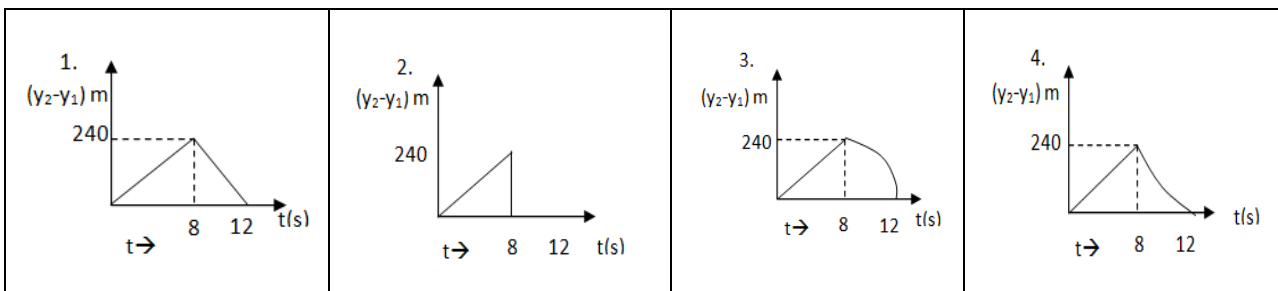
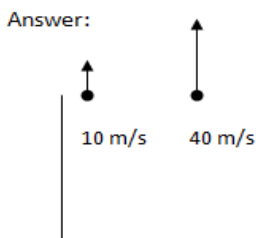




1. Two stones are thrown up simultaneously from the edge of a cliff 240 m high with initial speed of 10 m/s and 40 m/s respectively. Which of the following graph best represents the time variation of relative position of the second stone with respect to the first? (assume stones do not rebound after hitting the ground and neglect air resistance, take $g = 10 \text{ m/s}^2$) (The figures are schematic and not drawn to scale.)



Answer: Stone which is thrown with lesser speed will come to ground first, finding time after which stones will touch ground.
First stone thrown at 10 m/s



$$S = ut - \frac{1}{2}gt^2, u = 10,$$

$$S = -240, t = ?$$

$$-240 = 10t - \frac{1}{2} \times 10t^2$$

$$\text{or } 5t^2 - 10t - 240 = 0$$

$$\text{or } t^2 - 2t - 48 = 0$$

$$\text{or } t^2 - 8t + 6t - 48 = 0$$

$$\text{or } t(t - 8) + 6(t - 8) = 0$$

$$\text{or } t = 8, t \neq -6 \text{ (time can't be negative)}$$

For the 2nd stone thrown with speed 40 m/s

$$S = ut - \frac{1}{2}gt^2, u = 40,$$

$$\text{or } S = -240 = 40t - \frac{1}{2} \times 10t^2$$

$$\text{or } 5t^2 - 40t - 240 = 0$$

$$\text{or } t^2 - 8t - 48 = 0$$

$$\text{or } t^2 - 12t + 4t - 48 = 0$$

$$\text{or } t(t - 12) + 4(t - 12) = 0$$

$$\text{or } (t - 12)(t + 4) = 0$$

$$\text{or } t = 12 \text{ as } t \neq -4 \text{ only real value taken.}$$

Thus first stone touches after 8 seconds and 2nd stone touches after 12 seconds. Therefore upto 8 seconds relative velocity = 40-10 = 30m/s, and acceleration = 0 after 8 seconds till 12 seconds acceleration = g, hence relative velocity will increase from 8 to 12 second.

Answer is (C)