

Inquiry 16.1 Analyzing Tidal Data

Directions: Write down the purpose and answer any question in the inquiry.

Purpose: How does the moon affect the Earth's high and low tides?



Background Information:

Tides – The rise and fall of water every 12.5 hours.

Procedures:

Examine the data in Table 16.1: Tides for Virginia Beach: April 3 – 30, 2001. work with your group to analyze the patterns that exist in the rise and fall of tides, and then answer the following questions in your notebook:

- 1) At what time did the high tides occur on April 5, 2001?
- 2) At what time did the Moon rise on April 9, 2001?
- 3) At what time did the second high tide occur on April 9, 2001?
- 4) How much of the Moon was visible on April 8, 2001?
- 5) Given the percentage to the question above, what phase was the Moon in on April 8?
- 6) How much of the Moon was visible on April 16, 2001?
- 7) Given the percentage to the question above, what phase was the Moon in on April 16?
- 8) Where did the tides in Table 16.1 occur?
- 9) Examine the height of tides each day. How much time do tides take to go from High tide to high tide?
- 10) A high tide occurs when the tide reaches its maximum height on each rise. How many high tides normally occur along Virginia Beach in 24 hours?
- 11) A low tide occurs when the tide reaches its minimum height on each fall. How many low tides normally occur along Virginia Beach in 24 hours?
- 12) Why do you think this pattern in high and low tides exists?
- 13) Compare the times that high and low tides occur each day over a two-week period. What do you observe? Explain why you think this happens.
- 14) Examine the data showing moonrise and moonset times. Compare these times to the times of high and low tides. What patterns do you observe? What explanation can you give for these patterns?
- 15) Examine the data showing phases. Compare the phases of the Moon to the times of high and low tides. During what phase or phases do the lowest high tides occur?
- 16) During what phases do highest high tides occur?
- 17) What explanation can you give for these patterns?

Graphing:

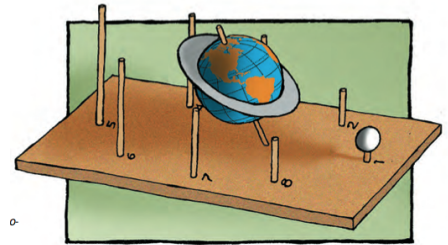
Directions: Use your graph paper to show the relationship between two sets of data examined during this inquiry. Work with your group to decide what to graph.

Graphs might include one or more of the following:

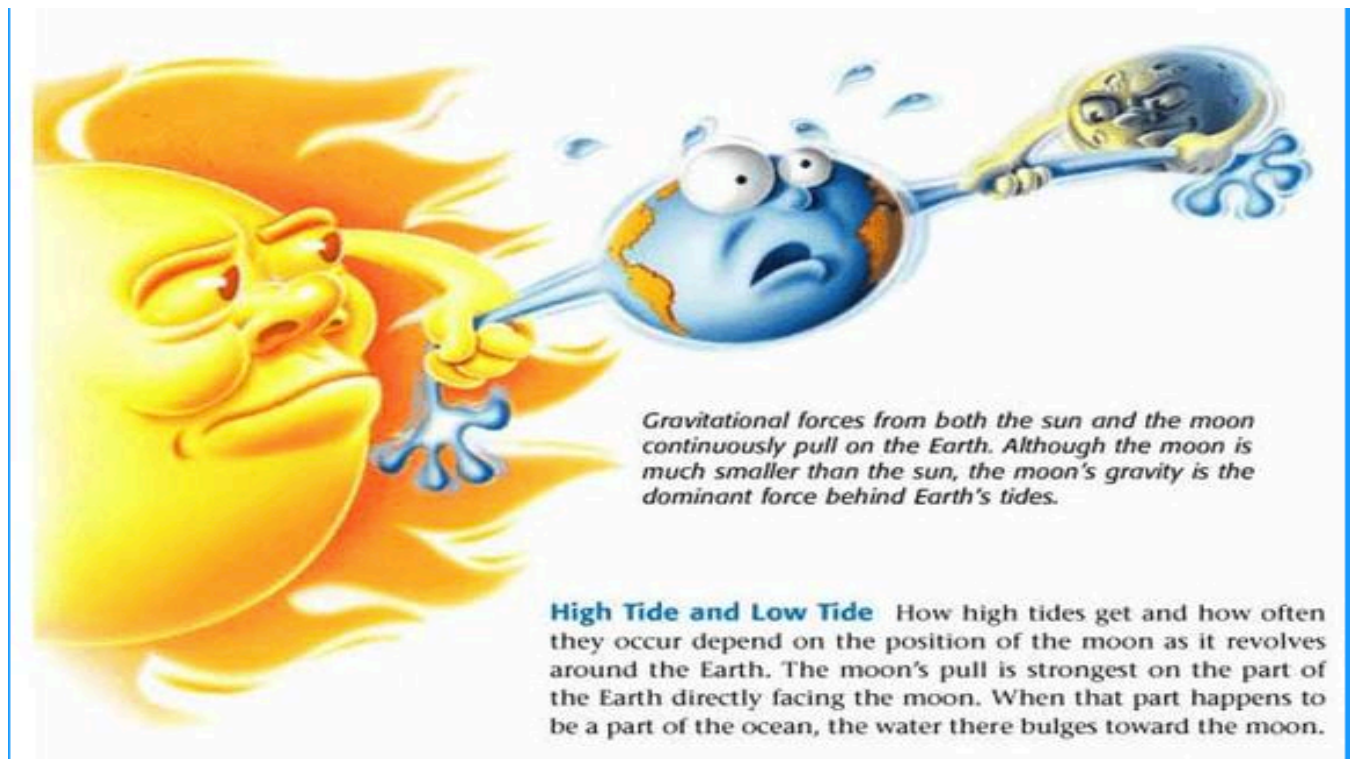
- Times and heights of tides for each day over 4 days
- Times and heights of tides and times of moonrise and moonset for each day over 4 days
- Times and heights of tides and phases of the Moon over 1 month

When you have completed your graph show it to your teacher. Then get and cut out the cardboard pattern for the tidal bulge from the teacher.

Place the bulge (cut out) around the 12-cm Earth on the SEM board to model how Earth's high and low tides occur throughout the day and month (see Figure to the right for one setup). How can you show that a high tide – low tide – high tide – low tide pattern occurs for any place on Earth every 6 hours? Discuss your answers with your group and then show your teacher your answer on the SEM board when you think you have the correct solution.



Read "Can Water Fall Up" from the teacher's website then answer the Analyzing the Reading questions in your spiral.



Gravitational forces from both the sun and the moon continuously pull on the Earth. Although the moon is much smaller than the sun, the moon's gravity is the dominant force behind Earth's tides.

High Tide and Low Tide How high tides get and how often they occur depend on the position of the moon as it revolves around the Earth. The moon's pull is strongest on the part of the Earth directly facing the moon. When that part happens to be a part of the ocean, the water there bulges toward the moon.

Analyzing the Reading:

- 1) Why does the Moon exert twice the amount of tidal effect on Earth than the larger Sun?
- 2) During which two Moon phases do spring tides (higher than normal tides) occur?
- 3) Draw a picture of the Sun, Earth and Moon during a Spring Tide.
- 4) During which two Moon phases do neap tides (lower than normal high tides) occur?
- 5) Draw a picture of the Sun, Earth and Moon during a Neap Tide.
- 6) What are two effects of Earth's gravitational pull on the Moon or the Moon's on the Earth?
- 7) What is a sign that tidal forces are at work on the Moon?
- 8) Why was the article called "Can Water Fall Up," explain your answer.
- 9) Does a Spring Tide or a Neap tide create high tides that are twice as high as regular high tides. Explain why you think this happens. (Hint re-watch the video called "Action of Tides" in your science drive folder)

Analyzing the Data:

- 1) Spring tides occur during what moon phase?
- 2) Neap tides occur during what moon phases?
- 3) According to the data, approximately how much time (hours) occurs between high tides? (High tide to high tide)
- 4) How much time is in-between high to low tides?
- 5) What patterns in tides do you see?
- 6) How does the moon affect the Earth's high and low tides?

Table 16.1 Tides for Virginia Beach: April 3–30, 2001

Day	High/Low	Tide Time	Height Feet	Moon	Time	% MoonVisible
Tu 3	High	4:11 AM	3.7	Set	4:07 AM	67
3	Low	10:39 AM	0.3	Rise	2:29 PM	
3	High	4:42 PM	3.3			
3	Low	10:49 PM	0.0			
W 4	High	5:18 AM	3.9	Set	4:52 AM	77
4	Low	11:38 AM	0.0	Rise	3:40 PM	
4	High	5:45 PM	3.6			
4	Low	11:54 PM	-0.3			
Th 5	High	6:17 AM	4.0	Set	5:32 AM	86
5	Low	12:31 PM	-0.1	Rise	4:51 PM	
5	High	6:42 PM	3.9			
F 6	Low	12:53 AM	-0.4	Set	6:08 AM	93
6	High	7:11 AM	4.0	Rise	6:01 PM	
6	Low	1:20 PM	-0.4			
6	High	7:34 PM	4.1			

Table 16.1 Tides for Virginia Beach: April 3–30, 2001 (continued)

Day	High/Low	Tide Time	Height Feet	Moon	Time	% MoonVisible
Sa 7	Low	1:47 AM	-0.5	Set	6:42 AM	98
7	High	8:01 AM	4.0	Rise	7:11 PM	
7	Low	2:07 PM	-0.4			
7	High	8:23 PM	4.3			
Su 8	Low	2:38 AM	-0.7	Set	7:15 AM	99
8	High	8:49 AM	4.0	Rise	8:19 PM	
8	Low	2:51 PM	-0.5			
8	High	9:09 PM	4.4			
M 9	Low	3:27 AM	-0.5	Set	7:48 AM	99
9	High	9:34 AM	3.9	Rise	9:26 PM	
9	Low	3:34 PM	-0.4			
9	High	9:55 PM	4.3			
Tu 10	Low	4:14 AM	-0.4	Set	8:23 AM	95
10	High	10:18 AM	3.7	Rise	10:31 PM	
10	Low	4:17 PM	-0.3			
10	High	10:39 PM	4.1			
W 11	Low	5:01 AM	-0.1	Set	9:01 AM	90
11	High	11:02 AM	3.5	Rise	11:34 PM	
11	Low	5:00 PM	0.0			
11	High	11:24 PM	4.0			
Th 12	Low	5:48 AM	0.1	Set	9:42 AM	83
12	High	11:47 AM	3.3			
12	Low	5:44 PM	0.1			

Table 16.1 Tides for Virginia Beach: April 3–30, 2001 (continued)

Day	High/Low	Tide Time	Height Feet	Moon	Time	% Moon Visible
F 13	High	12:10 AM	3.7	Rise	12:33 AM	74
13	Low	6:37 AM	0.4	Set	10:27 AM	
13	High	12:34 PM	3.0			
13	Low	6:32 PM	0.4			
Sa 14	High	1:00 AM	3.5	Rise	1:27 AM	65
14	Low	7:29 AM	0.5	Set	11:16 AM	
14	High	1:25 PM	2.9			
14	Low	7:25 PM	0.5			
Su 15	High	1:55 AM	3.3	Rise	2:15 AM	56
15	Low	8:24 AM	0.8	Set	12:09 PM	
15	High	2:22 PM	2.9			
15	Low	8:24 PM	0.7			
M 16	High	2:54 AM	3.2	Rise	2:58 AM	46
16	Low	9:21 AM	0.8	Set	1:04 PM	
16	High	3:22 PM	2.9			
16	Low	9:26 PM	0.8			
Tu 17	High	3:54 AM	3.2	Rise	3:37 AM	37
17	Low	10:16 AM	0.8	Set	2:00 PM	
17	High	4:20 PM	3.0			
17	Low	10:26 PM	0.7			
W 18	High	4:49 AM	3.2	Rise	4:11 AM	28
18	Low	11:06 AM	0.7	Set	2:57 PM	
18	High	5:13 PM	3.2			
18	Low	11:21 PM	0.7			

Table 16.1 Tides for Virginia Beach: April 3–30, 2001 (continued)

Day	High/Low	Tide Time	Height Feet	Moon	Time	% MoonVisible
Th 19	High	5:38 AM	3.3	Rise	4:43 AM	20
19	Low	11:50 AM	0.5	Set	3:55 PM	
19	High	6:00 PM	3.5			
F 20	Low	12:10 AM	0.4	Rise	5:12 AM	13
20	High	6:23 AM	3.5	Set	4:53 PM	
20	Low	12:30 PM	0.4			
20	High	6:43 PM	3.6			
Sa 21	Low	12:56 AM	0.3	Rise	5:40 AM	7
21	High	7:05 AM	3.6	Set	5:52 PM	
21	Low	1:09 PM	0.3			
21	High	7:23 PM	3.9			
Su 22	Low	1:39 AM	0.1	Rise	6:08 AM	2
22	High	7:45 AM	3.6	Set	6:53 PM	
22	Low	1:46 PM	0.3			
22	High	8:01 PM	4.0			
M 23	Low	2:20 AM	0.1	Rise	6:38 AM	0
23	High	8:24 AM	3.7	Set	7:55 PM	
23	Low	2:22 PM	0.1			
23	High	8:40 PM	4.1			
Tu 24	Low	3:01 AM	0.0	Rise	7:09 AM	0
24	High	9:04 AM	3.7	Set	8:59 PM	
24	Low	3:00 PM	0.1			
24	High	9:19 PM	4.3			

Table 16.1 Tides for Virginia Beach: April 3–30, 2001 (continued)

Day	High/Low	Tide Time	Height Feet	Moon	Time	% Moon Visible
W 25	Low	3:44 AM	0.0	Rise	7:45 AM	2
25	High	9:45 AM	3.6	Set	10:05 PM	
25	Low	3:40 PM	0.1			
25	High	10:01 PM	4.3			
Th 26	Low	4:28 AM	0.0	Rise	8:26 AM	6
26	High	10:29 AM	3.5	Set	11:10 PM	
26	Low	4:23 PM	0.1			
26	High	10:47 PM	4.1			
F 27	Low	5:16 AM	0.1	Rise	9:14 AM	12
27	High	11:16 AM	3.5			
27	Low	5:11 PM	0.1			
27	High	11:37 PM	4.1			
Sa 28	Low	6:09 AM	0.3	Set	12:14 AM	20
28	High	12:09 PM	3.3	Rise	10:10 AM	
28	Low	6:06 PM	0.3			
Su 29	High	12:34 AM	3.9	Set	1:13 AM	30
29	Low	7:07 AM	0.3	Rise	11:11 AM	
29	High	1:09 PM	3.2			
29	Low	7:09 PM	0.3			
M 30	High	1:37 AM	3.7	Set	2:05 AM	41
30	Low	8:10 AM	0.3	Rise	12:18 PM	
30	High	2:15 PM	3.2			
30	Low	8:19 PM	0.3			