Conceptual Physics Review (Chapters 2 & 3)

Chapter 2

- Define speed, velocity, and acceleration and be able to give examples of units for each.
- Describe the difference between speed and velocity.
- Describe the difference between instantaneous speed and average speed. Which one is shown on your car's speedometer? Which one is used in calculating distance traveled over a period of time?
- Describe what is meant by free fall. What affects a freely falling object?
- Be familiar with the relationships between the acceleration, velocity, and distance fallen for a freely falling object. What equations are useful when calculating these quantities?
- Be familiar with the graphs of velocity vs. time and distance vs. time for moving objects traveling at constant acceleration, and for objects traveling at constant velocity.
- Review all homework problems you completed from this Chapter, making sure that you understand the answers to each.
- Review all worksheets you did in class that relate to this Chapter, as they are a great review of the concepts.

Chapter 3

- What is the difference between a scalar and a vector?
- Be able to combine vectors into their resultant vector, using the parallelogram rule.
- Be able to determine the horizontal and vertical components of a given vector, using the parallelogram rule.
- Know how to use the Pythagorean theorem to determine the lengths of sides of a right triangle.
- Describe the relationship between the vertical and horizontal components of motion for a projectile. Are they independent or are they affected by each other?
- Describe how a projectile's actual path relates to an imaginary line that it would follow if gravity were not affecting it.
- Discuss why satellites do not fall to earth. What is holding them up? Why don't they fall down?
- Review all homework problems you completed from this Chapter, making sure that you understand the answers to each.
- Review all worksheets you did in class that relate to this Chapter, as they are a great review of the concepts.

Labs

- Review Lab #1: Average Speed & Lab #2: Conceptual Graphing

Sample Calculations

1. My friend and I decide to race down a straight stretch of road. We both get in our cars and start from rest. I hold the steering wheel steady, slam on the gas, and my speedometer shows an increase in speed of 10 meters per second every second.

a) What is my acceleration?

b) If I maintain that constant acceleration, how fast will I be going at the end of 10 seconds?

c) How far have I traveled in those 10 seconds?

2. Grace is driving her sports car at 30 m/s when a ball rolls out into the street in front of her. She slams on the brakes and comes to a stop in 3.0 s. What was the acceleration of Grace's car? (Use a positive sign if she is speeding up, and a negative sign if she is slowing down)

3. A torpedo fired from a submerged submarine is propelled through the water with a constant speed of 20.00 m/s and explodes upon impact with a target 2000.0 m away.

a) How long does it take the torpedo to reach its target?

b) If the sound of the impact is heard by the people inside the submarine 101.4 s after the torpedo was fired, what is the speed of sound in water?

4. Bobby, a lab, rat has 2.0 minutes to go through a maze to get the yummy cheese. He starts off by meandering 100 cm down a path at a rate of 2.0 cm/s before stopping, sniffing and deciding to go left or right. It takes him 10.0 seconds to decide to turn right. He then scurries down a 50 cm path at a rate of 2.5 cm/s before making a left, speeding up to 3.0 cm/s and racing to the cheese, which is 90 cm away. Does he make it before a trap door crashes down, blocking the cheese?

a) Does Bobby get to eat the yummy cheese? (Show your work)

b) Draw a distance vs. time graph of the situation. Label your axes with words, units, and a numbered scale.

5. King Kong carries Fay Wray up the Umpire State Building in New Fork City. At the top of the skyscraper, Fay Wray's shoe falls from her foot. It hits the ground 15 seconds later. For this problem, ignore air resistance.

a) How fast is the shoe going the instant before it hits the ground?

b) How tall is the Umpire State Building?

6. The Steamboat Geyser in Jellystone National Park is capable of shooting its hot water up from the ground with a speed of 50 m/s. How high can the geyser shoot? Ignore air resistance.

7. At Six Flags Great Adventure Amusement Park in New Jersey, a popular ride known as "Free Fall" carries passengers up to a height of 33.5 m and drops them to the ground inside a small cage. How fast are the passengers going at the bottom of this exhilarating journey? Ignore air resistance.

8. A pop fly is hit straight up at an initial speed of 40 m/s. Ignore air resistance.

a) How long is it in the air if it is caught at the same height from which it was hit?

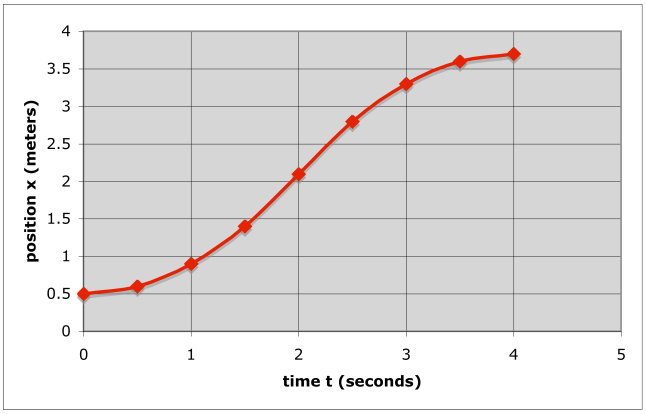
b) How high is it 2 seconds after it is hit?

c) How high does it go?

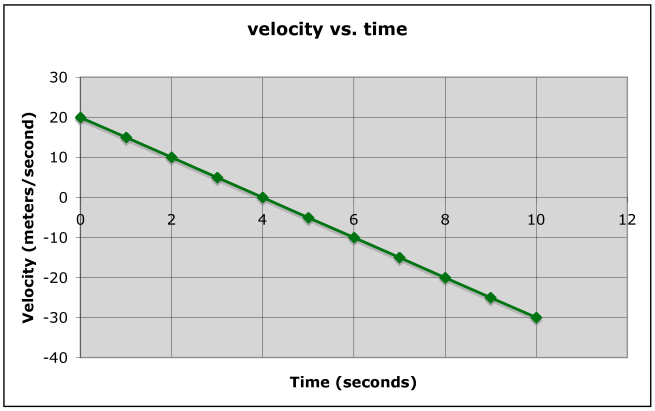
d) What is its velocity 6 seconds after it was hit?

e) How high above its starting point is it 6 seconds after it was hit?

9. Write a description of an object whose motion is represented by the following graph. Be sure to give a chronological description, starting with what is happening at time = 0. Use appropriate physics vocabulary such as velocity and acceleration.



10. Write a description of an object whose motion is represented by the following graph. Be sure to give a chronological description, starting with what is happening at time = 0. Use appropriate physics vocabulary such as velocity and acceleration.



11. Rochelle is flying to New York for her big Broadway debut. If the plane heads out of Los Angeles with a velocity of 220.0 m/s in a northeast direction, relative to the ground, and encounters a wind blowing head-on at 45 m/s, what is the resultant velocity of the plane, relative to the ground? Draw a picture of the situation.

12. In her physics lab, Melanie rolls a 10-g marble down a ramp and off the table with a horizontal velocity of 1.2 m/s. The marble falls into a cup placed on the floor 0.51 m from the bottom of the table. How high is the table? Draw a picture of the situation.

13. Bert is standing on a ladder picking apples in his grandfather's orchard. As he pulls each apple off the tree, he tosses it into a basket that sits on the ground 3.0 m below at a horizontal distance of 2.0 m from Bert. How fast must Bert throw the apples (horizontally) in order for them to land in the basket? Draw a picture of the situation.

14. A cannon is fired up from the ground at an angle of 53° from the horizontal, with a velocity of 100 m/s. Draw a picture of the cannon and label the angle of launch and draw the velocity vector, in the direction the cannonball will be fired.

a. On your diagram above, draw and label the component vectors (horizontal and vertical) for the initial velocity of a cannonball to be fired from the cannon. Hint: Based on the angle of launch, you can infer that the right triangle formed by the two component vectors and the resultant is a 3-4-5 right triangle.

b. How long will it take the cannonball, after it is fired, to reach its highest point?

c. How long after being fired will the cannonball hit the ground?

d. How high above the ground is the cannonball at its highest point?

e. How far away from the cannon does the cannonball land (horizontal distance)?

f. In the space below, draw the cannonball at two-second intervals and draw the horizontal and vertical components of its velocity (vectors) at each two-second interval.