**Final Answer**

A) = 1067 kJ
B) = 10.64 g
C) = 91.85 °C

**Problem Statement**

A) Calculate water at 100 °C
B) Calculate water loss
C) Calculate equilibrium temperature.
D) Calculate ice needed to chill drink.
E) Calculate volume of ice to the end.

**Represent the Problem and Organize Information**

3 Liters of water starting at 15°C

assume water coefficients.

boiling point: 100°C

freezing point: 0°C

F to C Conversion: $\frac{9}{5}$°C + 32 ; $\frac{5}{9}(F-32)$

temp change conversion

1° temp change in C = 1 K in change

Change in 1.8°F in a change in C

Specific heat of water.

= 1.0 cal/g°C

or 4186...

Formulas:

$Q = mc\Delta T$

$Q = mL$

$\Delta L = \alpha L_0 \Delta T$

$0 = \alpha E \Delta T$

$\Delta V = \beta V_0 \Delta T$

**Calculations**

A) $Q = mC\Delta T$

$Q = (3\text{Liters})(4186)(100-15) = 1067130$ J/kg

B) 1067 kJ + 720 kJ = 1787 kJ @ 100°C

Latent heat Vaporization

$L_f = L_v = 540$ cal/g or 339 kJ/kg

720 kJ / 4.184 = 172001 calories convert

$\frac{Q}{L_v} = \frac{172001}{540} = 318.5$

% of to boil away

$\frac{m_2}{m} \times 100 = \frac{318.5\,g}{3000\,g} = 0.106 \times 100$

= 10.6%

C) equilibrium Calculations.

mass of boiling water = 3 Liters − 10.6 water loss

= 3000g − (3000·10.6%) = 2682 g = 2.682 L

2.682 L @ 100° + 0.3 kg ice at 11°C

equilibrium = convert 0.3 kg to liters = 0.3 Liters

$Q = (2.682 \cdot 4186 \cdot 100) = (0.3 \cdot 4186 \cdot M) = T(C° + 273)$

$= (2.682 - (373 - T)) = (0.3 - (T - 292))$

$= 1000.836 - 2.682T + 0.3T - 87.6$

$= 2.982T = 1087.986$

$= T = 364.85$ Kelvin

$-273$ K

= 91.85°C

D) $Q_{ice\ from\ -11°C\ -0°C} = (0.5)(11)\,mass_{ice}$

$Q_{melt} = M_{ice}(79.6)$

$Q_{ice\ of\ 0°-4°} = m_{ice}(1)(4)$

$Q_{ice\ of\ 91.85-4°C} = m_{ice}(1)(4)$

mass of water = 3000g · 10.64%

= 2681 g @ 100°C

300 g @

91.85 + $m_{ice}$ = 4°C

$m_{ice}$ @ −11°C

91.85°C + $m_{ice}(-11)$ = 4°C

$Q_{warm\ ice} \rightarrow Q_{melt\ ice}$

$\rightarrow Q_{equilibrium} \rightarrow Q_{final}$

91.85°C 4°C

$Q_{wi} = \text{mass}_{ice} \cdot (.5)(0-(-11))$

$(m_{ice} \cdot 0.5 \cdot 11) = Q_{wi}$

$Q_{ice\ melt} = \text{ice mass} \cdot (1)(79.6)$

$Q_{final} = \text{ice mass} \cdot (1)(4)$

$Q = \text{ice mass}\,(89.1)$

$Q = mc\Delta T$

985837610.1 / 89.1

= 11064395.74

**Evaluate**

- [x] My units are consistent and cancel through the calculations.
- [x] My equations are appropriate for the physical system being evaluated and are written in variable form.
- [x] My answer is reasonable given the magnitude of the values in the problem.
- [x] My final solution answers the problem statement.
- [x] My final solution is in the appropriate form (vector or scalar) and has appropriate units

**Final Answer**

D = 2.934 g

E = 5.920 L

**Problem Statement**

D) Calculate ice in grams

E) Calculate final volume

**Represent the Problem and Organize Information**

3 liters of water @ 15°C

Q = 1067 Kj

% of water boiled 10.64%

equilibrium temperature: 91.85°C

**Calculations**

D) $Q = m_{ice}(89.1)$ (+ added)

$(11°C \cdot .5) + 5.5$

$5.5° + 4° + 79.6° = 89.1$

$m_{ice} = \frac{261793}{89.1} = \boxed{2938 \text{ grams}}$

Calculate Q

$Q = mc\Delta T$

$Q = 1067 kj + 720 Kj = 1787$

$3000 g \cdot .1064$ (10.64% ↓)

$= 3000 - 319.2$

$= 2680.8$

+300g of water added

$= 2980.8$ mass

$-(2980 \cdot (1 g/cal) \cdot (4°C - 91.15))$ (equilibrium temp.)

$= +261793$

E) $2980 + 2938 = 5918 g$

$= 5918 g \cdot \frac{1}{1000} \cdot \frac{1}{1000} = 0.005918 m^3$

or $\boxed{5.920 L}$

**Evaluate**

___ My units are consistent and cancel through the calculations.

___ My equations are appropriate for the physical system being evaluated and are written in variable form.

___ My answer is reasonable given the magnitude of the values in the problem.

___ My final solution answers the problem statement.

___ My final solution is in the appropriate form (vector or scalar) and has appropriate units