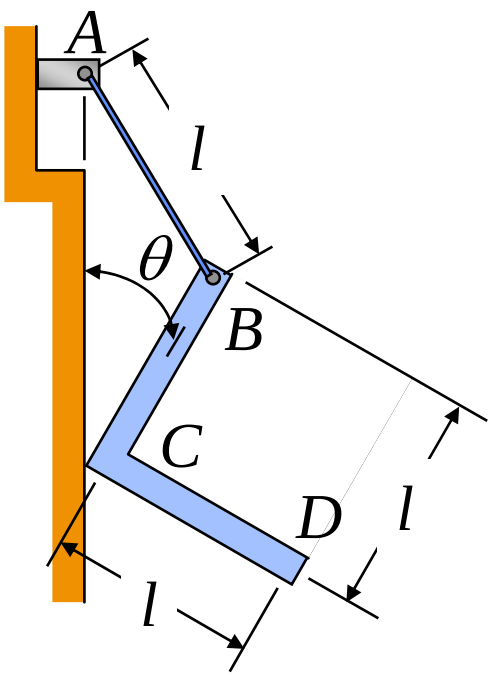
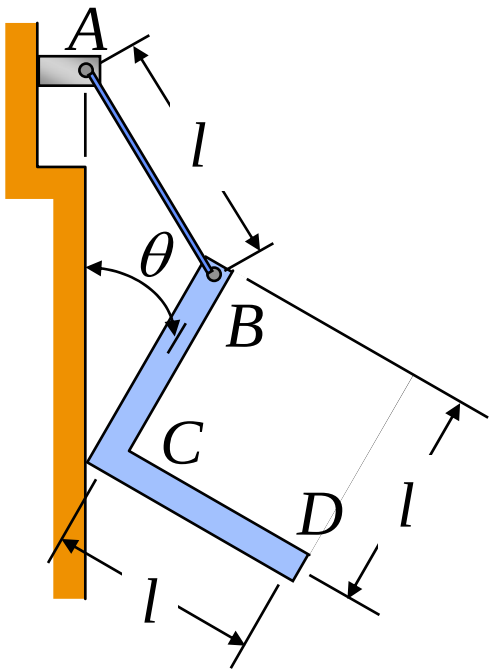
Problem 10.107



Two rods, each of mass *m*, are welded together to form the L-shaped member BCD that is suspended from cable AB. Neglecting the effect of friction, determine the angle θ corresponding to equilibrium.



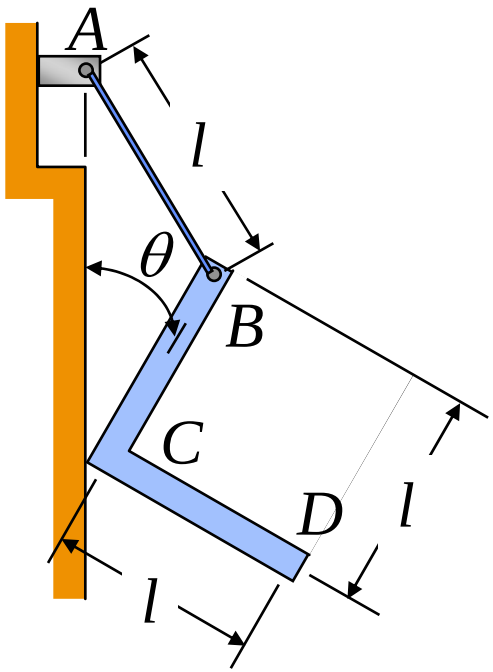
Problem 10.107

Solving Problems on Your Own

Two rods, each of mass *m*, are welded together to form the L-shaped member *BCD* that is suspended from cable *AB*. Neglecting the effect of friction, determine the angle θ corresponding to equilibrium.

1. *Express all distances and angles in terms of a single variable.*

The variable can be length or angle. The determination of the equilibrium position requires the computation of the derivative of the potential energy with respect to the variable.



Problem 10.107

Solving Problems on Your Own

Two rods, each of mass m, are welded together to form the L-shaped member BCD that is suspended from cable AB. Neglecting the effect of friction, determine the angle θ corresponding to equilibrium.

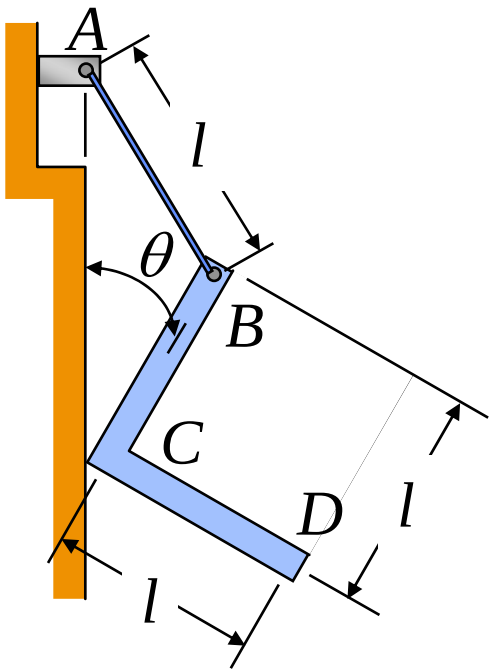
2. Write the potential energy V of the system. It is the sum of the potential energies associated with the various forces acting on the system that do work as the system moves.

Potential energy of a weight or a constant vertical force is $V_g = Wy$ where y is the elevation of the weight W.

Potential energy of a spring is $V_e = (1/2)kx^2$ where k is the spring constant and x is the deformation of the spring measured from its unstretched position.

Problem 10.107

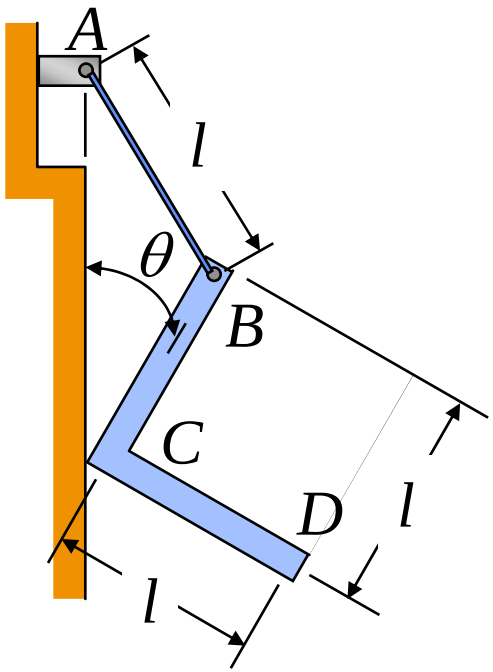
Solving Problems on Your Own



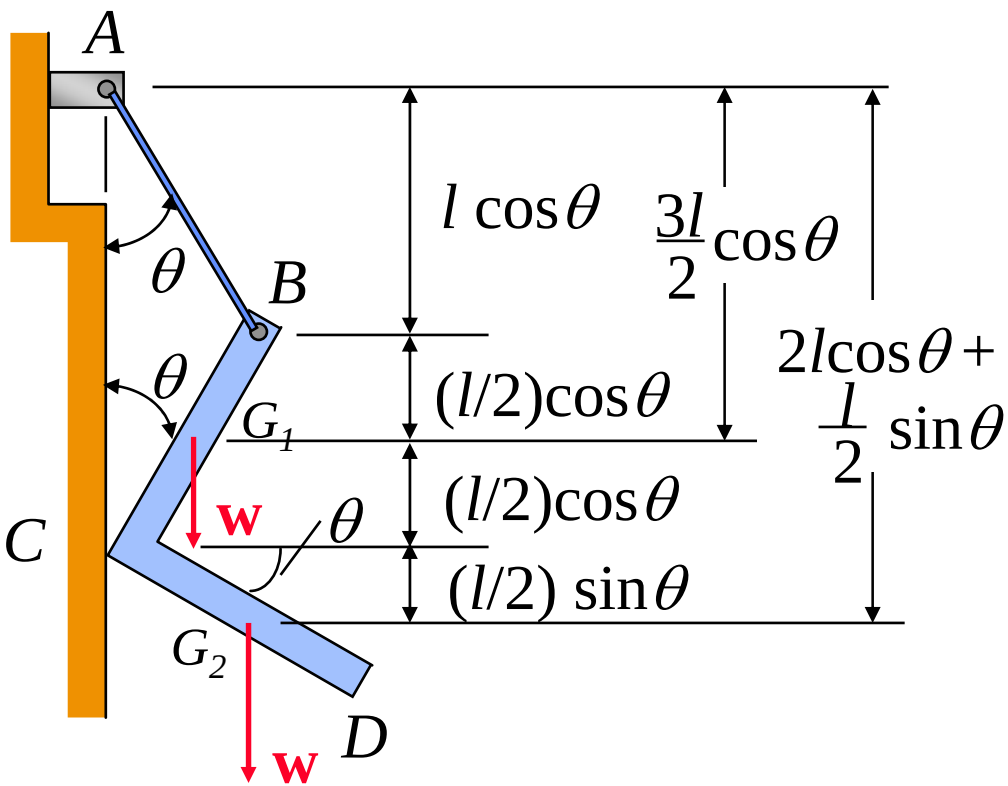
Two rods, each of mass *m*, are welded together to form the L-shaped member *BCD* that is suspended from cable *AB*. Neglecting the effect of friction, determine the angle θ corresponding to equilibrium.

3. *Determine the position of equilibrium*. Once the potential energy V has been expressed in terms of a single variable, e.g. θ, compute its derivative and solve the equation $dV/d\theta = 0$ for θ.

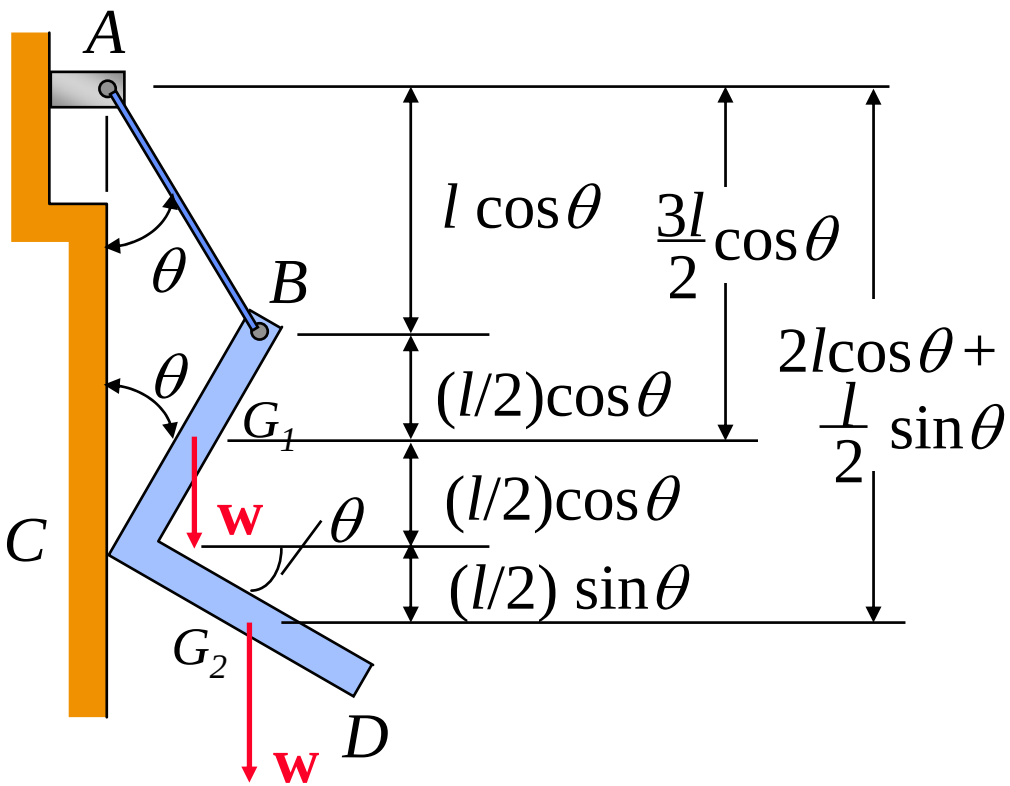
Problem 10.107 Solution



Express all distances and angles in terms of a single variable.



Problem 10.107 Solution



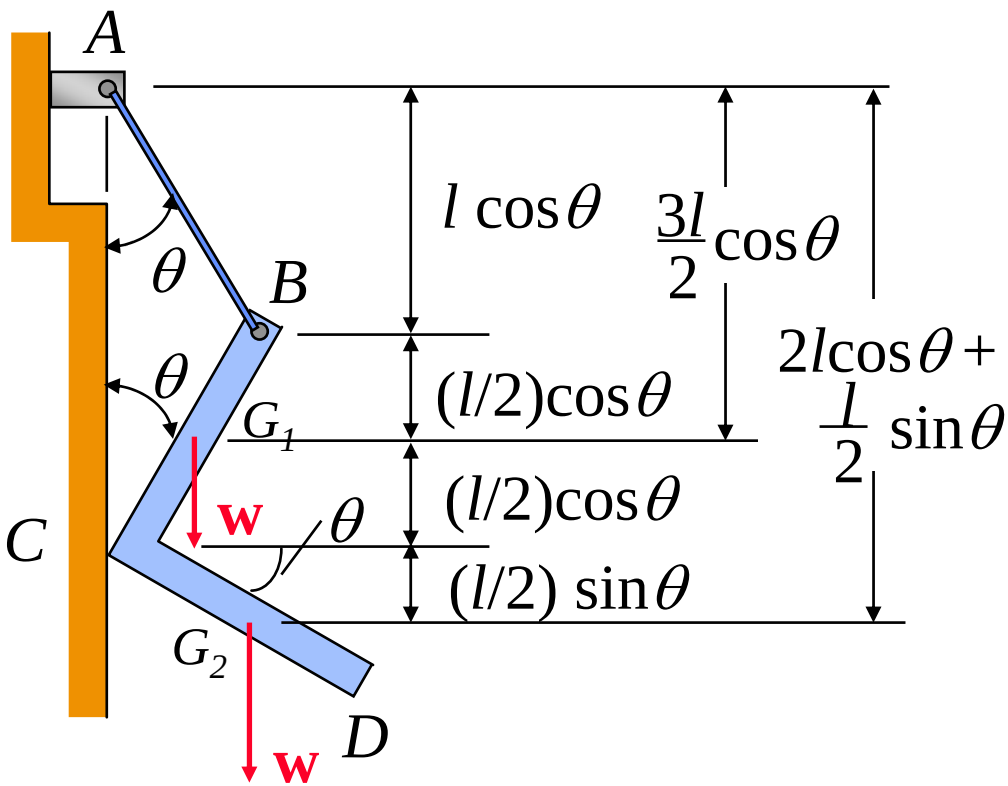
Write the potential energy V of the system.

$$V = -W\left(\frac{3}{2}\cos\theta\right) - W\left(2l\cos\theta + \frac{l}{2}\sin\theta\right)$$

$$V = Wl\left(-\frac{7}{2}\cos\theta - \frac{1}{2}\sin\theta\right)$$

$$\frac{dV}{d\theta} = Wl\left(\frac{7}{2}\sin\theta - \frac{1}{2}\cos\theta\right)$$

Problem 10.107 Solution



Determine the position of equilibrium.

$$\frac{dV}{d\theta} = Wl\left(\frac{7}{2}\sin\theta - \frac{1}{2}\cos\theta\right)$$

$$\frac{dV}{d\theta} = 0; \qquad \frac{7}{2}\sin\theta = \frac{1}{2}\cos\theta$$

$$\tan\theta = \frac{1}{7} \qquad \boxed{\theta = 8.13^{\circ}}$$