

# Tides

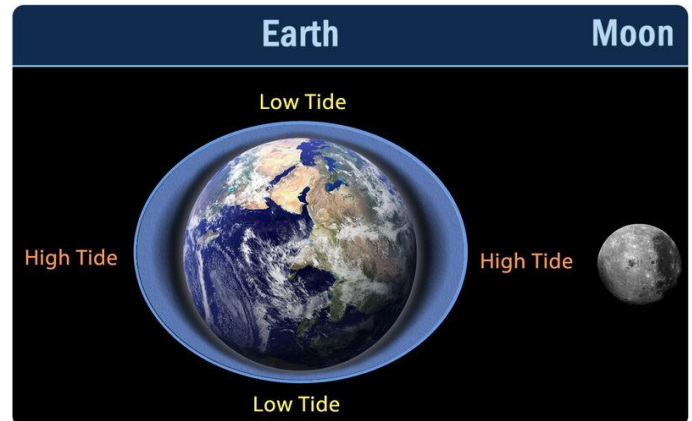
## The Tides

**Tides** are the daily rise and fall of sea level at any given place.

- Primary cause: pull of the Moon's gravity on Earth
- Secondary cause: pull of the Sun's gravity on Earth
- The Moon has a greater effect because, although it is much smaller than the Sun, it is much closer (Moon's pull is about twice that of Sun's)
- Effect of Moon on Earth:
  - As the Moon revolves around our planet, its gravity pulls Earth toward it
  - Lithosphere is unable to move much, but the water is pulled by the gravity and a bulge is created: high tide beneath the Moon
  - On the other side of the Earth, a high tide is produced where the Moon's pull is weakest
  - These two water bulges on opposite sides of the Earth aligned with the Moon are the **high tides**
  - The places directly in between the high tides are low tides
  - As the Earth rotates beneath the Moon, a single spot will experience two high tides and two low tides approximately every day
- Gravity of the Sun also pulls Earth's water towards it and causes its own tides
  - Because the sun is so far away, its pull is smaller than the Moon's
- Some coastal areas do not follow this pattern at all
  - May have one high and one low tide per day or a different amount of time between two high tides
  - These differences are often because of local conditions, (i.e. shape of coastline that the tide is entering)
- **Tidal range:** difference between the ocean level at high tide and the ocean level at low tide
  - Depends on a number of factors (e.g. slope of the seafloor, since water appears to move a greater distance on a gentle slope than on a steep slope)

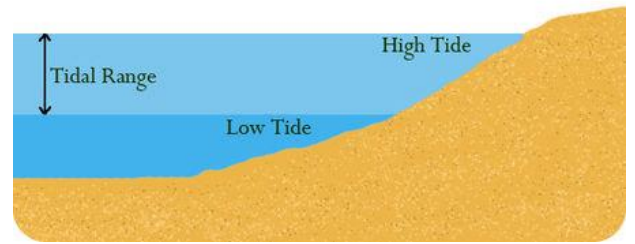
### Study Tip

Remember that the Moon takes 24 hours and 50 minutes to rotate once around the Earth, so the Moon is over the same location every 24 hours and 50 minutes. Since high tides occur twice a day, one arrives each 12 hours and 25 minutes.



*The gravitational attraction of the Moon to ocean water creates the high and low tide.*

- Waves are additive, so when the gravitational pull of both bodies is in the same direction, the high tides are higher and the low tides lower than at other times through the month
  - **Spring tides:** more extreme tides, with greater tidal range; occur whenever the Moon is in a new-moon or full-moon phase, about every 14 days
  - **Neap tides:** tides that have the smallest tidal range; occur when Earth, Moon, and Sun form a  $90^\circ$  angle; occur exactly halfway between the spring tides, when the Moon is at first or last quarter



*The tidal range is the difference between the ocean level at high tide and low tide.*

## Concept Check

- Using the terminology of waves, describe how the gravitational attraction of the Moon and Sun make a high tide and a low tide.
- Describe the causes of spring and neap tides.
- What are the possible reasons that the Bay of Fundy has such a large tidal range?