10-6 What are the tides?

Objective
Describe what causes and affects the tides.

Key Terms
tide: regular change in the level of Earth's oceans
flood tide: incoming, or rising, tide
ebb tide: outgoing, or falling, tide

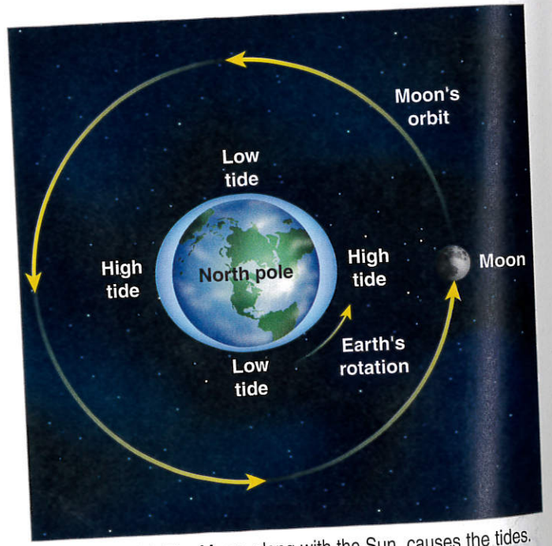
Ocean Water Levels The water level of the ocean rises and falls throughout the day. Early in the day, ocean water rises and covers part of the beach. Later in the day, the ocean level falls. The beach is exposed. These regular changes in ocean water levels are called **tides.** A low water level is called low tide. A high water level is called high tide.

▲ **Figure 10-17** Low tide (above) and an incoming tide (below) in the same location

1 **DEFINE:** What are tides?

Causes of Tides You probably know that Earth's gravitational pull on the Moon keeps the Moon in orbit around us. But did you know that the Moon also pulls back on Earth and causes the tides? The Sun's gravitational pull also affects Earth's tides, but because it is so far away from us, not as strongly.

Earth's continents are slightly stretched by the pull of the Moon. Earth's oceans, which move more freely, are stretched even more. This stretching effect creates two bulges of water on Earth, one facing the Moon, the other directly opposite it. These bulges are the high tides. The bulging water also causes two areas with low tides between the high tides. As the Earth turns on its axis, the tide levels rise and fall.



▲ **Figure 10-18** The Moon, along with the Sun, causes the tides. Whether it is high tide or low tide depends mostly on where you are on Earth relative to the Moon.

2 **IDENTIFY:** What mainly causes tides on Earth?

Changing Tides Some newspapers print tide tables. A tide table tells the times at which high tide and low tide will occur. If you look at a tide table, you will notice that it often shows two high tides and two low tides each day. The tides change about every 6 hours and 15 minutes.

TIDE TABLE

Sunday	Monday	Tuesday	Wednesday
1 Low 4:45a	2 Low: 5:38a	3 Low: 6:27a	4 Low: 7:11a
High 11:31a	High 12:32p	High 1:25p	High 2:10p
Low 4:30p	Low 5:24p	Low 6:15p	Low 7:02p
High 10:24p	High 11:10p	High 11:55p	
8 Low 2:47a	9 Low: 3:31a	10 Low 4:18a	11 Low 5:10a
High 9:40p	High 10:13a	High 10:48p	High 11:23a
Low 4:26p	Low 4:58p	Low 5:30p	Low 6:05p
High 9:58p	High 10:46p	High 11:36p	

▲ **Figure 10-19** A newspaper gives the times for high and low tide.

Each quarter rotation of Earth causes a major change in tides. Water slowly floods the beach until high tide is reached. The incoming tide is called a **flood tide.** As Earth rotates another quarter turn, the water begins to leave the beach until low tide is reached. This outgoing tide is called an **ebb tide.**

3 **INFER:** How often each day do flood tides occur?

CHECKING CONCEPTS

1. What is the outgoing tide called?
2. What causes tides?
3. What is a flood tide?
4. How many times do the tides change each day?

THINKING CRITICALLY

5. **INFER:** Who would use a tide table? Why?
6. **PREDICT:** If low tide occurs at 6:30 A.M., when will the next low tide probably occur?
7. **HYPOTHESIZE:** Suppose you docked a boat where the tides rise and fall about 1 m. How would this affect the use of the boat?

INTERPRETING VISUALS

Use Figure 10-19 to answer the following question.

8. **INFER:** Fishing is best on mornings with high tides. Which day should you go?

Real-Life Science
TIDES AND FISHING

Grunions are small silver fish that live in the Pacific Ocean off the coast of California. Grunions spawn and lay their eggs on sandy beaches from late February to early September, but only on nights of the highest tides. During this time, thousands of grunions cover the beaches. Many people gather on the beaches and catch the fish by hand. Some newspapers announce the nights the fish are expected to be on the beach.

▲ **Figure 10-20** Catching grunions on the beach is a common event in California.

Much of the fishing industry depends on an understanding of tides. Tides involve the movements of huge volumes of water. The water carries fresh oxygen. It also carries microorganisms, which serve as food for fish. Fish carried in with high tides can be easily trapped in nets later in the day.

The Bay of Fundy, between Nova Scotia and New Brunswick, Canada, is known worldwide for its tides. The difference between high and low tides can be over 10 m. This region is famous for its fishing industry.

Thinking Critically Why do you think the fish carried in with the high tides are easily trapped in the nets?