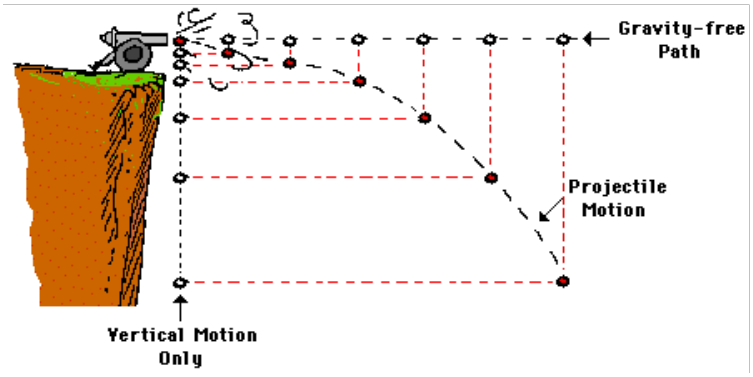
Section 1: What is a Projectile?

A **projectile** is any object which once *projected* continues in motion by its own inertia and is **influenced only by the downward force of gravity**. If there were any other force acting upon an object, then that object would not be a projectile. Thus, the free-body diagram of a projectile would show a single force acting downwards and labeled "force of gravity" (or simply F_{grav}).
(Remember: A force is **not** required to keep an object in motion. A force is only required to maintain an acceleration.)

Real-life examples of projectiles

http://www.flickr.com/photos/physicsclassroom/galleries/72157625381723822/#photo_3869601978

Gravity, being a downward force, acts to influence the **vertical motion** of the projectile, thus causing a vertical acceleration. The force of gravity could never alter the horizontal velocity of an object since perpendicular components of motion are independent of each other; a vertical force does not affect a horizontal motion. The result of vertical force acting upon a horizontally-moving object is to cause the object to deviate from its otherwise linear path.



The **horizontal motion** of the projectile is the result of the tendency of any object in motion to remain in motion at **constant velocity**. Due to the absence of horizontal forces, a **projectile** remains in motion with a **constant horizontal velocity**; horizontal forces are not required to keep a projectile moving horizontally. The only force acting upon a projectile is gravity!

A projectile will follow a parabolic path. There are the two components the projectile's motion - horizontal and vertical motion. And since "perpendicular components of motion are independent of each other," these two components of motion can (and must) be discussed separately. **The projectile travels with a constant horizontal velocity and a downward vertical acceleration.**

The above information can be summarized by the following table:

	HorizontalMotion	VerticalMotion
Forces(Present? - Yes or No) If present, what direction)	No	Yes The force of gravity acts downward
Acceleration (Present? - Yes or No) If present, what direction)	No	Yes "g" is downward at 9.8 m/s/s
Velocity(Constant or Changing)	Constant	Changing (by 9.8 m/s each second)

Summary

1. A projectile is any object upon which the only force acting is gravity.

2. Projectiles travels with a parabolic trajectory due to the influence of gravity.

3. The velocity vector of projectile motion can be resolved into two components: vertical and horizontal.

4. Acceleration due to gravity affects the vertical component only. Therefore, the kinematics equations for uniformly accelerated motion can be applied to the vertical component of the velocity only.

5. The horizontal component (velocity) remains constant throughout the motion. (because there are no horizontal forces acting). Therefore, the kinematics equation for uniform motion ($V_{ave} = \Delta d / \Delta t$) can be applied to the horizontal component of the velocity.

6. If balls are kicked *horizontally* from a roof top or cliff, *they will all reach the ground at the same time*, independent of the speed with which they left the cliff because in the beginning they had no upward speed component. This statement *cannot be made* about balls *kicked at an angle* with the ground because at the beginning such balls do have an upward speed component as well as a horizontal component.

7. The greater the initial velocity in the direction, the greater the range (ie. the distance travelled in the x-direction.

http://www.physicsclassroom.com/Class/vectors/U3L2a.cfm