

Answer on Question #74040 Physics / Classical Mechanics

A particle A is dropped from a point P at $t = 0$. At the same time another particle B is thrown from a point O which is 2m to the right and 10m below P , with velocity v making an angle θ with horizontal. B collides with the particle A . If the two particles collide 2 sec after they start, find v . (Acceleration due to gravity is 10m/s in negative y direction. Point O is not necessarily on ground.)

Solution:

Let the origin is at point O . The y axis is directed upward. The x axis is directed to the left. So, the equations of motion of particles A and B

$$y_A(t) = 10 - \frac{gt^2}{2}$$

$$x_A(t) = 2$$

$$y_B(t) = v \sin \theta t - \frac{gt^2}{2}$$

$$x_B(t) = v \cos \theta t$$

When particles collide

$$x_A(t) = x_B(t) \text{ and } y_A(t) = y_B(t), t = 2 \text{ s}$$

Thus

$$2 = 2v \cos \theta \Rightarrow v \cos \theta = 1$$

$$10 - \frac{10 \times 2^2}{2} = 2v \sin \theta - \frac{10 \times 2^2}{2} \Rightarrow v \sin \theta = 5$$

Finally

$$v^2 \cos^2 \theta + v^2 \sin^2 \theta = 1^2 + 5^2$$

$$v^2 = 26$$

$$v = \sqrt{26} \text{ m/s}$$

Answer: $v = \sqrt{26}$ m/s

Answer provided by <https://www.AssignmentExpert.com>