Tutorial Answers

Topic 3 Kinematics

Question 1

$s_y = u_y t + \frac{1}{2} a_y t^2$

$-50 = 0 + \frac{1}{2}(-9.81)t^2$

$t = 3.2$ s

$s_x = u_x t$

$90 = u_x (3.2)$, **u_x = 28.1 ms^{-1}**

Question 2

(a) $v^2 = u^2 + 2as$

$0 = (20 \sin 37°)^2 + 2(-9.81)s$

s = **7.38 m**

(b) $v = u + at$

$0 = (20 \sin 37°) + (-9.81)t$

time to reached max. height = 1.23 s

time before it hits ground, t = 1.23 x 2 = **2.46 s**

(c) $s = ut = (20 \cos 37°)(2.46)$

= 39.3 m

(d) at max. height the resultant velocity is equals to horizontal velocity only.

$V_{max.\ height} = 20 \cos 37°$ = **16 ms^{-1}**

(e) a = **9.81 ms^{-2}**

Question 3

(a) $s = ut$

$= (V_0\cos\theta_0)(2V_0\sin\theta_0 / g)$

Range, $s = v_0^2 \sin 2\theta / g$

(b) $320 = 60^2 \sin(2\theta) / 9.81 =$ **30.3°**

Question 4

(a) $s_y = ½ a_y t^2$

$-200 = ½ (-9.81)t^2$; t = 6.4 s

$s_x = u_x t = (70)(6.4) =$ **448 m**

(b) $s_x = u_x t$

$400 = (70)t$, t = 5.7 s

Substitute t = 5.7 s into the equation below:

$s_y = u_y t + ½ a_y t^2$

$-200 = u_y(5.7) + ½(-9.81)(5.7)^2$

$u_y =$ - 7.13 ms^{-1} (downwards)

(c) vertical velocity at the climber's position.

$v_y = u_y + at$

$= (-7.13) + (-9.81)(5.7) = 63.1\ ms^{-1}$

$v = \sqrt{(63.1)^2 + (70)^2} =$ **94.2 ms^{-1}**

Question 5

a.) 14 cos30° = **12.1 ms^{-1}**

b.) 14 sin30° = **7.0 ms^{-1}**

c.) v = u +at

0 = (7) + (-9.81)t

t = **0.71 s**

d.) Horizontal distance,

$s_x = u_x t$

= (12.1)(2 x 0.71) = 17.2 m

Number of cars = 17.2 / 1.6 = 10.8

= **10 cars**

Question 6

a.) **20 ms^{-1}**

b.) **2 ms^{-2}**

c.) **-7 ms^{-2}**

d.) **300 m**

e.) **250 m**

f.) **The velocity decreases uniformly in section E until the object comes to rest.**

The object then travels in the opposite direction.

The speed of the object increases uniformly until 5 ms^{-1}.

The object then travels at constant speed in section F and comes to rest instantaneously at t = 65 s.

g.)