

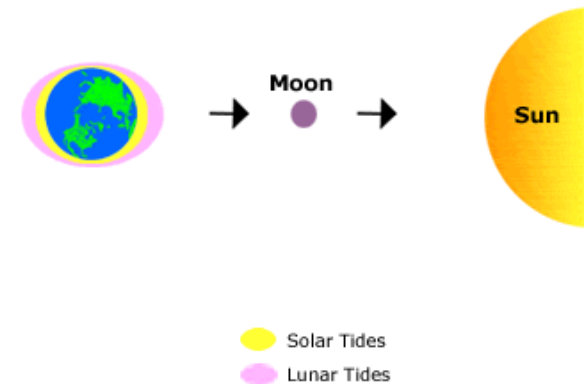
Tides



TIDES

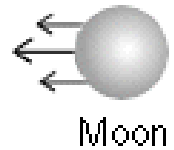
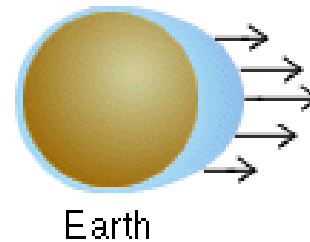
- What are tides?
 - The periodic rise and fall of the sea level under the gravitational pull of the moon
- Tides are one of the most reliable phenomena in the world. As the sun rises in the east and the stars come out at night, we are confident that the ocean waters will regularly rise and fall along our shores.

Spring Tides



Moon Tide

- The Moon's gravity exerts a strong pull on Earth.
- The water bulges outward as Earth and the Moon revolve around a common center of mass.
- The moon's gravity pulls on the earth, and pulls the water towards it. The water moves up into a slight bulge on the side of the earth that faces the moon.



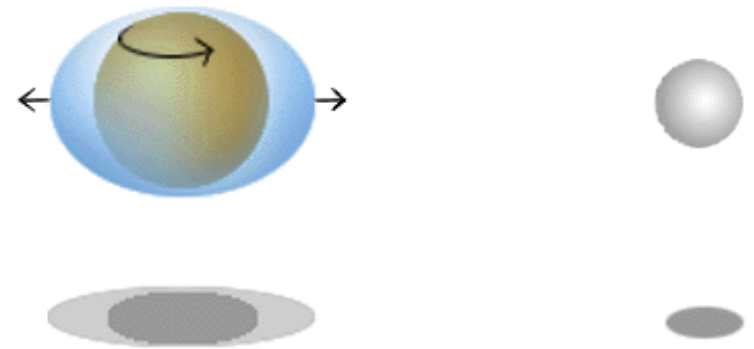
Brain Check

- Think to yourself, what causes tides?
- On your white board, write down what causes tides.



Moon Tides

- The gravitational and centrifugal forces are constant, always pulling water towards the moon and directly away from the moon. The forces in either direction are equal to each other.
- The bodies of water that feel these forces change constantly as the earth rotates within these forces, but the force directions are always toward and away from the moon.



Semidiurnal tides

- As the earth turns upon its own axis in about 24 hours, a point on the earth moves through areas with these different forces acting on it.
- In one rotation (one day), a point on earth travels from an area of high tide (where there is a force pulling water outward), through an area of low tide, through an area of high tide again (the opposite pull), and through another area of low tide, before it returns to the point of origin at high tide.
- This results in two high tides and two low tides in a day (called semidiurnal tides).



0 hrs



The Tidal Day

- The moon does not stay put, but rotates around the earth at a rate of about 12° a day, or one rotation a month.

- The rotation is in the same direction as the earth's spin, so by the time the earth has done one rotation, the moon has shifted 12° further, and it takes an extra 50 minutes for the moon to be in the same position relative to a point on the earth.

- Therefore, the tidal cycle is not 24 hours long, but 24 hours and 50 minutes. Because of this, high and low tides are about 50 minutes later every day.



0 hrs



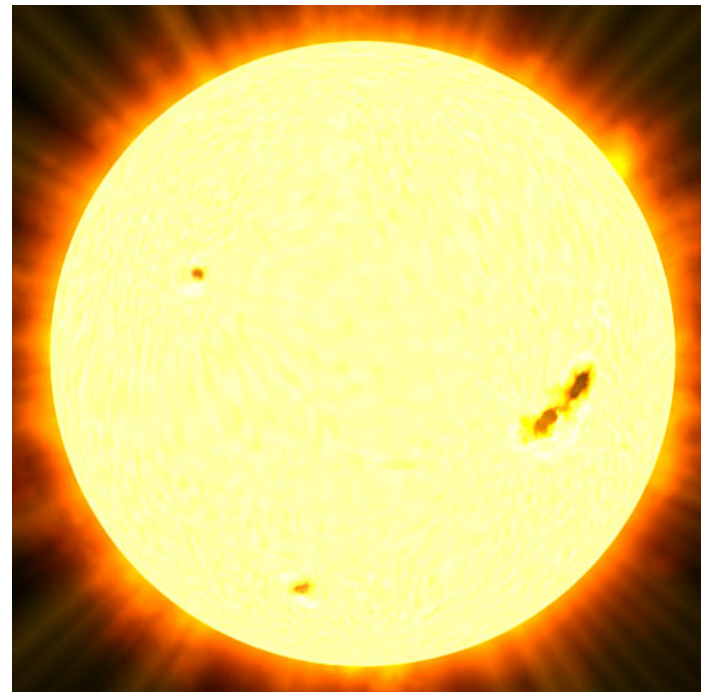
Brain Check

- Think to yourself, what is the length of a tidal day?
- On your white board answer the following question:
 - If high tide is at 12pm today, when will it be tomorrow.
 - Show me your white board.



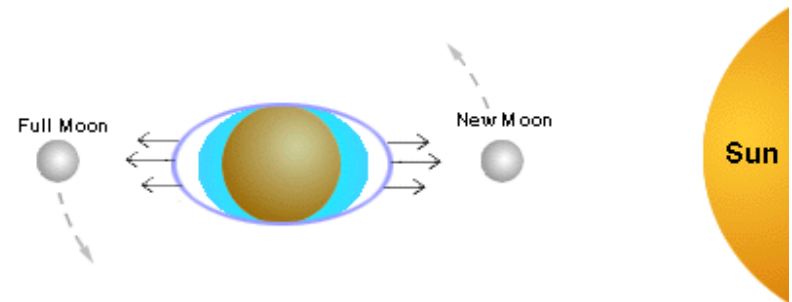
The Sun Tide

- The sun's pull can heighten the moon's effects or counteract them, depending on where the moon is in relation to the sun.



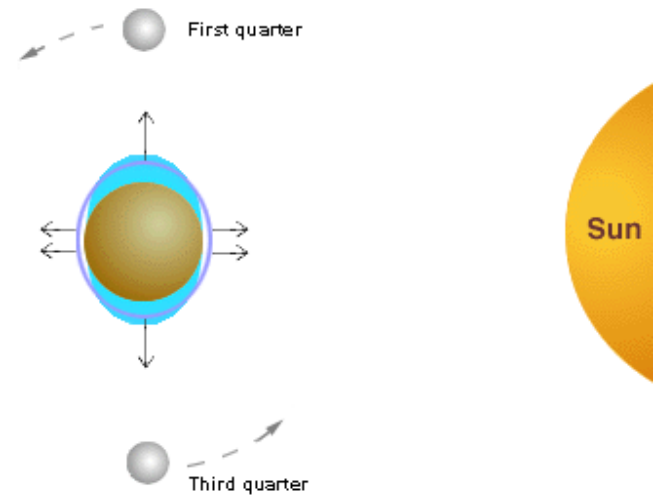
Spring Tides

- Spring tides are especially strong tides (they do not have anything to do with the season Spring). They occur when the Earth, the Sun, and the Moon are in a line. The gravitational forces of the Moon and the Sun both contribute to the tides. Spring tides occur during the full moon and the new moon.
- The Moon & the Sun's gravitational force combine to create a particularly strong tide.



Neap Tides

- Neap tides are especially weak tides.
- Moon & Sun are perpendicular to each other.
- Moon & the Sun's gravity cancel each other out.
- They occur when the gravitational forces of the Moon and the Sun are perpendicular to one another (with respect to the Earth). Neap tides occur during quarter moons.



Brain Check

- Think to yourself, what is the difference between spring and neap tides?
- On your white board, draw a Venn diagram comparing and contrasting spring and neap tides.
- Using your white board as a guide, discuss with your neighbor the similarities and differences of spring and neap tides.



Tidal Range

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



Mont St. Michel

- A great example of tidal surge is the castle Mont St. Michel in France.
- The tides surrounding the "Mount" can vary by 14 meters between high and low tides, and move in as rapidly as 1 meter a second.
- The "Mount" is connected to the mainland by a thin natural land bridge, which before modernization was covered by the sea at high tide, and revealed during the low tide.



Isaac Newton

- Isaac Newton (1642 - 1727) was the first person to explain tides scientifically. His explanation of the tides (and many other phenomena) was published in 1686, in the second volume of the Principia.



Tying it all together

- Think to yourself, what you have learned about tides.
- On a half piece of paper, write a power outline about tides as well as a graphic which describes tides.

