

**Answer on Question #74038 Physics / Molecular Physics | Thermodynamics**

An arrow is shot straight up from a pit 12 m below ground at 38 m/s. a) Find its max height above ground b) At what times is it at ground level.

**Solution:**

The equation of motion of arrow is given by

$$y(t) = y_0 + v_0 t - \frac{gt^2}{2}$$

$$v(t) = v_0 - gt$$

In our case

$$y(t) = -12 + 38t - 4.9t^2$$

$$v(t) = 38 - 9.8t$$

At the maximum height point  $v(t) = 0$ . So time needed to reach maximum height

$$t = \frac{38}{9.8} = 3.87 \text{ s}$$

The maximum height

$$h_{max} = y(3.87) = -12 + 38 \times 3.87 - 4.9 \times 3.87^2 = 63 \text{ m}$$

An arrow will be at ground level when  $y(t) = 0$ . So

$$0 = -12 + 38t - 4.9t^2$$

Roots

$$t = 0.33 \text{ s and } t = 7.59 \text{ s}$$

**Answers:**

- A) 63 m
- B) 0.33 s and 7.59 s

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