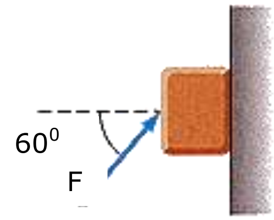
Q1- A block of mass 5.00 kg is pushed up against a wall by a force F that makes a 60.0° angle with the horizontal. The coefficient of static friction between the block and the wall is 0.30. Determine the possible value(s) for the magnitude of F that allow the block to remain stationary.

The forces acting on the block are its weight and the force applied. The horizontal component of the applied force will push the block to the wall and thus the normal reaction of the wall will be




N = F $\cos 60^0$

The vertical component F $\sin 60^0$ will try to hold it against its weight

The minimum force F will be such that the block will not slide done and the friction force will be upwards. Thus

F $\sin 60^0$ + $\mu$N = Mg

Or $$F = \frac{Mg}{\sin 60^0 + \mu \cos 60^0} = \frac{5*9.8}{0.866+0.30*0.500} = 48.2\ N$$

And for maximum value of F (block sliding up) friction is downward.

F $\sin 60^0$ - $\mu$N = Mg

Or $$F = \frac{Mg}{\sin 60^0 - \mu \cos 60^0} = \frac{5*9.8}{0.866-0.30*0.500} = 68.4\ N$$

Q2- A relaxed spring with spring constant k = 80 N/m is stretched a distance di = 65 cm and held there. A block of mass M = 6 kg is attached to the spring. The spring is then released from rest and contracts, dragging the block across a rough horizontal floor until it stops without passing through the relaxed position, at which point the spring is stretched by an amount df = di/10. What is the coefficient of kinetic friction between the block and the floor?

The problem can be solved easily by considering the work done and change in the energies. The block is dragged against the friction and the work done in dragging it is equal to the loss in elastic potential energy of the spring.

As the block is dragged the frictional force between the surface and the block is given by the product of coefficient of kinetic friction and the normal reaction of the surface. The normal reaction is equal to the weight of the block and equal to mg, and if the coefficient of kinetic friction is $\mu$, then the force of friction will be $\mu$mg. The work done against the friction will be $\mu mg\,(d_i - d_f)$
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Hence we have

loss in elastic potential energy = work done against friction

Or $\frac{1}{2} K(d_i^2 - d_f^2) = \mu mg\,(d_i - d_f)$
Or $\frac{1}{2} K(di + df) = \mu mg$
Or $0.5*80(0.65 + 0.065) = \mu*6.0*9.8$
Gives $\mu = 0.4864$