

MONDAY MORNING SCIENCE BLAST #10-008

Ride the Tide - Earth Science - Oceanography

The surface of our Earth is seventy percent covered with water. Although Earth's oceans are all connected and truly one world ocean, they are often divided into four major "oceans": Arctic, Atlantic, Indian and Pacific. Earth also has more than 100 smaller seas. The water in the oceans is constantly moving. By far the most important factor affecting the movement of water across the oceans are the tides. Long ago, humans living near seas noticed that the water rose and fell twice a day. For those living near a steep coast the water merely rose and fell, but for people who lived near coastal flats the water came in and went out.

These tides (the periodic rise and fall of the water) are created because the Earth and the Moon are attracted to each other, just like magnets are attracted to each other. The Moon tries to pull at anything on the Earth to bring it closer but the Earth is able to hold onto everything except the water. Since the water is always moving, the Earth cannot hold onto it, and the Moon is able to pull at it. As the Earth and Moon spin, gravity pulls them together and the Moon pulls the ocean water right beneath it, causing it to rise and fall. Typically water will rise for about six hours, followed by six hours of falling water depths.

Spring tides are extremely high and extremely low tides. These tides are created when the Sun and Moon pull together. These occur twice each month near the full and new moons. Neap tides do not rise as high nor fall as low as spring tides. They occur twice a month when the Moon is near its first and last quarters and are caused by the Moon and Sun pulling at a right angle to each other. In this lab, students will be discovering how the heights of high and low tides change over time.

Instruct your students to use the tide chart provided to complete the Data Table for the tides for a period of two weeks, recording the time of each tide and the height of each tide to the nearest 0.1 foot. They are then to construct a line graph displaying the rise and fall of the tide during this period and answer the questions.

Understanding how the tides are caused and the factors that affect them is difficult for some students to understand. This activity, which is an analysis of tide sequence and tide height, is intended to help them in this process. To further enhance my students' understandings, I use video clips and illustrations on the web that provide visual models of the Earth's tides. I find that assigning student groups to design a "flip" book to explain the tides is a great way of solidifying these concepts in the students' minds.

Ride the Tide

QUESTION: How do the heights of high and low tides change over time?

MATERIALS:

graph paper
tide chart (attached)

PROCEDURE:

1. Use this June tide chart for San Francisco, CA, to complete the Data Table for the tides. Record the height of each tide to the nearest 0.1 foot.

CALIFORNIA COAST & SAN FRANCISCO BAY						
HIGH Tides SAN FRANCISCO Dist.						
DATE	DOT'S	TIME	A.M.	TIME	P.M.	FT.
DAY	GUIDE					
1	Fri ●	0:30	6.0	3:06	4.5	
2	Sat ●	1:09	6.0	3:56	4.5	
3	SUN ●	1:55	5.8	4:47	4.6	
4	Mon ●	2:50	5.5	5:39	4.7	
5	Tues ●	3:53	5.1	6:27	4.9	
6	Wed ●	5:05	4.7	7:13	5.2	
7	Thur ●	6:27	4.3	7:54	5.5	
8	Fri ●	7:57	4.0	8:35	5.9	
9	Sat ●	9:18	4.0	9:15	6.1	
10	SUN ●	10:33	4.2	9:55	6.4	
11	Mon ●	11:39	4.4	10:34	6.5	
12	Tues ●	12:36 P	4.5	11:13	6.5	
13	Wed ●	1:31 P	4.7	11:55	6.4	
14	Thur ●	2:24	4.7	
15	Fri ●	0:34	6.2	3:09	4.7	
16	Sat ●	1:13	5.9	3:58	4.7	
17	SUN ●	1:55	5.5	4:43	4.6	
18	Mon ●	2:40	5.1	5:25	4.6	
19	Tues ●	3:29	4.6	6:07	4.7	
20	Wed ●	4:24	4.1	6:45	4.8	
21	Thur ●	5:33	3.7	7:15	4.9	
22	Fri ●	6:57	3.4	7:46	5.2	
23	Sat ●	8:27	3.4	8:19	5.4	
24	SUN ●	9:49	3.5	8:54	5.7	
25	Mon ●	10:53	3.8	9:29	5.9	
26	Tues ●	11:48	4.1	10:05	6.1	
27	Wed ●	12:34 P	4.3	10:47	6.3	
28	Thur ●	1:16 P	4.5	11:29	6.4	
29	Fri ●	2:03	4.6	
30	Sat ●	0:11	6.5	2:45	4.8	

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• BIGGER THE DOT – BETTER THE FISHING

CALIFORNIA COAST & SAN FRANCISCO BAY						
LOW Tides SAN FRANCISCO Dist.						
DATE	DOT'S	TIME	A.M.	TIME	P.M.	FT.
DAY	GUIDE					
1	Fri ●	7:22	-1.3	7:03	3.2	
2	Sat ●	8:07	-1.3	7:57	3.3	
3	SUN ●	8:56	-1.2	8:57	3.3	
4	Mon ●	9:50	-1.0	10:14	3.1	
5	Tues ●	10:45	-0.7	11:35	2.7	
6	Wed ●	11:41	-0.3	
7	Thur ●	0:55	2.0	12:38	0.1	
8	Fri ●	1:59	1.2	1:32	0.6	
9	Sat ●	2:55	0.4	2:27	1.1	
10	SUN ●	3:48	-0.4	3:16	1.6	
11	Mon ●	4:34	-1.0	4:06	2.1	
12	Tues ●	5:19	-1.3	4:57	2.5	
13	Wed ●	6:05	-1.4	5:43	2.7	
14	Thur ●	6:47	-1.4	6:33	3.0	
15	Fri ●	7:29	-1.2	7:21	3.2	
16	Sat ●	8:11	-0.9	8:15	3.3	
17	SUN ●	8:54	-0.6	9:14	3.3	
18	Mon ●	9:38	-0.3	10:19	3.1	
19	Tues ●	10:22	0.1	11:29	2.9	
20	Wed ●	11:08	0.5	
21	Thur ●	0:35	2.4	11:54 A	0.9	
22	Fri ●	1:34	1.9	12:44	1.4	
23	Sat ●	2:22	1.3	1:33	1.8	
24	SUN ●	3:08	0.7	2:19	2.2	
25	Mon ●	3:50	0.1	3:04	2.5	
26	Tues ●	4:25	-0.4	3:50	2.8	
27	Wed ●	5:04	-0.8	4:35	3.0	
28	Thur ●	5:42	-1.2	5:18	3.1	
29	Fri ●	6:25	-1.4	6:00	3.2	
30	Sat ●	7:07	-1.5	6:52	3.1	

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DAYLIGHT TIME

2. Construct a line graph that displays the rise and fall of the tide during this period.

DATA:

	LOW TIDES				HIGH TIDES			
	A.M.		P.M.		A.M.		P.M.	
Date	Height	Time	Height	Time	Height	Time	Height	Time
June 10								
June 11								
June 12								
June 13								
June 14								
June 15								
June 16								
June 17								
June 18								
June 19								
June 20								
June 21								
June 22								
June 23								

QUESTIONS:

1. About how much time is there between the two high tides each day? How much time is there between the two low tides?
2. How do the times for the three highest tides compare over the 3-day period?
3. On what day is the lowest tide and what is its height?
4. On what day is the highest tide and what is its height?
5. What is the difference in height between the highest and lowest tides during this period?
6. Generally speaking, during what time of day do the lowest tides occur during June?
7. Draw a simple diagram that illustrates the probable position of the Earth, Moon and Sun during this period.