

Solution:

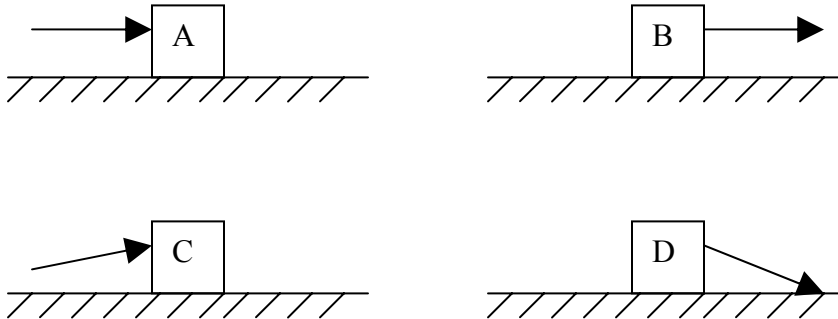
Three students are competing to move boxes.

A is pushing the box horizontally.

B is hauling the box horizontally.

C is pushing the box at an angle of 15 degrees tilted up.

D is hauling the box at an angle of 30 degrees tilted down.



Assume all the boxes are identical and located on the same frictional flat surface. All the students exerted forces with the same magnitude. (please refer to the graphs above.)

Please rank the acceleration of the boxes in the DESCENDING order.

$A=B>D$, and C could be either larger or smaller than A, depending on the coefficient of kinetic friction.

For C, the normal force is $mg - F\sin(15^\circ)$, therefore the friction is $\mu(mg - F\sin(15^\circ))$

The horizontal component of total force on C is $F\cos(15^\circ) - \mu(mg - F\sin(15^\circ))$. One cannot judge whether it is larger or smaller than that in scenario A/B.