

Predicting the Tides - Worksheet

Go to www.tidetimes.co.uk and select a location on the UK coastline.

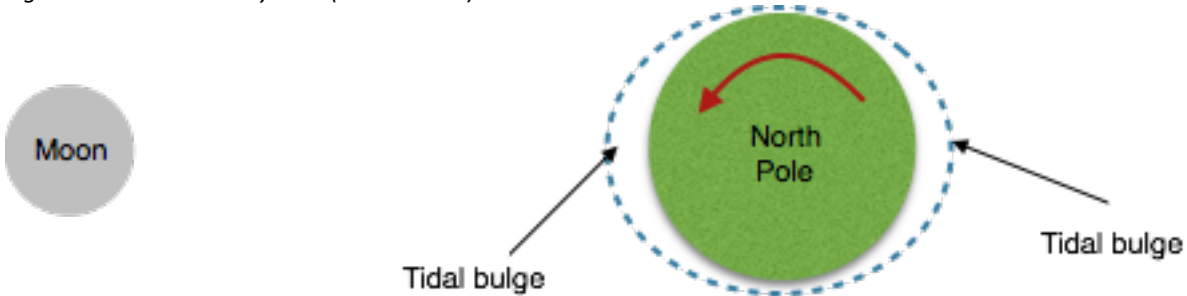
Scroll down to the bottom of the webpage to see information about the local tides and answer the following questions.

Date: Location:

- 1) What is the average tidal range (The difference between high tide and low tide)?
- 2) When is the first high tide today?
- 3) When is the first high tide tomorrow?
- 4) How long is the period of time between the two?

The frequency of our tides is governed by the moon. Any object with mass exerts a force of gravity, but it's only noticeable for very large objects like the moon. The force of gravity between two objects decreases when the objects are further apart and parts of the earth are further from the moon. This means the moon's gravity varies across the ocean. If we imagine the earth to be a smooth sphere covered in water, the overall effect of the moon is to shift the water slightly in front and behind creating two tidal bulges.

Figure 1 - Earth-Moon system (Not to scale)



In reality, the earth isn't completely covered in water – there are islands and continents. As the earth spins, the sea level around our island rises and falls as we pass these bulges.

- 5) Is your answer to question 4 greater or less than 24hr (the time it takes the earth to spin around its axis)?
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- 6) What does this tell us about the moon's direction of travel? Is it orbiting in the same direction as the earth is rotating or is it going in the opposite direction?
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- 7) Try modelling the movement of the earth and moon by acting it out with a friend. One person is the earth and spins around on the spot. The other person is the moon and moves in a circle around them. Has this changed your answer to question 6? Why?
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Scientists and engineers frequently use models (physical or virtual) to help them act out scenarios and test out different ideas. For example, Filipa is a civil engineer at Cardiff University. As part of her research she has been working on a cross-flow water turbine. It would use energy from rivers and streams to generate electricity, providing a low carbon, sustainable source of power. To test out her ideas she analyses the turbine using computer models, and also tests physical models in a flume tank in the laboratory. Being able to spot trends in the data, and understand what it means, is an important part of her work.

8) Look again at the tide times website and the tide curves graph at the bottom of the page. Is the size of the tides increasing or decreasing over the course of this week?

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Remember that any object with mass exerts a force of gravity. This means the moon is not the only object that influences our tides. The largest mass in our solar system is the sun and it also creates tidal bulges on the earth.

Also remember that the force of gravity between two objects decreases when the objects are further apart. So even though the sun is much bigger, it is nearly 400 times further away than the moon. This means the difference in the sun's gravity across the earth is not as great as the difference in the moon's gravity. The tidal bulge caused by the sun is only about 45% the size of the tidal bulge caused by the moon.

When the sun, earth and moon are all in a line, the bulges add together to create extra large tides (spring tides). When they are at right angles to each other the bulges are spread out around the earth and the tides are smallest (neap tides).

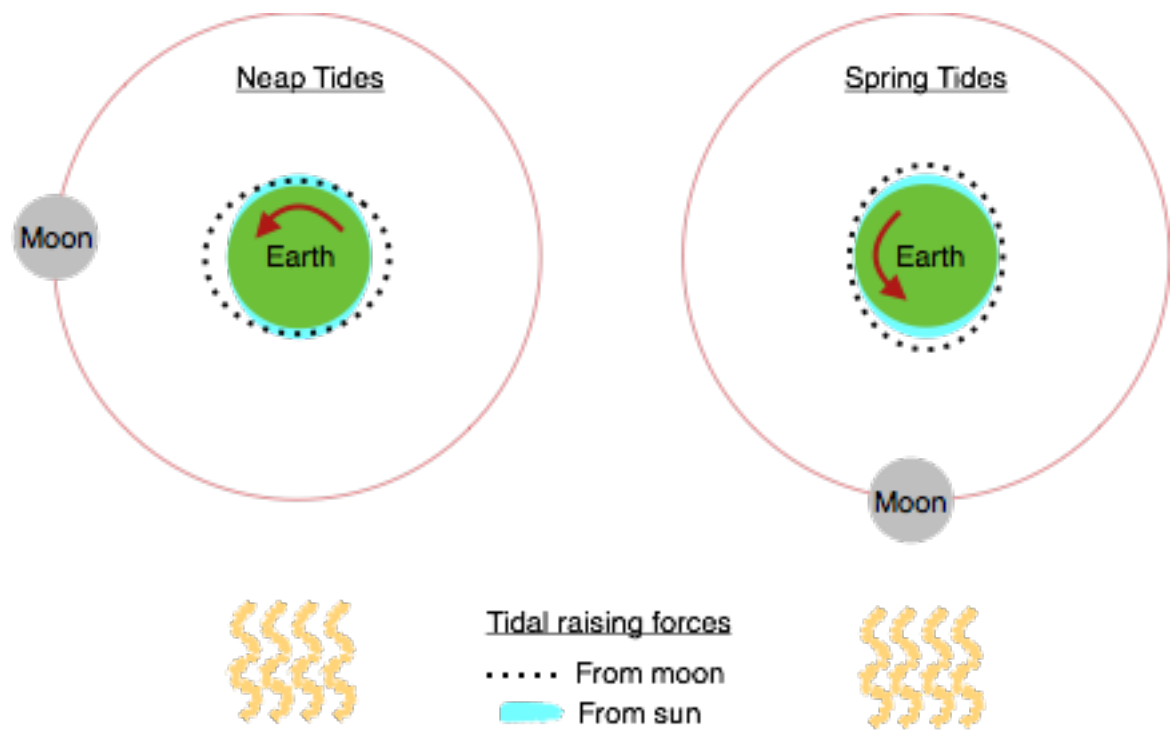


Figure 2 (Not to scale)

9) Look at the tide times for your chosen location. How often do we have spring tides (i.e. the tidal range reaches a maximum)? (Click on the calendar to see data from previous weeks).

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