Total Time of Flight for an Object Shot Straight Upwards

Solution:

The correct answer is c.)

When an object is shot straight upwards at a certain initial speed, it decelerates until it reaches the apex of its trajectory, momentarily comes to rest, and then drops back.

Since the upward and downward segments of the object's flight cover the same distance (height) with the same value of acceleration, the total time taken for the object to return to its point of projection is simply twice the time taken to cover each individual segment.

Total Time of Flight for an Object Shot Straight Upwards

For the upward segment of the trajectory, the object has an initial speed v_0, an acceleration -g and a final speed 0, when it momentarily comes to rest at the apex of its trajectory, so that the time taken for upward segment is given by:

$$0 = v_0 + (-g)t \Rightarrow t = \left(\frac{v_0}{g}\right)$$

Thus, total time of flight: $T = 2 \times t = \left(\frac{2v_0}{g}\right)$