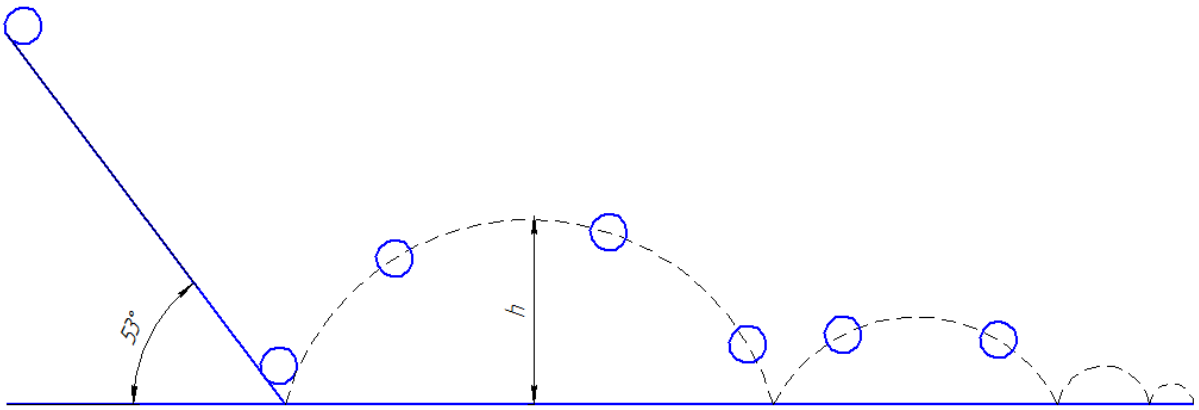
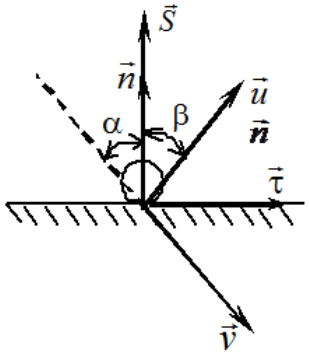
**Task:**

A ball is released from rest at a height of 10m on an inclined plane of inclination 53 degrees. If coefficient of restitution for collision is 3/4 .
Then its total time of motion is approximately…
a) 3.5 sec b) 8.6 sec c) 12.8 sec d) 22 sec
what is the exact process of doing this question???

**Solution:**




$$mu_n - mv_n = S$$

$$mu_\tau - mv_\tau = 0$$

$$k = \frac{|u_n|}{|v_n|}$$

$$k = \frac{\operatorname{tg}\alpha}{\operatorname{tg}\beta}$$

$$u_n = u\cos\beta$$
$$u_\tau = u\sin\beta$$
$$v_n = -v\cos\alpha$$
$$v_\tau = v\sin\alpha$$

$$u = v\sqrt{\sin^2\alpha + k^2\cos^2\alpha}$$

$$S = m(k+1)v\cos\alpha$$

$k = \frac{3}{4}$

$\alpha = 90° - 53° = 37°$

$tg\beta = \frac{tg37°}{\frac{3}{4}}, \beta = \arctan\frac{tg37°}{\frac{3}{4}} = 45.1354°$

$10\,m = \frac{g \cdot {t_{inc}}^2}{2}$

$$t_{inc} = \sqrt{\frac{2 \cdot 10m}{g}} = 1.4278\ s$$

$$10\ m = \frac{{v_n}^2}{2g}$$

$$v_n = \sqrt{2 \cdot g \cdot 10m} = 14.0071 \frac{m}{s}$$

$$h = \frac{{u_n}^2}{2g} = u_n \cdot \frac{t}{2} - g \cdot \frac{\left(\frac{t}{2}\right)^2}{2}$$

$$\frac{{u_n}^2}{g} = u_n \cdot t - g \cdot \left(\frac{t}{2}\right)^2$$

$$t = \frac{2 \cdot u_n}{g} - the\ time\ of\ flying\ up\ and\ down$$

$$t_{total} = t_{inc} + \sum_{i=1}^{\infty} \frac{2 \cdot u_{n_i}}{g} = t_{inc} + \frac{2}{g} \sum_{i=1}^{\infty} u_{n_i}$$

$$u_{n_i} = k \cdot u_{n_{i-1}}$$

$$u_{n_i} = u_{n_1} \cdot k^{i-1} = v_n \cdot k^{i-1}$$

$$t_{total} = t_{inc} + \frac{2}{g} \sum_{i=1}^{\infty} v_n \cdot k^{i-1} = t_{inc} + \frac{2}{g} \cdot \frac{v_n}{1-k} = 1.4278\ s + \frac{2}{9.81 \frac{m}{s^2}} \cdot \frac{14.0071 \frac{m}{s}}{1 - \frac{3}{4}} = 12.8\ s$$

**Answer:**

$$t_{total} = 12.8\ s$$