Pendulum Puzzles

Galileo was at church in Italy and the preacher was talking through an extensive sermon. He became bored. A slight earthquake shook the church. The service continued regardless as such activity was commonplace. The shake did cause one of the large chain suspended lamps to start to swing. Galileo studied the arc is moved through as a passage and started to time each period (swing up and back) using his pulse.
He was inquisitive to understand:

What variables do you think affect the rate of a pendulum's swing?

Set up a weight on a long piece of string or fishing line. Observe how it travels and start to make predictions.

1. Does the height from which it is released affect the periods? If so, how?
2. What is the effect of changing the weights (the bobs)?
3. What is the influence of the length of the string? Will a shorter line with the same mass travel through the same number of periods in a period of time as a long line?
4. If a very long pendulum line is allowed to commence its swing from between the eyes of a brave student, will they be at risk and have the bob hit their face?

#1 You should accurately measure the height from which the pendulum is released. So that no energy is given to the pendulum swing by way of a push, the bob can be held up by a ruler or book, which is simply dropped to allow the bob to swing. Graph the height of release data against the number of periods in 2 minutes that result.

#2 Set up a pendulum and keep the length accurate. Have a range of bobs that vary in weight. On a graph list the weights in progressive order along an axis.
Now release the bobs and count the number of periods in two minutes from each.

#3 Secure a short line, and use the same weight bob. Graph the number of periods against the length of the line for 2-minute intervals.

#4 You now understand that the pendulum will lose energy in its swing and that for a long line, (suspended from a street lamp or high part of a hall roof) the pendulum will swing out and return in a way that looks scary and precarious for the student who is standing still at the release point. It won't cause damage if the bob is released without push from the subject's face. The student needs to have faith in the laws of physics. God doesn't alter them at whim. They are dependable. This demonstration is a fine thing to do for a school assembly or chapel. It is quite spectacular and teaches some good points. You will discover that dependable laws govern the world. Pendulums operate in predictable ways. This world shows signs of order, law and rationality. This is because the source is not dark cold absolute nothingness, it is the result of a source that possesses rationality, is orderly and creates using structured laws.

What about in other parts of the solar system where gravity is different to that of earth, how would pendulums operate? The moon for example is smaller than earth and has a gravitational field 1/6 that of earth's. Would you expect pendulums to operate somewhat differently there?
http://school.discoveryeducation.com/lessonplans/activities/pendulums/
This site allows you to simulate an on line pendulum on the lunar surface.

You can read more about Galileo's pendulum experiments in this site, but don't read it till you have conducted your own experiments!
http://galileo.rice.edu/lib/student_work/experiment95/galileo_pendulum.html

Find out some of the application of pendulums in technology.

A plumb line is a simple but accurate tool used for determining whether or not something is perfectly vertical i.e. *upright*. They were used extensively in Bible times; a plumb line consists merely of a line and a weight of some type, most weights made from lead. The Latin word for lead is *plumbum*. As pipes were often made of lead, the derivative of lead is seen in the name "plumber" today. It is a bit like a static pendulum. Read Amos 7:7-9. The Word of God is our plumb line today, when we line up with it precisely our life is satisfying and a blessing to others.

Galileo's life story

Galileo lived in Italy from 1564-1642. People in those days believed that the earth was the centre of the universe. They thought that the sun, moon and stars moved around the earth. Because the great teacher, Aristotle, had said that this was so, everyone believed it. Everyone, that is, except Galileo. He was one who wanted to find out truth for himself.

Galileo's brain couldn't rest. He had heard of a boy in Holland who had looked through a tube with spectacle glass in each end, and who found that distant objects looked much bigger. Galileo was determined to work out how this gadget worked.

He soon did. But Galileo's invention was far superior to the Dutch one. Through his telescope he could see Jupiter, which had four moons, Saturn with its rings, the spots on the sun and the Milky Way. Now that he had seen these things for himself, he was sure that the earth moved around the sun, and not the sun around the earth.

Galileo was very excited. He now understood that God's creation was greater than people had ever realised. Enthusiastically he started telling people of his discovery. However, trouble lay ahead. Galileo was called before the Pope.
"How dare you defy the teachings of Aristotle!" shouted the Pope. "You must promise not to talk or write about your theory!"

Galileo kept quiet for seventeen years, but continued working silently. Then finally, he could keep quiet no longer. He published a book of his discoveries. He was brought before the Pope again.
"Deny your theory or you will be imprisoned!" the Pope demanded.

Now quite old, and unable to bear the thought of imprisonment or torture, Galileo decided to agree that he had made some mistakes. But in his heart he knew that he had discovered the truth. Galileo lived the rest of his life quietly, working until his death in 1642.

In due time, the world found out that his discoveries were true, for truth cannot be stopped by threats of imprisonment or torture. Soon others took up the teachings of Galileo, which opened people's eyes to the laws of the Creation and the glory of the stars.