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B4 Trajectories

Complete the values in the table below, assuming that all projectiles are launched horizontally and fall downwards with an acceleration of 9.8 ms^{-2}.

	Horizontal distance* /m	Horizontal speed /m s^{-1}	Time to target /s	Distance fallen /m
B4.1	4.0	4.0	(a)	(b)
B4.2	(a)	20.0	(b)	0.020
B4.3	86	220	(a)	(b)
B4.4	1.5	(a)	(b)	0.32
B4.5	(a)	280	(b)	6300

* to target

B4.6 You shoot horizontally at a target that is 30 m away with a gun which fires a bullet at 150 m s^{-1}. How high must the gun be above the target in order to hit it?

B4.7 You are trying to drop essential survival supplies from an aeroplane to help the survivors of a crash who are stranded. You are flying 300 m above them, and your aircraft can travel no slower than 30 m s^{-1}. You fly on a straight line which will pass over the survivors. How far (in metres) in advance of overflying the survivors do you need to drop the package?

B4.8 A rugby player is aiming for a conversion. He kicks the ball at 15 m s^{-1} at an angle of 50° to the horizontal. At the time, he is 20 m from the posts.

a) How long will the ball take to reach the posts?

b) How high will the ball be when it reaches the posts?

B4.9 A cricket batsman hits a ball at a speed of 27 m s^{-1} at an angle of 60° to the horizontal. How far away would you have to stand in order to catch it, assuming you want to catch it just before it hits the ground?