Trajectories 1

GCSE C C C

A Level P P P

Essential Pre-Uni Physics B4.1

Complete the values in the table, assuming that all projectiles are launched horizontally and fall downwards with an acceleration of $9.8\,\mathrm{m\,s^{-2}}$. Give all your answers to 2 significant figures.

Horizontal distance / m	Horizontal speed / $\mathrm{m\,s^{-1}}$	Time to reach target / s	Distance fallen / m
4.0	4.0	(a)	(b)

Part A Time to reach target

a) Time to reach target in seconds?

Part B Distance fallen

b) Distance fallen in metres?

Trajectories 2

GCSE C C C A Level P P P

Essential Pre-Uni Physics B4.2

Complete the values in the table, assuming that all projectiles are launched horizontally and fall downwards with an acceleration of $9.8\,\mathrm{m\,s^{-2}}$. Give all your answers to 2 significant figures.

Horizontal distance / m	Horizontal speed / $\mathrm{m\,s^{-1}}$	Time to reach target / s	Distance fallen / m
(a)	20.0	(b)	0.020

Part A Horizontal distance

a) Horizontal distance in metres?

Part B Time to reach target

b) Time to reach target in seconds?

Gameboard:
STEM SMART Physics 6 - Trajectories

Trajectories 6

A Level

Essential Pre-Uni Physics B4.6

You are trying to shoot horizontally at a target $30\,\mathrm{m}$ away with a gun which fires a bullet at $150\,\mathrm{m\,s^{-1}}$. How high must the gun be above the target in order to hit it? Assume the downward acceleration is $9.8\,\mathrm{m\,s^{-2}}$. Please give your answer to 2 significant figures.

Gameboard:

STEM SMART Physics 6 - Trajectories

Trajectories 7

A Level

Essential Pre-Uni Physics 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 $300\,\mathrm{m}$ above them, and your aircraft can travel no slower than $30\,\mathrm{m\,s^{-1}}$. 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? Assume that the downward acceleration is $9.8\,\mathrm{m\,s^{-2}}$. Please give your answer to 2 significant figures.

Gameboard:

STEM SMART Physics 6 - Trajectories

Trajectories 8

A Level

C C C

Essential Pre-Uni Physics B4.8

A rugby player is aiming for a conversion. They kick the ball at $15\,\mathrm{m\,s^{-1}}$ at an angle of 50° to the horizontal. At the time, they are $20\,\mathrm{m}$ from the posts.

Assume that the downward acceleration is $9.8\,\mathrm{m\,s^{-2}}$.

Part A Time to reach the posts

How much time will the ball take to reach the posts?

Part B Height at the posts

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

Gameboard:

STEM SMART Physics 6 - Trajectories

Trajectories 9

A Level

C C C

Essential Pre-Uni Physics B4.9

A cricketer bats a ball at a speed of $27\,\mathrm{m\,s^{-1}}$ 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)?

Assume the downward acceleration is $9.8\,\mathrm{m\,s^{-2}}$.

Gameboard:

STEM SMART Physics 6 - Trajectories

Broken Cannon

A Level

C C C

A cannon on horizontal ground, at point C, is used to target a point T, $25\,\mathrm{m}$ behind a narrow wall. Unfortunately the cannon is damaged and can only fire at a 45° angle and at one speed. So, the only way to aim the cannon is by moving it towards and away from the target. The gunners aren't sure if they can actually hit the target.

Part A Hitting the target

If the cannonball leaves the cannon at $u = 35\,\mathrm{m\,s^{-1}}$; at what distance, d , must the cannon be placed in front of the wall in order to hit the target, if the wall is ignored and the target is at the same height as the cannon?

Part B Clearing the wall

The wall is $15.0\,\mathrm{m}$ high. Does the cannonball actually go over the wall and hit the target? If so, by how much?

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Gameboard:

STEM SMART Physics 6 - Trajectories

The Bolt Thrower

A Level

C C C

A castle wall has bolt throwers which fire a bolt horizontally at a speed v . In order to fire over the enemy's shields, the bolt must make an angle of at least $\theta = 45^\circ$ to the horizontal when it hits the ground. The bolt throwers can be mounted at different heights in the wall and set to fire at different speeds. Ignore friction.

Part A Maximum Range

Find the maximum range s of a bolt fired from a height h.

The following symbols may be useful: `g`, `h`

Part B Speed for Maximum Range

Find the speed v required to reach the maximum range worked out in part A.

The following symbols may be useful: `g`, `h`

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