Question #77218, Physics / Mechanics | Relativity

1. a train starting from rest, moves with a uniform acceleration of 15 km for 2 min. it travel at the uniform speed for the next 4 min and it brought to rest again with uniform retardation in 720 meter.

a. draw a velocity time graph of the motion

b. i. The total distance traveled in meter

ii. The total time taken for the journey

iii. The magnitude of the uniform retardation

Solution

a.

$$v = \frac{1}{2}\frac{15000}{120} = 62.5\frac{m}{s}$$

b. i.

$$s = 15000 + 720 + 240(62.5) = 30720\,m$$

ii.

$$t = 366\,s.$$

iii.

$$a = 2.7\frac{m}{s^2}$$

2. A small smooth object slide from rest down a smooth inclined plane at 30 degree to the horizontal. What is

a. The acceleration down the plane

b. The time to reach the button, if the plane is 5m long. The object is now thrown up the plane with an initial velocity of 15m/s.

c. See now how long does the object take to come to rest.

d. How far up the plane as the object travel

Solution

a.

$$a = g\sin\theta = 10\sin 30 = 5\frac{m}{s^2}.$$

b.

$$v^2 - (v - at)^2 = 2as$$

$$(v - at)^2 = v^2 - 2as$$

$$v - at = \sqrt{v^2 - 2as}$$

$$t = \frac{1}{a}\left(v - \sqrt{v^2 - 2as}\right) = \frac{1}{5}\left(15 - \sqrt{15^2 - 2(5)(5)}\right) = 0.35\ s.$$

c.

$$v - at$$

$$t = \frac{v}{a} = \frac{15}{5} = 3\ s.$$

d.

$$d = vt - \frac{at^2}{2} = 15(3) - \frac{5}{2}(3)^2 = 22.5\ m.$$