Answer on Question#37649, Physics, Other

Question:

A fountain sends a stream of water straight up into the air to a maximum height of 4.33 m. The effective area of the pipe feeding the fountain is 5.82 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:

$T + U = const$ - the law of conservation of energy;

T - kinetic energy of water,

U - potential energy of water,

$$T = \frac{mv^2}{2} \qquad U = mgh$$

h - maximum height,

m - mass, v – speed.

In our case: $0 + mgh = \frac{m{v_0}^2}{2} + 0$

Therefore, initial velocity of water equals: $v_0 = \sqrt{2gh} = 9.21\frac{m}{s}$

Volume of the water equals: $V = Av_0t$

A - effective area of the pipe, t – time.

Full volume per 1 minute equals: $V = 9.21\frac{m}{s}5.82 * 10^{-4}\ m^2 * 60\ s = 0.322\ m^3$

Full volume in gallons: $V = \frac{0.322}{3.79*10^{-3}} = 85\ gallons$

Answer: $85\ gallons$