

The Extreme Environments of Earth and Beyond

9.2

For humans, an extreme environment is a place where the conditions are so harsh that human survival is difficult or impossible. Polar regions, deserts, oceans, volcanoes, and space are examples of extreme environments. Although each environment is different, they are all characterized by extreme conditions, such as very hot or very cold temperatures, little or no water, crushing pressure, or no air.

Figure 1 is a map of the world showing the locations of extreme environments.

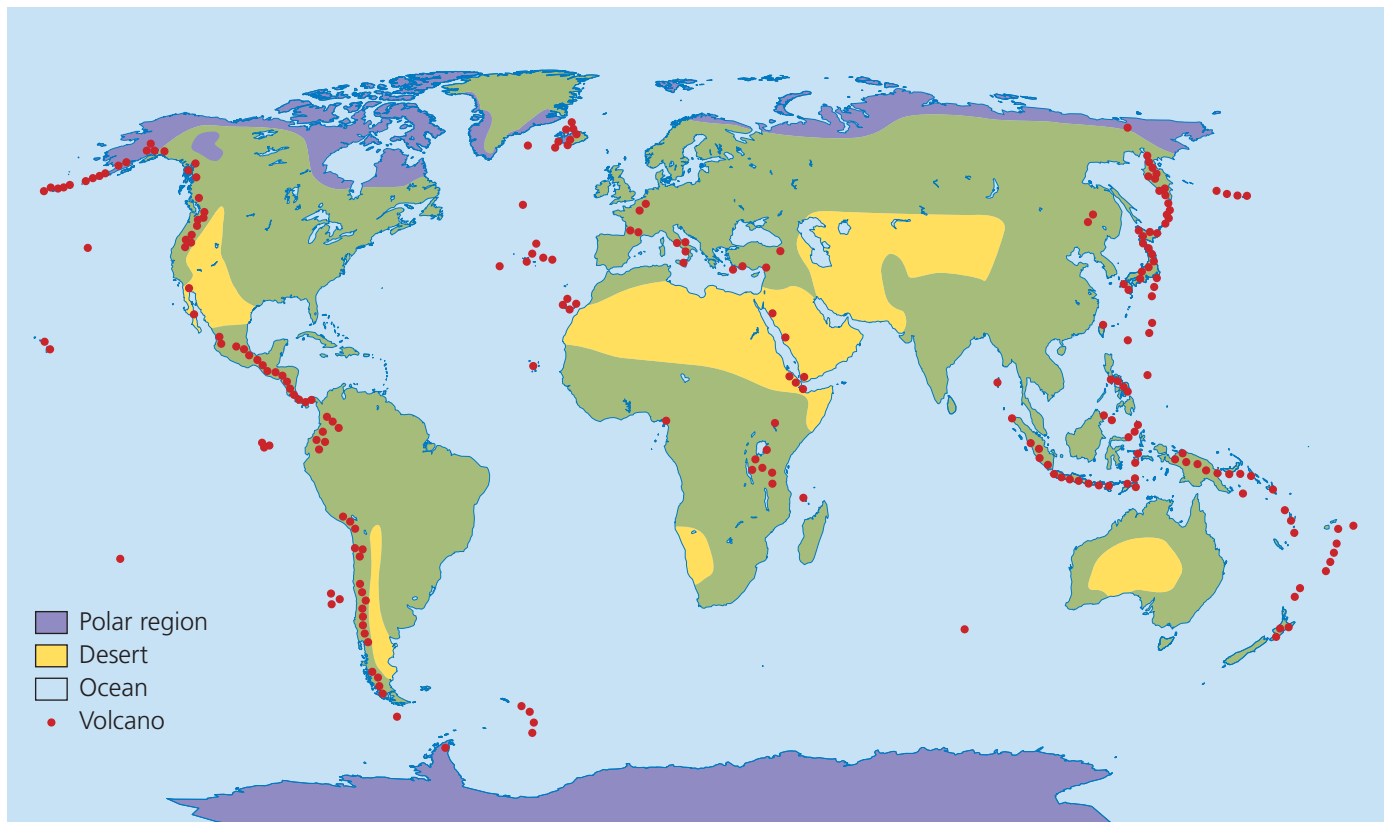


Figure 1

Polar regions (in purple), deserts (in yellow), oceans (blue), and volcanoes (red dots) are extreme environments.



▶ LEARNING TIP

Look through the headings in this section. Before you read the section, predict what makes each of these environments extreme.

Polar Regions

There are two polar regions: the Arctic and Antarctica. The Arctic is the cold area around the North Pole. It includes the Arctic Ocean at the centre and the land that surrounds the Arctic Ocean. It is usually identified as the area north of the Arctic Circle. The average annual temperature is 0°C . The Arctic is home to many animals, such as polar bears, arctic foxes, arctic wolves, walruses, seals, and whales. These animals have developed adaptations to the frigid conditions. People, such as the Inuvialuit [in-oo-vee-AL-oo-it], also live in the Arctic (**Figure 2**). They have survived by developing the technology to protect themselves from the extreme cold.



Figure 2

The town of Inuvik, Northwest Territories, is the largest town north of the Arctic Circle. The extreme minimum temperature is -56.7°C . Inuvik receives 56 days of total sunlight in summer and 30 days of total darkness in winter.

Antarctica is a continent that is located almost entirely within the Antarctic Circle. It is the coldest, highest, and windiest place on Earth, and holds the record for the coldest temperature: -89.2°C . Since Antarctica is mostly covered with ice, most of the animals that live on land are microscopic animals and insects. The penguins that live on the coasts are the one exception. In comparison to the land, the ocean surrounding Antarctica supports a wide variety of life, such as zooplankton [ZOE-eh-PLANK-tuhn], penguins, seals, whales, and dolphins. Antarctica is the only continent that has no permanent population of humans. However, scientists from all over the world, including Russia, Japan, the United States, Australia, and New Zealand, work and live in scientific stations in Antarctica.

Deserts

Deserts are very dry areas that get less than 25 cm of rain a year (**Figure 3**). Most people think that deserts are hot places, but deserts can also be very cold. Both the Arctic and Antarctica are deserts. The Atacama desert in Chile is the driest place on Earth. It receives less than 0.01 cm of rain per year. Some deserts are sandy, but most are wildernesses of rock and stone. Animals and plants that live in deserts have special adaptations that allow them to survive, despite the lack of water. People also live in some deserts. For example, the Afar people of Ethiopia, Africa, live in one of the hottest place on Earth, where temperatures are between 35 °C and 40 °C year-round. The living conditions are harsh, but the Afar have found ways to survive.



Figure 3

The “Pocket Desert” near Osoyoos, in the South Okanagan Valley, British Columbia, gets less than 20 cm of rain a year. About one-fifth of Earth’s land surface is desert.

Oceans

Most of Earth’s surface (about 71%) is covered by oceans. Even though people can travel on the surface of the ocean, the deepest parts of the ocean are very hard to explore. The ocean depths are pitch black. There is no air to breathe, and the crushing pressure increases the deeper you go. **Figure 4** shows some of the amazing creatures that live in the ocean depths.



Figure 4

Life near thermal vents in the Mariana Trench, the deepest part of the ocean. This photo was taken by ROPOS, a Canadian robotic submersible.



Volcanoes

Volcanoes are vents in Earth's surface where molten rock from below the surface can rise up and spill over (**Figure 5**). Volcanoes are particularly dangerous because they are unpredictable. Some volcanoes are dormant, or sleeping, and do not erupt. Active volcanoes produce hot lava, steam, and ash, which can destroy the surrounding area. Today, there are over 1000 active volcanoes on land and many more in the oceans. Volcanologists study volcanoes to predict when they may erupt and to understand what causes them to erupt.



Figure 5

Kilauea, in Hawaii, is the world's most active volcano. Lava erupts frequently, which poses a danger to the surrounding area and the people who live there.

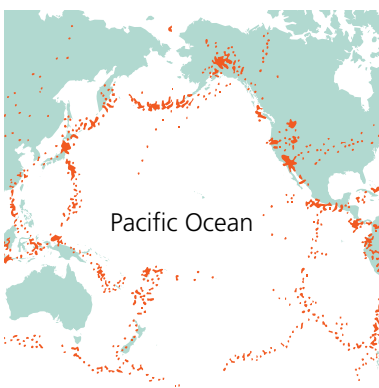


Figure 6

Ring of Fire

Volcanoes are located in specific parts of the world. One of the most important areas that scientists are exploring is a chain of volcanoes that encircles the Pacific Ocean. This chain is known as the Ring of Fire (**Figure 6**). Indonesia has the most active volcanoes. Scientists believe, however, that there are probably more volcanoes on the ocean floor than there are on land.

Outer Space

For centuries, people have looked up into the sky and imagined travelling through space (**Figure 7**). Space is the region beyond Earth's atmosphere [AT-muhs-FEAR]—the ultimate extreme environment. The temperatures are *really* extreme—from boiling hot in the light of the Sun to freezing cold in the shadow of Earth—and there is no air to breathe. As well, space is close to a vacuum. Space contains atoms and particles of dust, but they are spread so thinly that space is considered to be empty.

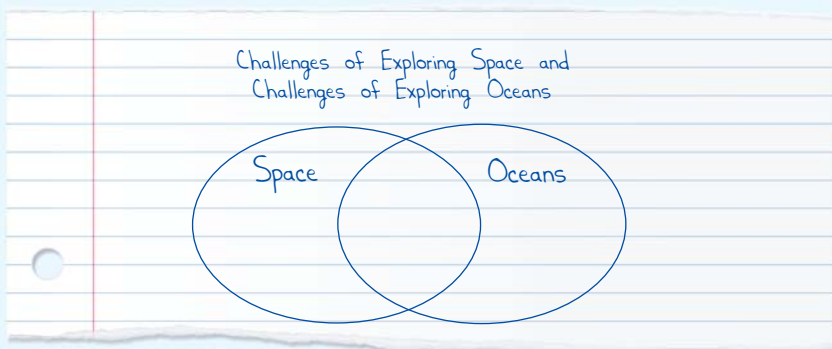


Figure 7

People have always wondered about what is in space. However, it is only in the past 50 years that people have been able to travel to and survive the extreme conditions of space.

CHECK YOUR UNDERSTANDING

1. What are some characteristics of an extreme environment?
2. What is the main characteristic of a desert? Is a desert always a hot place? Explain why or why not.
3. Why do oceans present such a challenge for human exploration?
4. Create a Venn diagram to compare and contrast the challenges of exploring in space with the challenges of exploring the oceans.



5. Choose one extreme environment. Discuss the conditions in this environment that affect human travel.