

# Simple Projectiles

## Question Paper 4

<b>Level</b>	A Level
<b>Subject</b>	Maths
<b>Exam Board</b>	AQA
<b>Module</b>	Mechanics 1
<b>Topic</b>	Projectiles
<b>Sub Topic</b>	Simple Projectiles
<b>Booklet</b>	Question Paper - 4

**Time Allowed:** 57 minutes

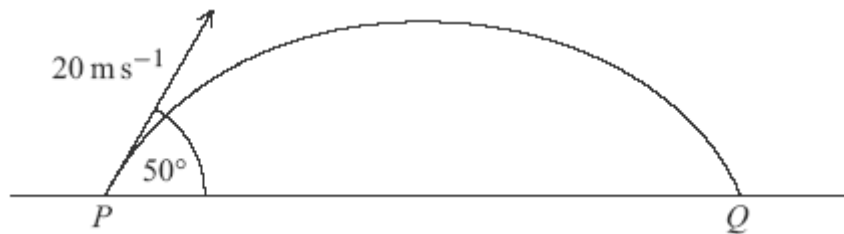
**Score:** /47

**Percentage:** /100

**Grade Boundaries:**

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

- Q1.** A ball is kicked from the point  $P$  on a horizontal surface. It leaves the surface with a velocity of  $20 \text{ m s}^{-1}$  at an angle of  $50^\circ$  above the horizontal and hits the surface for the first time at the point  $Q$ . Assume that the ball is a particle that moves only under the influence of gravity.

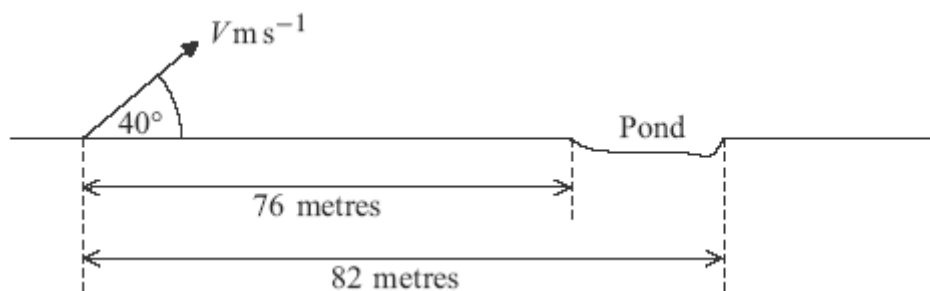


- (a) Show that the time that it takes the ball to travel from  $P$  to  $Q$  is  $3.13 \text{ s}$ , correct to three significant figures. (4)
- (b) Find the distance between the points  $P$  and  $Q$ . (2)
- (c) If a heavier ball were projected from  $P$  with the same velocity, how would the distance between  $P$  and  $Q$ , calculated using the same modelling assumptions, compare with your answer to part (b)? Give a reason for your answer. (2)
- (d) Find the maximum height of the ball above the horizontal surface. (3)
- (e) State the magnitude and direction of the velocity of the ball as it hits the surface. (2)
- (Total 13 marks)**

- Q2.** A pellet is fired from a window at a height of  $3 \text{ metres}$  above horizontal ground. Initially, the pellet travels at  $70 \text{ m s}^{-1}$  at an angle of  $10^\circ$  above the horizontal.

- (a) Show that the time for which the pellet travels before it hits the ground is 2.71 seconds, correct to three significant figures. (6)
- (b) Find the horizontal distance that the pellet travels before it hits the ground. (2)
- (c) Find the minimum speed of the pellet during its flight. (2)
- (d) Find the speed of the pellet when it hits the ground. (4)
- (Total 14 marks)

**Q3.** A golfer hits a ball which is on horizontal ground. The ball initially moves with speed  $V \text{ m s}^{-1}$  at an angle of  $40^\circ$  above the horizontal. There is a pond further along the horizontal ground. The diagram below shows the initial position of the ball and the position of the pond.



- (a) State **two** assumptions that you should make in order to model the motion of the ball. (2)
- (b) Show that the horizontal distance, in metres, travelled by the ball when it returns to ground level is

$$\frac{V^2 \sin 40^\circ \cos 40^\circ}{4.9}$$

(6)

- (c) Find the range of values of  $V$  for which the ball lands in the pond.

(4)

(Total 12 marks)

**Q4.** A ball is kicked so that it leaves a horizontal surface, at the point  $A$ , travelling at  $16 \text{ m s}^{-1}$  and at an angle  $\theta$  above the horizontal. The ball hits the surface again 2 seconds later, at the point  $B$ . Assume that the ball is a particle that moves only under the influence of gravity.

- (a) Show that  $\theta = 37.8^\circ$ , correct to three significant figures.

(3)

- (b) Find the time for which the ball is more than 2 metres above the surface.

(5)

(Total 8 marks)