Answer on Question #72827, Physics / Molecular Physics | Thermodynamics

An electric kettle or negligible heat capacity is rated at 3500 watts if 4kg of water is put into it now how long does it take the temperature of a water to rise from 30 degree celcius to 120 degree celcius . Specific heat capacity of water =4200kg-1 k-1

Solution

P = $\frac{Q}{t}$, where P – power of heater, Q – heating energy.

Q = Cm(T_2-T_1) – where C – water specific heat capacity (4200 J/kg×K)

t = $\frac{Q}{P} = \frac{Cm(\mathrm{T2}-\mathrm{T1})}{P}$;

t = $\frac{4200\times4\times(120-30)}{3500}$ = **432 (s)**

Perhaps there is a mistake in a problem, because any electric kettle is not able to heat any amount of water to 120°C under pressure of 1 atm. It's impossible because water starts to evaporate. Then it turns into steam and steam leaves the kettle, otherwise the kettle will explode. Kettle cannot heat steam from 100°C to 120°C. The maximum temperature is the boiling point of water: 100°C.

t = $\frac{Q}{P} = \frac{Cm(\mathrm{T2}-\mathrm{T1})}{P}$;

t = $\frac{4200\times4\times(100-30)}{3500}$ = **336 (s)**

Answer

432 (s) – time that kettle needs to raise the temperature of 4.0 kg of water from 30°C to 120°C. (that is completely impossible).

336 (s) – time that kettle needs to raise the temperature of 4.0 kg of water from 30°C to 100°C.