a WOW Lab BLUEPRINT

Tumbling Dominoes

Additional Information

In a uniform gravitational field, the centre of mass of an object equals its centre of gravity. The centre of mass is a unique point of an object that is the mean location of the object's mass. At the centre of mass, there is no net torque on the object and the object will remain static if suspended from its centre of mass. A formal calculation of the centre of mass of a solid object requires the use of integral calculus. However, there are simpler ways through which the centre of mass can be determined. For an object of uniformly distributed mass, such as a wooden domino, the centre of mass is the geometric centre of the object.

The stability of an object's equilibrium can be determined by examining the change in gravitational potential energy of its centre of mass when the object is moved. A stable equilibrium is a situation where work would have to be done on the centre of mass in order to move the object. In a neutral equilibrium, there is not any change in the potential energy of the centre of mass. An unstable equilibrium is one where the centre of mass is initially at a higher energy state than after it is moved.

An object will not topple as long as the plumb line from its centre of mass goes through the area of the base of the object. For a standing domino, the centre of mass is above the ground, so it has positive gravitational potential energy. If the centre of mass is pushed off the base, the energy stored in the domino will drive it to the ground, because that is a lower energy state (**Figure 1**). As the first domino falls, it pushes the second domino's centre of mass past the second domino's base. Once the first domino is set in motion, the reaction is self-sustaining.

Note that what is technically metastable equilibrium is referred to as unstable equilibrium in the activity documents since the concept of metastability is beyond high school level physics.

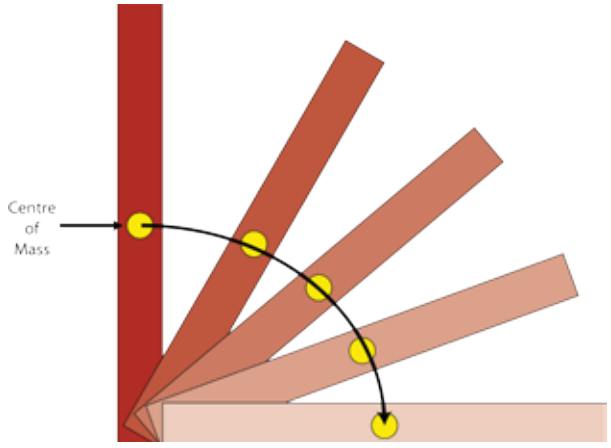

Figure 1