Question
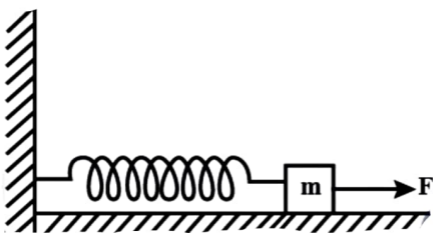
A block of mass m, lying on a smooth horizontal surface, is attached to a spring (of negligible mass) of spring constant k. The other end of the spring is fixed, as shown in the figure. The block is initially at rest in its equilibrium position. If now the block is pulled with a constant force F, the maximum speed of the block is :

A $\dfrac{\pi F}{\sqrt{mk}}$

B $\dfrac{2F}{\sqrt{mk}}$

C $\dfrac{F}{\sqrt{mk}}$

D $\dfrac{F}{\pi\sqrt{mk}}$

Solution

Correct option is C)

Maximum speed is at mean position(equilibrium). F = kx

$x = \dfrac{F}{k}$

$W_F + W_{sp} = \Delta KE$

$F(x) - \dfrac{1}{2}kx^2 = \dfrac{1}{2}mv^2 - 0$

$F\left(\dfrac{F}{k}\right) - \dfrac{1}{2}k\left(\dfrac{F}{k}\right)^2 = \dfrac{1}{2}mv^2$

$\Rightarrow V_{max} = \dfrac{F}{\sqrt{mk}}$