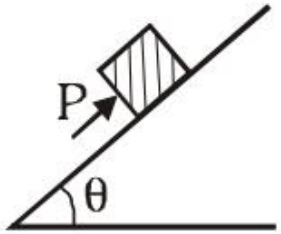
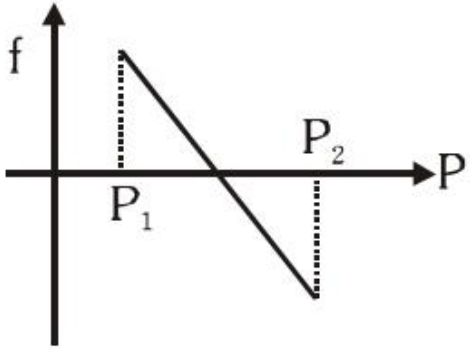
A block of mass m is on an inclined plane of angle θ. The coefficient of friction between the block and the plane is μ and tanθ >μ. The block is held stationary by applying a force P parallel to the plane. The direction of force pointing up the plane is taken to be positive. As P is varied from $P_1 = mg(\sin\theta - \mu\cos\theta)$ to $P_2 = mg(\sin\theta + \mu\cos\theta)$, the frictional force f versus P graph will look like

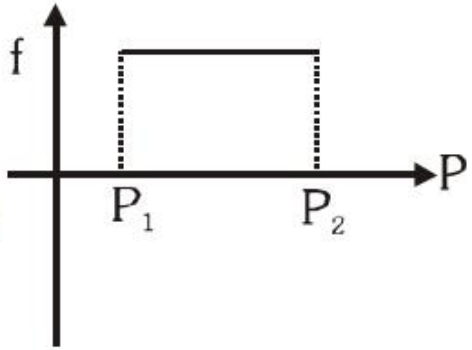
[IIT-JEE-2010]



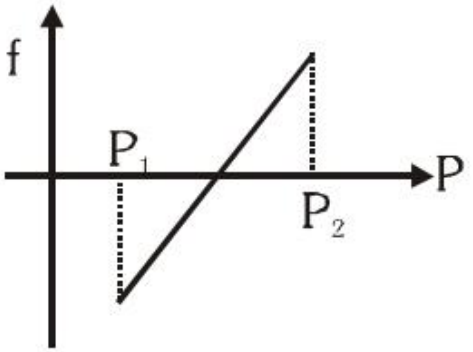
(A)



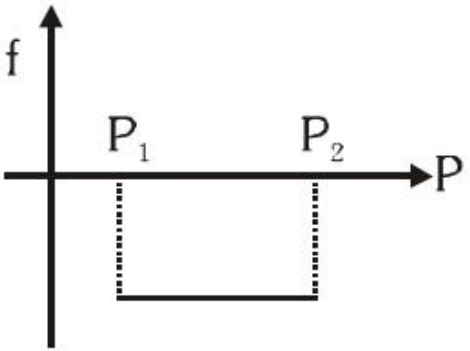
(B)



(C)



(D)



Soln ⇒

as $\tan\theta > \mu$

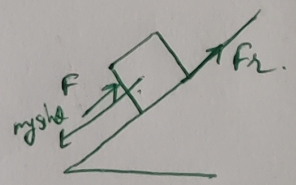
So, min Force req. to be stationary $= mg\sin\theta - \mu mg\cos\theta$

~~So, from P_1 to P_2 box will~~

min force for block to move up $= mg\sin\theta + \mu mg\cos\theta$

So, from P_1 to P_2 Block will be stationary. (eqbm)

So,



$mg\sin\theta = F + f_r$

$f_r = mg\sin\theta - F$ — (1)

So, F is linearly varied

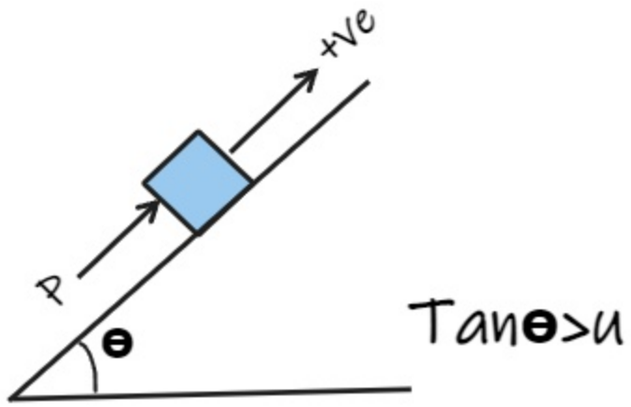
So, f_r is linear.

and f_r initial ⇒ $\mu mg\cos\theta$

Find ⇒ $-\mu mg\cos\theta$

(by eqn (1))

So, (A) opt^n



$P_1 = mg\sin\theta - \mu mg\cos\theta$

$P_2 = mg\sin\theta + \mu mg\cos\theta$

Initially block has tendency to slide down and as $\tan\theta > \mu$, maximum friction $\mu mg\cos\theta$ will act in positive direction. When magnitude P is increased from P_1 to P_2, friction reverse its direction from positive to negative and becomes maximum i.e.$\mu mg\cos\theta$ in opposite direction.