Two similar objects of mass, M, and radius, R, are launched from the edge of a cliff with initial speed, \( v_0 \), one vertically upward and the other vertically downward. If both ultimately fall to the valley floor H meters below, how many seconds, \( \Delta t \), is the object which was launched upward behind the other in hitting the valley floor? \( \Delta t = \)

a) \( \frac{gH}{v_0^2} \)  

b) \( \frac{H}{v_0} \)  

c) \( \frac{v_0}{g} \)  

d) \( \frac{2v_0}{g} \)  

e) None of the above
The correct delay time is \( d) \frac{2v_o}{g} \); as follows.

- The object launched upward arrives at its maximum height at the time, \( t^{\text{MAX}} \), when

- its vertical velocity falls to zero:

- Thus \( v = 0 = v_o - g \ t^{\text{MAX}} \)

  implies \( t^{\text{MAX}} = \frac{v_o}{g} \).

- Subsequently, it falls back to its launch height, arriving there at \( 2 \ t^{\text{MAX}} = 2 \ \frac{v_o}{g} \),

- but now with a downward velocity, \( v_o \).

- Thence it follows the same trajectory of the downward launched particle, but delayed by \( \Delta t = 2 \ \frac{v_o}{g} \).