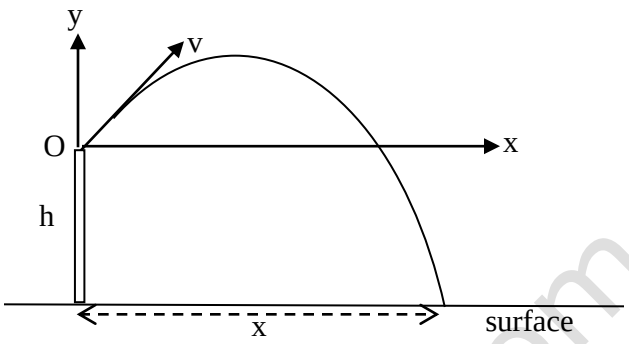
Q- A shall is fired from a hill of height 'h' at an angle of 45^0. What is the magnitude of its velocity of projection v as a function of its horizontal distance x covered on ground, acceleration due to gravity g and height h?



The height of the hill is h and let the velocity of a rock is v. If g is the acceleration due to gravity than the horizontal distance x covered from the point of projection is given by using the equation of trajectory of the projectile as

$$[\, y = x\tan\theta - \frac{gx^2}{2v^2\cos^2\theta}\ ]$$

Here taking point of projection as the origin we get

$$-h = x\tan 45^0 - \frac{gx^2}{2v^2\cos^2 45^0}$$

Or $$-h = x - \frac{gx^2}{v^2}$$ [$\tan 45^0 = 1$: $\cos 45^0 = 1/\sqrt{2}$]

Or $$\frac{gx^2}{v^2} = h + x$$

Or $$v^2 = \frac{gx^2}{h+x}$$

Gives $$v = \sqrt{\frac{gx^2}{h+x}}$$