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Phys 101 – Sec # 1 **Quiz # 3 (Ch. 4)**

Key

Name: **ID #**

1- A projectile is thrown from the origin with an initial velocity Vo = (20 i + 98 j) m/s. If the projectile hits a target that is at a horizontal distance of 400 m away, what is the time of flight of the projectile?

$\Delta X = 400$ m

$v_{ox} = 20$ m/s.

$a_x = 0$ (Projectile motion)

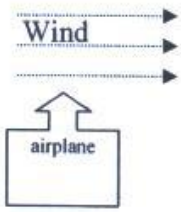
applying $\Delta X = v_{ox} t$

$$\Rightarrow t = \frac{\Delta X}{v_{ox}} = \frac{400 \text{ m}}{20 \text{ m/s}} = \boxed{20 \text{ s}}$$

2- An airplane is moving due North at a speed of 150 m/s. It faces a wind with speed of 40 m/s due East. Calculate the speed of the airplane with respect to the ground.

$\vec{v}_{wg} = 40\,\hat{i}$

$\vec{v}_{aw} = 150\,\hat{j}$



$\vec{v}_{ag} = \vec{v}_{aw} + \vec{v}_{wg} = 40\,\hat{i} + 150\,\hat{j}$

$\text{Speed} = |\vec{v}_{ag}| = \sqrt{40^2 + 150^2} \simeq \boxed{155 \text{ m/s}}$

Phys 101 – Sec # 2 **Quiz # 3 (Ch. 4)**

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1- A particle leaves the origin with an initial velocity $\vec{v}_0 = (3\hat{i})$ m/s and constant acceleration $\vec{a} = (-\hat{i} - 5\hat{j})$ m/s^2.

What is the particles **velocity** when it reaches its maximum x-coordinate?

$v_{0x} = 3 \frac{m}{s}$, $a_x = -1 \frac{m}{s^2}$, $v_{0y} = 0$, $a_y = -5 \frac{m}{s^2}$

at max. x-coordinate $\boxed{v_x = 0}$

use: $v_x = v_{0x} + a_x t$

$0 = 3 - (1)t \Rightarrow t = 3\ s.$

then use $v_y = v_{0y} + a_y t = 0 - 5(3) = -15 \frac{m}{s}$

$\vec{v}_f = v_x \hat{i} + v_y \hat{j} = \boxed{-15\ \hat{j}\ \frac{m}{s}}$

2- An astronaut is rotated in a horizontal centrifuge at a radius of 5 m. What is the astronaut's speed if the centripetal acceleration has a magnitude of 7g? (Where g = 9.8 m/s^2). Find the Period.

$a = \frac{v^2}{r}$

$v = \sqrt{ar} = \sqrt{7(9.8)(5)}$

$= \boxed{18.5 \frac{m}{s}}$

Period $= \frac{\text{Circumference}}{v} = \frac{2\pi r\ (m)}{18.5\ (\frac{m}{s})} = \frac{31.4}{18.5} = \boxed{1.7\ s}$

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Phys. 101 - Sec # 3 **Quiz # 3 (Ch. 4)**

Name: Key ID #

1- A ball is thrown horizontally from the top of a building 100 m high. The ball strikes the ground at a point 65 m horizontally away from the base of the building.
What is the **speed** of the ball just before it strikes the ground?

$\Delta y = -100$ m

$v_{oy} = 0$

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

apply

$\Delta y = v_{oy} t + \frac{1}{2} a_y t^2$

$-100 = 0 - \frac{1}{2}(9.8) t^2$

$\Rightarrow$ $t = 4.5$ s

we know that

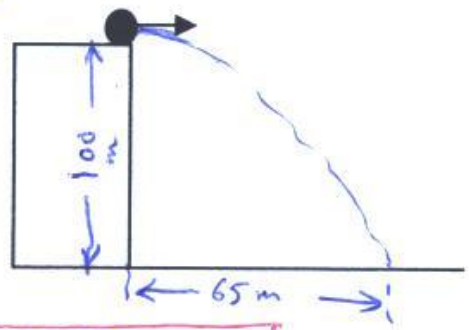
$v_{ox} = v_x = \text{const.}$

and

$\Delta X = v_{ox} t$

$\Rightarrow v_{ox} = \frac{\Delta X}{t}$

$= \frac{65}{4.5} = 14.4 \ m/s = v_x$



then

$v_y = v_{oy} + a_y t$

$v_y = -9.8 (4.5) = -44 \ m/s$

The final speed $= |v| = \sqrt{v_x^2 + v_y^2}$

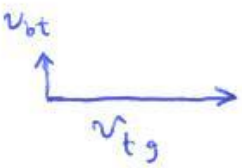
$= \sqrt{14.4^2 + 44^2}$

$= 46.3 \ m/s$

2- A train moves due **east** at 6 m/s, along a straight level track. A boy on the train rolls a ball along the floor with a speed of 3 m/s relative to the train. The ball is rolled directly across the width of the train from **South to North**. Find the speed of the ball relative to the ground. (Show all steps)

$\vec{v}_{tg} = 6 \hat{i}$

$\vec{v}_{bt} = 3 \hat{j}$



$\Rightarrow \vec{v}_{bg} = \vec{v}_{bt} + \vec{v}_{tg} = 6 \hat{i} + 3 \hat{j}$

Speed $= |\vec{v}_{bg}| = \sqrt{6^2 + 3^2} = 6.7 \ m/s$.