Question 27238

The density of wood is $\rho = 2\frac{g}{ml} = 2000\frac{kg}{m^3}$.

Usual weight is given by $P = m\,g = \rho\,g\,V$.

In case if body is immersed into fluid or gas, buoyancy force acts on this body vertically up. The value of this force is $F_b = \rho_{fluid}\,g\,V$, where ρ_{fluid} is the density of fluid, $g = 9.81\frac{m}{s^2}$ is the gravitational constant and V is the volume of immersed part of the body. For water, $\rho_{water} = 1000\frac{kg}{m^3}$.

The weight in water is the difference of weight $P = m\,g$ and buoyancy force:

$$P' = P - \rho_{water}\,g\,V = 9.81\mathrm{m}/s^2 \cdot (0.1 \cdot 0.1 \cdot 0.2)\,m^3 \cdot 2000\frac{kg}{m^3} - 1000\frac{kg}{m^3} \cdot 9.81\frac{m}{s^2} \cdot (0.1 \cdot 0.1 \cdot 0.2)\,m^3 = 19.62\,N$$

Hence, the weight of box in the water is $P' = 19.62\,N$.