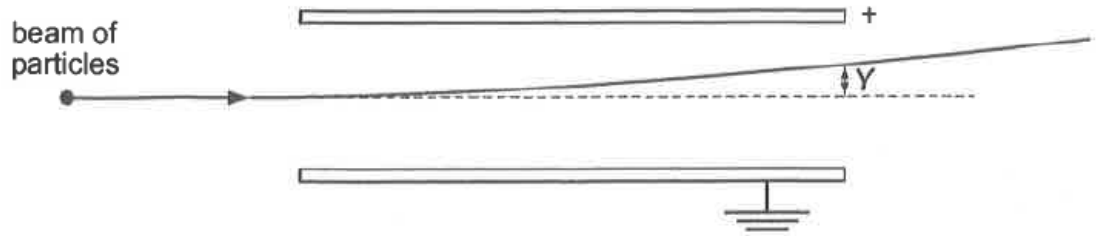
2023 Sec 3 Advanced Physics AS 1

Kinematics: Non-linear Motion

Name: _____ ( ) Class: 3 / ___

1 Two horizontal metal plates are situated in a vacuum. A potential difference is maintained between the plates.



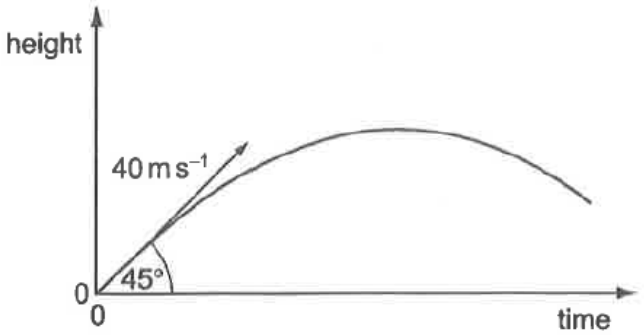
A beam of negatively-charged particles is horizontal when it enters the region between the plates. It is deflected as shown in the diagram.

The potential difference is then increased. How does this affect the time *T* that a particle in the beam spends between the plates and the vertical deflection *Y*?

	effect on *T*	effect on *Y*
A	decreases	decreases
B	no change	increases
C	no change	decreases
D	increases	increases

( )

2 An object is projected with velocity 40 ms^{-1} at an angle of 45° to the horizontal. Air resistance is negligible.



What is the speed of the object after 5.0 s?

A 21 m s^{-1} **B** 28 m s^{-1} **C** 36 m s^{-1} **D** 49 m s^{-1}

( )

3 A student throws a ball from a point S to a friend at point F. The path of the ball is shown in Fig. 3.1.

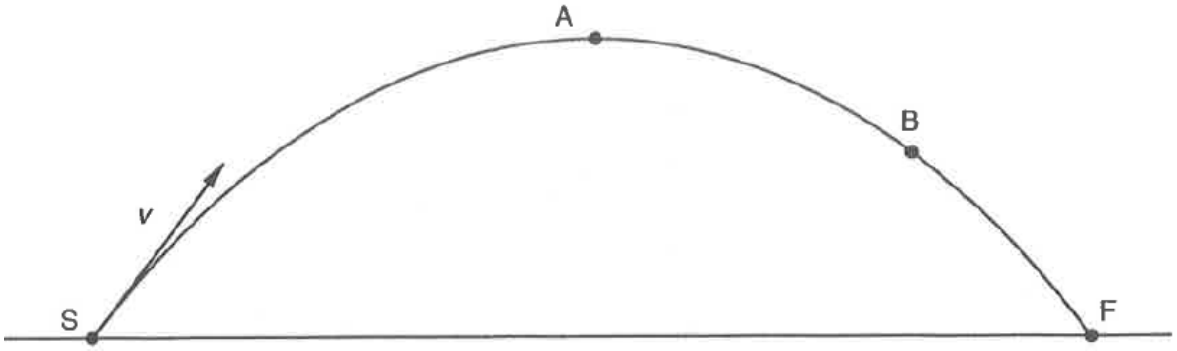


Fig. 3.1

The points S and F are on the same horizontal level. Air resistance is negligible. The ball is thrown from point S with velocity v, represented by the vector arrow shown on Fig. 3.1

(a) On Fig. 3.1,

(i) draw arrows from **S** to represent the initial horizontal and vertical components of the velocity *v*, and label these components $\boldsymbol{v}_{\mathbf{H}}$ and $\boldsymbol{v}_{\mathbf{v}}$ respectively,

(ii) draw and label arrows at **A** and at **B** to represent the horizontal and vertical components of the velocity of the ball at these two points.

(b) The initial velocity of the ball at S is 25 m s^{-1} at an angle of 45° to the horizontal.

(i) Calculate the vertical component of the ball's initial velocity.

vertical component of velocity = ……..

(ii) Determine the maximum height reached by the ball, assuming no air resistance.

maximum height = ……..

(iii) Determine the horizontal distance SF.

distance = ……..

4 A ball is to be kicked so that, at the highest point of its path, it just clears a horizontal cross-bar on a pair of goal-posts. The ground is level and the cross-bar is 2.5 m high. The ball is kicked from ground level with an initial speed of 8.0 m s^{-1}.

(a) Calculate the angle of projection of the ball.

angle of projection = ……..

(b) Calculate the horizontal velocity of the ball as it passes over the cross-bar.

horizontal velocity = ……..

(c) Calculate the distance of the point where the ball is kicked from the goal-line.

distance from goal-line = ……..

(d) Determine the time the ball is in the air before it reaches the ground on the other side of the cross-bar.

time = ……..

5 Fig. 5.1 shows a plane flying at 150 m s^{-1} at an angle of 27° to the horizontal that releases a package from a height of 300 m.

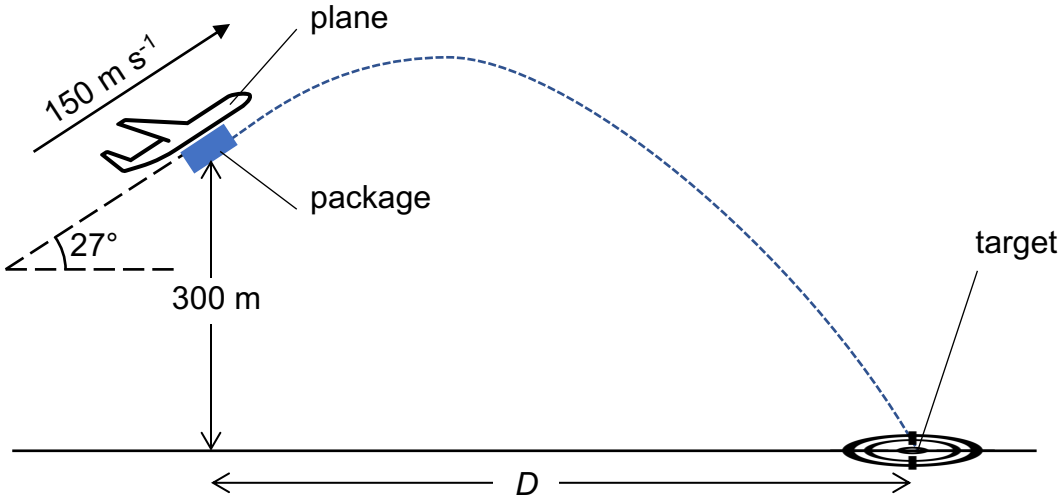


Fig. 5.1

Assume air resistance on the package is insignificant.

(a) Determine the distance from the target, *D*, from which the package should be released to hit a target on the ground.

D = ... [3]

(b) On Fig 5.1, show clearly the path the package would take if released in a similar manner from the plane, but now experiences air resistance. [1]

Answers:	1. B 2. C 3(aii) v_H is constant at all points, v_V is zero at A & downwards at B 4(a) 62° (b) 3.7 m s^{-1} (c) 2.6 m, (d) 1.4 s. 5(a) 2.29 km