these sections is the complex nature of the "Ice Age." There were several periods of glaciation followed by periods of time very similar to today. I will not ask you for specific names or dates, but the overall idea is important.

Some of the connections between climate and history and the effects of human activity on glaciers are interesting sections, but you will not be tested over that information.

Glaciation on Other Planets and Moons (p. 576)

Read if you are interested in the subject. You will not be tested on this section.