DO NOT WRITE IN THIS AREA

2 A coin and a feather are dropped from the same height, through air.

Which row of the table is correct as the coin and feather fall to the ground?

	Initial acceleration	Time taken to reach the ground
☒ **A**	Greater for coin	Less for coin
☒ **B**	Greater for coin	Same for coin and feather
☒ **C**	Same for coin and feather	Less for coin
☒ **D**	Same for coin and feather	Same for coin and feather

(Total for Question 2 = 1 mark)

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7 A ball bearing falls vertically from rest through a distance of 50 cm in a time of 0.32 s.

Which expression gives the acceleration of the ball bearing in $m\,s^{-2}$?

☒ **A** $1 \div 0.32^2$

☒ **B** $0.5 \div 0.32$

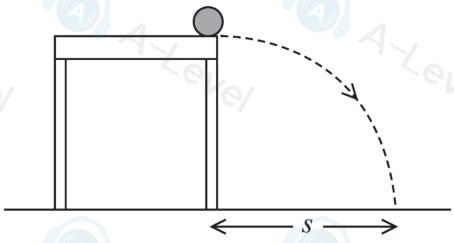
☒ **C** $100 \div 0.32^2$

☒ **D** $50 \div 0.32$

(Total for Question 7 = 1 mark)

DO NOT WRITE IN THIS A

4 A ball rolls off a table with a horizontal velocity of $1.2\,m\,s^{-1}$. The ball takes 0.9 s to reach the ground and lands a distance s from the table as shown.



Which of the following expressions could be used to determine the value of s in metres?

☒ **A** $\dfrac{1.2^2}{2 \times 9.81}$

☒ **B** 1.2×0.9

☒ **C** $\frac{1}{2} \times 9.81 \times 0.9^2$

☒ **D** $(1.2 \times 0.9) + (\frac{1}{2} \times 9.81 \times 0.9^2)$

(Total for Question 4 = 1 mark)

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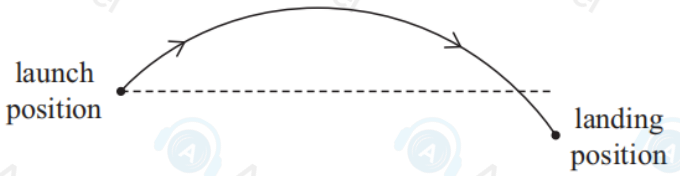
6 The path of a projectile is shown.



The projectile landed at a height lower than the height from which it was launched.

Assuming there is no air resistance acting on the projectile, which of the following is a correct statement?

A At the maximum height, the horizontal velocity is a minimum.

B At the maximum height, the vertical velocity is a maximum.

C The initial horizontal velocity is equal to the final horizontal velocity.

D The initial vertical velocity is equal to the final vertical velocity.

(Total for Question 6 = 1 mark)

4 A student measures the time t taken for a ball bearing to fall different measured distances s from rest. The student uses his measurements to plot a graph with a gradient equal to the acceleration due to gravity g.

Which row of the table shows a graph with a gradient equal to g?

		y-axis	x-axis
☒	**A**	s	t^2
☒	**B**	$2s$	t^2
☒	**C**	t^2	s
☒	**D**	t^2	$2s$

(Total for Question 4 = 1 mark)

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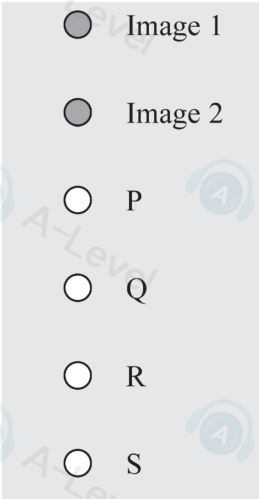
9 A student used a falling sphere to determine the acceleration of free fall.

A camera produced images of the sphere at constant time intervals as it fell.

The positions of the sphere in the first two images are shown. Image 1 shows the sphere's position at the instant it was released.



Which of the positions P, Q, R or S will the sphere be at in Image 3?

☒ **A** P

☒ **B** Q

☒ **C** R

☒ **D** S

(Total for Question 9 = 1 mark)

14 A firework is launched into the air and explodes once it reaches a maximum height.

(a) The firework is designed to explode at a maximum height of 350 m.

(i) Show that the vertical component of the velocity at launch is about 80 m s^{-1}.

(2)

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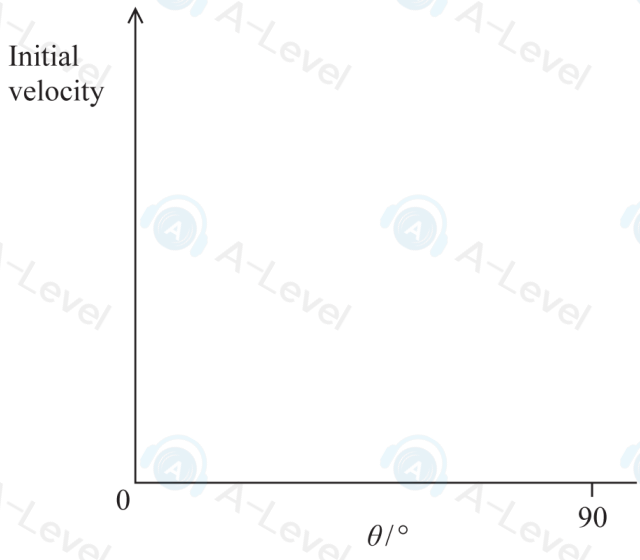
(ii) The vertical component of the velocity at launch depends on both the initial velocity of the firework and θ, the angle between the initial velocity and the horizontal.

Sketch a graph showing how the initial velocity required for the firework to reach the maximum height of 350 m varies with θ for the firework.

(4)



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19 In the sport of shot put, a person launches a heavy ball called a 'shot' into the air.

The photograph shows a person about to launch a shot.

(Source: © Lim Weixiang - Zeitgeist Photos/Getty Images)

(a) The shot is very dense and has a large mass.

Explain why the equations of motion can be used to give an accurate prediction for the path of the shot.

(2)

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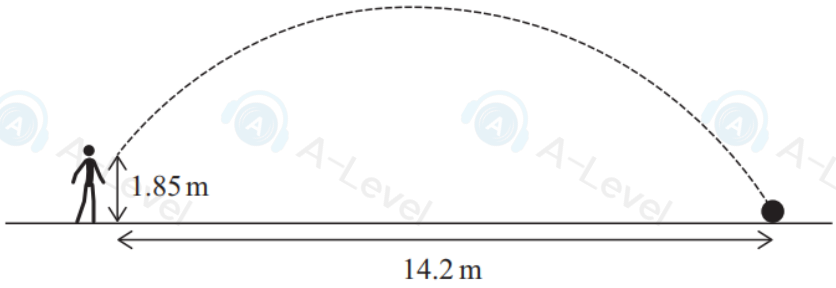
(b) The shot was released from a height of 1.85 m above the ground. The shot travelled a horizontal distance of 14.2 m before landing on the ground, as shown.

Not to scale



The shot moved through the air for a time of 1.61 s.

(i) Show that the horizontal speed of the shot was about 8.8 m s^{-1}.

(2)

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(ii) Determine the velocity of the shot at the point it was released.

(5)

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Magnitude of velocity = ...

Angle to horizontal = ...

(Total for Question 19 = 9 marks)