Projectiles Past Paper Questions

Jan 2002 to Jan 2009

Q8 Jan 2002

8 (a) A cricketer throws a ball vertically upwards so that the ball leaves his hands at a speed of $25\,m\,s^{-1}$. If air resistance can be neglected, calculate

(i) the maximum height reached by the ball,

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(ii) the time taken to reach maximum height,

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(iii) the speed of the ball when it is at 50% of the maximum height.

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(4 marks)

(b) When catching the ball, the cricketer moves his hands for a short distance in the direction of travel of the ball as it makes contact with his hands. Explain why this technique results in less force being exerted on the cricketer's hands.

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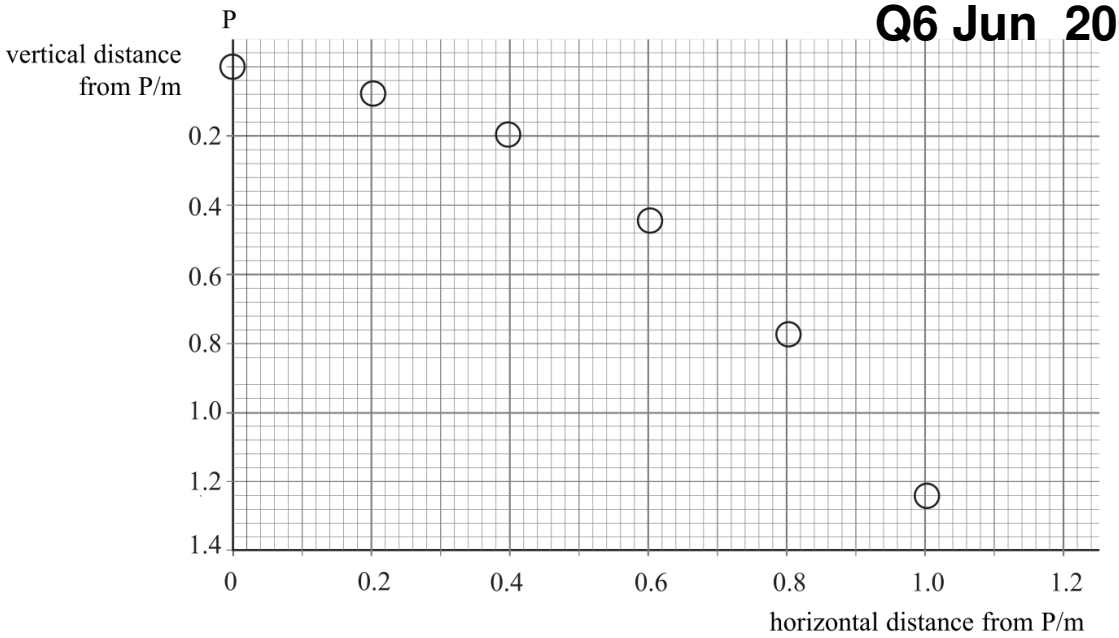
(2 marks)

6 The graph shows how the position of a steel ball which has been projected horizontally from P changes with time. The position of the ball is shown at constant time intervals.

Q6 Jun 2002



(a) Explain how the horizontal motion of the ball shows that air resistance is negligible.

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(2 marks)

(b) Explain the vertical motion of the ball.

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(2 marks)

(c) If air resistance were not negligible, describe how this would affect

(i) the horizontal motion of the ball,

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(ii) the vertical motion of the ball.

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(3 marks)

Q6 Jan 2003

6 (a) A man jumps from a plane that is travelling horizontally at a speed of $70\,m\,s^{-1}$. If air resistance can be ignored, determine

(i) his horizontal velocity 2.0 s after jumping,

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(ii) his vertical velocity 2.0 s after jumping,

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(iii) the magnitude and direction of his resultant velocity 2.0 s after jumping.

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(5 marks)

(b) After 2.0 s the man opens his parachute. Air resistance is no longer negligible. Explain in terms of Newton's laws of motion, why

(i) his velocity initially decreases,

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(ii) a terminal velocity is reached.

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(4 marks)

Q1 Jun 2004

1 The aeroplane shown in **Figure 1** is travelling horizontally at $95\,m\,s^{-1}$. It has to drop a crate of emergency supplies.
The air resistance acting on the crate may be neglected.

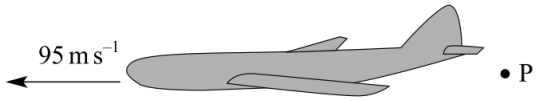

Figure 1

(a) (i) The crate is released from the aircraft at point **P** and lands at point **Q**. Sketch the path followed by the crate between **P** and **Q** as seen from the ground.

(ii) Explain why the horizontal component of the crate's velocity remains constant while it is moving through the air.

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(3 marks)

(b) (i) To avoid damage to the crate, the maximum vertical component of the crate's velocity on landing should be $32\,m\,s^{-1}$. Show that the maximum height from which the crate can be dropped is approximately 52 m.

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(ii) Calculate the time taken for the crate to reach the ground if the crate is dropped from a height of 52 m.

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(iii) If **R** is a point on the ground directly below **P**, calculate the horizontal distance **QR**.

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(6 marks)

(c) In practice air resistance is **not** negligible. State and explain the effect this has on the maximum height from which the crate can be dropped.

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(2 marks)

4 A dart is thrown horizontally at a speed of $8.0\,m\,s^{-1}$ towards the centre of a dartboard that is 2.0 m away. At the same instant that the dart is released, the support holding the dartboard fails and the dartboard falls freely, vertically downwards. The dart hits the dartboard in the centre before they both reach the ground.

(a) State and explain the motion of the dart and the dartboard, while the dart is in flight.

You may be awarded additional marks to those shown in brackets for the quality of written communication in your answer.

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(4 marks)

(b) Calculate

Q4 Jan 2008

(i) the time taken for the dart to hit the dartboard,

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(ii) the vertical component of the dart's velocity just before it strikes the dartboard,

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(iii) the magnitude and direction of the resultant velocity of the dart as it strikes the dartboard.

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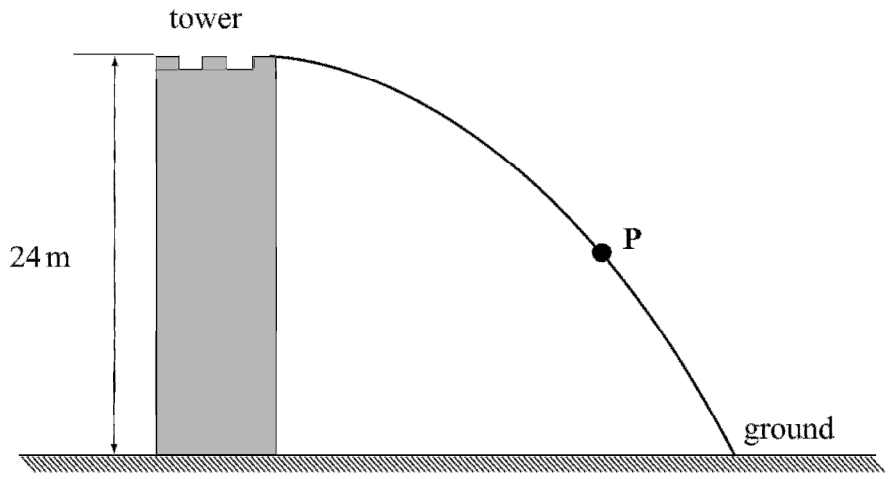
(5 marks)

4 **Figure 3** shows the path of a ball thrown horizontally from the top of a tower of height 24 m which is surrounded by level ground.

Figure 3 **Q4 Jan 2009**



4 (a) Using two labelled arrows, show on **Figure 3** the direction of the velocity, v, and the acceleration, a, of the ball when it is at point **P**.

(2 marks)

4 (b) (i) Calculate the time taken from when the ball is thrown to when it first hits the ground. Assume air resistance is negligible.

Answer ..... s

(2 marks)

4 (b) (ii) The ball hits the ground 27 m from the base of the tower. Calculate the speed at which the ball is thrown.

Answer ..... $m\,s^{-1}$

(2 marks)