State Examination Commission – Physics Higher Level, 2006

Question 12c

Define (i) power, (ii) specific heat capacity. (9)
400 g of water at a temperature of 15 ºC is placed in an electric kettle. The power rating of the kettle is 3.0 kW. Calculate
(i) the energy required to raise the temperature of the water to 100 ºC;
(ii) the energy supplied by the kettle per second;
(iii) the least amount of time it would take to heat the water to 100 ºC. (15)
In reality, the time taken to heat the water will be greater. Explain why. (4)
(specific heat capacity of water = 4200 J kg^{-1} K^{-1})

Define (i) power, (ii) specific heat capacity.

Basic definitions

(9)

400 g of water at a temperature of 15 ºC is placed in an electric kettle. The power rating of the kettle is 3.0 kW. Calculate
(i) the energy required to raise the temperature of the water to 100 ºC;

$E = mc\Delta\theta$
$= 0.4 \times 4200 \times 85$
$= 1.43 \times 10^5$ J

(ii) the energy supplied by the kettle per second;

P = 3000 W => 3000 joules supplied per second

(iii) the least amount of time it would take to heat the water to 100 ºC. (15)

P = Work done/time taken
= energy supplied/time taken
time taken = energy supplied/Power
$= 1.43 \times 10^5 / 3000$
$= 48$ s

In reality, the time taken to heat the water will be greater. Explain why. (4)

Heat will be lost to the environment