

51000, Physics, Other

Question An object is rolled up an incline. If the object is 2.75 m up the incline after 4.50s and rolling back down at a velocity of 1.90m/s, what is the acceleration of the object?

Solution We will need two equation here: equation of motion and equation for velocity. Here they are

$$s(t) = v_0t - at^2/2$$

$$v(t) = v_0 - at$$

where v_0 is initial velocity and a is needed acceleration. We know that at moment $t_1 = 4.5$ s velocity was $v_1 = -1.9$ m/s and distance was $s_1 = 2.75$. So we substitute it and we get

$$s_1 = v_0t_1 - at_1^2/2$$

$$v_1 = v_0 - at_1$$

Now we can solve them for a :

$$v_0 = v_1 + at_1$$

$$s_1 = (v_1 + at_1)t_1 - at_1^2/2$$

$$s_1 = v_1t_1 + at_1^2/2$$

And we find acceleration:

$$a = 2(s_1 - v_1t_1)/t_1^2 \approx -0.57m/s^2$$