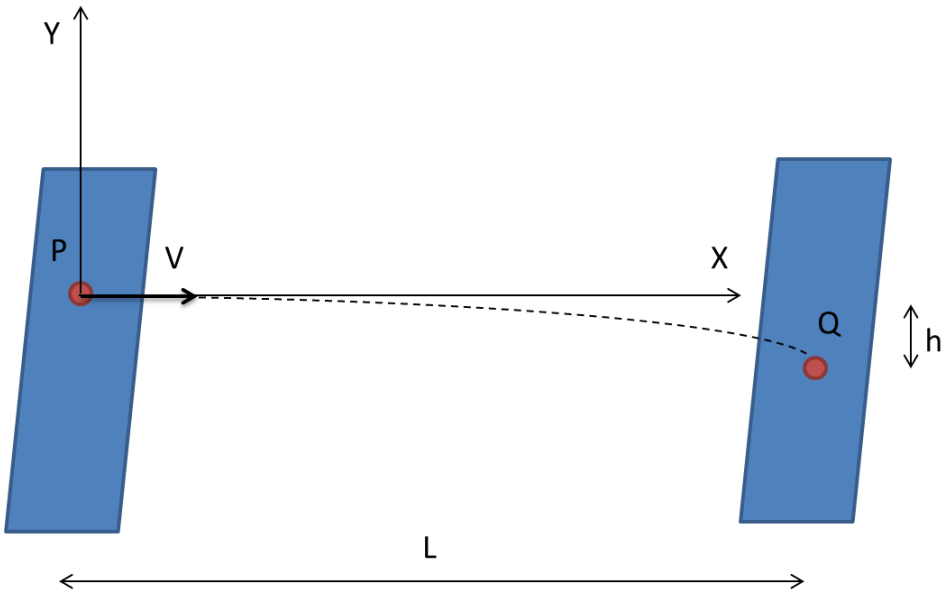
Answer on Question #45341, Physics, Mechanics | Kinematics | Dynamics

Two paper screens A and B are seperated by distance 100m. A bullet penetrates A and B at points P and Q respectively, where Q is 10 cm below P. If bullet is travelling horizontally at the time of hitting A, the velocity of bullet at A is

Solution.



Kinematics equations of motions:

$$OX: L = Vt$$

$$OY: h = \frac{gt^2}{2}$$

Where t is the time between bullet's hits with papers. So from the second equation:

$$t = \sqrt{\frac{2h}{g}}$$

And:

$$V = \frac{L}{t} = L\sqrt{\frac{g}{2h}}$$

Numerically:

$$V = 100m \cdot \sqrt{\frac{9.8\frac{m}{s^2}}{2 \cdot 0.1m}} = 700\frac{m}{s}$$

Answer: 700 m/s

Attachment:

Let's speak about vertical projection of bullet's speed.

Initially it was equal to 0 (point P), in the point Q it equal to:

$$V_{yQ} = V_{yP} - gt = 0 - gt = -\boldsymbol{gt}$$

Where t is the time between bullet's hits with papers.

This vertical component is responsible for vertical displacement – value h on the picture. Let's obtain this value:

$$h_y = -h = \int_0^t V_y(t)dt = -\int_0^t gt \cdot dt = -\frac{gt^2}{2}$$

So

$$h = \frac{gt^2}{2}$$

We've just obtained the relation that initially was used to solve this problem.

In union with kinematic equation in projection on X axis its enough to obtain the answer.