Q- A 7gram bullet moves directly to the right at 1000m/s toward a 5 kg block that is at rest on a horizontal tabletop. The bullet emerges from the block moving to the right at 400m/s. determine how far the block will slide if the coefficient of kinetic friction between the block and the table is 0.3, assuming that no mass of the block is removed as a result of the bullet passing through it.

Let the velocity of the block just after collision is v then as the time taken by the bullet to cross the block is very small, we may apply the law of conservation of momentum and we have

$$0.007*1000 = 0.007*400 + 5.0*v$$

Gives v = (7 – 2.8)/5.0 = 0.84 m/s

The acceleration produced by the friction force on the block will be

$$a = - \mu mg/m =- \mu g = - 0.3*9.8 = - 2.94 \text{ m/s}^2.$$

Hence the distance moves by the block s is given by using the third equation of motion as

$$v^2 = u^2 + 2*a*s$$

Or $0 = 0.84^2 +2*(-2.94)*s$

Gives s = 0.12 m = 12 cm.