Answer on Question#37461, Physics, Other

Question:

A fountain sends a stream of water straight up into the air to a maximum height of 4.87 m. The effective area of the pipe feeding the fountain is 5.71 x 10-4 m2. Neglecting air resistance and any viscous effects, determine how many gallons per minute are being used by the fountain. (1 gal = 3.79 x 10-3 m3)

Answer:

The law of conservation of energy:

$$T + U = const$$

where $T = \frac{mv^2}{2}$ - kinetic energy of water, m - mass, v - speed

$U = mgh$ - potential energy of water, h is maximum height

$$0 + mgh = \frac{m{v_0}^2}{2} + 0$$

Therefore, initial velocity of water equals:

$$v_0 = \sqrt{2gh} = 9.77\frac{m}{s}$$

Volume of the water equals:

$$V = Av_0t$$

where A is effective area of the pipe, t – time.

Volume per 1 minute equals:

$$V = 9.77\frac{m}{s}5.71 * 10^{-4}\ m^2 * 60\ s = 0.335\ m^3$$

In gallons:

$$V = \frac{0.237}{3.79 * 10^{-3}} = 88.3\ gallons$$

Answer: $88.3\ gallons$