Answer on Question #48843 – Physics – Relativity

1. A person in an elevator accelerating upwards with an acceleration of 2m/sec^2, tosses a coin vertically upwards with a speed of 20m/sec. After how much time will a coin fall back into his hand? (g=10m/sec^2): (1) 1.3; (2) 2.3; (3) 3.3; (4) 4.3. All are in seconds.

$a_0 = 2\frac{m}{s^2}$

$v = 20\frac{m}{s}$

$g = 10\frac{m}{s^2}$

$t - ?$

Solution.

Let write the law of motion of the coin in a non-inertial reference system, which is connected with the elevator. If Z-axis is directed upwards, then

$ma = F_z - ma_0$.

($F_z = -mg$ is the gravitational force.)

So, the acceleration of the coin is $a = -g - a_0$.

v is its initial speed in this reference system.

Let find the time of flying to the highest point (until stopping):

$$-g - a_0 = \frac{0 - v}{t}, \quad -g - a_0 = \frac{0 - v}{t_1}, \quad t_1 = \frac{v}{g + a_0}.$$

The time of returning is twice longer: $t = 2t_1$, $\boxed{t = \frac{2v}{g + a_0}}$.

Let check the dimension: $[t] = \frac{m}{s} : \frac{m}{s^2} = s$.

Let evaluate the quantity: $t = \frac{2 \cdot 20}{10 + 2} = 3.33(s)$.

Answer: 3.