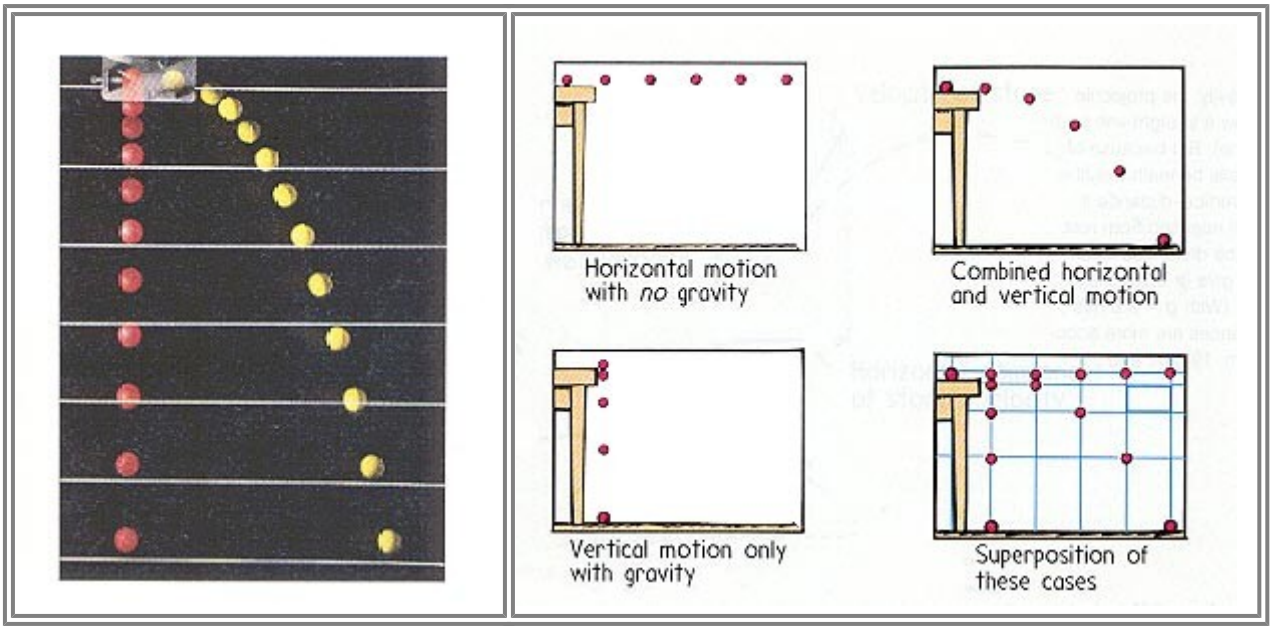
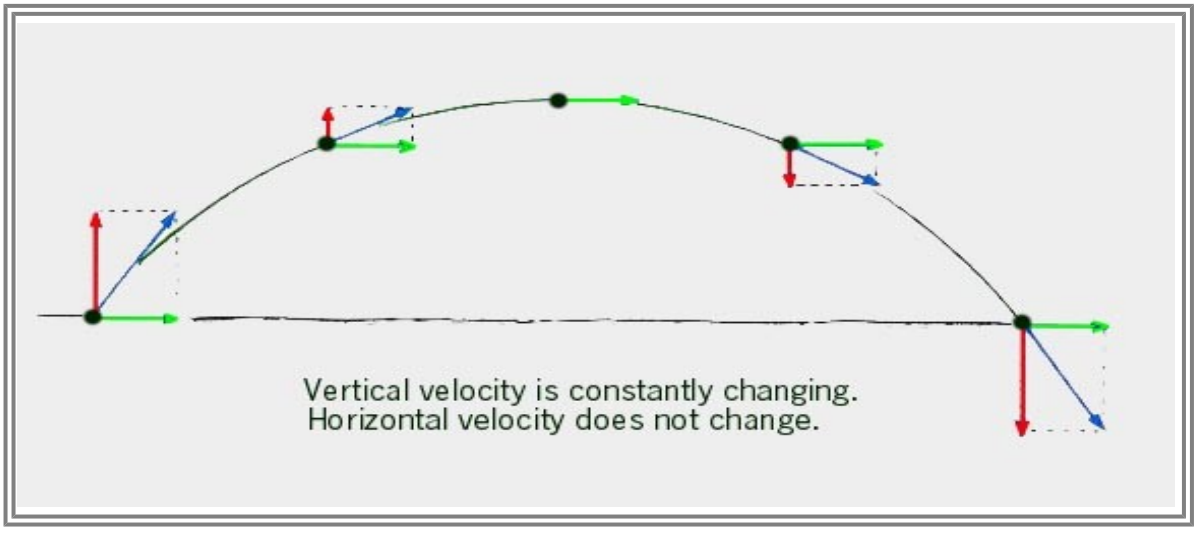
Physics 12 Section 3-5
Projectile Motion



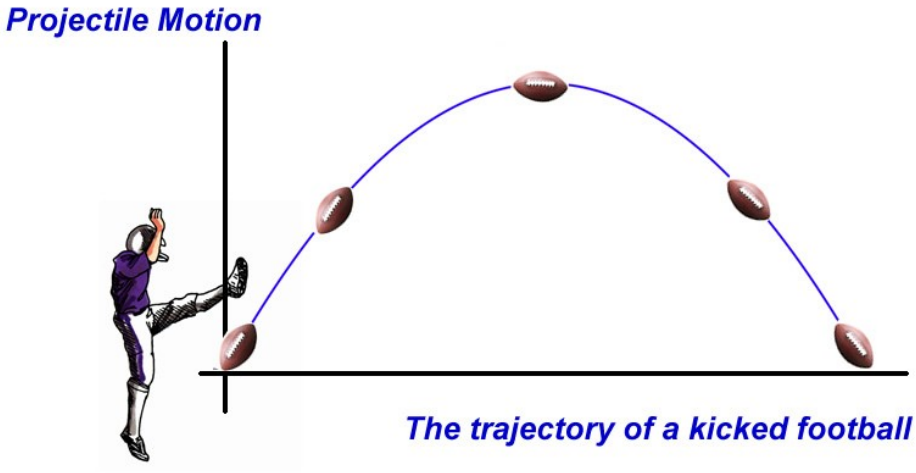
1. The above diagrams illustrate that an object projected horizontally will reach the ground in the same time as an object dropped vertically. This is from physics 11.

2. When an object is launched at some angle to the horizontal we must employ two dimensional analysis.

Vertical and Horizontal Velocities



Example 1: Suppose a football was kicked and left the kickers foot at a height of 1.00m above the ground. The angle the ball leaves the foot is 37.0° and the velocity is 20.0m/s. How far did the football travel before hitting the ground?



$$y = y_o + v_{yo}t + \frac{1}{2}at^2$$

y = -1.00m if you set the foot height as zero

$$y_o = 0$$

$$v_{yo} = 20.0 \sin 37^\circ$$

$$v_{yo} = 12.0 \text{m/s}$$

$$-1.00\text{m} = 0 + (12.0\text{m/s})t + \frac{1}{2}(-9.8\text{m/s}^2)t^2$$

Solve for t by using the quadratic formula:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$t = 2.53s$ or $-0.081s$

Use 2.53s since the –0.081s is if the ball started on the ground under the foot.

To finally solve for the distance use $x = v_{xo}t$

$x = (16.0m/s)(2.53s)$

$x = 40.5m$