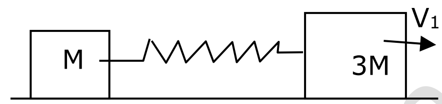
Q- Two blocks of masses M and 3M are placed on a horizontal, frictionless surface. A light spring is attached to one of them, and the blocks are pushed together with the spring between them. When the blocks released, the block of mass 3m moves to the right with a speed of 2.00m/s (a) What is the velocity of the block of mass M? (b) Find the system's original elastic potential energy, taking M=0.350 kg.



The forces acting on the blocks are the internal force of the compressed spring. In the process of coming back to the natural length the elastic forces push the blocks and as there is no other horizontal force on the system, its momentum will be conserved.

(a)

Initial velocity of both the bodies was zero hence initial momentum of the system is zero.

Say after the spring gets natural length and the blocks separated, velocity of 3M block is v_1= 2.00 m/s and velocity of the block of mass M is v_2, then the final momentum of the system is

$3Mv_1 + Mv_2$

Hence according to law of conservation of momentum

Final momentum = initial momentum

Or $3Mv_1 + Mv_2 = 0$

Or $3v_1 + v_2 = 0$

Or $v_2 = -3v_1 = -3*2.00 = -6.00$ m/s

Hence the smaller mass will move to the left with speed of 6.00 m/s

(b)

The kinetic energy of the system after the spring is relaxed is the sum of the kinetic energies of the two blocks

$KE = KE_1 + KE_2$

$= ½*3M*v_1^2 + ½*M*v_2^2$

$= 0.5*M*(3v_1^2 + v_2^2) = 0.5*0.350*(3*2.00^2 + 6.0^2) = 8.4$ J

This energy is received by the blocks from the elastic potential energy stored in the compressed spring and hence the original elastic energy of the spring was also 8.4 J