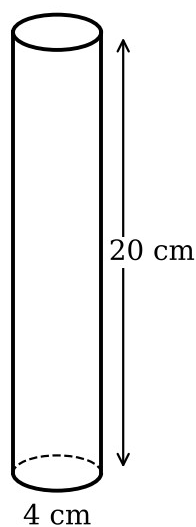


3D Rigid Bodies in Equilibrium

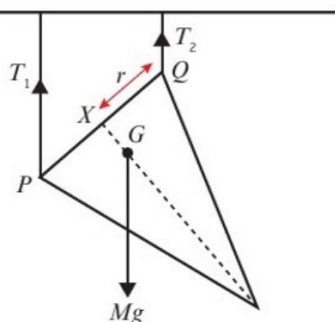
If a body is in equilibrium:

When a rigid body is suspended freely from a fixed point and rests in equilibrium:

1. A uniform solid hemisphere has radius r . It is suspended by a string attached to a point A on the rim of its base. Find the angle between the axis of the hemisphere and the downward vertical when the hemisphere is in equilibrium.
2. A non-uniform cylinder has height 20 cm and radius 2 cm. At any height h cm above its base, the density of the cylinder is given by $\rho = 3(2 - h/50) \text{ g cm}^{-3}$. The cylinder is freely suspended from a point P that lies on the circumference of its top face. Find the angle between the downward vertical and the top face of the cylinder.



3. The diagram shows a uniform solid right circular cone, of mass M with radius r and height $3r$. P and Q are points at opposite ends of a diameter on the circular plane face of the cone. The cone is suspended from a horizontal beam by two vertical inelastic strings fastened at P and Q . Given that the cone is in equilibrium with its axis at an angle of 45° to the horizontal, find the values of the tensions in the strings, giving your answers in terms of M and g .



4. Two smooth uniform spheres of radius 4 cm and mass 5 kg are suspended from the same point A by identical light inextensible strings of length 8 cm attached to their surfaces. The spheres hang in equilibrium, touching each other. What is the reaction between them?

