EF ACADEMY

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PHYSICS SL INTERNAL ASSESMENT

ANGLE REQUIRES FOR A BASKETBALL TO GET TO THE BASKET

INTRODUCTION

Projectile motion

A projectile motion is when an object called projectile upon which the only force is gravity, this force causes the projectile to accelerate in a downward direction. On this motion the force do not alters the horizontal velocity for instance it is constant. Apart from the horizontal velocity the motion is also divided into vertical velocity, which unlike the horizontal, it is not constant and it changes continuously.

The diagrams below explains the motion and the division of velocities.

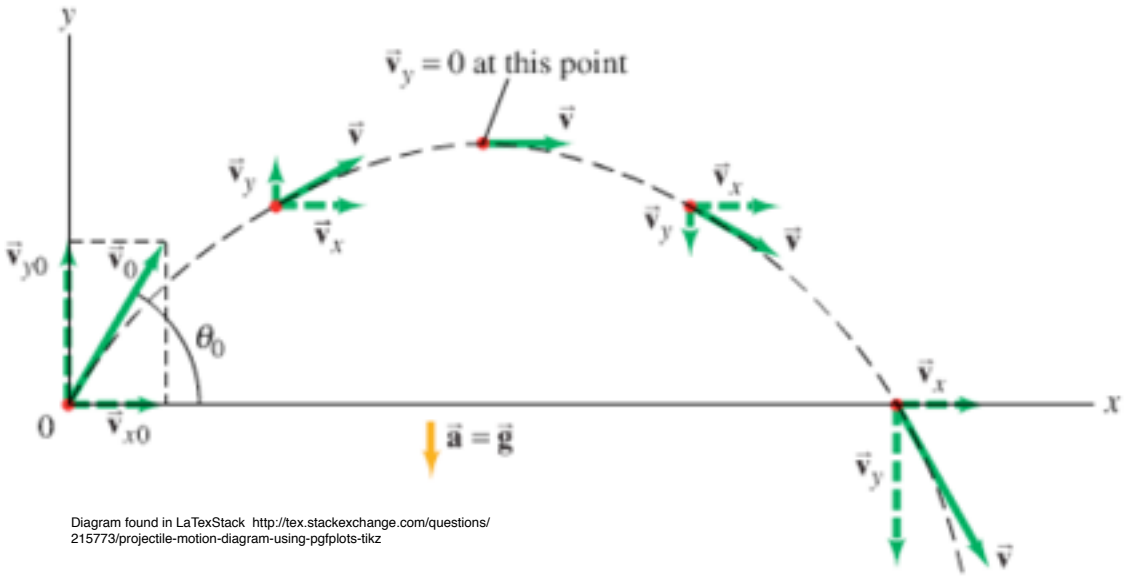


Diagram found in LaTexStack http://tex.stackexchange.com/questions/215773/projectile-motion-diagram-using-pgfplots-tikz

On real life situation the projectile motion on sports such as volleyball, basketball or even soccer just as the diagram below shows .

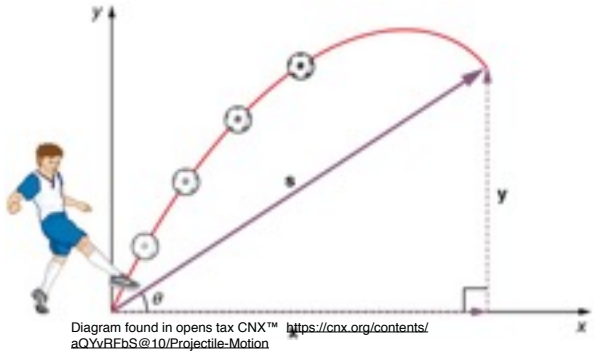


Diagram found in opens tax CNX™ https://cnx.org/contents/aQYvRFbS@10/Projectile-Motion

Justification and research question

As we mention on the last paragraph in several sports is possible to see a projectile motion, the one I will be analyzing on this assessment is basketball. I will do the analysis to have a better understanding of the projectile motion in real life. The projectile motion I choose, was the motion of a basketball from a players hand to the basket and for the analysis I will like to find the required angle for the ball, to get to the basket. Therefore our research question is: Which is the angle required for a basketball doing a projectile motion to get into the basket?

To answer the research question we will use a basketball player and he will be doing a basketball shoot and I will be taking measurements such as time distance from the basketball to the basket, height etc.

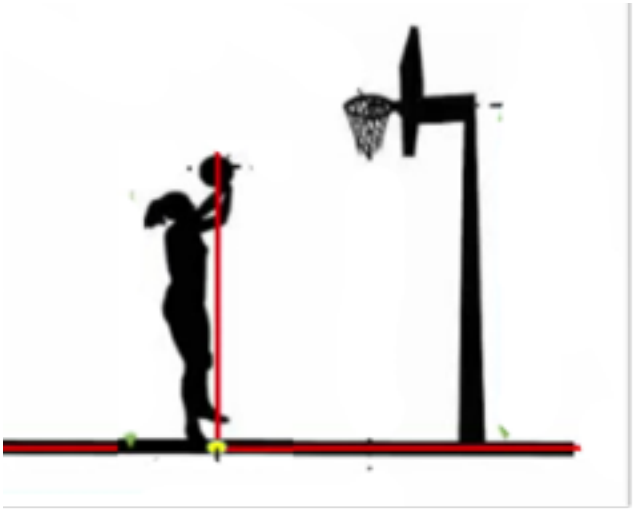
Variables

- Vertical Velocity
- Horizontal Velocity
- Time
- Height of the basket
- Height of the player
- Gravity of 9.81 m/s

Apparatus

- Basket
- Basketball
- Stop Watch ± 0.01 s
- measuring tape ± 0.001m

Diagram of the experiment



Method

- Position the basketball player away from the basket
- measure the basketball player
- measure the height of the basket
- measure distance between the basket and the basketball player
- Make the basketball player throw the ball
- With the stop watch take the time that the ball required to get to the basket

Data recolectada

Distance between the basket and the player: 10 ± 0.001m

Height of the Player: 2 ± 0.001m

Height of the basket: 3.05 ± 0.001m

Time that it took the ball to get to the basket : 1 ± 0.01 s

Analysis of data

With the data gather we will need to see what was the angle in which the player throw the ball. For this we will need the initial velocity and for this we will use the next formula:

$$s = Vo + \frac{1}{2}at^2$$

S=range
Vo= Initial Velocity
a= acceleration (gravity)
t= time of travel

We have all the data except for the initial velocity so we will clear the variable and the result will be the next:

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

With the data gather we see that

s= 10 ± 0.001m

a= -9.81 m/s^2

t= 1 ± 0.01 s

Therefore the formula ends up as shown below

$$Vo = \frac{10 \pm .001m - \frac{1}{2} * -9.81 * 1^2 \pm .01s}{1 \pm .01s}$$

And the result is

$$Vo = \frac{10 \pm .001 - \frac{1}{2} * 9.81 * 1^2 \pm \frac{1}{2} * 9.81 * 1^2 * (\frac{.01}{1})}{1 \pm .01}$$

$$Vo = \frac{10 \pm .001 - (-4.905 \pm .04905)}{1 \pm .01}$$

$$Vo = \frac{10 + 4.905 \pm (.01 + .001)}{1 \pm .01}$$

$$Vo = \frac{14.905 \pm (.011)}{1 \pm .01}$$

$$Vo = \frac{14.905}{1} \pm 14.905(\frac{.011}{14.905} + \frac{.01}{1})$$

$$Vo = 14.905 \pm .160\frac{m}{s}$$

After calculating the initial velocity will use the next formula to calculate the angle

$$S = \frac{Vo^2 sin2\Theta}{a}$$

After clearing the variable we will end up with the next equation

$$\Theta = \frac{sin^{-1}(\frac{s*a}{Vo^2})}{2}$$

$$\Theta = \frac{sin^{-1}(\frac{10*(-9.81)\pm(10*9.81)(\frac{.001}{10})}{14.905^2 \pm .160})}{2}$$

$$\Theta = sin^{-1}(\frac{-98.1 \pm .00981}{14.905^2 \pm 14.905^2(\frac{2(.160)}{14.905})})$$

$$\Theta = sin^{-1}(\frac{-98.1}{222.15} \pm (\frac{98.1}{22.15})((\frac{.00981}{98.1}) + (\frac{4.7696}{222.15}))$$

$$\Theta = \frac{sin^{-1}(-.4415 \pm .0009525)}{2}$$

$$\Theta = \frac{-26.2055 \pm .0009525}{2}$$

$$\Theta = 13.103$$

According to the equation the initial angle required for the ball to get to the basket is 13.103 but this angle will only work with the data gathered before in other words that initial angle will function with a person of 2 meters and a range of 10 meters and an initial velocity of 14.905 m per second

Conclusion

In conclusion with this analysis we get that the initial angle is 13.103 ± .0009525 and we are aware that this angle will only function if the situation is equal to the one that we analyzed the uncertainty of ± . 0009525 comes from the uncertainty of the Apparatus such as the stop watch and measure tape. This analysis gave me a better understating of the topic and also help me review for my ib exams

Improvements

One improvement would be that I should had recorded the projectile motion to analyze with better detail and precision,another improvement is that I should had used another stopwatch to have a more precise data for the time

References

"Parabolic Motion of Projectiles." Parabolic Motion of Projectiles. The Physics Classroom. Web. 22 Feb. 2016.

"Projectile Motion Diagram Using PGFplots/tikz?" - TeX. Stack Exchange. Web. 22 Feb. 2016.