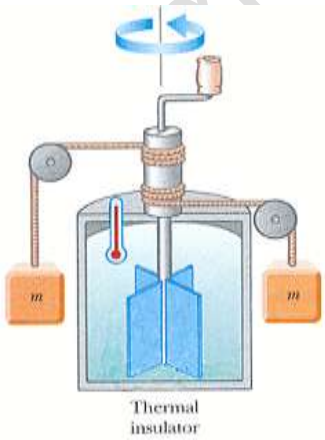
Q- Work is done on the water by a rotating paddle wheel, which is driven by two blocks falling at a constant speed. The temperature of the stirred water increases due to friction between the water and the paddles. If the energy lost in the bearings and through the walls is neglected, then the loss in potential energy associated with the blocks equals the work done by the paddle wheel on the water. If each block has a mass of 1.75 kg and the insulated tank is filled with 200 g of water, what is the increase in temperature of the water after the blocks fall through a distance of 3.25 m?
As the blocks are moving with constant speed their kinetic energy does not changes, hence the loss in their gravitational potential energy will be converted to thermal energy of water.



Loss in potential energy of the blocks

$U = 2*mg*h = 2*1.75*9.8*3.25$ m

$= 111.475$ J

If the temperature of water is increased by Δt^0C, the gain in thermal energy of water

$Q = m' c \Delta t$

Where c is the specific heat of water

Or $Q = (0.2 \text{ kg})*(4.186*10^3 \text{ J/kg/}^o\text{C})* \Delta t = 837.2*\Delta t$ J

As the other loss of energy is negligible we can write

Gain in thermal energy = loss in potential energy

Or $837.2*\Delta t = 111.475$

Gives $\Delta t = 111.475/837.2 = 0.133^0$C

Hence increase in temperature of water will be 0.133^0C.