Answer on Question #45186, Physics, Other

A body is thrown vertically upwards and takes 5 seconds to reach maximum height. The distance travelled by the body will be same in

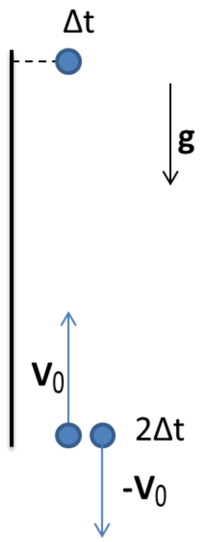
(1) 1st &10 th sec

(2) 2nd & 8 th sec

(3) 4th & 6th sec

(4) Both (2) &(3)

Solution.



Let’s calculate distances travelled by the body in n-th second.

$$S_n = V_{n-1}\Delta t - \frac{g\Delta t^2}{2}$$

Let’s find V_0 - the initial velocity of the body:

$$0 = V_0 - g \cdot 5\Delta t \rightarrow V_0 = 5g\Delta t$$

Where V_{n-1} is a projections of body’s velocity on the vertical axis upwards, **Δt = 1s.**

$$V_{n-1} = V_0 - gt_{n-1} = V_0 - g(n-1)\Delta t$$

Where (n-1) is a number of seconds passed before beginning of n-th second. So:

$$S_n = (V_0 - g(n-1)\Delta t)\Delta t - \frac{g\Delta t^2}{2} = V_0\Delta t - ng\Delta t^2 + \frac{g\Delta t^2}{2}$$
$$= 5g\Delta t^2 - ng\Delta t^2 + \frac{g\Delta t^2}{2}$$

Let Δt be 1:

$$S_n = 5g - ng + \frac{g}{2} = \frac{11g}{2} - ng$$

Here the dimension of g is meters.

So distances traveled by the body are:

n	Sn
1	9/2 g
2	7/2 g
3	5/2 g
4	3/2 g
5	1/2 g
6	-1/2 g
7	-3/2 g
8	-5/2 g
9	-7/2 g
10	-9/2 g

As we can see, from proposed answers only first is right: absolute amount of distances travelled in 1st &10 th seconds are equal.

Answer: (1) 1st &10 th sec