

Answer on Question #50816-Physics-Mechanics-Kinematics-Dynamics

A) Why to empty h meter deep fulfilled well, the height is used $h/2$?

B) Why to raise water from a h meter deep fulfilled well, the height is used h ?

C) Why to empty the half of a fulfilled well which is h meter deep, the height is used $h/4$?

D) why to raise water from a h meter deep well which has water level at $h/4$, the height is used $3h/4$?

What is the main concept?

Solution

The main concept

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

$$dE = dmgh = \rho Adhgh = (\rho gA)h dh.$$

If we want to raise the mass from level 1 to level 2, we need energy

$$E_2 - E_1 = mg(h_2 - h_1).$$

To empty the part of a fulfilled well we should use integration:

$$E = \int_{h_1}^{h_2} (\rho gA)h dh.$$

A) To fulfill the well we need

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

The volume is $V = AH$.

B) If we want to raise the mass m of water from the depth h we need energy

$$E = mg(h - 0).$$

C) To empty the half of a fulfilled well which is h meter deep, we need energy

$$E = \int_0^{\frac{H}{2}} (\rho gA)h dh = (\rho gA) \frac{h^2}{2} \Big|_0^{\frac{H}{2}} = (\rho gA) \frac{\left(\frac{H}{2}\right)^2}{2} = \frac{mgH}{4}.$$

The volume is $V = A \frac{H}{2}$.

D) To raise water from a h meter deep well which has water level at $\frac{H}{4}$, we need energy

$$E = mg \left(H - \frac{H}{4} \right) = mg \cdot \frac{3}{4}H.$$