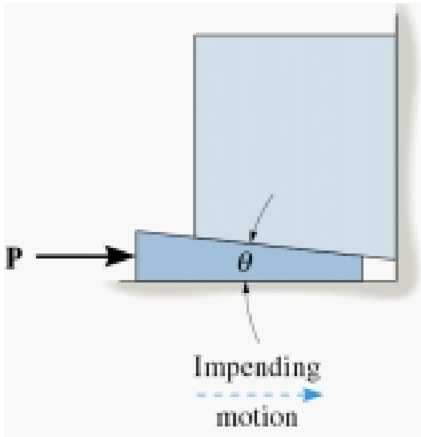
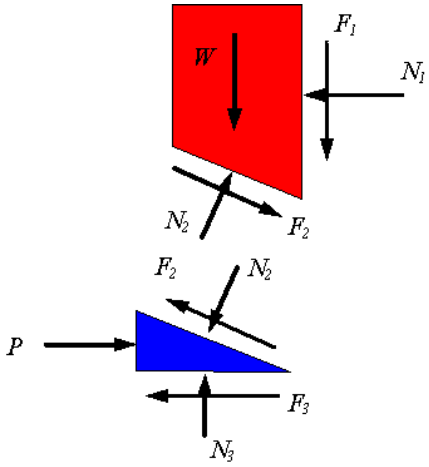
Friction- Part 2:



Wedges: Wedges are a useful engineering tool, and the approach used for wedges also finds its way into other engineering applications. A wedge is in general a triangular object which is placed between two objects to either hold them in place or is used to move one relative to the other. For example, the following shows a wedge under a block that is supported by the wall.

A good rule to stick to is that when a wedge is in use, the forces on the faces will both be in the same direction. That is either towards, or away from the point of the wedge.

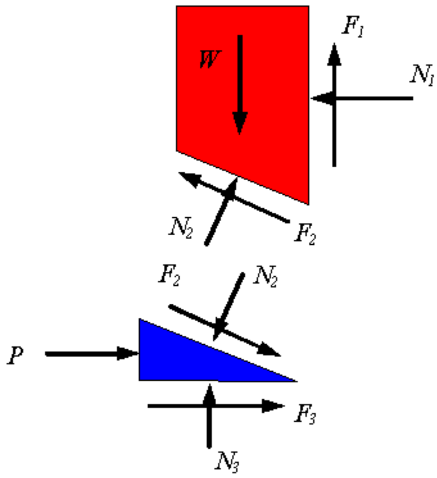


If the force P is large enough to push the wedge forward, then the block will rise and the following is an appropriate free-body diagram. Note that for the wedge to move one needs to have slip on all three surfaces. The direction of the friction force on each surface will oppose the slipping.

Since before the wedge can move each surface must overcome the resistance to slipping, one can assume that

$$F_1 = \mu N_1$$
$$F_2 = \mu N_2$$
$$F_3 = \mu N_3$$

These equations and the equations of equilibrium are combined to solve the problem.



If the force P is not large enough to hold the top block from coming down, then the wedge will be pushed to the left and the appropriate free-body diagram is the following. Note that the only change is the direction of the frictional forces. A similar analysis to the above yield the solution to the problem. Remember:

Number of unknowns is 7:

P, F_1, F_2, F_3, N_1, N_2, & N_3

Number of equilibrium equations is 4:

$\sum F_x = 0, \quad \sum F_y = 0$ for block & wedge

Number of frictional forces' equations is 3:

$$F_1 = \mu_1 N_1, \quad F_2 = \mu_2 N_2, \quad F_3 = \mu_3 N_3$$

If P=0 and F1, F2 and F3 hold the block in place, then the wedge is self-locked.