Answer on Question 49942, Physics, Mechanics | Kinematics | Dynamics

Question:

A pebble thrown from the top of α cliff at a speed of 10 m/s and at 30° above the horizontal. It hits the sea below the cliff 6s later. Find,
1) The height of the cliff
2) The distance from the base of the cliff at which the pebble falls into the sea.

Solution:

1) Let us write the projections of the initial speed of the pebble on axis x and y:

$$v_{0x} = v_0 \cos 30^\circ = 10\frac{m}{s} \cdot 0.866 = 8.66\frac{m}{s},$$
$$v_{0y} = v_0 \sin 30^\circ = 10\frac{m}{s} \cdot 0.5 = 5\frac{m}{s}.$$

Let us obtain the height of the cliff (we choose the axis y upward from the base of the cliff):

$$y = h = v_{0y}t - \frac{1}{2}gt^2 = 5\frac{m}{s} \cdot 6s - 0.5 \cdot 9.8\frac{m}{s^2} \cdot (6s)^2 = -146.4\frac{m}{s}.$$

Because we taken the positive axis y upward we obtain the height of the cliff with sign minus. So, the correct answer is $h = 146.4m.$

2) Let us obtain the distance from the base of the cliff at which the pebble falls into the sea:

$$x = v_{0x}t = 8.66\frac{m}{s} \cdot 6s = 52m.$$

Answer:

1) $h = 146.4m.$

2) $x = 52m.$