

Q 3 In a shotput event an athlete throws the shotput of mass 10 kg with an initial speed of 1ms^{-1} at 45° from a height 1.5 m above ground. Assuming air resistance to be negligible and acceleration due to gravity to be 10ms^{-2} , the kinetic energy of the shotput when it just reaches the ground will be

- 1) 5.0 J
- 2) 2.5 J
- 3) 155.0 J
- 4) 52.5 J

Sol. 3) 155.0 J

If air resistance is negligible, the total mechanical energy of the system will remain constant. And let us take the ground as a reference where potential energy will be zero.

According to the problem, $h = 1.5\text{ m}$, $v = 1\text{ m/s}$, $m = 10\text{ kg}$, $g = 10\text{ ms}^{-2}$

Initial energy of the shotput = $(PE)_i + (KE)_i = mgh + \frac{1}{2}mv^2$

$$= 10 \times 10 \times 1.5 + \frac{1}{2} \times 10 \times (1)^2$$

$$= 150 + 5 = 155\text{ J}$$

Now from conservation of mechanical energy we have,

$$(PE)_i + (KE)_i = (PE)_f + (KE)_f$$

$$155\text{ J} = 0 + (KE)_f$$

Hence, final kinetic energy of the shotput is 155 J