

A projectile is fired horizontally from the edge of a cliff at a speed of  $12 \text{ m s}^{-1}$  and hits the sea 60m away.

find a) the time of flight.

b) the height of the starting point above sea level.

a). horizontal.

$$d = 60 \text{ m}$$

$$v = 12 \text{ m s}^{-1}$$

$$d = v \times t$$

$$\rightarrow t = \frac{d}{v} = \frac{60}{12}$$

$$\underline{t = 5 \text{ s}}$$

In a projectile problem, always treat the vertical and horizontal motion separately.

b). from part (a),  $t = 5 \text{ s}$

vertical motion

$$u = 0 \text{ m s}^{-1}$$

$$v = ?$$

$$a = -9.8 \text{ m s}^{-2}$$

$$t = 5 \text{ s}$$

$$s = ?$$

use this to select an equation for vertical motion

$$v^x = u^x + a^x t^x \quad \underline{\text{no } s}$$

$$s^x = u^x t^x + \frac{1}{2} a^x t^{x2} \quad \underline{\text{yes}}$$

$$v_x^2 = u_x^2 + 2a_x s_x \quad \underline{\text{no } v}$$

Use  $s = ut + \frac{1}{2} at^2$

$$s = (0 \times t) + \left(\frac{1}{2} \times (-9.8) \times 5^2\right)$$

$$s = \underline{-122.5\text{m}}$$

the minus tells us  
the stone fell this  
distance.

The starting height is 123m above the  
sea.  
sig figs