

General Physics 1

Quarter 1 – Module 4:

Title: Components of Projectile Motion

STEM_GP12KIN-Ic22



Science – Grade 12
Alternative Delivery Mode
Quarter 1 – Module 3: Components of Projectile Motion
First Edition, 2020

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General Physics 1

Quarter 1 – Module 3: Components of Projectile Motion

Introductory Message

For the facilitator:

Welcome to the General Physics 1 12 Alternative Delivery Mode (ADM) Module on Newtons Law of Motion and its Application!

This module was collaboratively designed, developed and reviewed by educators both from public and private institutions to assist you, the teacher or facilitator in helping the learners meet the standards set by the K to 12 Curriculum while overcoming their personal, social, and economic constraints in schooling.

This learning resource hopes to engage the learners into guided and independent learning activities at their own pace and time. Furthermore, this also aims to help learners acquire the needed 21st century skills while taking into consideration their needs and circumstances.

In addition to the material in the main text, you will also see this box in the body of the module:



Notes to the Teacher

This contains helpful tips or strategies that will help you in guiding the learners.

As a facilitator you are expected to orient the learners on how to use this module. You also need to keep track of the learners' progress while allowing them to manage their own learning. Furthermore, you are expected to encourage and assist the learners as they do the tasks included in the module.

For the learner:

Welcome to the General Physics 1 12 Alternative Delivery Mode (ADM) Module on Newtons Law of Motion and its Application!

The hand is one of the most symbolized part of the human body. It is often used to depict skill, action and purpose. Through our hands we may learn, create and accomplish. Hence, the hand in this learning resource signifies that you as a learner is capable and empowered to successfully achieve the relevant competencies and skills at your own pace and time. Your academic success lies in your own hands!

This module was designed to provide you with fun and meaningful opportunities for guided and independent learning at your own pace and time. You will be enabled to process the contents of the learning resource while being an active learner.

This module has the following parts and corresponding icons:



What I Need to Know

This will give you an idea of the skills or competencies you are expected to learn in the module.



What I Know

This part includes an activity that aims to check what you already know about the lesson to take. If you get all the answers correct (100%), you may decide to skip this module.



What's In

This is a brief drill or review to help you link the current lesson with the previous one.



What's New

In this portion, the new lesson will be introduced to you in various ways such as a story, a song, a poem, a problem opener, an activity or a situation.



What is It

This section provides a brief discussion of the lesson. This aims to help you discover and understand new concepts and skills.



What's More

This comprises activities for independent practice to solidify your understanding and skills of the topic. You may check the answers to the exercises using the Answer Key at the end of the module.



What I Have Learned

This includes questions or blank sentence/paragraph to be filled into process what you learned from the lesson.



What I Can Do

This section provides an activity which will help you transfer your new knowledge or skill into real life situations or concerns.



Assessment

This is a task which aims to evaluate your level of mastery in achieving the learning competency.



Additional Activities

In this portion, another activity will be given to you to enrich your knowledge or skill of the lesson learned. This also tends retention of learned concepts.



Answer Key

This contains answers to all activities in the module.

At the end of this module you will also find:

References

This is a list of all sources used in developing this module.

The following are some reminders in using this module:

1. Use the module with care. Do not put unnecessary mark/s on any part of the module. Use a separate sheet of paper in answering the exercises.
2. Don't forget to answer *What I Know* before moving on to the other activities included in the module.
3. Read the instruction carefully before doing each task.
4. Observe honesty and integrity in doing the tasks and checking your answers.
5. Finish the task at hand before proceeding to the next.
6. Return this module to your teacher/facilitator once you are through with it.

If you encounter any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator. Always bear in mind that you are not alone.

We hope that through this material, you will experience meaningful learning and gain deep understanding of the relevant competencies. You can do it!



What I Need to Know

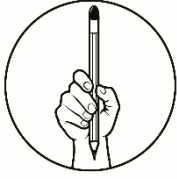
This module was designed and written with you in mind. It is here to help you master the accuracy and precision. The scope of this module permits it to be used in many different learning situations. The language used recognizes the diverse vocabulary level of students. The lessons are arranged to follow the standard sequence of the course. But the order in which you read them can be changed to correspond with the textbook you are now using.

The module has one lesson, namely:

- Lesson 3 – Components of Projectile Motion





After going through this module, you are expected to:

1. Define projectile motion.
2. Describe and draw the motion of object
3. Explain the independence of projectile motion in vertical and horizontal components.



What I Know

Read each problem or situations carefully. Choose the letter of the correct answer and write it on your answer sheet.

1. What is a projectile?
 - a. a motion
 - b. a motion with angle
 - c. object
 - d. path
2. Which of the following motion is experienced by a projectile thrown or fired along the surface of the earth?
 - a. horizontal motion
 - b. projectile motion
 - c. random motion
 - d. vertical motion
3. What is the vector representation of the projectile motion?
 - a. circular arrow 
 - b. downward arrow 
 - c. vertical arrow 
 - d. Upward arrow 
4. What do you call the motion of object moving in two dimensions under the influenced of gravity?
 - a. circular motion
 - b. horizontal motion
 - c. projectile motion
 - d. vertical motion
5. What is the path of a projectile motion?
 - a. muddy path
 - b. parabolic path
 - c. relative path
 - d. wavy path
6. What is the path taken by a projectile?
 - a. curve line
 - b. projectile
 - c. straight line
 - d. trajectory

7. What angle can a projectile achieved the farthest distance, neglecting the air resistance?
 - a. 30 degree
 - b. 45 degree
 - c. 60 degree
 - d. 90 degree
8. What angle can a projectile achieved the shortest distance?
 - a. 30 degree
 - b. 45 degree
 - c. 60 degree
 - d. 90 degree
9. Which of the following is not an example of a projectile?
 - a. A ball in top of the table
 - b. A ball shoot in three points
 - c. A ball dropped at the top of the hill
 - d. An egg drops at the edge of the table
10. Which of the two ball will hit the ground first? The ball that is thrown horizontally or the ball that is dropped with the same height with the ball that is thrown horizontally.
 - a. both the ball hit the ground on the same time
 - b. don't know what will happen on the balls
 - c. the ball that is dropped will hit the ground first
 - d. the ball that is thrown horizontally will hit the ground first
11. For general projectile motion, which statement is true when the projectile is at the initial and final points of the parabolic path?
 - a. The magnitude of the x and y components of its velocity are the same at both points
 - b. The magnitude of its x component of velocity at the initial point is smaller than its magnitude of the y
 - c. The magnitude of its x component of velocity at the initial point is bigger than its magnitude of Y component of velocity at the final point
 - d. The velocity of components is zero at both points.
12. Which of the following is an example of projectile motion?
 - a. A can throws straight down into the recycle bin
 - b. A jet lifting off a runway
 - c. A space shuttle being launched
 - d. A volleyball served over a net
13. Which of the following situation is not considered as a projectile?
 - a. a ball that is thrown at an angle
 - b. a ball that is thrown into the air
 - c. a ball that rolls off the table
 - d. a ball that is thrown upward
14. The only force acting in a horizontal projectile motion is
 - a. electrostatic force
 - b. gravitational force
 - c. magnetic force
 - d. no force

15. The only force acting in a vertical projectile motion is
- a. electrostatic force
 - b. gravitational force
 - c. magnetic force
 - d. no force

Lesson

1

Components of Projectile Motion

Projectile Motion is the motion experienced by the object (projectile) being throw along the earth's surface following the parabolic path (trajectory) affected by the pull of gravity and air resistance (drag force).



What's In

How do you use component method for adding vectors?

What is the triangle law in vector addition?

How to find the velocity of the vertical and horizontal components of a vector?



Notes to the Teacher

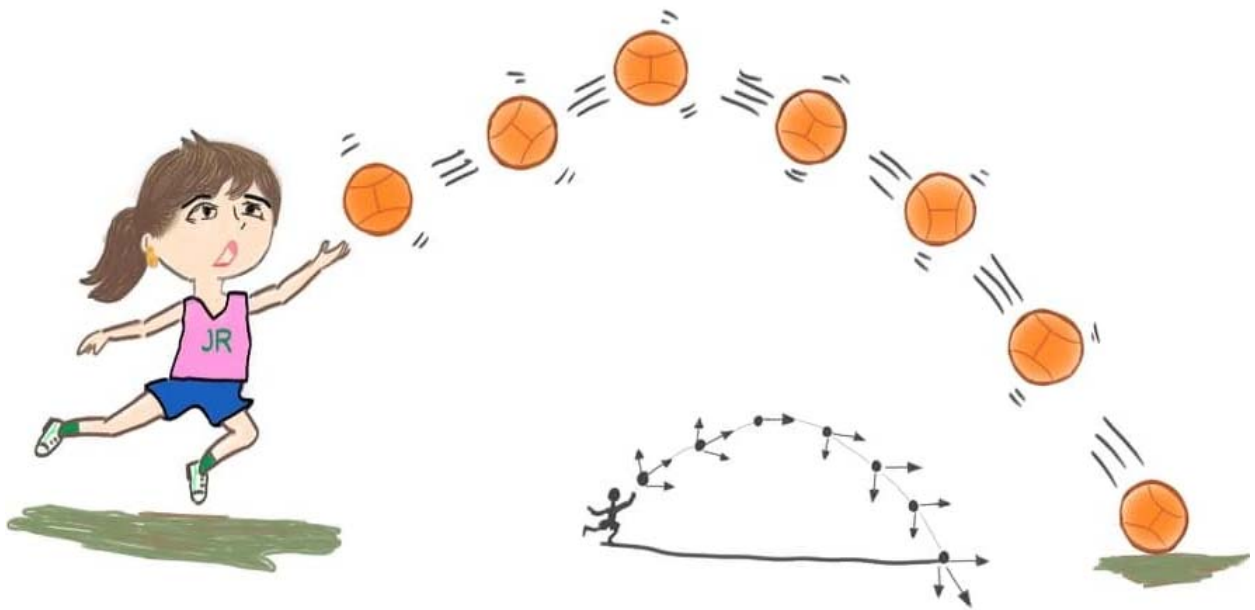
It is important that learners must have knowledge about Vectors. They must also knowledge in solving problems in vector using analytical and geometrical method.



What's New

Components of Projectile Motion

1. Horizontal Motion – or horizontal component: constant velocity
2. Vertical Motion – or vertical component: constant acceleration





What is It

Projectile Motion

Projectile Motion is the motion of an object or projectile travelling into the air. The object thrown will follow a parabolic path called trajectory. The path was affected by air resistance and the pull force acting is the gravity, its value is 9.8 m/s^2 .

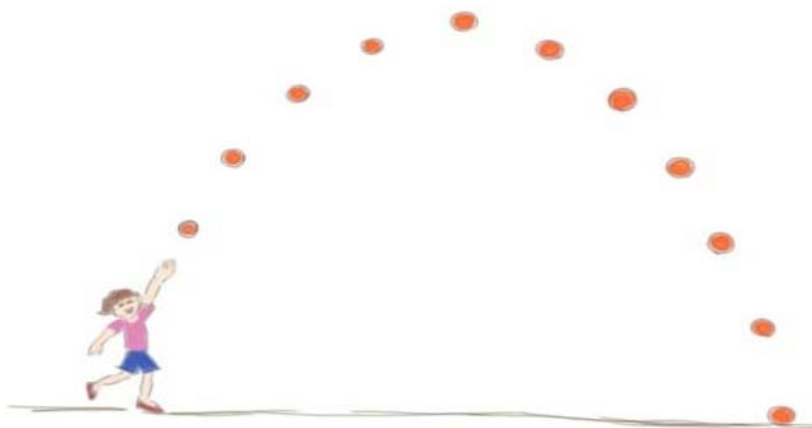
Types of Projectile Motion



b. Object dropped from rest



a. Object thrown upward (vertical)



c. Object thrown at an angle to the horizontal projection

Example of Projectile Motion

1. Basketball
2. Baseball
3. Volleyball
4. Firing of rifle into the air
5. Jumping horizontally

Factors that affect the Projectile Motion

1. Gravity
2. Air Resistance
3. Angle
4. Speed
5. Height

Components of Projectile Motion

1. **Horizontal Motion**- the motion of the object that travels along x-axis direction, wherein the motion is constant in the whole travel. No horizontal force acting on the object that makes it travel in a constant velocity.
 - a. Horizontal distance, $x = V_x t$
 - b. Horizontal velocity, $V_x = V_{ix}$

Where:

V_x – velocity along x-axis

V_{ix} – initial velocity along x-axis

g – acceleration due to gravity

t – time taken

2. **Vertical Motion** – the motion of the object that travels along y-axis direction, wherein the motion changes in the whole travel. The only force acting on the object is the gravitational force and it changes by 9.8 m/s/s in each seconds of fall. The velocity is zero at the highest point of the projectile.

- a. Vertical distance, $y = V_{iy}t - \frac{1}{2}gt^2$
- b. Vertical velocity, $V_y = V_{iy} - gt$

Where:

V_y – velocity along y-axis

V_{iy} – initial velocity along y-axis

g – acceleration due to gravity

t – time taken

How to find the velocity of horizontal and vertical motion a Projectile Motion

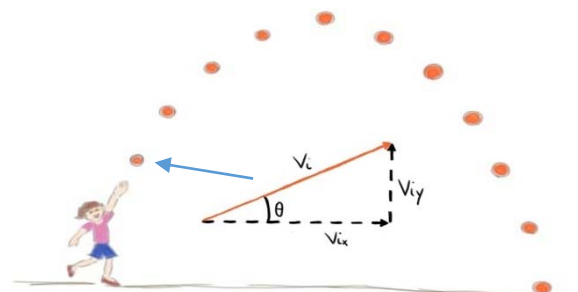
Vertical Motion Initial Velocity

$$V_{ix} = V_i \cos \theta$$

Horizontal Motion Initial Velocity

$$V_{iy} = V_i \sin \theta$$

Note: finding the final velocity is same as finding the initial velocity



Sample problem

A girl throws a ball with an initial velocity of 10m/s at an angle of 30° into the air. What is the horizontal and vertical initial motion of the ball?

Solution:

Vertical Motion Initial Velocity

$$V_{ix} = V_i \cos \theta$$

$$V_{ix} = 10 \cos 30$$

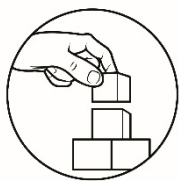
$$= 8.7 \text{ m/s, vertical motion of the ball}$$

Horizontal Motion Initial Velocity

$$V_{iy} = V_i \sin \theta$$

$$V_{iy} = 10 \sin 30$$

$$= 5.0 \text{ m/s, horizontal motion of the ball}$$



What's More

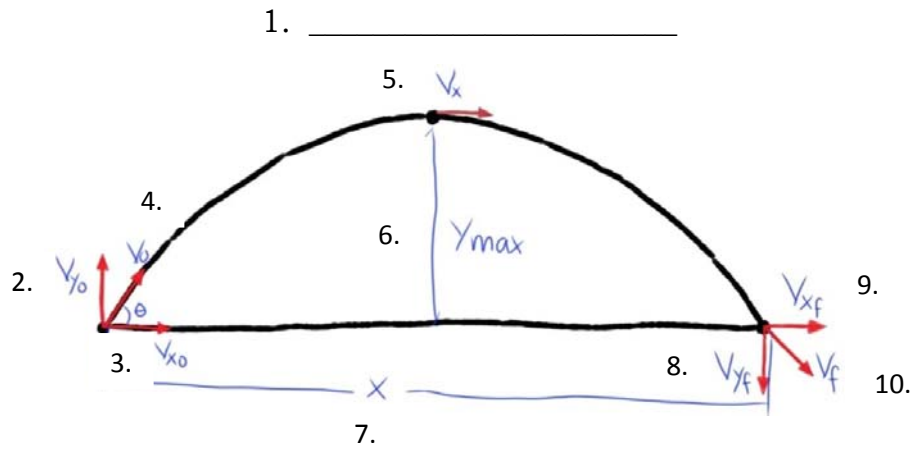
Activity 1

- I. Tell whether the following projectile in motion has either horizontal or vertical motion, or both horizontal and vertical motion. Answer yes if there is either horizontal or vertical motion and No if there is no either horizontal or vertical motion.

Projectile in Motion	Horizontal Motion	Vertical Motion
1. The ball was kick horizontally.		
2. The player tosses the ball upward		
3. The basketball player shoots his three points shoot.		
4. The ball is placed at rest on the top of the table.		
5. The egg rolls and drop at the edge of the table.		
6. The egg is in the nest on top of the tree.		
7. The volleyball player pitches the ball 30° above the head.		
8. The coins were flick on the top of the table.		
9. Ball thrown 45° at the edge of the 15-meter height building.		
10. The ball was drop on 10-meter-high building.		

Activity 2

II. Identify and name its part of the components of the projectile motion.

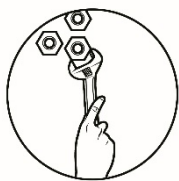


1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	



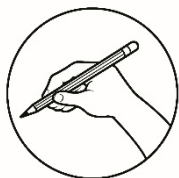
What I Have Learned

1. Projectile Motion is the motion of an object or projectile travelling into the air. The object thrown will follow a parabolic path called trajectory.
2. The path was affected by the pull of gravity and air resistance.
3. The example of Projectile Motion is basketball, baseball, volleyball, firing of rifle into the air, and jumping horizontally.
4. Factors that affect the Projectile Motion are gravity, air Resistance, angle, speed, and height.
5. There are also three types of Projectile Motion, the object dropped from rest, object thrown upward (vertical) and object thrown at an angle to the horizontal projection.
6. The Projectile Motion is divided into two components, the horizontal motion along x-axis direction and the vertical motion along y-axis direction.
7. Projectile motion formula.



What I Can Do

1. Can you explain projectile motion?
2. Can you identify the path that an object thrown, or a projectile follows?
3. Can you identify the components of projectile motion?
4. Can you identify the factors that affect the projectile motion?
5. Can you enumerate some example of projectile in motion you encountered in your daily life?



Assessment

Multiple Choice. Choose the letter of the best answer. Write the chosen letter on a separate sheet of paper.

1. What is the unit use in vertical and horizontal velocities of components of projectile motion?
 - a. meter
 - b. meter per second
 - b. meter per second square
 - d. meter second
2. Which of the following is an example of projectile in motion?
 - a. A young boy slides in the floor
 - b. A young boy throws the garbage
 - c. A young girl slides down the slide
 - d. A young girl throws a ball into the air
3. What do you call the path of a projectile?
 - a. curved path
 - b. projector
 - c. road to success
 - d. trajectory
4. What is the only force acting on the projectile?
 - a. Gravitational force
 - b. Magnetic force
 - c. Normal force
 - d. Tensional force

5. What are the major components of a projectile motion?
 - a. Horizontal and vertical axis
 - b. Horizontal and vertical motion
 - c. Vertical and horizontal projection
 - d. Vertical and irregular motion
6. Which of the following is the best way to analyze two-dimensional projectile motion?
 - a. breaking it into two independent motion along vertical and horizontal axes
 - b. following the path of projectile motion
 - c. it's hard to analyze because of the motion
 - d. looking at the motion
7. Which of the following is the horizontal velocity of a horizontal motion of a projectile?
 - a. Changes in value
 - b. Changing per second
 - c. Increasing per second
 - d. Never changing in value
8. Which of the following is the vertical velocity of a vertical motion of projectile?
 - a. Changes in value
 - b. Changing per second
 - c. Increasing per second
 - d. Never changing in value
9. What is the velocity of the projectile in its highest point?
 - a. 0 m/s
 - b. -0 m/s
 - c. 9.8 m/s
 - d. 9.8 m/s
10. What is the initial velocity of an object being dropped at certain height?
 - a. 0 m/s
 - b. -0 m/s
 - c. 9.8 m/s
 - d. -9.8 m/s
11. What is the force acting on the vertical direction of the projectile?
 - a. Electrostatic force
 - b. Gravitational force
 - c. Magnetic force
 - d. Tensional force
12. Which of the following is the formula used in finding the component of vertical motion?
 - a. $V_f \cos \theta$
 - b. $V_f \sin \theta$
 - c. $V_i \cos \theta$
 - d. $V_i \sin \theta$
13. Which of the following is the formula used in finding the component of horizontal motion?
 - a. $V_f \cos \theta$
 - b. $V_f \sin \theta$
 - c. $V_i \cos \theta$
 - d. $V_i \sin \theta$

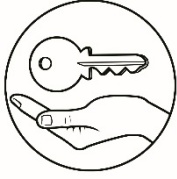
14. What is the vertical motion of the ball thrown in air with an initial velocity of 12 m/s at an angle of 30° ?
- a. 5 m/s
 - b. 6 m/s
 - c. 6.93 m/s
 - d. 10.39 m/s
15. What is the horizontal motion of a stone thrown in air with an initial velocity of 15 m/s at an angle of 25° ?
- a. 5 m/s
 - b. 6.34 m/s
 - c. 6.99 m/s
 - d. 13.59 m/s



Additional Activities

I. Solve the components of Projectile Motion. Complete the Table.

Projectile	Component of Projectile Motion	Initial Velocity, V_0 (m/s)	Final Velocity, V_f (m/s)	Acceleration, a (m/s²)	Time, t (s)	Distance, d (m)
1. Ball thrown at 30°	Upward Motion (y_0)					
	Downward Motion (y_f)					
	Vertical Motion (x)					
2. Ball thrown at 45°	Upward Motion (y)					
	Downward Motion (y)					
	Vertical Motion (x)					
3. Ball thrown at 90°	Upward Motion (y)					
	Downward Motion (y)					
	Vertical Motion (x)					



Answer Key

What I Know

1. C
2. B
3. C
4. C
5. B
6. D
7. B
8. D
9. A
10. C
11. A
12. D
13. D
14. D
15. B

What's More

Activity 1

Horizontal Motion	Vertical Motion
1. Yes	1. YES
2. NO	2. YES
3. Yes	3. YES
4. NO	4. NO
5. YES	5. YES
6. NO	6. NO
7. YES	7. NO
8. YES	8. YES
9. YES	9. YES
10. NO	10. YES

Activity 2

1. Projectile Motion
2. $V_{iy} = V_i \sin \theta$
3. $V_{ix} = V_i \cos \theta$
4. V_i – initial velocity
5. $V_x = 0$
6. Height, H_{\max}
7. Range, R
8. V_{fy} or $V_{fy} = v \sin \theta$
9. V_{fx} or $V_{fx} = v \cos \theta$
10. V_f – final velocity

Assessment

1. B
2. D
3. D
4. A
5. B
6. A
7. A
8. B
9. A
10. A
11. B
12. C
13. D
14. D
15. B

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