Challenge Problem ⑧

How many grams of ice at 0.0 °C would you have to add
to 250.0 mL of water at 75.0 °C to cool it to 12.0 °C?

M.P. = 0.00 °C   B.P. 100.0 °C ΔH_{vap} = 40.7 KJ/mol ΔH_{fus} = 6.01 KJ/mol

C_{solid} = 2.06 J/g °C C_{liquid} = 4.18 J/g °C C_{gas} = 2.00 J/g °C

1st – solve for heat needed to cool H_2O (g=mcΔT)

2nd – solve for g of ice (ΔH)

① q = mCΔT

$250.0 mL \left(\dfrac{1 g H_2O}{1 mL H_2O} \right) = 250.0 g H_2O$

ΔT = 12.0°C – 75.0°C = -63

$q = (250.0g)\left(4.18 \dfrac{J}{g°C}\right)(-63°C)$

$q = -65835 J$

$= -65.8 KJ$

(heat absorbed by H_2O
so q = -)

② heat given by ice so ice q = +

$+65.8 KJ \left(\dfrac{1 mol H_2O}{6.01 KJ} \right)\left(\dfrac{18.0 g}{1 mol H_2O} \right) = 197.07 g$ ice