Textbook Questions - Chapter 5

Projectile Motion.

8. A 9. B

19. D

Object 1

$v_i = 0$

$d = -50\ m$

$a = -9.8\ m/s^2$

$t = ?$

$d = v_i t + \frac{1}{2} a t^2$

$t = \sqrt{\frac{2d}{a}}$

$= \sqrt{\frac{2(-50)}{-9.8}}$

$t_1 = 3.19\ s$

Object 2

$v_i = -13.0\ m/s$

$d = -50\ m$

$a = -9.8\ m/s^2$

$t = ?$

$d = v_i t + \frac{1}{2} a t^2$

$-50 = -13t + \frac{1}{2}(-9.8)t^2$

$4.9t^2 + 13t - 50 = 0$

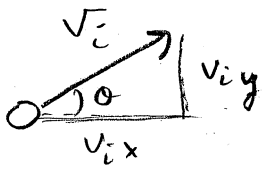
$t = \frac{-13 \pm \sqrt{(13)^2 - 4(4.9)(-50)}}{2(4.9)}$

$t_2 = 2.13\ s$

$t_1 - t_2 = 3.19 - 2.13 = 1.06$

20. B

29. D



Assuming the water balloon cannon is on the ground.

x

$v_{ix} = v_i \cos\theta$

$d = ?$

$t =$

$d = v_i t + \frac{1}{2} a t^2$

$d = v_i \cos\theta \, t$

$= (30 \cos 50)(4.69)$

$d = 90.44\text{m}$

y

$v_{iy} = v_i \sin\theta$

$d = 0$

$a = -9.8\ \text{m/s}^2$

$t =$

$d = v_i t + \frac{1}{2} a t^2$

$-v_i t = \frac{1}{2} a t^2$

$t = \frac{-v_i}{\frac{1}{2}a} = \frac{-v_i \sin\theta}{\frac{1}{2}a}$

$t = \frac{-30 \sin 50}{\frac{1}{2}(-9.8)} = 4.69\text{s}$

30. A

$\theta = 45°$

Assuming both the cannon and the target are on the ground.

x

$v_{ix} = v_i \cos\theta$

$d = 100\ m$

$t = $ —

$d = v_i t + \frac{1}{2}at^2$

$t = \frac{d}{v_i} = \frac{d}{v_i \cos\theta}$

y

$v_{iy} = v_i \sin\theta$

$d = 0$

$a = -9.8\ m/s^2$

$t = $ —

$d = v_i t + \frac{1}{2}at^2$

$-v_i t = \frac{1}{2}at^2$

$t = \frac{-2v_i}{a} = \frac{-2v_i \sin\theta}{a}$

$$\frac{d}{v_i \cos\theta} = \frac{-2v_i \sin\theta}{a}$$

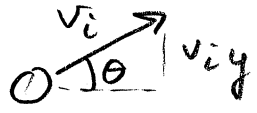
$$v_i = \sqrt{\frac{da}{-2\sin\theta\cos\theta}}$$

$$= \sqrt{\frac{100(-9.8)}{-2\sin 45 \cos 45}}$$

$$v_i = 31.3\ m/s$$

43. B 44. A

45. B



$\theta = 40°$

at maximum height $v_{fy} = 0$

y

$v_{iy} = v_i \sin\theta$

$v_{fy} = 0$

$d = 10\,m$

$a = -9.8\,m/s^2$

$v_{fy}^2 = v_{iy}^2 + 2ad$

$v_{iy}^2 = -2ad$

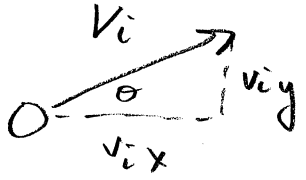
$(v_i \sin\theta)^2 = -2ad$

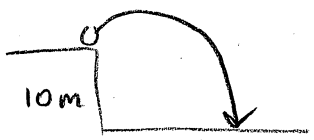
$$v_i = \frac{\sqrt{-2ad}}{\sin\theta}$$

$$= \frac{\sqrt{-2(-9.8)(10)}}{\sin 40} = \frac{14}{\sin 40}$$

$= 21.78\ m/s$

46. A





$\theta = 60^\circ$

x

$v_{ix} = v_i \cos\theta$

$d = ?$

$t = \_\_\_$

$d = v_{ix}t + \frac{1}{2}at^2$

$= (v_i \cos\theta)t$

$= (30\cos 60)(5.66)$

$= 84.94\ m$

y

$v_{iy} = v_i \sin\theta$

$d = -10m$

$a = -9.8\ m/s^2$

$t = \_\_\_$

$d = v_{iy}t + \frac{1}{2}at^2$

$d = v_i \sin\theta\, t + \frac{1}{2}at^2$

$-10 = (30\sin 60)t + \frac{1}{2}(-9.8)t^2$

$4.9t^2 - 25.98t - 10 = 0$

$$t = \frac{25.98 \pm \sqrt{(-25.98)^2 - 4(4.9)(-10)}}{2(4.9)}$$

$t = 5.66s$

66. B 67. B 68. B 69. C

85. A 86. B