Q 4 Two particles are projected from the same point with the same speed u such that they have the same range R, but different maximum heights, h_1 and h_2. Which of the following is correct ? **[Main 12 April 2019 (II)]**

(a) $R^2 = 4 h_1 h_2$ (b) $R^2 = 16 h_1 h_2$

(c) $R^2 = 2 h_1 h_2$ (d) $R^2 = h_1 h_2$

ans

(b) For same range, the angle of projections are : θ and $90° - \theta$. So,

$$h_1 = \frac{u^2 \sin^2\theta}{2g} \text{ and}$$

$$h_2 = \frac{u^2 \sin^2(90° - \theta)}{2g} = \frac{u^2 \cos^2\theta}{2g}$$

Also, $R = \dfrac{u^2 \sin 2\theta}{g}$

$$h_1 h_2 = \frac{u^2 \sin^2\theta}{2g} \times \frac{u^2 \cos^2\theta}{2g}$$

$$= \frac{u^2}{16} \frac{u^2 (2\sin\theta\cos\theta)^2}{g^2} = \frac{R^2}{16}$$

or $R^2 = 16 h_1 h_2$