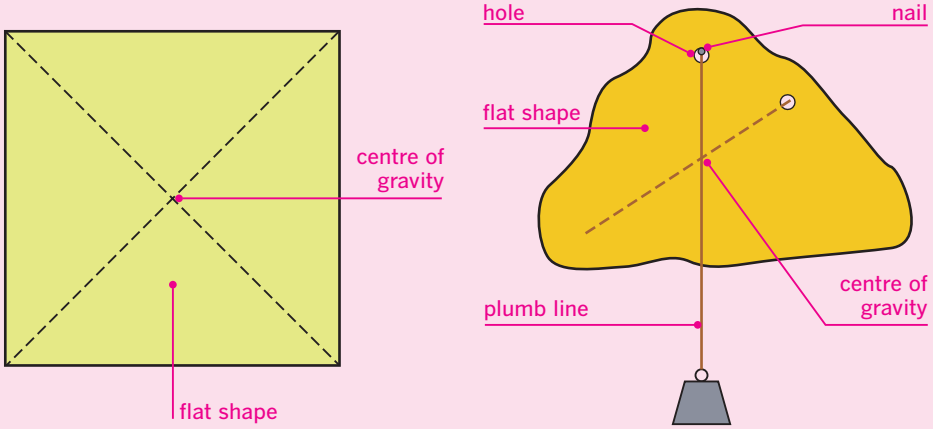
Center of gravity and stability

Key words

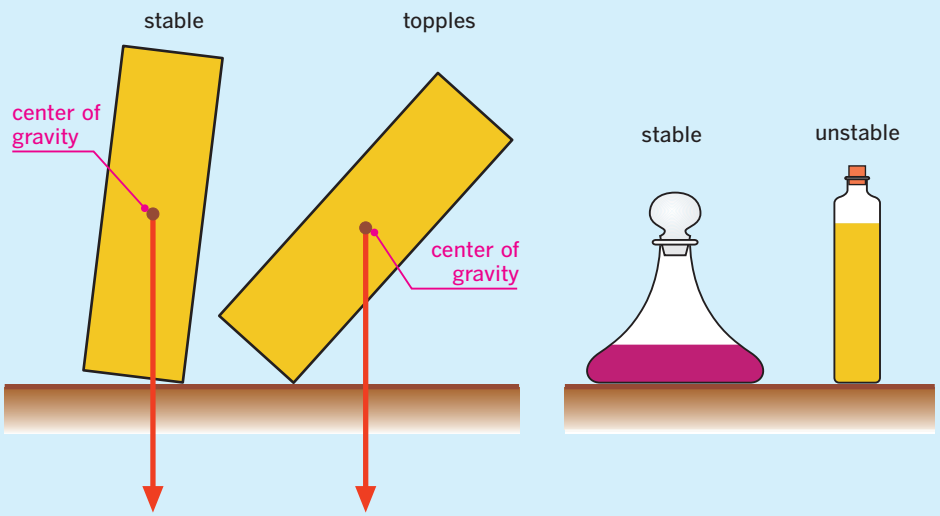
center of mass
equilibrium

1 Center of gravity



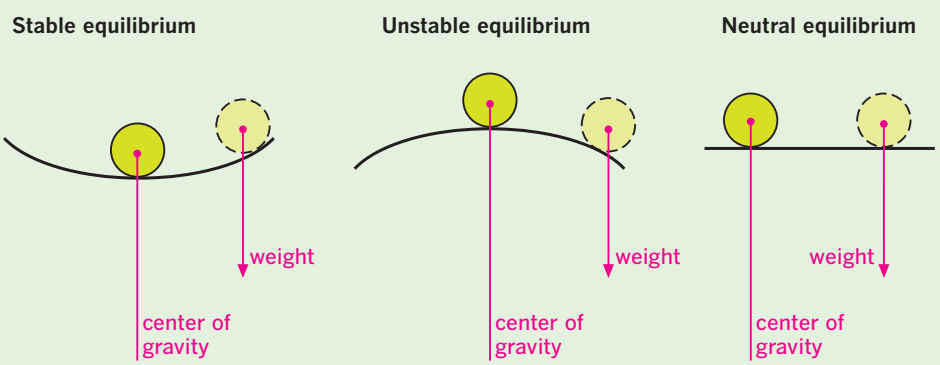
- A body behaves as if its whole weight is concentrated at one point which is called the center of gravity. Since the force of gravity is effectively constant over the small volume of an object on Earth, the center of gravity and *center of mass* are effectively the same point.
- In a regular flat shape, the center of gravity is at the geometric center of the shape.
- In an irregular flat shape the center of gravity is found by suspending the shape on a nail so that it can swing freely, and tying a plumb line (a thread with a weight attached) to the nail. The shape hangs in such a way that its center of gravity is directly below the point from which it is suspended i.e. there is no moment in either direction. The position of the plumb line is marked and the process repeated, suspending the shape from a different place. The center of gravity is where the two lines intersect.

2 Stability



- An object's shape and position affects whether it topples over easily or not.
- An object will topple over if its center of gravity moves outside its base.
- Objects with broad bases are more stable than objects with narrow bases.

3 Equilibrium



- An object is in stable *equilibrium* if, when released after a small displacement (to the position marked with a dotted outline), it moves back to its original position.
- An object is in unstable equilibrium if, when released after a small displacement, it moves further away from its original position.
- An object is in neutral equilibrium if, when released after a small displacement, it remains in the new position.