Answer on Question #50804-Physics-Mechanics-Kinematics-Dynamics

If a $H = 3\ m$ deep well is half filled with water, then how much time needed to raise $m = 2\ kg$ water with a $P = 10\ kW$ pump whose efficiency is $\eta = 70\%$?

Solution

To up the mass $dm = \rho A dh$ of water from the depth h, where A is area, we need energy

$$dE = dmgh = \rho A dhgh = (\rho g A)hdh.$$

To fulfill the well we need

$$E = \int_0^H (\rho g A)hdh = (\rho g A)\frac{h^2}{2}\Big|_0^H = (\rho g A)\frac{H^2}{2} = \frac{mgH}{2}.$$

The efficient power is

$$\eta P = \frac{E}{t}.$$

Thus

$$t = \frac{E}{\eta P} = \frac{mgH}{2\eta P} = \frac{2 \cdot 9.8 \cdot 3}{2 \cdot 0.7 \cdot 10000} = 4.2\ ms.$$

Answer: $4.2\ ms$.

http://www.AssignmentExpert.com/