

Earlier in the chapter, we read about Newton's studies of horizontal motion. But Newton was also interested in vertical motion. He was looking for an explanation for what holds the moon in its orbit. He reported that one day, while sitting in his garden, he noticed an apple fall from the tree. He began to speculate about how the force of gravity extends to the top of trees and even to the tops of mountains. If it extends that far, perhaps it extends all the way to the moon. Newton had already established that an object tends to move in a straight line if no outside force acts on it. The moon does not move in a straight line, however; the moon revolves around the earth. Newton concluded that the gravitational pull holds the sun and the planets in their places. Newton determined the weight is the gravitational force or pull acting on an object. If you travel to the moon, the mass of your body will be precisely the same, but your weight will be less, due to the proportionally smaller size of the moon. Similarly, if you travelled to different planets, your weight would vary with the mass of each planet in our solar system. Newton was able to calculate the relative weights of the sun, the earth, and the planets by comparing their relative gravitational strength. The greater the mass of two bodies, the greater is the force of attraction between them. Thus, the force of attraction between the earth and a 200-pound person is greater than the force of attraction between the earth and a 100-pound person. Gravitational force depends not only on the masses of the two bodies, but also on the distance between them. Thus, astronauts experience weightlessness on the way to the moon because they are not close enough to be affected by the gravitational pull of the earth or the moon, Newton extended his law even further. He said that every object in the universe exerts a gravitational pull on every other object. This means that you are exerting a force on the person sitting next to you, your desk is exerting a force on your pencil, etc. If you are wondering why we don't feel this force, it is because gravity is only a strong force when a huge body, such as the earth, is involved. Newton also explained the tides of the ocean. For thousands of years, it was noticed that there was a correlation between the ocean's tides and the phases of the moon, but no one was able to explain it. He reasoned that just as the earth pulls on the moon, the moon pulls on the earth. The gravitational pull of the moon has little effect on our land masses, but it pulls on the oceans which are free to move. Thus, the law of gravity applies everywhere in the universe. The concept of universal gravity was the greatest contribution of Isaac Newton, the man many consider to be one of the greatest thinkers of all time.