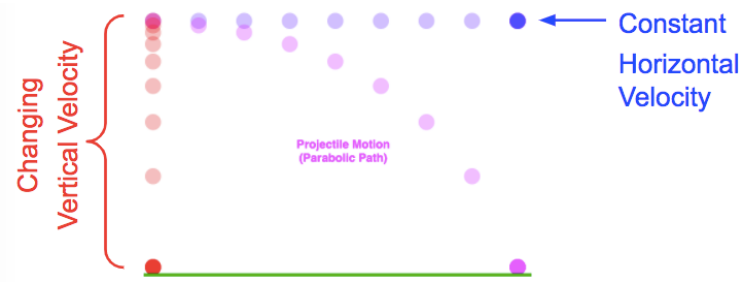
Velocity Components of a Projectiles

Lesson Notes

Projectile Review

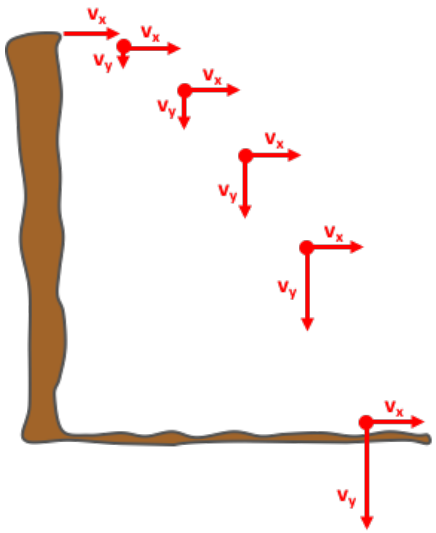
- Projectiles display two independent and simultaneous motions - an x- and a y-motion.
- Gravity is a vertical force and causes a vertical acceleration. The vertical velocity is changing.
- The horizontal velocity is not affected by this vertical force; it remains a constant value.



Vector Diagrams

A **vector diagram** can be used to show the velocity (**v**) of a projectile during its fall.

- The **horizontal velocity** (v_x) is constant.
- The **vertical velocity** (v_y) is changing.



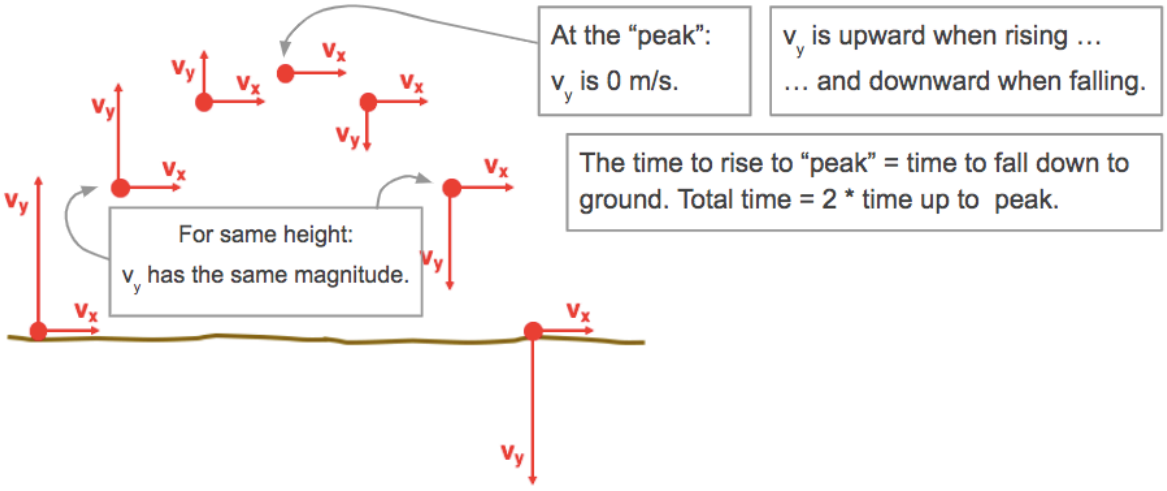
Acceleration Caused by Gravity

- A free-falling object accelerates at 9.8 m/s/s.
- This value is known as the **acceleration caused by gravity** or the **acceleration of gravity**.
- The V_y value changes by -9.8 m/s (approx. 10 m/s) each second.
- The V_x value remains constant.

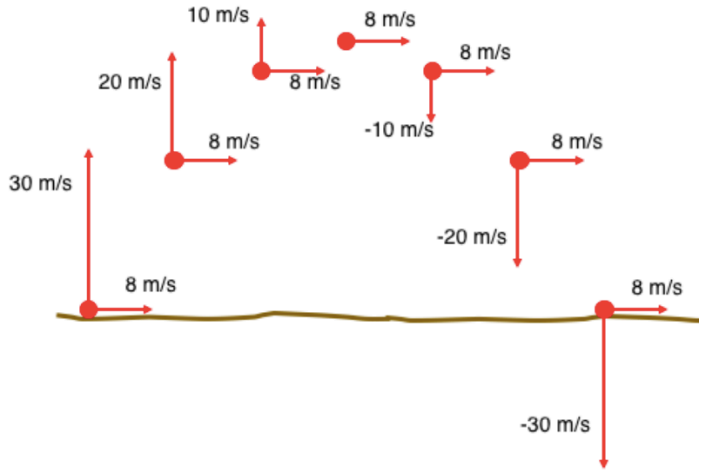
Time (s)	Vx (m/s)	Vy (m/s)
0.0	8.0	0.0
1.0	8.0	-10
2.0	8.0	-20
3.0	8.0	-30
4.0	8.0	-40
5.0	8.0	-50

Angle Launched Projectiles

Consider a projectile launched from ground level upward at an angle: The horizontal velocity is constant; the vertical velocity is changing.



Consider a projectile launched from ground level upward at an angle. Initially, v_x = 8 m/s and v_y = 30 m/s



	Time (s)	Vx (m/s)	Vy (m/s)
Rising	0.0	8	30
	1.0	8	20
	2.0	8	10
Falling	3.0	8	0
	4.0	8	-10
	5.0	8	-20
	6.0	8	-30

Predicting Time in Air

A projectile accelerates vertically at -10 m/s/s. So the time in the air can be predicted from knowledge of the original vertical velocity (v_{oy}).Predict the total time in the air for the following projectiles:

In general ...

$t_{up} = v_{oy}/10$ m/s/s

or

$t_{up} = v_{oy}/9.8$ m/s/s