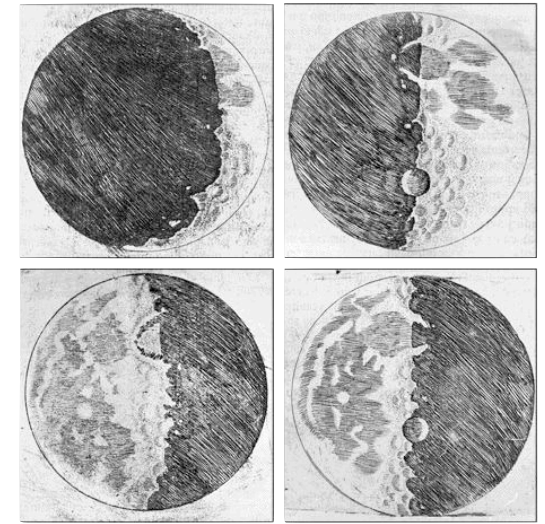


GALILEO'S RISE



All truths are easy to understand once they are discovered; the point is to discover them.

"PHILOSOPHY [I.E. PHYSICS] IS WRITTEN IN THIS GRAND BOOK — I MEAN THE UNIVERSE — WHICH STANDS CONTINUALLY OPEN TO OUR GAZE, BUT IT CANNOT BE UNDERSTOOD UNLESS ONE FIRST LEARNS TO COMPREHEND THE LANGUAGE AND INTERPRET THE CHARACTERS IN WHICH IT IS WRITTEN. IT IS WRITTEN IN THE **LANGUAGE OF MATHEMATICS**, AND ITS CHARACTERS ARE TRIANGLES, CIRCLES, AND OTHER GEOMETRICAL FIGURES, WITHOUT WHICH IT IS HUMANLY IMPOSSIBLE TO UNDERSTAND A SINGLE WORD OF IT; WITHOUT THESE, ONE IS WANDERING AROUND IN **A DARK LABYRINTH.**"



The surface of the moon was cratered, it was not a perfect orb.

CRITICAL THINKING

IGNORANCE



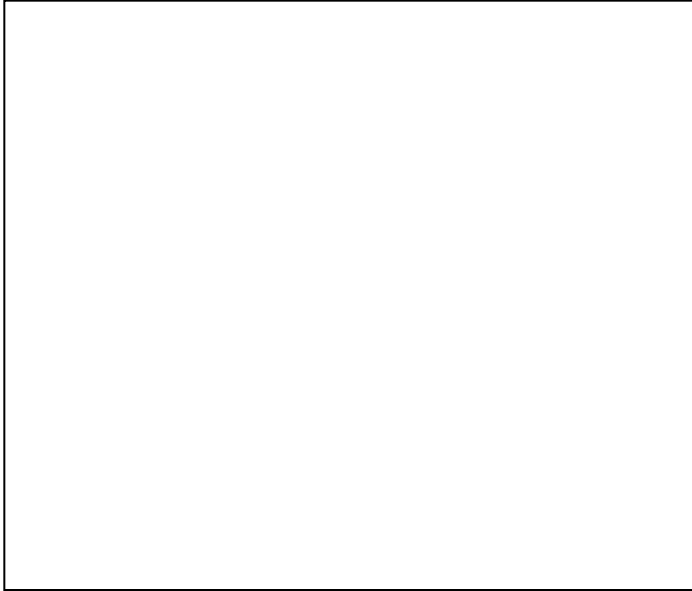
Galileo discusses his discoveries with the church.

NAME _____


DATE _____

PERIOD _____

ABOUT GALILEO GALILEI



THE PURPOSE OF THIS LAB

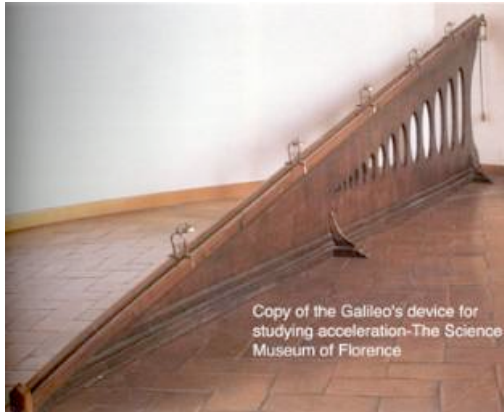


DATA ANALYSIS

1. Looking at your data from a distance, what do you notice?
2. Looking at your data very closely, what do you see?
3. What can you say about the relationship between the angle of the ball falling and the acceleration (little g) of the ball?
4. What can you say about the relationship between the distance down the incline and the acceleration (little g) of the ball?
5. After conferring with your colleagues about 'little g', what can you theorize about the mass of an object and the acceleration (little g) of the object?
6. What is the ratio (H/D) used in finding 'little g'?
7. Where could you have reduced your error to get better data? How would you set up and perform an experiment to get more accurate data?
8. What did you and Galileo discover about the acceleration due to gravity of the earth?



GALILEO'S FALL

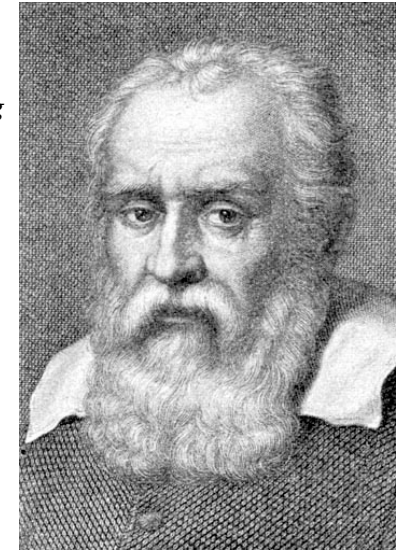


Copy of the Galileo's device for studying acceleration-The Science Museum of Florence

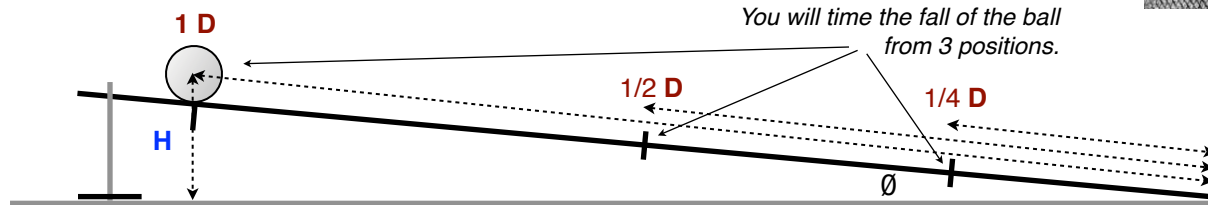
Having placed this board in a **sloping position**, by raising one end some one or two cubits above the other, we rolled the ball, as I was just saying, along the channel, noting, in a manner presently to be described, the time required to make the descent.

A piece of wooden moulding, about 12 cubits long, half a cubit wide, and three finger-breadths thick, was taken; on its edge was cut a channel a little more than one finger in breadth; having made this groove very straight, smooth, and polished, and having lined it with parchment, also as smooth and polished as possible, we rolled along it a hard, smooth, and very round bronze ball.

We repeated this experiment more than once in order to measure the time with an accuracy such that the deviation between two observations never exceeded one-tenth of a pulse-beat. Having performed this operation and having assured ourselves of its reliability, we now rolled the ball only one-quarter the length of the channel; and having measured the time of its descent, we found it precisely one-half of the former.



Timer, ball, ramp, ringstand, protractor ruler, meter stick



What is this ratio?

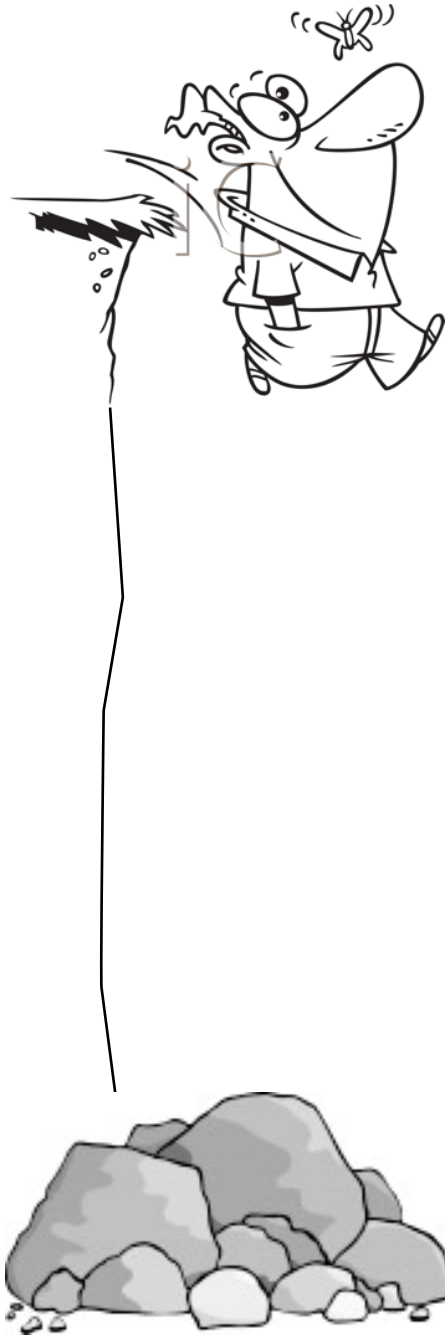
little g

DATA ACQUISITION

Protractor Angle θ	Trial	Time (s)	Time (s)	Time (s)	Ave Time (s)	Distance along Ramp (m)	Height to Ball on ramp (m)	$a = 2D/t^2$ m/s ²	$g = a / (H/D)$ m/s ²
~8° <input type="checkbox"/>	1/4 D								
	1/2 D								
	1 D								
~13° <input type="checkbox"/>	1/4 D								
	1/2 D								
	1 D								
~18° <input type="checkbox"/>	1/4 D								
	1/2 D								
	1 D								

WHY DO SMALL ANGLES WORK BEST?

WHICH ANGLE PRODUCED THE MOST ACCURATE RESULTS?



A NIGHTMARE IN MENIFEE

One hot summer night, a student (football player) is having another terrible nightmare about walking off a cliff and falling into the ocean. The cliff is only 253 meters up from the ocean and sharp rocks below. How much time will pass as the student falls into the ocean below? If a lurking shark can swim 18.5 m/s and is 213 m away, how long after the splash will the student need to wake up before the shark reaches him? The frightened student must draw a coordinate axis system, label his seven parameters for both problems, and solve the problems before the shark reaches him. What could the student have done to prevent this occurring nightmare? What do the rocks and the shark represent?