

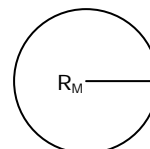
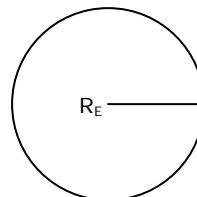


Lunar CRater Observation and Sensing Satellite

Considering the Moon's Surface Gravity

The surface gravity¹ of the Moon or the acceleration² of a body when dropped near to the Moon's surface is determined solely by the mass³ and the radius⁴ or size of the Moon. When compared to Earth's surface gravity derived from Earth's mass and size, the surface gravity on the Moon is one sixth that of Earth's. Objects, regardless of their masses, will accelerate at exactly the same rate (or reach the ground at the same time) when dropped on the surface of the Moon, just as they do when dropped near the surface of the Earth (if there were no air resistance on Earth). But that rate or acceleration of gravity is less for the Moon than the Earth.

How much an object or a person weighs on the surface of the Earth or the Moon or any planetary body results from the gravitational attraction of the planet or the moon. The weight of a body can be defined as the gravitational force exerted by the planet. According to Newton's second law of motion " $F = m a$ ", when a body of mass " m " experiences an acceleration " a ", it must have a force " F " acting on it. When the acceleration is due to gravity, we often refer to this force as *weight*.



The radius and mass of the Moon and Earth determine their surface gravity. The difference in size between the Earth and Moon is really much larger than shown in this figure.

What are the implications of less surface gravity on the Moon? If the Moon's surface gravity or " a " is $1/6^{\text{th}}$ that of Earth's, on the Moon you will weigh one sixth what you do on Earth! A student weighing sixty pounds on Earth would weigh 10 pounds on the Moon or about the weight of a toy poodle breed dog! On the moon, the scale the student stood on would not only read 10 pounds, but with his or her same physical strength as on Earth the student could leave the ground making high strides on the Moon with each step they took while just walking!

How much higher can the student really jump on the Moon compared to Earth? The equation which computes how high the student can jump has one variable⁵ that changes between jumping on the Earth or Moon. This is the Moon's surface gravity, which is $1/6^{\text{th}}$ of Earth's. The height the student can jump on the Moon is inversely proportional⁶ to the surface gravity. This means with less surface gravity than Earth, the student can jump *six* times higher while on the moon than on Earth! Jumping on the Moon would be fun regardless of your age! Astronauts on the moon found that the most efficient way to move around was sort of a hopping motion rather than normal walking.



On Earth

On the Moon

The ball has 2.45 times longer to travel horizontally⁹ on the Moon before hitting the ground due to the Moon's lower surface gravity.

What would happen to the path or trajectory⁷ of a baseball when thrown straight ahead on the Moon, in $1/6^{\text{th}}$ the Earth's surface gravity? Basic physics and mathematical considerations tell scientists that it takes the ball 2.45 times longer (the square root⁸ of 6 to reach the ground in $1/6^{\text{th}}$ the surface gravity, whether the ball is dropped straight down or thrown straight ahead. In the case when the ball is thrown straight ahead, this greater time or slower decent before it falls to the surface, gives the ball that much more time to travel away from the person who threw it before landing. The ball will therefore travel 2.45 times further from the person who threw it on the Moon, than when they threw it on Earth. The ball will travel more than twice as far on the Moon!

1: Surface gravity - the gravitational acceleration experienced at the surface of a celestial body. 2: Acceleration - the rate of change of velocity with respect to time. 3: Mass - a measure of the total amount of material in a body; defined either by the inertial properties of the body or by its gravitational influence on other bodies. 4: Radius - a line segment which joins the center of a circle or sphere with any point on its circumference or surface. 5: Variable - a symbol in an equation representing a quantity capable of assuming any of a set of values. 6: Proportional - having the same or a constant ratio. 7: Trajectory - the path of a projectile or other moving body through space. 8: Square root - a number that when multiplied by itself will result in a given number. 9: Horizontally - parallel to the plane of the horizon.

