

A cylinder with a frictionless piston contains 0.200 kg of water at 100 degrees Celsius. What is the change in internal energy of water when it is converted to steam at 100 degrees Celsius at constant pressure of 1 atm. The density of steam = 0.600 kg/m³, the density of water = 1.00×10³ kg/m³, and the heat of vaporization for water is 2256 kJ/kg.

$$\begin{aligned}
 \Delta E_{int} &= Q - W \\
 &= mL_v - P(V_f - V_i) \\
 &= mL_v - P\left(\frac{m}{\rho_s} - \frac{m}{\rho_w}\right) \\
 &= m\left[L_v - P\left(\frac{1}{\rho_s} - \frac{1}{\rho_w}\right)\right] \\
 &= 0.200\left[2256 \times 10^3 - 1.01 \times 10^5 \left(\frac{1}{0.600} - \frac{1}{1.00 \times 10^3}\right)\right] \\
 &= 418 \text{ kJ}
 \end{aligned}$$

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Solutions of the quizzes can be found on the webpage: http://faculty.kfupm.edu.sa/phys/aljalal/phys102.htm														
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