

Video Notes for Free Fall

Two Questions:

- What exactly is free fall?
- And how is free fall motion described?

Free Fall Definition

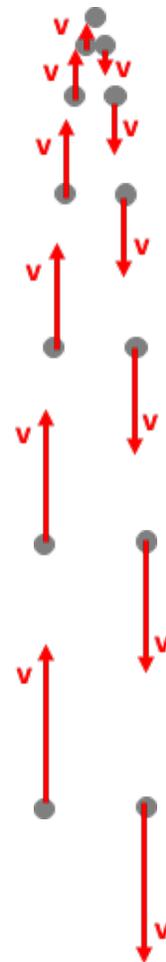
- Moving through the air under the sole influence of gravity.
(Other forces are either non-existent or too weak to be significant.)

Acceleration Caused By Gravity

- Gravity (when the only force) always causes an acceleration.
- The direction of the free fall acceleration is down.
- The value of the free fall acceleration is a constant value of 9.8 m/s^2
(The estimated value of 10 m/s^2 is often used.)
- Objects slow down as they rise; objects speed up as they fall.

Velocity Vector

- Velocity is a vector and has a magnitude or numerical value (we call this speed) and a direction.
- Velocity is speed with a direction.
- The velocity value decreases as objects rise upward; the velocity value increases as objects fall downward.
- The direction of the velocity is always in the direction that the object moves.
- The diagram at the right is known as a **velocity vector diagram**. The arrows represent velocity. The length of the arrow represents the speed. The direction of the arrow represents the direction of the velocity vector.

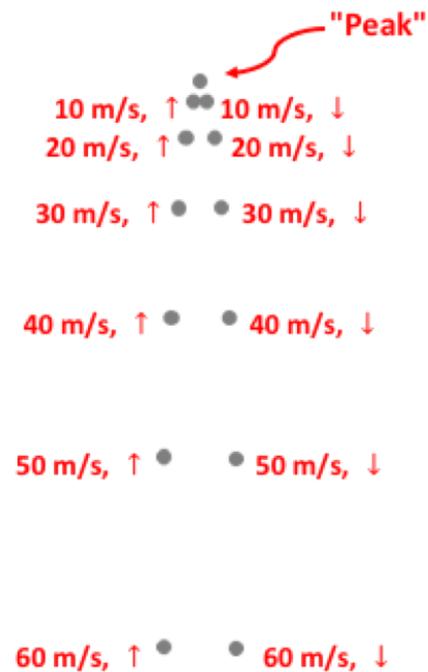


Numerical Representation - Falling from Rest

Time	Velocity
0 s	0 m/s
1 s	10 m/s, ↓ or -10 m/s
2 s	20 m/s, ↓ or -20 m/s
3 s	30 m/s, ↓ or -30 m/s
4 s	40 m/s, ↓ or -40 m/s
5 s	50 m/s, ↓ or -50 m/s
6 s	60 m/s, ↓ or -60 m/s

Numerical Representation - Thrown Upward From Ground

Time	Velocity
0 s	60 m/s, ↑ or +60 m/s
1 s	50 m/s, ↑ or +50 m/s
2 s	40 m/s, ↑ or +40 m/s
3 s	30 m/s, ↑ or +30 m/s
4 s	20 m/s, ↑ or +20 m/s
5 s	10 m/s, ↑ or +10 m/s
6 s	0 m/s ← Peak
7 s	10 m/s, ↓ or -10 m/s
8 s	20 m/s, ↓ or -20 m/s
9 s	30 m/s, ↓ or -30 m/s
10 s	40 m/s, ↓ or -40 m/s
11 s	50 m/s, ↓ or -50 m/s
12 s	60 m/s, ↓ or -60 m/s



Numerical Patterns:

- When rising, velocity values decrease by 10 m/s for every 1 s of time Δ .
- When falling, velocity values increase by 10 m/s for every 1 s of time Δ .
- The velocity at the highest position is 0 m/s.
- For a launch velocity of 60 m/s, it takes 6 s to slow down to 0 m/s.
- For a launch velocity of 60 m/s, it takes 6 s to rise to the peak, 6 s to fall from the peak, and the total time in the air is 12 seconds.
- There are two locations where the speed is 20 m/s. One is 2 seconds before the peak and one is 2 seconds after the peak.
- Whenever objects are at the same height they have the same speed.