# Worksheet: Independence of Motion
## C H A P T E R   5 :   P R O J E C T I L E   M O T I O N

**Directions**: Answer the following questions using your notes and textbook (Chapter 5)

$$a = \frac{\Delta v}{\Delta t} \qquad v = \frac{d}{t} \qquad v = v_0 + gt \qquad d = \frac{1}{2}gt^2 \qquad t = \sqrt{\frac{2d}{g}}$$

1. Why will a ball thrown in the air never go as far as physics ideally would predict?

2. In the absence of air resistance, the angle at which a thrown ball will go the farthest is?

3. You drop a rock off of a tall building.  It takes 5.5 seconds to hit the ground.  How tall is the building?

4. In the absence of air resistance, at what other angle will a thrown ball go the same distance as one thrown at an angle of 30 degrees?

5. Suppose a small plane can fly at 200 km/h relative to the surrounding air. Suppose also that there is a 40 km/h tailwind. How fast does the plane's shadow move across the ground?

6. The _____ is the path of a projectile.

7. A cannon with a barrel velocity of 120 m/s launches a cannonball horizontally from a tower. Neglecting air resistance, how far vertically will the cannonball have fallen after 2 seconds?

8. A bike travels at a constant speed of 5.0 m/s for 15 seconds.  How far did it travel?

9. At the instant a ball is thrown horizontally with a large force, an identical ball is dropped from the same height. Which ball hits the ground first?  Explain

10. In the absence of air resistance, objects fall at constant _____.

11. A freely falling object starts from rest. After falling for 9 seconds, it will have a speed of about?

12. What does it mean when we say the vertical and horizontal components of a projectile of independent of each other?

13. A projectile launched horizontally hits the ground in 1.5 seconds. If it had been launched with a much higher speed in the same direction, it would have hit the ground (neglecting Earth's curvature and air resistance) in how much time? Explain.

14. A ball is thrown straight upward at 25 m/s. Ideally (no air resistance), the ball will return to the thrower's hand with a speed of?
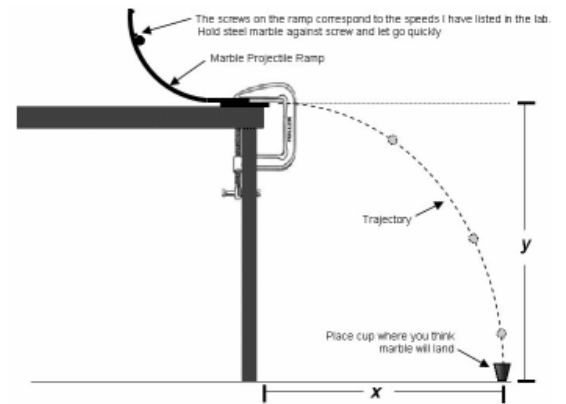
15. What is the difference between a scalar and vector quantity?  Give an example of each

16. You drop a rock off of the top of a 25 m tall building.  How long does it take before it hits the ground?

17. A ball is thrown straight up and then falls straight back down. When it attains maximum height, the ball's velocity is?

18. You drop a rock off of a tall building.  It hits the ground in 4.8 seconds.  What is the rocks final velocity?

19. If the height of the ramp was 1.2 m above the floor, how long would it take for the marble to hit the ground after it left the ramp?



The screws on the ramp correspond to the speeds I have listed in the lab.
Hold steel marble against screw and let go quickly

Marble Projectile Ramp

Trajectory

y

Place cup where you think
marble will land

x

20. If it takes 1.5 seconds for the pendulum to swing forward and backwards one time, what is the period (T) of the pendulum?