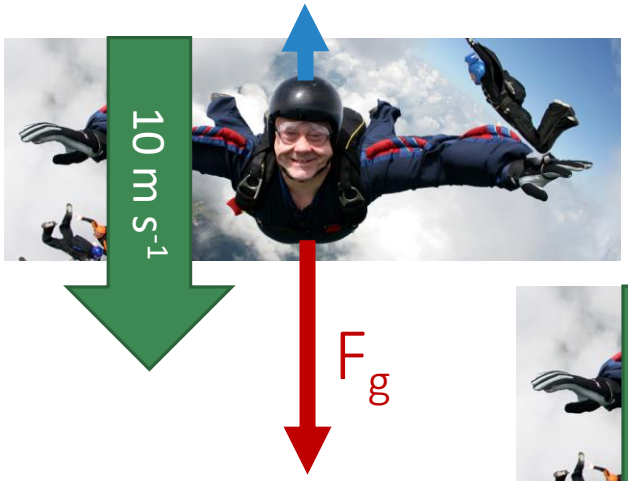
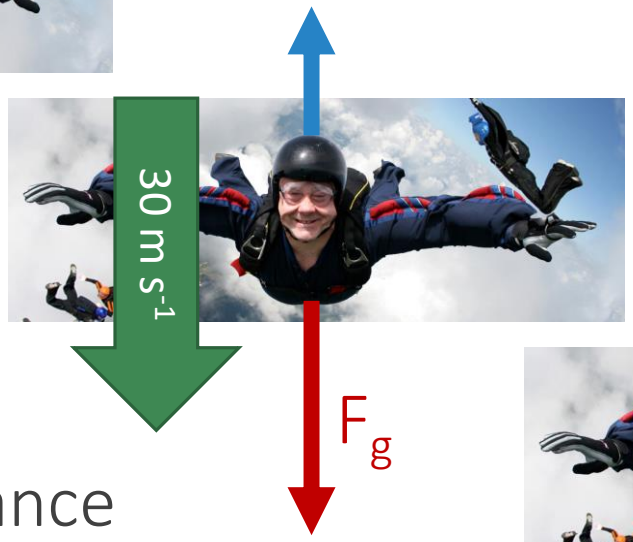
Air Resistance

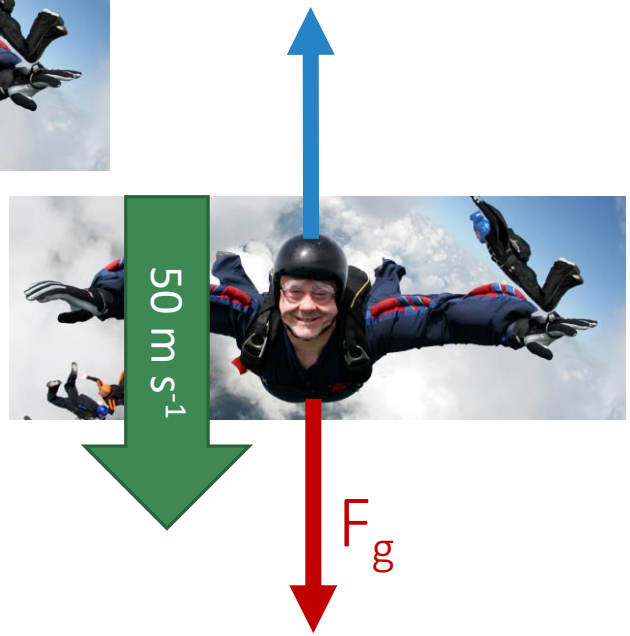
IB PHYSICS | FORCES

Air Resistance



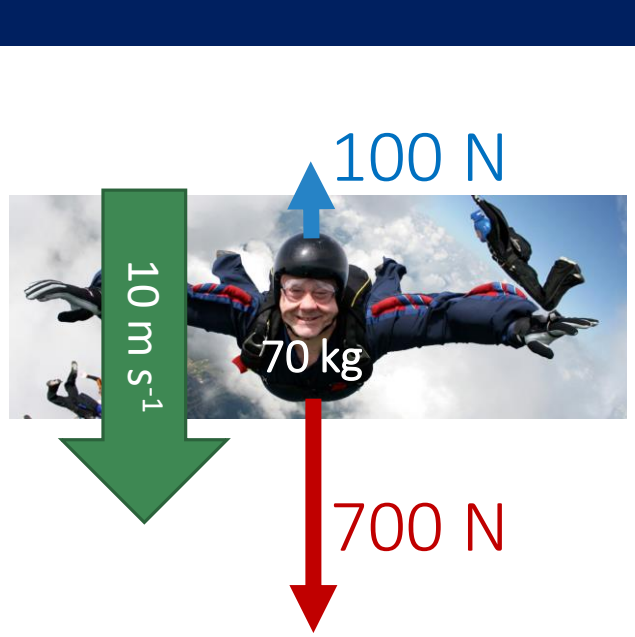
Force of gravity is always _constant_





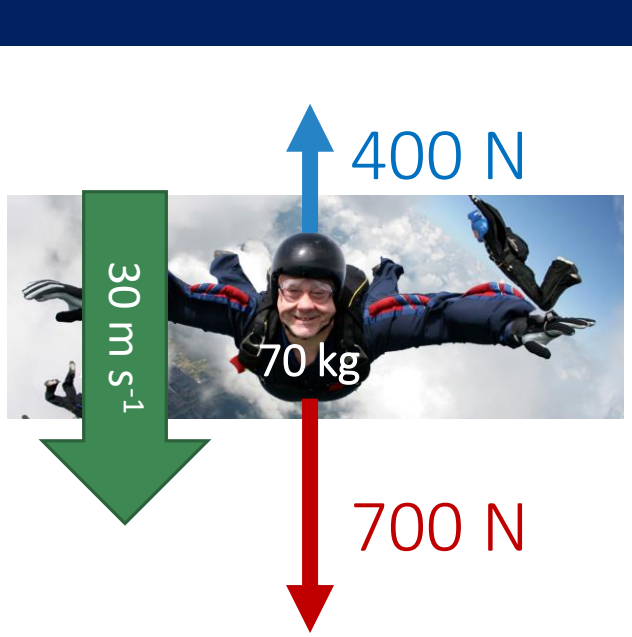
Force of air resistance _increases_ when velocity increases

Calculate the Acceleration



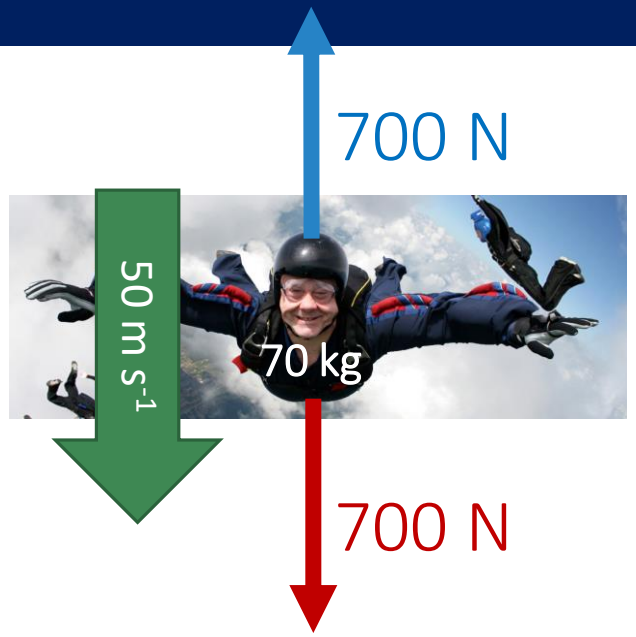
F_{net} = 600 N ↓

$$a = \frac{F}{m} = \frac{600}{70} = \mathbf{8.57\ m\ s^{-2}}$$



F_{net} = 300 N ↓

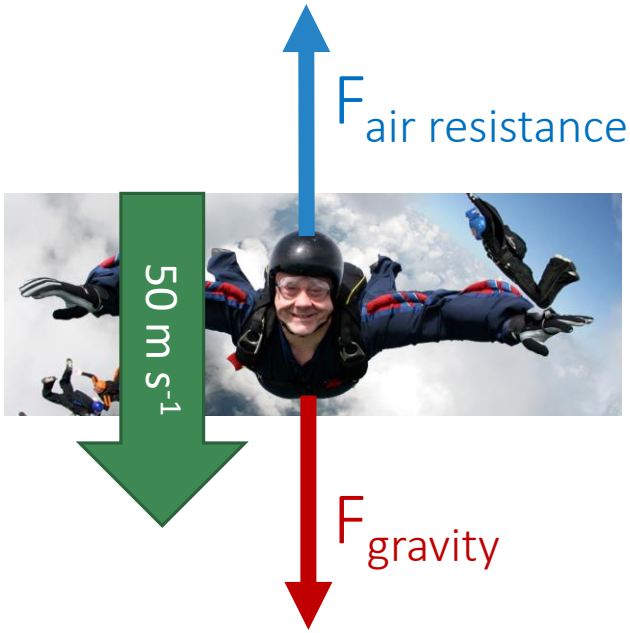
$$a = \frac{300}{70} = \mathbf{4.29\ m\ s^{-2}}$$



F_{net} = 0 N

$$a = \frac{0}{70} = \mathbf{0\ m\ s^{-2}}$$

Terminal Velocity

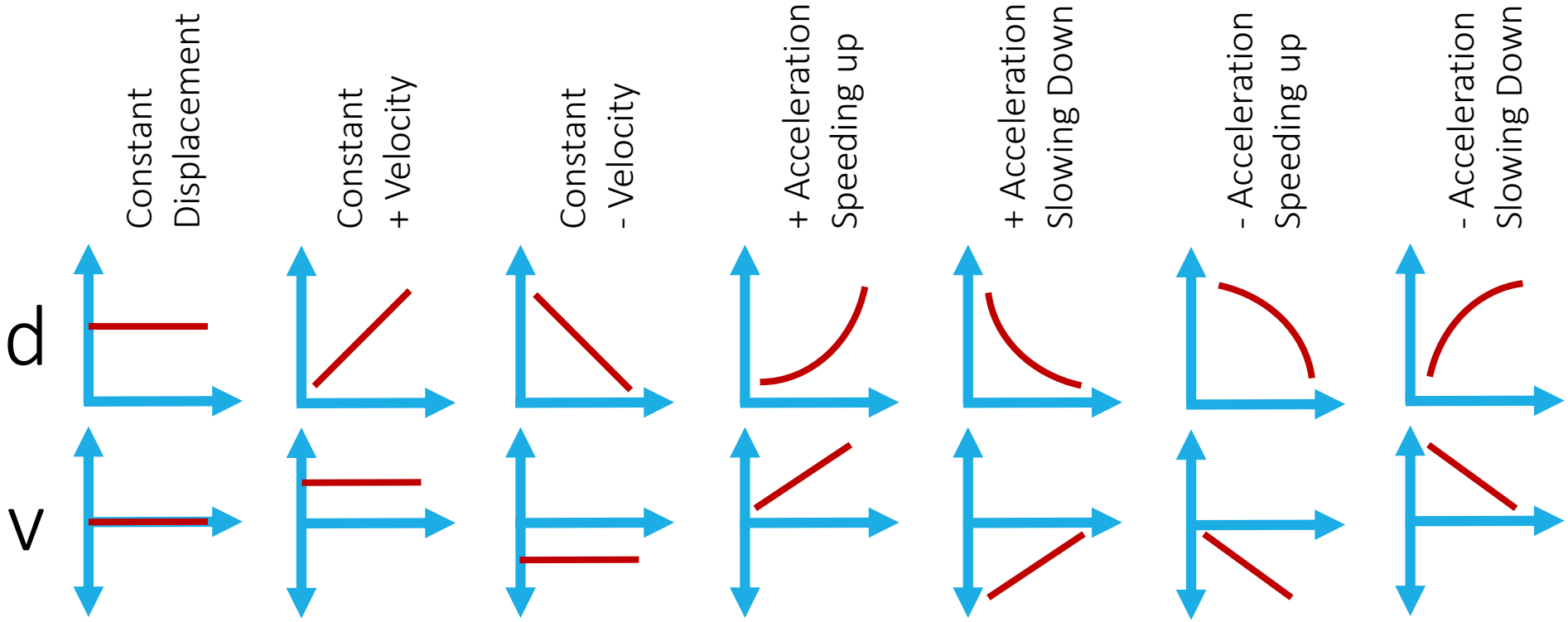


At a certain velocity, the air resistance acting on an object (or person) is equal to the force of gravity.

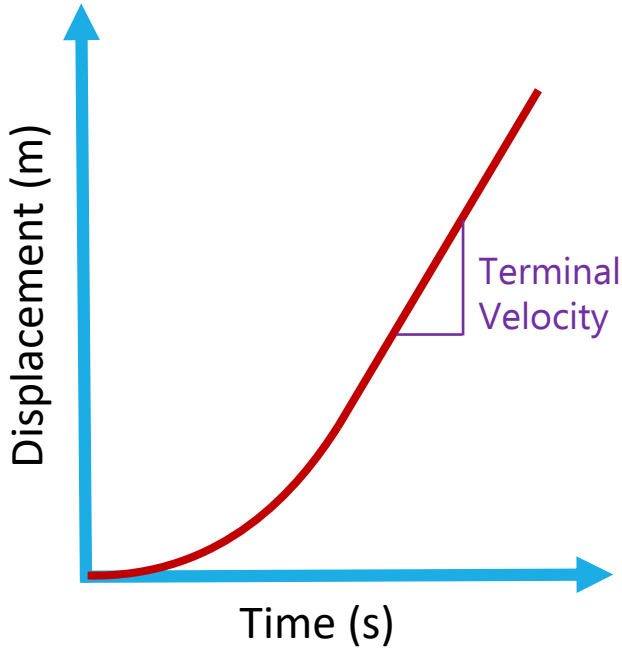
F_{net} = **0 N**

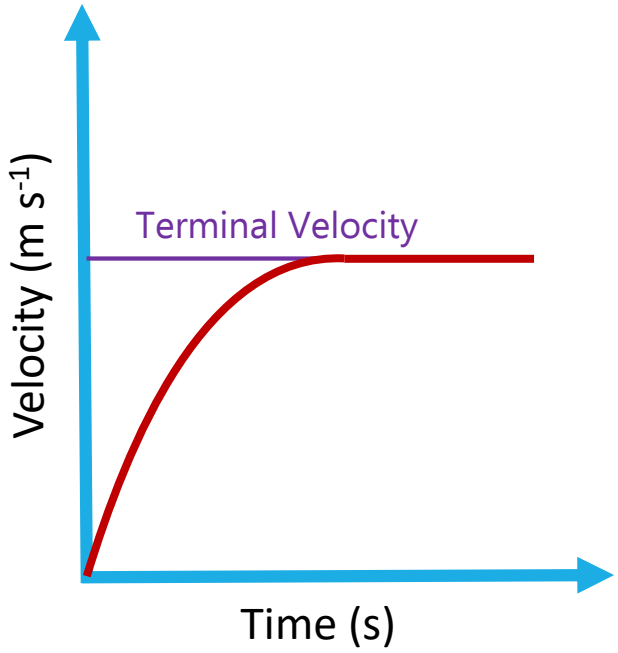
This is the top speed for a falling object

Motion Graphs Guide



Terminal Velocity





Note: these graphs treat the downward direction as positive

When the Parachute opens…

F_{net} = 500 N ↑

$$a = \frac{F}{m} = \frac{500}{70} = \mathbf{7.14\ m\ s^{-2}}$$

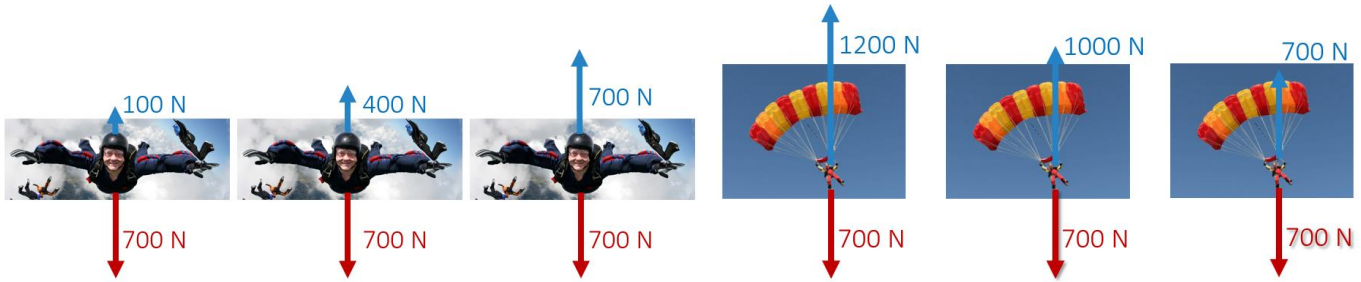
F_{net} = 300 N ↑

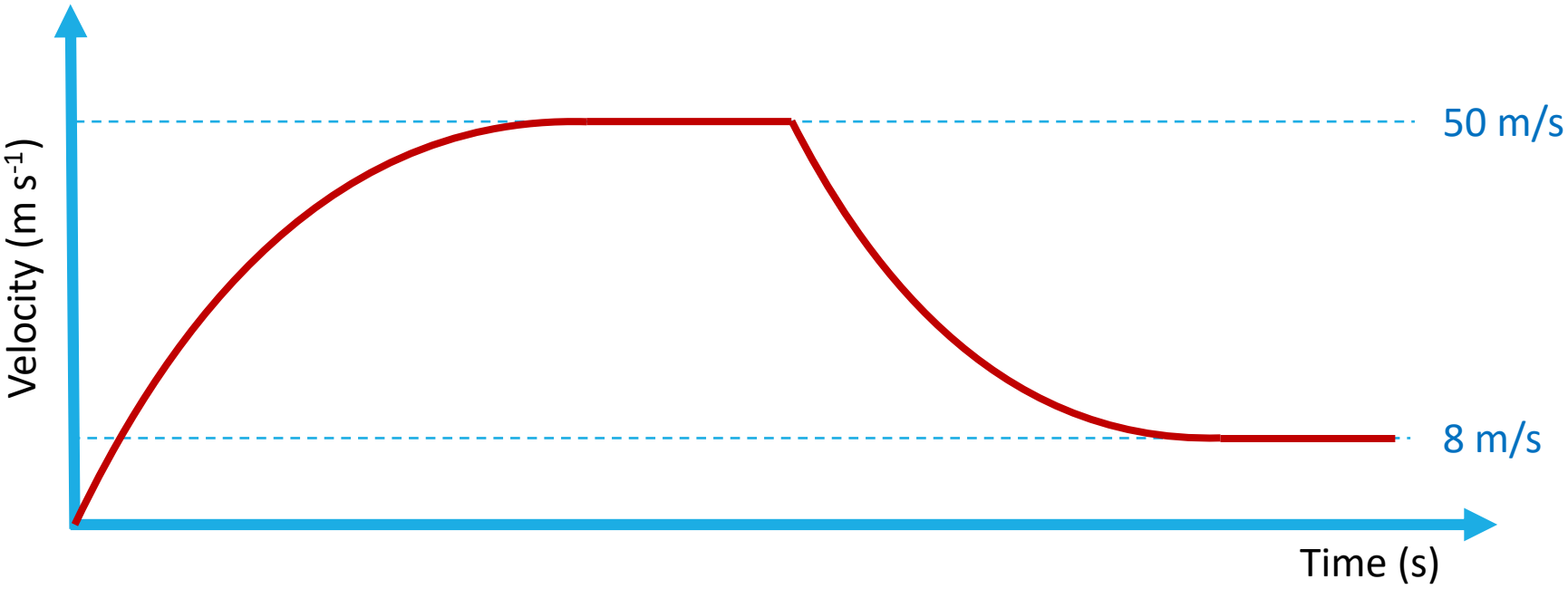
$$a = \frac{300}{70} = \mathbf{4.29\ m\ s^{-2}}$$

F_{net} = 0 N

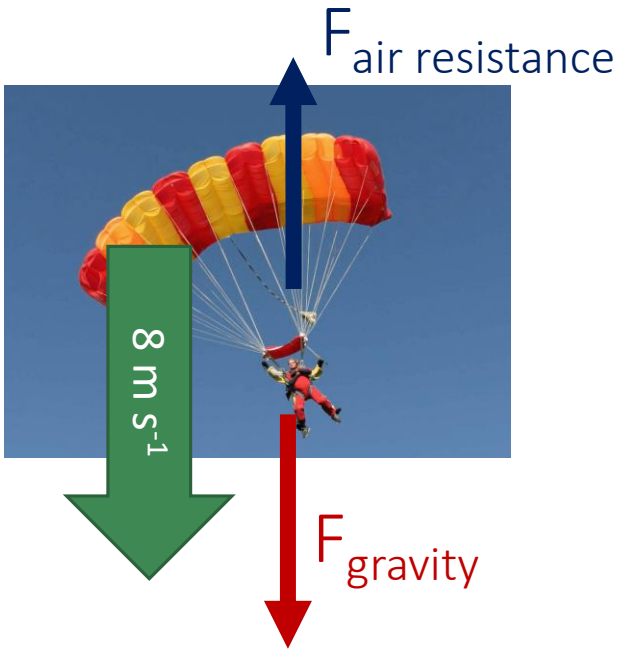
$$a = \frac{0}{70} = \mathbf{0\ m\ s^{-2}}$$

Terminal Velocity

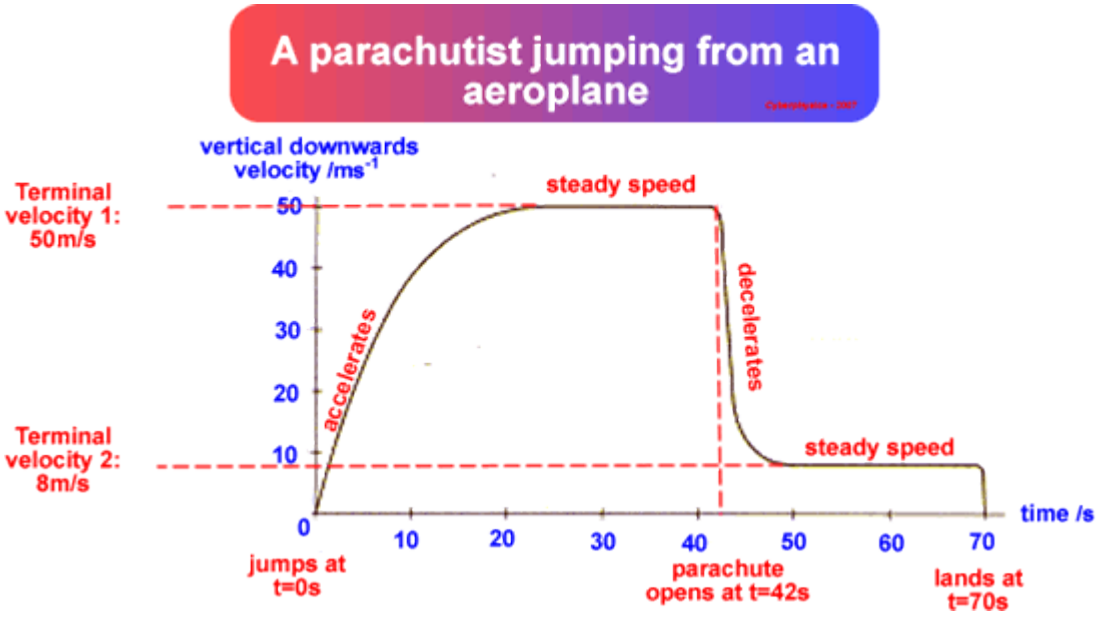




Terminal Velocity



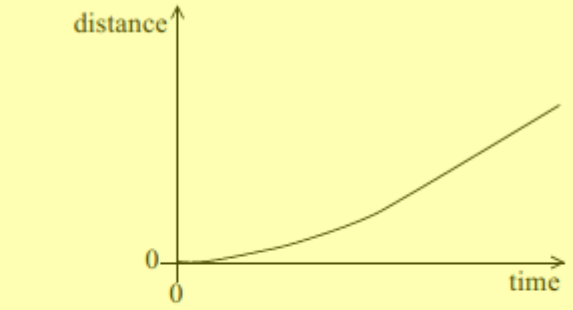
A parachute dramatically decreases the terminal velocity where air resistance balances out the weight



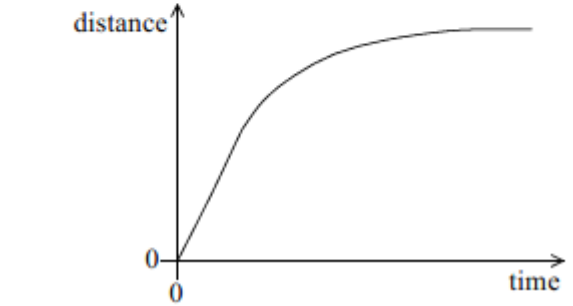
Sample IB Problem

An object falls vertically from rest. Air resistance acts on the object and it reaches a terminal speed. Which of the following is the distance-time graph for its motion?

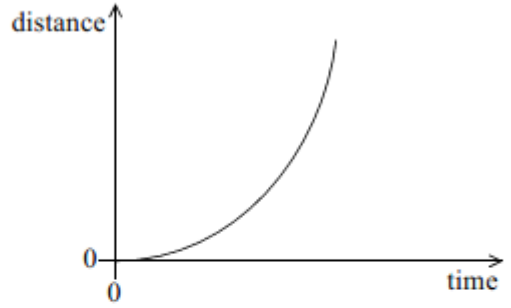
A.



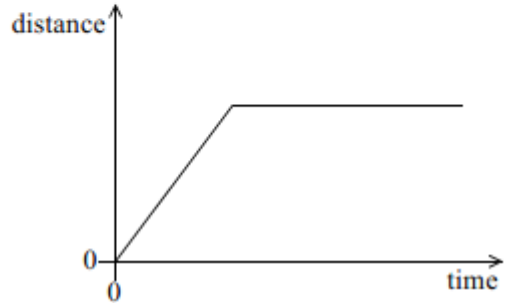
B.



C.



D.



Sample IB Problem

3. A skydiver jumped out of an airplane. On reaching a terminal speed of 60 $m s^{-1}$, she opened her parachute. Which of the following describes her motion after opening her parachute?

A. She went upwards for a short time, before falling to Earth at a speed of 60 $m s^{-1}$.

B. She continued downwards at 60 $m s^{-1}$, but hit the ground with less force.

C. She continued to fall but reached a new terminal speed of less than 60 $m s^{-1}$.

D. She went upwards for a short time, before falling to Earth at a speed of less than 60 $m s^{-1}$.

Sample IB Problem

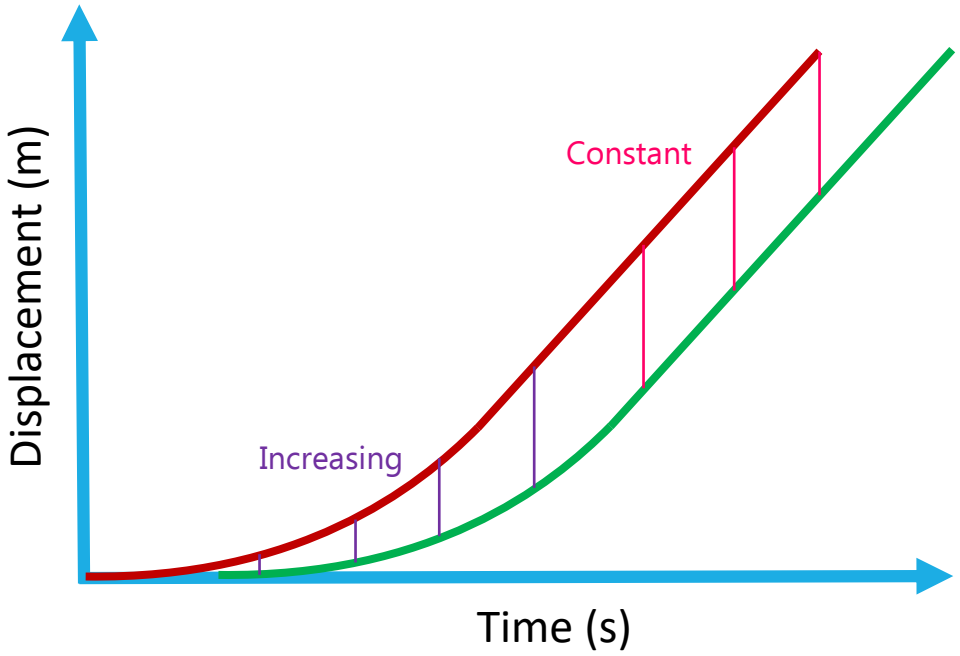
4. Two identical balls are dropped from a tall building, one a few seconds after the other. Air resistance is **not** negligible. As the balls fall, the distance between the balls will

A. decrease.

B. increase.

C. increase then remain constant.

D. remain constant.



Lesson Takeaways

- ❑ I can describe the factors that affect air resistance and how the resistance changes with velocity
- ❑ I can define Terminal Velocity in terms of net force
- ❑ I can graph the change in position and velocity for an object falling with air resistance and reaching terminal velocity