

Scenario

Subject (field/title)	Mechanics/Balance: leaning tower
Length of movie	2:46
Main Goals	Rigid body statics. Location of the center of mass/center of gravity of the body. Types of equilibrium of a rigid body depending on the location of the center of mass/gravity relative to the support point of the body.
Detailed Goals	Description : There are three types of equilibrium: stable, unstable, and neutral. Equilibrium – conditions of remaining in equilibrium of bodies supported below their center of mass/gravity. The problem of certainty of equilibrium of a rigid body standing on the surface of the Earth. A system is said to be in stable equilibrium if, when displaced from equilibrium, it experiences a net force or torque in a direction opposite to the direction of the displacement.
Structure and description experiments :	
Introduction	Description : The equilibrium of a body is a state in which all forces and moments acting on it are balanced. What happens to a rigid body when its fulcrum (suspension) is changed relative to its center of gravity.
Main topic	The aim of the experiment is to show students the conditions that must be met for the solid to be in equilibrium.
Part 1	
	<p>Tools :</p> <ul style="list-style-type: none"> • <i>Leaning tower</i> - a movable, rectangular stand with a plumb line placed at the center of gravity for testing the state of equilibrium <p>Description :</p> <p>We place the tower on its base so that all its levels are parallel to the plane of the base and the plumb line fixed in the center of gravity of the tower, on its middle level, points to the center of the base. The tower is in stable equilibrium.</p> <p>We move the upper plane of the tower relative to its base to the right or left (shear motion). We put the tower on the table. The tower of the table is inclined at a certain angle to the ground. It remains in a stable balance. The plumb line remains within the base of the tower.</p> <p>We increase the angle of inclination of the tower. The tower is still in balance. The plumb line suspended in the center of gravity of the tower still remains within the base of the tower.</p> <p>We increase the angle of inclination of the tower once more by moving it with the upper plane. The plumb line indicates the edge of the tower. The tower is still in balance.</p>

	<p>We increase the angle of inclination of the tower again. The plumb line extends beyond the base of the tower. The tower loses its balance and falls over.</p> <p>Questions : Why do people and structures standing on the ground not lose their balance even though their center of mass/gravity is above the fulcrum? What conditions must be met for a rigid body to remain in equilibrium - from the point of view of forces and moments of forces? What conditions must be met for a rigid body to remain in equilibrium - from the point of view of potential energy. What conditions must be met for a rigid body to remain in equilibrium - from the point of view of its center of gravity relative to its fulcrum? How does a solid supported (suspended) at a point below its center of mass/gravity behave? Where is the human center of mass/gravity? Is the center of mass/gravity at exactly the same point in a woman's body as in a man's?</p> <p>Conclusions: For a rigid body to remain in static equilibrium in the field of gravity, the forces of gravity applied to the body must be balanced by the reaction forces of the body's suspension or support. The moments of forces must also be balanced by the moments of ground reaction forces. The balance of the solid is certain when the base has a large area and the center of gravity is located at a short distance from the base. The projection of the center of gravity of a solid onto its base must be within the base. If a homogeneous solid is tilted so that the direction of the vertical dropped from the center of gravity goes beyond the perimeter of the base, it will fall over on the other wall, because then a pair of forces is created that overturns the solid. Such overturning of a solid requires work to be done against the force of gravity, and thus with an increase in the potential energy of the solid. After tipping over the other wall, the potential energy reaches its previous value.</p>
<p>1. Summary, evaluation and comments</p>	<p>Application: The video can be used at the beginning of a lesson as an introduction to a lesson about balance and the role of center of mass/gravity. Question: What conditions must be met for the body to remain in equilibrium? The film can be used in the implementation phase of the lesson as an illustration of the discussed issue. It can serve as an illustration for the discussion of maintaining balance by man.</p>

	<p>The video can be used as a conclusion to lessons and reflections on balance.</p> <p>The film can be an introduction to a discussion about:</p> <ul style="list-style-type: none">stability of buildings and structuresstability of vehicles moving on uneven terrain.human stability when sitting down, getting up, moving,sports where the movement of the center of mass/gravity is very important <p>Level: secondary school</p>
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