Honors Physics
Projectiles and Vectors

This unit will allow each student to:

a. gain a better understanding of the concepts of vectors and projectile motion as well as describing projectiles as they apply to free fall and through the use of graphs
b. continue making proper scientific measurements and calculations
c. define and properly use all vocabulary
d. properly apply all terms and concepts in describing/explaining real world examples
e. continue making and interpreting scientific graphs
f. teach someone else the concepts discussed
g. practice proper laboratory safety

This will be accomplished by each student that is able to:

1. recognize and relate SI and USCS units of time, distance, speed, velocity, and acceleration
2. recognize a time, distance, speed, velocity, and acceleration by the units only
3. perform calculations using proper problem solving techniques (K-U-E-S) to determine (a) speed, time, or distance (b) velocity, displacement, or time and (c) acceleration, change in velocity, or time
4. completely describe the motion of an object undergoing free fall motion
5. describe how air affects the motion of a falling object
6. experimentally determine various velocities and accelerations
7. experimentally determine the acceleration due to the gravity of the earth
8. recognize that free fall motion is an everyday example of constant acceleration
9. distinguish between scalar and vector quantities
10. draw a vector to properly represent a vector quantity
11. determine the resultant of two vectors: (a) in the same direction, (b) in opposite directions, and (c) perpendicular to each other
12. graphically determine the horizontal and vertical components of a vector
13. completely describe the motion of projectile
14. explain the independence of horizontal and vertical components of a projectile's motion
15. use the concept of free fall to assist in determining velocity vectors of a projectile
16. predict the range of a projectile based on the launch angle
17. perform calculations using proper problem solving techniques (K-U-E-S) to determine the variables of projectile motion
18. experimentally determine the range of a horizontally launched projectile
19. describe satellite motion as a special case of projectile motion

Textbook Reference – Physics

Chapter 3 – Two-Dimensional Motion and Vectors

Key Terms

acceleration, free fall, scalar, vector, satellite, projectile, resultant, parabolic path, horizontal component, vertical component, range

Projectiles and Vectors

Answer each question as completely as possible on a separate sheet of paper.

1. What is free fall and how does it relate to gravity?
2. What is the value for the acceleration due to gravity here near the surface of the earth?
3. If a ball is thrown upward at 10 m/s, what will be the speed of the ball when it is caught, back at the original point of the throw?
4. If you throw a ball straight upward, what is the ball's instantaneous speed at the top of its path?
5. If you throw a ball straight upward, what is the ball's acceleration at the top of its path?
6. Calculate the time for a rock to fall 5 m? The rock is at rest to begin with.
7. Calculate the distance a ball falls the first 6 seconds freefall? The ball is at rest to begin with.
8. Sketch two graphs of a car undergoing a constant positive acceleration. The first graph should be position v. time and the second graph is velocity v. time.
9. What is a scalar? Give three examples of scalar quantities.
10. What is a vector? Give three examples of vector quantities.
11. Explain how to determine the resultant of two vectors (a) in opposite directions (b) in the same direction, and (c) perpendicular to each other.
12. What is the maximum resultant for a 5 cm vector and a 2 cm vector? the minimum resultant?

    Draw each set of vectors and the resultant.
13. What is the resultant velocity of a boat going across a river the boat's velocimeter reads 4 m/s West and the river is flowing 3 m/s South? Draw your solution and then use the Pythagorean Theorem to verify the magnitude.
14. Define projectile. Give some examples of projectiles.
15. Draw the path of a projectile. Label the horizontal and vertical velocity vectors at a point going up, at a point going down, and at the top of the path.
16. How are a projectile's horizontal velocity and vertical velocity related?
17. Which component (horizontal or vertical) of a projectile's velocity does not change if we ignore the air?
18. At what point in its flight does a projectile have its minimum resultant speed?
19. Find the resultant speed of a projectile with a horizontal speed of 5 m/s and a vertical speed of 30 m/s. How long will this projectile stay in the air?
20. Identify the relationship of different launch angles with a projectile's range (the horizontal distance traveled.)
21. What is the vertical speed of a horizontally launched projectile two seconds after it is launched?
22. Explain how a satellite orbiting the earth is actually just "falling around the earth."
23. About how fast does an object need to travel horizontally in order to orbit the earth?