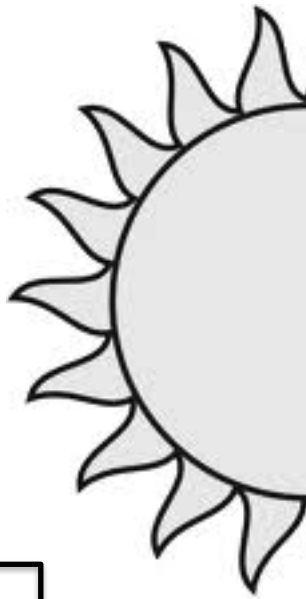
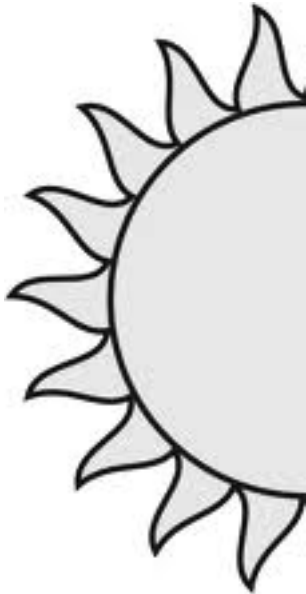


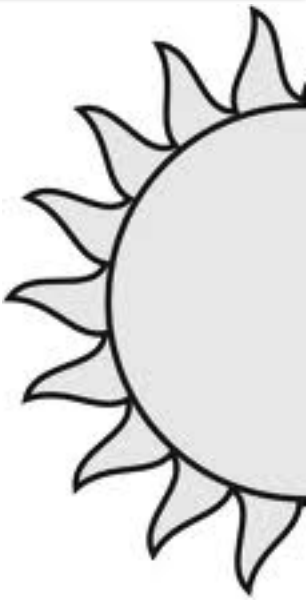
FULL moon



QUARTER moon



NEW moon



Calculate the gravitational force from the sun and from the moon

1.  $Force \propto \frac{mass}{distance^2}$
2. Sun's mass is 27 million times greater than moon, but the sun is 390 times farther away from the Earth.  $390^3 = 59$  million.
3.  $\frac{27 \text{ million}}{59 \text{ million}} = 0.46$  so the sun's tidal force is only 46% that of the moon

Challenge questions:

- The largest exchanges are called SPRING tides (because they spring up the beach, not because they happen in the spring), and the smallest exchanges are called NEAP tides. What kinds of tides are experienced during a full moon? A new moon? A quarter moon?
- Does the entire world see the same fraction of the moon on the same day?
- Does the entire world experience a spring tide at the same time?
- What time of day does a full moon rise? New moon?
- The moon is closer to the earth at some points of its orbit. True or false: spring tides are their strongest when the moon is closest to the earth. Why true or false?

Snazzy tide trivia:

Anything that CAN deform WILL deform due to tidal forces

- Amplitude of tides in deep mid-ocean: about 1 meter.
- Shoreline tides can be more than 10 times as large as in mid-ocean.
- Amplitude of tides in the Earth's crust: about 20 cm.
- Tidal stretch of human body changes its height by fraction  $10^{-16}$ , an amount 1000 times smaller than the diameter of an atom. By comparison, the stress produced by the body's own weight causes a fractional change in body height of  $10^{-2}$ .