# Key Physics Concepts Related to Balance

FORCE: A push or pull that, by itself, causes a body to accelerate. All forces acting on a body must be added together to determine the motion. Direction is important. When you push a box across the floor, friction pushes the other way, tending to cancel your force. If a body is not moving, then there is no net force on it.

Moves to the right   At rest
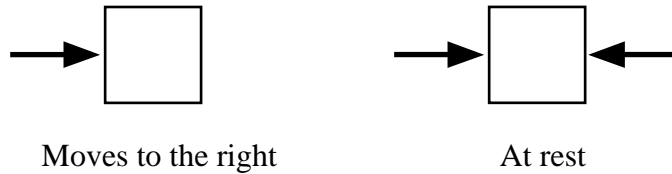
TORQUE: The product of force and distance from a pivot or fulcrum. A torque causes a body to rotate. The distance is measured from the pivot to the line along which the force acts, taking the shortest route. All torques acting on a body must be added together to determine the motion. Again direction is important; in this case, whether the torque is clockwise or counter-clockwise. If a body is not rotating, then there is no net torque on it.

Large Torque   Small Torque   Zero Torque
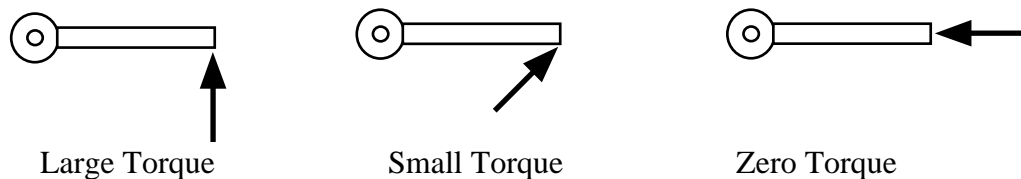
MASS: Property of a body that reduces the tendency of a force to accelerate it. Bodies with more mass accelerate more slowly for a given force.

WEIGHT: Force on a body with mass caused by gravity. A body in outer space has mass but no weight.

CENTER-OF-GRAVITY: (or Center-of Mass) The point about which the torques on a body due to gravity cancel or balance. If the center of gravity of a body is at the pivot point, or at a point along the vertical line through the pivot, then gravity will not cause the body to rotate.

BALANCE: A body is balanced when it is stationary. That means there must be no net force or torque. Hence, any forces and/or torques on the body must be canceled or balanced by opposing forces and/or torques.

STABILITY: Stability is the ability of a body to restore its balance after a disturbance (change in position or orientation). The quality of the stability is determined by how large a disturbance the body can withstand before the balance is lost. A body that is precariously balanced can withstand only a small disturbance and so has low stability. A body that is solidly balanced can be disturbed greatly and so has high stability.

| Most stable | high stability | low stability | unstable |