

Physics 10154 - Exam #2D

Answer the following two questions. Be sure to clearly indicate your answer with a circle or box. Show all work. If I cannot see how you arrived at an answer, I will deduct points!

1. A shell is fired with an initial speed of 35 meters/sec in a direction 15° below the horizontal from the top of a cliff. It hits a target on the ground below 4.5 seconds later.

How far from the base of the cliff (horizontal distance) does the shell hit the ground?

What is the magnitude and direction of the velocity of the shell the instant before it hits the ground?

$$\Delta x = ?$$

$$\Delta y = ?$$

$$v_{0x} = 35 \cos 15^\circ$$

$$v_{0y} = -35 \sin 15^\circ$$

$$v_x = 35 \cos 15^\circ$$

$$v_y = ?$$

$$a_x = 0$$

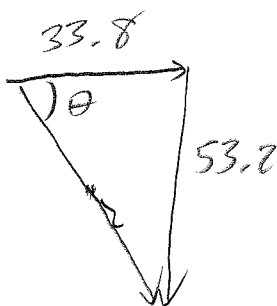
$$a_y = -9.8$$

$$t = 4.5$$

$$t = 4.5$$

$$\Delta x = (33.8)(4.5) = \boxed{150 \text{ m}}$$

$$v_y = v_{0y} + a_y t = -9.06 + (-9.8)(4.5) = -53.2 \text{ m/s}$$

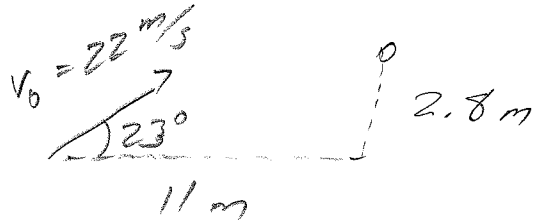


$$|\vec{v}| = \sqrt{33.8^2 + 53.2^2} = \boxed{63 \text{ m/s}}$$
$$\theta = \tan^{-1}\left(\frac{53.2}{33.8}\right) = \boxed{58^\circ \text{ below } +x}$$

2. A soccer ball is kicked toward a goal from a distance of 11 meters away. The top bar is 2.8 meters above ground level. The ball has an initial velocity of 22 meters/sec in a direction 23° above the horizontal. I recommend you maintain at least 3 SF while working this problem.

Does the ball go under or over the bar?

Is the ball on its way up or down as it passes the bar?



Find Δy when $\Delta x = 11 \text{ m}$

$$\Delta x = 11$$

$$\Delta y = ?$$

$$v_{0x} = 22 \cos 23^\circ$$

$$v_{0y} = 22 \sin 23^\circ$$

$$v_x = 22 \cos 23^\circ$$

$$v_y = ?$$

$$a_x = 0$$

$$a_y = -9.8$$

$$t = ?$$

$$t = ?$$

$$x: 11 = 20.25 t \quad t = 0.543 \text{ s}$$

$$y: \Delta y = (8.6)(0.543) - 4.9(0.543)^2 = \underline{3.22 \text{ m}}$$

$\Delta y > 2.8$, so it goes over

$$v_y = 8.6 + (-9.8)(0.543) = 3.28 \text{ m/s}$$

$v_y +$, so on way up