

How tides work

Use this model to explore how the Earth's Sun and Moon influence the tides

Suitable for Scouts

In most places on the Earth, there are 2 high tides and 2 low tides each day. This activity models the 'equilibrium theory' of tides, showing why there are two tides each day, why the heights of the tides change over the course of a month, and why the tides occur about an hour later each day.

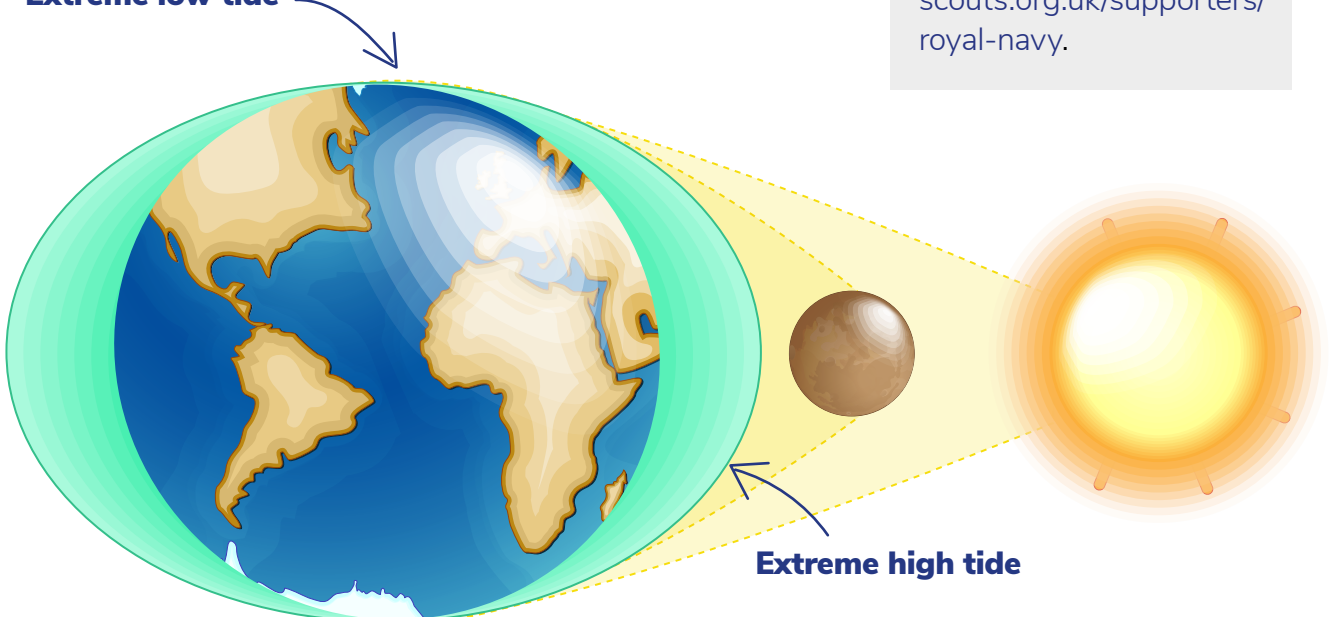
Before you start

Download the tidal templates from scouts.org.uk/supporters/royal-navy.

You will need

- Earth-Sun template, printed or copied onto white card or thick white paper
- Earth-Moon template, printed or copied onto tracing paper
- Earth model template, printed or copied onto white card or thick white paper
- 2 split pins
- pushpins
- large piece of white cardboard or card stock, at least 30x30cm (optional)

Extreme low tide



Time needed

90 minutes over several sessions

Badge



Royal Navy partners the Time on the Water Staged Activity Badge

Partner



Outcomes

Scouts will learn why there are tides and that these are caused by the gravitational forces of the Sun and Moon.

More information

To find out more go to scouts.org.uk/supporters/royal-navy.

Instructions

Part 1: solar tides

1 Cut out one of the rectangles containing the Earth and Sun from the Earth–Sun template, and one of the Earth models from the Earth model template. (Note that the perspective is centred over the North Pole.)

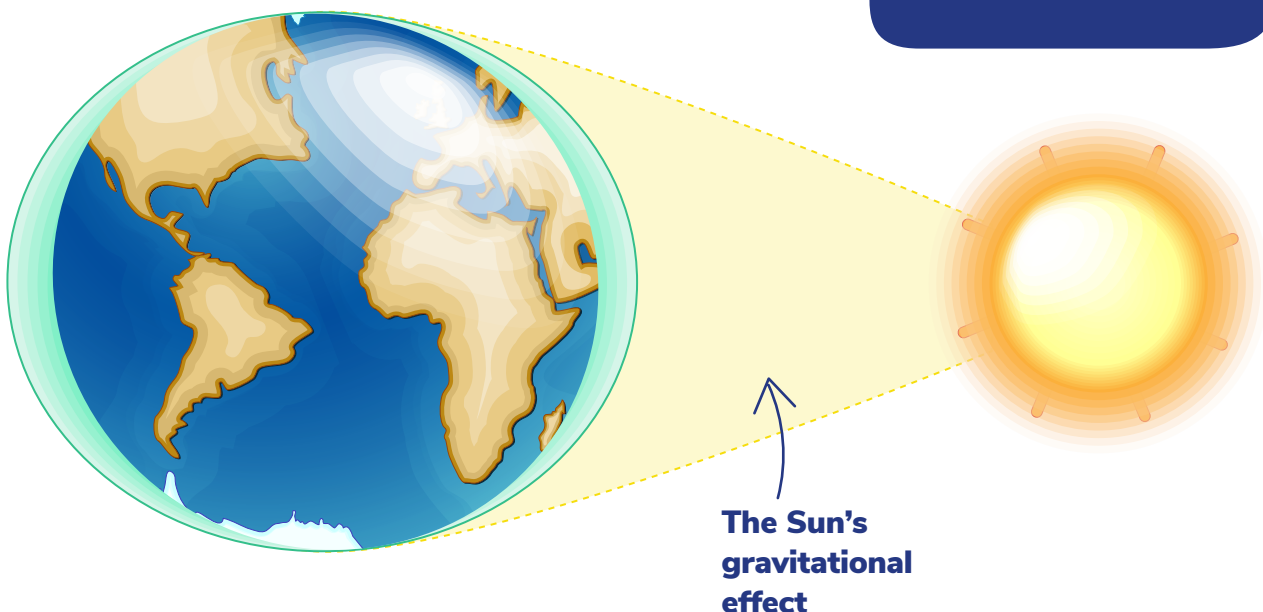
2 Use the pushpin to carefully make a hole at the + in the centre of the Earth template, and in the white circle with a + sign (which represents the Earth) on the Earth–Sun template. Attach them using a split pin. If you are using the large piece of cardboard or card stock as a background, make a hole through the centre of the Sun and use a split pin to attach it to the middle of the piece of cardboard/card stock.

3 Notice the tidal bulges on two sides of the Earth, indicated by the yellow ellipse around the Earth. Where are the tidal bulges located? When you revolve the Earth around the Sun, do the tidal bulges change?

4 Rotate the earth a full turn to show one day. How many tidal bulges does any one place on the earth pass through? (Draw a mark on the Earth to help you keep count.)

What's happening?

Tides are caused by gravity that's determined by the masses of and distances between objects (like the Earth, Sun and Moon). The force of gravity exerted by the Sun pulls our oceans towards it. This causes a high tide – one on the Sun side of the Earth and one on the opposite side, because gravity is also pulling on the Earth. The ocean on the side nearest the Sun experiences the largest force; the ocean on the side farthest from the Sun experiences the smallest force, and the Earth experiences a force somewhere in-between. As the Earth rotates on its axis, it passes through 2 high tides in one day. As Earth revolves around the Sun (which takes one year), the high tides stay in line with the Sun.





Instructions

Part 2: lunar tides (Moon tides)

1 Cut out one of the rectangles that includes both the Earth and the Moon from the Earth–Moon system template that you’ve printed or copied onto tracing paper.

2 Remove the split pin from the Earth–Sun model. Insert the Earth–Moon system between the Earth model and the Earth–Sun model. Make sure all the + signs line up, then re-insert the split pin so it passes through all three models.

3 Examine the graphics on the transparency. What do you notice? Where are the lunar tidal bulges located? When you revolve the Moon around the Earth, do these tidal bulges change position in relation to the Moon?

4 Rotate the transparency so that the Moon is in-between the Earth and the Sun, representing a new moon. Do the solar tides and lunar tides ‘line up’? Keeping the transparency still, rotate the Earth through one day. Through how many high and low tides does any one location on the Earth pass?

What’s happening?

Just like the Sun, the Moon also creates two high tides on the Earth – one on the side closest to the Moon and one on the opposite side.

These lunar tides are created by the same gravitational forces that produce solar tides. Although the Moon is much smaller than the Sun, it is also much closer to Earth, so its tidal influence is twice that of the Sun. As you rotate the paper Earth model through a full day, each part of the Earth rotates through 2 high tides, and therefore there are 2 high tides and 2 low tides per day on most parts of the Earth.

