

Motion of a Projectile

Question Paper 3

Level	International A Level
Subject	Maths
Exam Board	CIE
Topic	Motion of a Projectile
Sub Topic	
Booklet	Question Paper 3

Time Allowed: 59 minutes

Score: /49

Percentage: /100

Grade Boundaries:

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

- 1 The top of a vertical cliff is 20 m above sea level. A particle P is projected with speed 15 m s^{-1} at an angle of 30° above the horizontal from a point O at the top of the cliff. Calculate
- (i) the speed and direction of motion of P when it strikes the water, [4]
 - (ii) the distance OP at the instant P strikes the water. [4]
- 2 A small ball is projected with speed 20 m s^{-1} at an angle of 45° above the horizontal from a point O on horizontal ground. At time t s after projection, the horizontal and vertically upwards displacements of the ball from O are x m and y m respectively.
- (i) Express x and y in terms of t . [2]
 - (ii) Show that the equation of the trajectory of the ball is $y = x - \frac{1}{40}x^2$. [2]
 - (iii) State the distance from O of the point at which the ball first strikes the ground. [1]
- 3 A particle of mass 0.2 kg is projected vertically downwards with initial speed 4 m s^{-1} . A resisting force of magnitude $0.09v \text{ N}$ acts vertically upwards on the particle during its descent, where $v \text{ m s}^{-1}$ is the downwards velocity of the particle at time t s after being set in motion.
- (i) Show that the acceleration of the particle is $(10 - 0.45v) \text{ m s}^{-2}$. [1]
 - (ii) Find v when $t = 1.5$. [5]
- 4 A particle P is projected with speed 50 m s^{-1} at an angle of 40° above the horizontal from a point O . For the instant 2.5 s after projection, calculate
- (i) the speed of P , [3]
 - (ii) the angle between OP and the horizontal. [4]

- 5 A ball B is projected from a point O on horizontal ground at an angle of 40° above the horizontal. B hits the ground 1.8 s after the instant of projection. Calculate
- (i) the speed of projection of B , [2]
 - (ii) the greatest height of B , [2]
 - (iii) the distance from O of the point at which B hits the ground. [2]
- 6 A particle P is projected with speed 15 m s^{-1} at an angle of 60° above the horizontal. Find the direction of motion of P at the instant 0.9 s after projection. [4]
- 7 A ball is projected horizontally with speed 5 m s^{-1} from the top of a tower which is 30 m high. The tower stands on horizontal ground.
- (i) Find the speed and direction of motion of the ball when it reaches the ground. [3]
 - (ii) Calculate the distance from the foot of the tower to the point where the ball reaches the ground. [3]
- 8 A particle P is projected with speed 30 m s^{-1} at an angle of 60° above the horizontal from a point O on horizontal ground. For the instant when the speed of P is 17 m s^{-1} and increasing,
- (i) show that the vertical component of the velocity of P is 8 m s^{-1} downwards, [2]
 - (ii) calculate the distance of P from O . [5]