

Motion of a Projectile

Question Paper 2

Level	International A Level
Subject	Maths
Exam Board	CIE
Topic	Motion of a Projectile
Sub Topic	
Booklet	Question Paper 2

Time Allowed: 60 minutes

Score: /50

Percentage: /100

Grade Boundaries:

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

- 1** A particle P is projected with speed 50 m s^{-1} at an angle of 30° above the horizontal from a point O on a horizontal plane.
- (i) Calculate the speed of P when it has been in motion for 4 s, and calculate another time at which P has this speed. [5]
- (ii) Find the distance OP when P has been in motion for 4 s. [2]
- 2** A particle is projected with speed 12 m s^{-1} from a point on horizontal ground. The particle strikes the ground 1.6 s after the instant of projection. Calculate the angle of projection. [2]
- 3** A particle P is projected with speed 20 m s^{-1} at an angle of 40° above the horizontal from a point O on horizontal ground.
- (i) Find the height of P above the ground when P has speed 18 m s^{-1} . [2]
- (ii) Calculate the length of time for which the speed of P is less than 18 m s^{-1} , and find the horizontal distance travelled by P during this time. [6]
- 4** A particle P of mass 0.6 kg is released from rest at a point above ground level and falls vertically. The motion of P is opposed by a force of magnitude $3v \text{ N}$, where $v \text{ m s}^{-1}$ is the speed of P . Immediately before P reaches the ground, $v = 1.95$.
- (i) Calculate the time after its release when P reaches the ground. [5]
- P is now projected horizontally with speed 1.95 m s^{-1} across a smooth horizontal surface. The motion of P is again opposed by a force of magnitude $3v \text{ N}$, where $v \text{ m s}^{-1}$ is the speed of P .
- (ii) Calculate the distance P travels after projection before coming to rest. [3]

- 5 A small ball is thrown horizontally with speed 5 m s^{-1} from a point O on the roof of a building. At time t s after projection, the horizontal and vertically downwards displacements of the ball from O are x m and y m respectively.

(i) Express x and y in terms of t , and hence show that the equation of the trajectory of the ball is $y = 0.2x^2$. [3]

The ball strikes the horizontal ground which surrounds the building at a point A .

(ii) Given that $OA = 18$ m, calculate the value of x at A , and the speed of the ball immediately before it strikes the ground at A . [6]

- 6 A small ball B is projected from a point O with speed 14 m s^{-1} at an angle of 60° above the horizontal.

(i) Calculate the speed and direction of motion of B for the instant 1.8 s after projection. [5]

The point O is 2 m above a horizontal plane.

(ii) Calculate the time after projection when B reaches the plane. [3]

- 7 A particle P of mass 0.2 kg is projected horizontally with velocity 0.9 m s^{-1} from a point O on a rough horizontal surface. P moves in a straight line, and at time t s after projection the velocity of P is $v \text{ m s}^{-1}$. A force of magnitude $0.024t$ N acts on P in the direction OP . The coefficient of friction between P and the surface is 0.3 .

(i) Express the acceleration of P in terms of t , and hence show that, before P comes to rest,

$$v = 0.06(t^2 - 50t + 15). \quad [4]$$

(ii) Find the value of t when P comes to rest. [2]

(iii) Find the value of t when P subsequently begins to move again. [2]