

6.5 Air resistance

1. Describe air resistance, by filling in the blanks.

accelerate	acceleration	air resistance	balanced
decreases	greater	terminal velocity	velocity

When a skydiver jumps out of the plane, they _____ downwards at 9.8 m s^{-2} . As their velocity increases, air resistance increases, so acceleration _____. When acceleration is zero, and forces are _____, the skydiver has reached terminal velocity.

Opening a parachute at this time will increase air resistance so that it is _____ than gravitational force. This means net force is upwards, so _____ is upwards. The _____ is still downwards, but it decreases.

The decrease in velocity means that _____ decreases, until it is the same magnitude as weight. At this point, the net force on the skydiver is zero and they reach a new, slower _____.

2. Use a force vector diagram to show the forces acting on a skydiver at each stage of their jump.

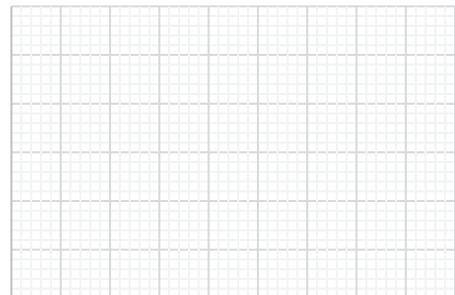
$t = 0 \text{ s}$ Just stepped out of the plane	$t = 1 \text{ s}$ After falling for one second	$t = 12 \text{ s}$ Terminal velocity of 200 km h^{-1} reached	$t = 68 \text{ s}$ Parachute opens	$t = 77 \text{ s}$ Terminal velocity of 5 m s^{-1} with the parachute reached
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3. Sketch a velocity-time graph for the jump, using the information in question 1 and 2.

4. At what stage of the jump is the net force:

- a) equal to weight? _____
 b) upward? _____
 c) zero? _____

velocity (m s^{-1})



time (s)

5. True or false? For each false statement, explain what is wrong with it.

- a) The instantaneous velocity of the skydiver can be calculated using $v = u + at$.

- b) The gradient of the velocity-time graph gives the acceleration of the skydiver.

- c) The area under the velocity-time graph gives the height of the skydiver above the ground.

- d) Air resistance can never be bigger than weight, otherwise the skydiver would move up.

- e) The higher the jump starts, the more force the skydiver will reach the ground with.
