Isolating The Numerical Value of the Displacement of a 90 Degree Vertical Launch From Kinetic And Potential Energy

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Beginning with potential energy being e=mgh, with m being mass, g being gravity, and h being height we can see that the value of the potential energy of an object with a measurable mass is a product of the acceleration of gravity, the mass, and the position (distance) of an object in space above a point of interaction from an alternative object. The value of potential energy of an object in comparison to the kinetic energy produced by the same object from the velocity squared, the mass, and a value of ½ using the equation e=½mv^2 is equivalent to the potential energy or equation e=mgh. As potential energy decreases kinetic increases until a point is reached where the kinetic is equal to the original value of the potential and the potential in equal to zero. Because of this the value of mgh, or e, is equal to ½mv^2, or e as well, meaning that e=e or mgh=e=½mv^2.

An example of this is if a 20 kg sphere is positioned 10 m off of the ground the potential energy is 20•9.81•10, using 9.81 m/s^2 as gravity, which equals 1962 joules of potential energy. The values of kinetic energy will then be ½•20•v^2, we have unknown velocity in the equation which is found from the potential energy. We take 1962 joules divide it by ½ and divide it by 20 then square root the value to give us v=14.00714103 meters per second. Input the numbers to the equation ½•20•14.00714103^2 and it equals 1962 joules, showing that mgh=e=½mv^2 or 20•9.81•10=1962=½•20•14.00714103^2.

To isolate the numerical value of the displacement or velocity achieved from the kinetic and potential energy produced in a vertical launch we follow a similar set of steps to finding the velocity achieved from the potential energy of a sphere falling:

$$e=mgh \quad e=\frac{1}{2}mv^2$$

$$mgh=e=\frac{1}{2}mv^2$$

$$mgh=\frac{1}{2}mv^2$$

$$gh=\frac{1}{2}v^2$$

$$h=\frac{\frac{1}{2}v^2}{g}$$

We begin with the two equations e=mgh and e=½mv^2, we start by lining them up to form mgh=e=½mv^2, we then remove e giving us mgh=½mv^2. With this equation, mgh=½mv^2, mass is apparent on both sides meaning that it cancels it self out when divided on either side, meaning that we end up with gh=½v^2 (Mass is irrelevant when dealing with displacement achieved from velocity sense gravity is consistent for all objects). Now that we are in a simpler form we can divide gravity to move it from one side to the other giving us a final equation of:

$$h=\frac{\frac{1}{2}v^2}{g}$$