

## ACCELERATION DUE TO GRAVITY - THROWING THINGS INTO THE AIR

Round off all answers to 1 decimal place!

If the movement is in the opposite direction (opposite vector) to gravity, then gravity has to be a **negative** as it will slow the movement down! If you miss this idea in the working, then look and think about your answer - it will look funny compared to what is happening in the question. See below!

Worked example:-

A juggling ball weighing 20g is thrown vertically up. If it takes 2.55s to reach the top of its flight, what was its initial velocity?

$t=2.55\text{s}$	$u = v - at$	$u = v - at$
$g=9.8\text{m/s}$	$u = v - gt$	$u = v - gt$
$v=0\text{m/s}$	$= 0 - (-9.8 \times 2.55)$	$u = v - (-g \times t)$
$u=?$	$= 0 - (-24.99)$	$= 0 - (-9.8 \times 2.55)$
	$= 24.99$	$= 0 - (-24.99)$
	$= \underline{25.0\text{ms}^{-1}} \text{ (25.0m/s)}$	$= 24.99$
		$= \underline{25.0\text{ms}^{-1}} \text{ (25.0m/s)}$

$$\begin{aligned} u &= v - at \\ u &= v - gt \\ u &= v - (g \times t) \\ &= 0 - (9.8 \times 2.55) \\ &= 0 - 24.99 \\ &= -24.99 \\ &= -25.0\text{ms}^{-1} \text{ (25.0m/s)} \\ &\text{"The ball is going backwards!"} \end{aligned}$$

1. A pen is thrown vertically up with an initial velocity of 25cm/s. how long does it take to reach the top of its travel?
2. A potato from a low powered potato gun is fired vertically upward. If it takes 10s to reach the top of its flight, what was its initial velocity?
3. A rock is thrown vertically up at 2m/s. how long before it reaches a speed of 0.4m/s?
4. A rock is thrown vertically down with an initial velocity of 1.7ms<sup>-1</sup>. If it flies for 10 seconds, what will be its final velocity at this point?
5. A hypervelocity bullet is fired vertically up at 1600ms<sup>-1</sup>. How long does it take to reach its maximum height?
6. A juggling ball of 20g is thrown vertically up to 50cm in a time of 0.67s, what speed was it thrown up at?
7. A brazil nut falls from a mature 50m tree in the Amazon jungle. If it takes 3.194s to reach the ground, what will be its final velocity?
8. An 88g arrow is fired vertically up at a velocity of 71m/s. What will be its velocity in 5.2s of its flight? In finding this answer, will it be at its highest point? Why or why not?
9. The same arrow as in Q8 is fired vertically down at the same starting velocity. What velocity will it attain after 5.2 seconds with this vector?
10. A 0.3 calibre high-powered rifle fires a 2g bullet vertically up. If it takes 58s to get back to where it was fired from, what was its initial velocity when it originally left the barrel in the first place?