A curved metal mirror with a surface area of 1.2 metre square focuses the heat energy from the sun on to a small tank containing water. Assuming that the average amount of energy received from the sun at the mirror, per square metre, is 550J, calculate the minimum time needed to increase the temperature of 5 Kg of water from 20 degrees celcius to 100 degrees celcius, given that the energy needed to increase the tempertature of 1 Kg of water by 1 degree celcius is 4200J.

Solution:

Let:

$S = 1.2\ m^2$

$m = 5\ kg$

$T_0 = 20℃$

$T = 100℃$

$c = 4200\ J\ kg/degree$

$U = 550\ J/m^2 sec$

$t-?$

$c * m * (T - T_0) = U * S * t$

$$\boldsymbol{t = \frac{cm(T-T_0)}{US} = \frac{4200*5*80}{550*1.2} = 2545.46\ sec \approx 42\ min\ 43\ sec}$$