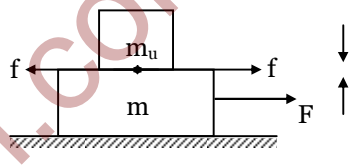
Friction

Block on block

Case I: (lower block pulled and there is no friction between lower block and the horizontal surface.)

a) When the lower block is pulled upper block is accelerated by the force of friction acting upon it.



b) The maximum acceleration of the system of two blocks for them to move together without slipping is $a = \mu_s g$, where μ_s is the coefficient of static friction between the two blocks.

c) If $a < \mu_s g$ blocks move together and applied force is $F = (m_B + m_u) a$.

d) If $a < \mu_s$ frictional force between the two blocks $f = m_u a$.

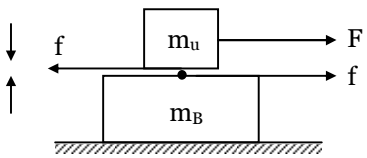
e) The maximum applied force for which both blocks move together is $F_{max} = \mu_s g (m_u + m_B)$.

f) If $F > F_{max}$ blocks slip relative to each other and have different accelerations. The acceleration of the upper block is $\mu_k g$ and lower block is

$$a = \frac{F}{m_B + m_u}.$$

Case - II (Upper block pulled and there is no friction between lower block and the horizontal surface)

a) When the upper block is pulled, lower block is accelerated by the force of friction acting upon it.



b) The maximum acceleration of the system of two blocks for them to move together without slipping is $a_{max} = \mu_s \frac{m_u}{m_B} g$ (μ_s = coefficient of static friction between the two blocks)

c) If $a < a_{max}$ frictional force between the two blocks is $f = M_B a$.

d) If a < a_{max}' then applied force on the upper block is F = (m_B + mu) a.

e) The maximum force for which both blocks move together is $F_{max} = \mu_s \frac{m_u}{m_B} g (m_u + m_B)$.

f) If F>F_{max} blocks slide relative to each other and hence have different accelerations. The accele-ration of the lower block is $\mu_k \frac{m_u}{m_B} g$ and the acceleration of the upper block is $\frac{(F - \mu_k m_u g)}{m_u}$.