Physics You Learned

Physics Concepts	Is There an Equation?
The gravitational field strength and the **acceleration** due to gravity of the Moon is one-sixth that of Earth.	
Distance (d) equals one-half the acceleration due to **gravity** (g) times the fall time squared (t^2).	$d = \frac{1}{2}gt^2$
For an object falling identical time on Earth and the Moon, the ratio of distances fallen is equal to the ratio of acceleration due to gravity.	$\frac{g_M}{g_E} = \frac{d_M}{d_E}$
The mass of an object on the Moon is the same as the mass of the same object on Earth.	
Weight (F_w) equals an object's mass (m) times the acceleration of gravity (g). The weight of an object on the Moon is one-sixth the weight of the same object on Earth.	$F_w = mg$
The strength of a planet's gravitational field depends upon the planet's mass and inversely on the square of the distance from the center of the planet.	
All falling objects accelerate at the same rate because the ratio of the force of gravity to the mass of the object is the same for all masses.	
The law of gravitation applies to all masses in the universe.	
Active Physics Plus: The force of gravity (F_g) equals the universal gravitational constant (G) times the product of the masses $(m_1$ and $m_2)$ divided by the square of the distance between their centers (r^2). The force of gravity between a planet and a mass depends upon the product of the mass of the planet and the mass being attracted, and is inversely proportional to the square of the distance to the planet's center.	$F_g = \frac{Gm_1m_2}{r^2}$
The **range** of a projectile launched horizontally on the Moon is $\sqrt{6}$ times its range on Earth. The horizontal range of a projectile launched upward at an angle is 6 times its range on Earth.	
The horizontal distance (d_x) covered by a projectile depends upon the time of flight (Δt) and the horizontal component of the launch velocity (v_x).	$d_x = v_x \Delta t$
The vertical position of a projectile (d_y) launched at a given angle (θ) equals the vertical velocity (v_y) times the time of flight (t) minus the distance the object would fall under the influence of gravity during the time of flight.	$d_y = v_y t - \frac{1}{2}gt^2$
Active Physics Plus: Time of flight (t_{total}) equals twice the initial vertical launch velocity (v_{0y}) divided by the acceleration of gravity (g). The flight time of a projectile launched at an angle is twice the time to the peak of the **trajectory**.	$t_{total} = 2t_{max} = \frac{2v_{0y}}{-g}$
Active Physics Plus: The maximum **projectile** height is proportional to the initial vertical velocity squared and inversely proportional to the gravitational field strength.	$y_{max} = \frac{v_{y0}^2}{-2g}$

Active Physics Plus Projectile range (R) equals twice the product of the initial vertical and horizontal velocities $(v_{x0})(v_{y0})$ divided by the gravitational field strength.	$R = x_{max} = \dfrac{2v_{x0}v_{y0}}{-g}$
Active Physics Plus Maximum range equals twice the initial velocity squared divided by the acceleration due to gravity. The maximum range of a projectile occurs at a launch angle of 45°.	$R = \dfrac{v_0^2}{g}$ when $\theta = 45°$
An object's **kinetic energy** (KE) is proportional to the object's mass (m) multiplied by its velocity squared (v^2). Kinetic energy is an object's energy of motion.	$KE = \dfrac{1}{2}mv^2$
Gravitational potential energy (GPE) is proportional to an object's mass (m) multiplied by its vertical height above the surface (Δh) and the acceleration due to gravity (g). Gravitational potential energy is energy due to an object's vertical position.	$GPE = mg\Delta h$
The law of conservation of energy states that energy may change forms, but is not lost during transformations. The total amount of energy remains the same during any changes in form.	$Energy_{before} = Energy_{after}$
Friction is a force acting between bodies in contact that resists their relative motion. It always acts parallel to the surfaces in contact, and depends upon the force holding the bodies together.	
The **period** (T) of a simple pendulum equals 2π times the square root of the pendulum's length (L) divided by the acceleration due to gravity (g). The period of a pendulum depends upon its length and is independent of its mass.	$T = 2\pi\sqrt{\dfrac{L}{g}}$
The period (T) of a cylindrical pendulum equals 5.1 times the square root of the pendulum's length (L) divided by the acceleration due to gravity (g). A cylinder swinging from a pivot (like a leg) swings more slowly on the Moon than on Earth due to the decreased acceleration of gravity.	$T = 5.1\sqrt{\dfrac{L}{g}}$
The acceleration of an object falling under the influence of gravity and **air resistance** depends upon the object's shape, mass, and speed.	
An object falling with air resistance will reach a constant **terminal velocity** when its acceleration is zero. Terminal velocity is reached when the force of air resistance equals an object's weight.	
Active Physics Plus Force of air resistance (F_A) equals a constant (c) times the velocity (v) squared.	$F_A = -cv^2$