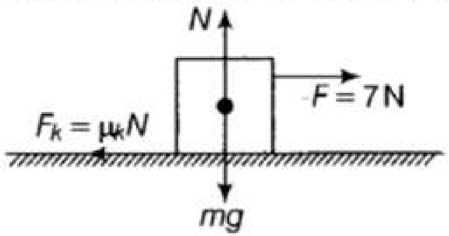
2. A body of mass of 2 kg initially at rest moves under the action of an applied horizontal force of 7 N on a table with the coefficient of kinetic friction = 0.1. Compute the

a. work done by the applied force in 10 s,
b. work done by friction in 10 s,
c. work done by the net force on the body in 10 s
d. change in kinetic energy of the body in 10 s, and interpret your results

Sol. The diagrammatic representation of the given problem may be shown as:



The mass of the body is m=2kg .Here, applied force F = 7 Newton
and opposing friction force, f = $\mu_k \cdot N = \mu_k \cdot mg = 0.1 \times 2 \times 9.8 = 1.96\text{N}$
Net accelerating force = F - f = 7 -1.96 = 5.04 N
∴ Acceleration, a = $\frac{\text{force}}{\text{mass}} = \frac{5.04\text{N}}{2\text{kg}} = 2.52\text{ms}^{-2}$

a. Distance covered in 10 s
$s = 0 + \frac{1}{2}at^2 = \frac{1}{2} \times 2.52 \times (10)^2 = 126\text{m}$ (where we assume, u =0)
∴Work done by the applied force
W = Fs = 7 × 126 = + 882 Joules

b. Work done by friction in 10 s
W ' = f s cos 180^0 = 1.96 × 126 = -247 Joules

c. Work done by net force in
10 s = W - W' = 882 -247
= + 635 Joules

d. Using newton's First equation of motion, the final velocity is calculated a
v =u+ at
⇒ v = 0 + (2.52 ms^{-2})(10 s)
⇒ v =25.2 m/s
Change in kinetic energy,
So, $\Delta K = (\frac{1}{2})(2kg)(25.2ms^{-1})^2 - (\frac{1}{2})(2kg)(0)$
⇒ $\Delta\text{K} = 635.04\text{J}$
This result is in accordance with Work. Energy theorem which states that the change in kinetic energy of an object is equal to the net work done on the object.