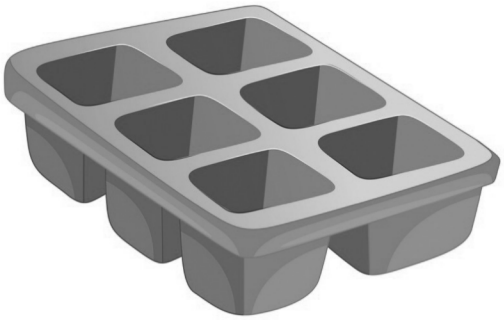
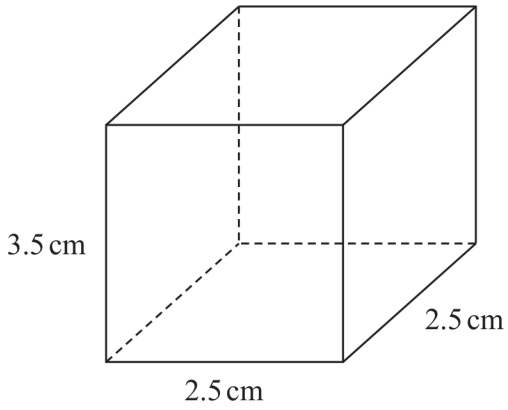
14 Ice cubes can be made in an ice cube tray. One type of ice cube tray is shown.



(Source: © GraphicsRF.com/Shutterstock)

Each compartment in the ice cube tray has dimensions 2.5 cm by 2.5 cm by 3.5 cm, as shown.



(a) Show that the mass of water needed to fill one compartment is about 0.02 kg.

density of water = $1.00 \times 10^3\,\text{kg}\,\text{m}^{-3}$

(3)

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(b) All 6 compartments in the ice cube tray are filled with water to a depth of 3.5 cm. The ice cube tray is placed in a freezer.

The initial temperature of the water is 22.5 °C.

It takes 12 minutes for all the water to become ice at 0 °C.

The manufacturer of the freezer states that the freezer can transfer energy at a rate of 110 W.

Evaluate whether energy is transferred from the water in the tray at a rate of 110 W.

specific heat capacity of water = 4180 $J kg^{-1} K^{-1}$
specific latent heat of fusion of water = 3.34×10^5 $J kg^{-1}$

(4)

(Total for Question 14 = 7 marks)