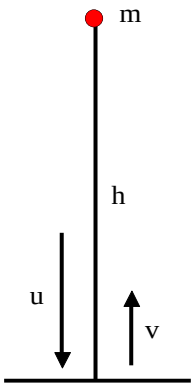
A ball of mass 50 gm falls from a height of 10 m. It rebounds with decreased speed having left with just $\frac{1}{4}th$ of its initial mechanical energy. If it remains in contact with the ground for small time δt, what is the impulse of the impact force? [$g = 9.8ms^{-2}$]

(A) 0.35 Ns (B) 1.05 Ns (C) 0.7 Ns (D) δt is needed to solve

Solution



$$mgh = \frac{1}{2}mu^2$$

$$\therefore u = \sqrt{2gh}$$

Now, $\frac{1}{2}mv^2 = \frac{1}{4}.\frac{1}{2}mu^2$

$$\therefore v = \frac{u}{2}$$

Impulse = $\Delta p = mv - [m(-u)] = m(u+v) = \frac{3}{2}mu$

Impulse = $\frac{3}{2}mu = \frac{3}{2}\times 50\times 10^{-3}\times\sqrt{2gh} = \frac{3}{2}\times 50\times 10^{-3}\times\sqrt{2\times 9.8\times 10} = 1.05Ns$

Hence, (B)