Answer to Question #67681, Physics / Molecular Physics | Thermodynamics

Question: 100g of 0°C ice mixed with 300g of 25°C water. Find temperature of mixture?

The options are:

a) -5/3°C

b) -5/2°C

c) -5°C

d) 0°C

The correct answer is 0°C while I got answer -5/4°C by using heat gained = heat lost formula. Please help!!!!

Solution: First of all, if the correct answer is provided among the choices available, one can either "guess" it or calculate the correct answer directly.

Lets first consider the "guessing" procedure. The system consist of ice, at 0°C and hot (25°C) water. The ice will melt, the water will cool down, but it will not be able to cool below 0°C, because there are no parts colder then 0°C in the system. As a result a), b) and c) does not fit, and the obvious answer is d)

Now lets calculate the final state directly. For this we will need to know the heat of fusion of ice

$$\lambda = 334 * 10^3 \, J/kg$$

And the specific heat of water

$$c = 4186 \, J/(kg * K)$$

To calculate the mass of ice that is going to melt write the following

$$cm_{water}(T - 0°) = \lambda m_{ice \, that \, melted}$$

$$m_{ice \, that \, melted} = \frac{cm_{water}(T - 0°)}{\lambda} = \frac{(4186 * 0.3 * 25)}{334000} = 0.094 \, kg < 0.1 \, kg$$

So all the ice did not melt, but the water is already cooled to 0°C. the rest of the ice is also at 0°C.

The final temperature is 0°C.