Sun, Earth and Moon: model it

Name: Class: Date:

Page 1 models the Moon's phases with a ball and a lamp. Page 2 compares a torch beam shone straight down and at a low angle. Page 3 finds the spring and neap tides in Darwin in March 2026.

PRACTICAL Model the Moon's phases

Each pair needs: a lamp with no shade and an LED bulb, on a bench at about head height; a ball about 7 cm across, such as a polystyrene ball pushed onto a pencil; a room that can be darkened.

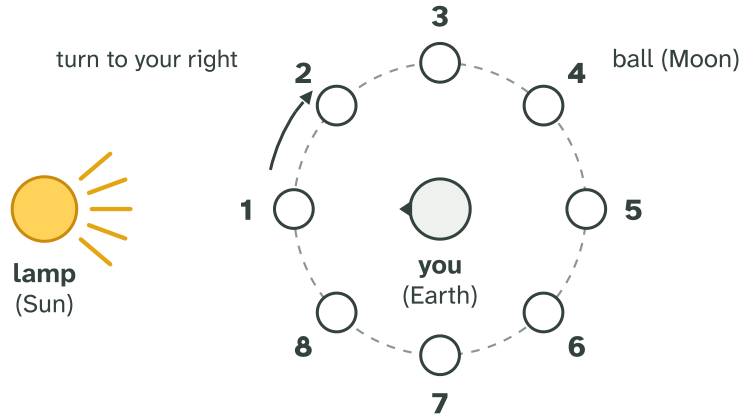
Safety. Don't look straight at the bulb. When the ball is between you and the lamp, hold it so that it hides the bulb. Don't touch the bulb, keep the lamp's cable taped down, and move slowly in the dark room.

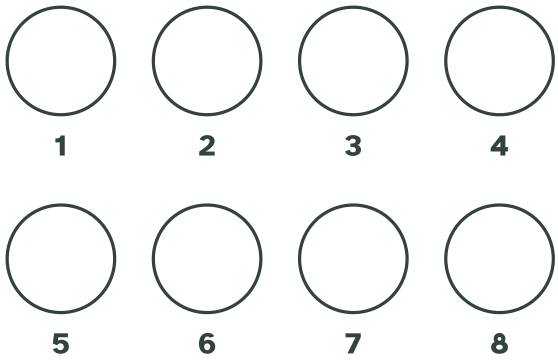
1. The lamp is the Sun, your head is Earth and the ball is the Moon. Turn on the lamp and darken the room.
2. Stand about 2 m from the lamp, facing it. Hold the ball at arm's length so that it hides the bulb. This is position 1.
3. Turn slowly to your right on the spot. Keep the ball at arm's length in front of your face and a little higher than your head, so that your head's shadow doesn't fall on it. Stop after each eighth of a turn, at positions 2 to 8.
4. At each position, look at the ball and shade the part that looks dark in the matching circle.
5. Swap with your partner, and compare your drawings.

Before you start: at which position do you think the ball will look fully lit? Why?

RECORD What the ball looks like

The drawing shows the positions from above your head, with the lamp on the left. Shade the dark part of the ball in each circle.





1. At which position did the ball look fully lit? Where was the ball compared with you and the lamp?

2. At which two positions did half of the ball look lit? What was different about them?

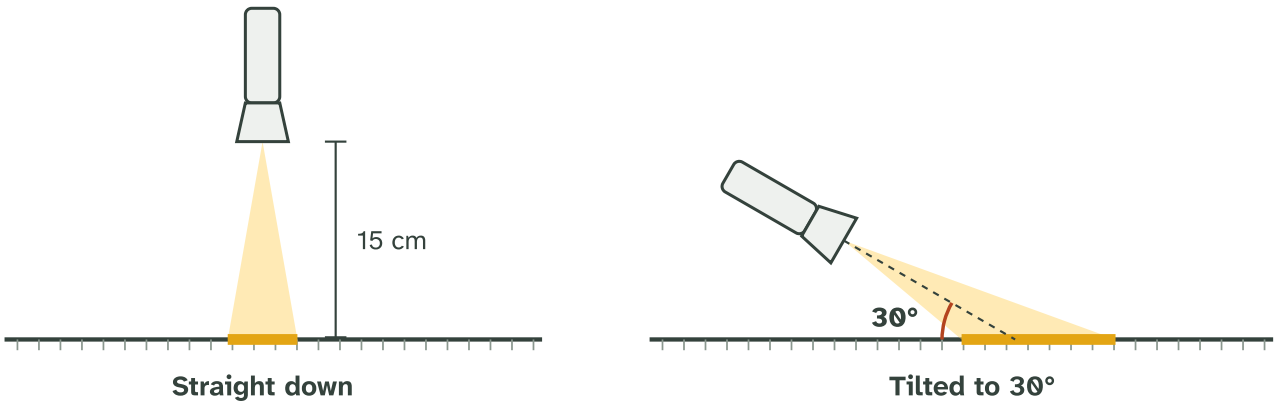
3. How much of the ball did the lamp light up at every position? How do you know?

4. At position 5, slowly lower the ball until it is level with your head, then raise it again. What happens to the ball? What does this model?

PRACTICAL Spread-out sunlight

Each pair needs: a torch with a narrow beam; a sheet of 1 cm grid paper taped to the bench; a protractor; a ruler; a pencil. Don't shine the torch into anyone's eyes.

1. Darken the room. Hold the torch straight down, with its front 15 cm above the middle of the grid paper.
2. Your partner traces around the edge of the bright patch.
3. Tilt the torch so that its beam meets the paper at 30°. Use the protractor to check the angle, and keep the front of the torch 15 cm from the middle of the patch.
4. Trace around the new patch.
5. Count the squares inside each outline. Count a square if at least half of it is inside.



Before you start: which patch do you think will look brighter? Why?

RECORD The two patches

Torch	Squares inside the outline	How bright the patch looked
Straight down (90°)		
Tilted (30°)		

1. Divide the squares for the tilted torch by the squares for the torch shone straight down. How many times bigger was the tilted patch?

2. The same torch lit both patches. Which patch got more light on each square? Explain.

3. At noon on 21 June in Hobart, the Sun is about 24° above the horizon. On 21 December it is about 71° above it. Use your results to explain one reason why Hobart is colder in June.

DATA Spring and neap tides in Darwin

The table gives the highest and lowest tides in Darwin on every second day of March 2026, from the Bureau of Meteorology's predictions. Heights are in metres above the lowest astronomical tide.

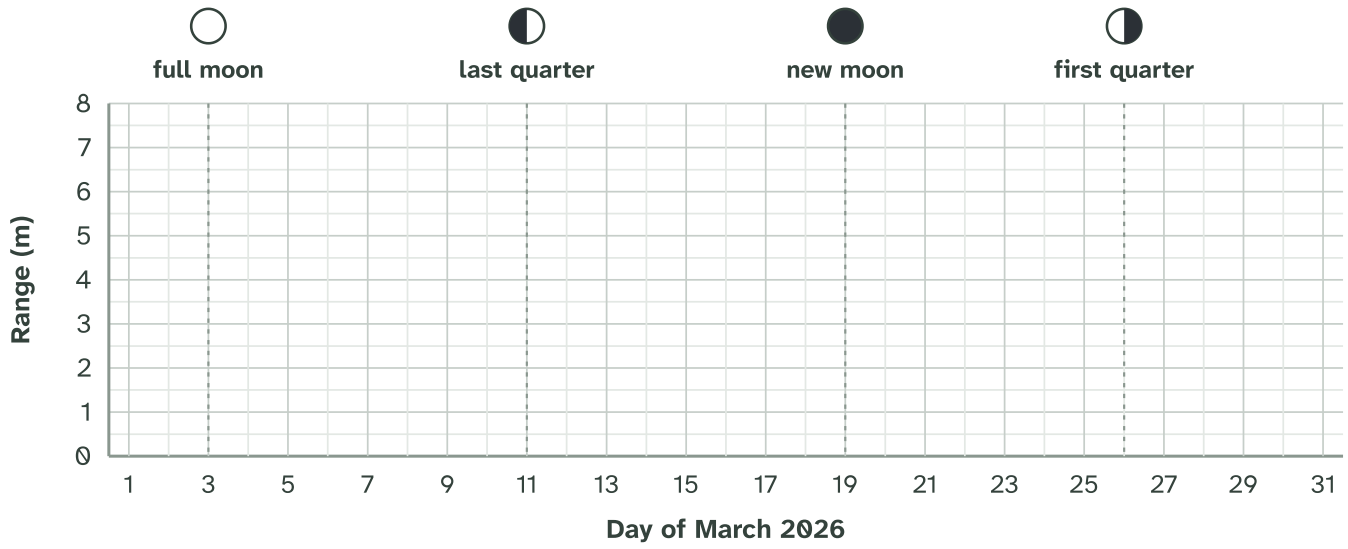
The Moon was full on 3 March, at last quarter on 11 March, new on 19 March and at first quarter on 26 March, in Darwin time. Work out each day's range: the highest tide take away the lowest. The first one is done for you.

Day	Highest tide (m)	Lowest tide (m)	Range (m)
1 March	6.85	1.98	4.87
3 March	7.62	1.30	
5 March	7.75	1.36	
7 March	7.36	1.30	
9 March	6.66	1.59	
11 March	5.78	2.35	
13 March	5.00	3.23	
15 March	5.95	3.00	

Day	Highest tide (m)	Lowest tide (m)	Range (m)
17 March	6.90	2.04	
19 March	7.56	1.49	
21 March	7.69	1.01	
23 March	7.55	0.72	
25 March	6.59	1.41	
27 March	5.51	2.66	
29 March	6.18	2.76	
31 March	6.99	2.06	

GRAPH Graph the ranges

Plot each day's range as a dot, and join the dots. The Moon's phases are marked along the top.



1. Near which dates were the ranges biggest? What was the Moon's phase then?

2. Near which dates were the ranges smallest? What was the Moon's phase then?

3. Explain the pattern. Use the words spring tides and neap tides, and say where the Sun and the Moon are.