



**CALIFORNIA STATE SCIENCE FAIR  
2002 PROJECT SUMMARY**

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**Project Title**  
**Using Experimentation, Modeling, and Observation, Is It Possible to Explain the Rise and Fall of Ocean Tides?**

**Abstract**

**Objectives/Goals**  
Explain why there are tides and why there are two high tides every day. Do this by using data and results from experiments, models, and observations.

**Methods/Materials**  
Methods: 1) General Observation. At the beach, observe that there is a high tide and low tide. 2) Detailed Tide and Moon Observation. From observation and study of tidal records notice that there are two high tides in a day and that the time of day the high tides occur changes each day. Notice that the high tide cycle repeats itself and this cycle is at the same frequency as is the orbit of the moon. 3) Make the connection between the tides and the moon. 4) Centripetal Force Experiment. Spin an object connected by a spring in a circular path. From this verify the centripetal force equation,  $F = m \cdot V^2 / r$ . Also, recognize that in order for the moon to be able to be in orbit about the earth, there must be a force that pulls it to earth. From research, determine that this force is due to gravity and that  $F_g = G \cdot M \cdot m / r^2$ . 5) Ocean Water Model. Using a physical model show how the ocean water rises under the influence of small gravitational forces. 6) Use results of the centripetal force experiment to explain why there are two high tides each day. 7) Verification. Observe location of the moon, go to the beach and record time of high tide. Compare with prediction.

Material: Centripetal Force Experiment: Drill motor, bungee cord, hockey puck, ladder, scale, weights, video camera. Ocean Water Model: Blocks and Springs

**Results**  
From observing the cycle of tides and the moon I was able to show that the moon controls tides. From the centripetal force experiment and research about gravity I showed that the pull of gravity and centrifugal force cause high tides twice a day. From the Ocean Water Model I show why the tide rises under the influence of small gravitational and centrifugal forces.

**Conclusions/Discussion**  
I was able to show why ocean water rises and falls twice every day by using experiment, models, and observation. This experiment is relevant because, by explaining natural phenomena of tides, we can formulate and check laws of nature. We can then use these laws of nature to predict other things.

**Summary Statement**  
Explains the rise and fall of ocean tides uses experiments, models, and observation.

**Help Received**  
Dad helped with experiments and equations. Mom helped with proof reading.