

Physics 10154 - Quiz 12A

120 grams of steam at a temperature of 145 °C is inside a 1.4 kg Aluminum container that is also holding 242 grams of water. The Aluminum container and 242 grams of water are initially at a temperature of 18°C.

The specific heat of aluminum is 900 J/kg-C.

The specific heat of steam is 2010 J/kg-C.

The specific heat of water is 4186 J/kg-C.

The latent heat of vaporization for water is 2.26×10^6 J/kg.

Does all of the steam condense?

If yes, what is the final temperature of the system?

If no, how much steam condenses?

Condense all steam:

$$\Delta Q_s = (.120)(2010)(-45) - (.120)(2.26 \times 10^6)$$

$$= -282,054 \text{ J} \quad \leftarrow \text{larger, so not}$$

Heat Alum & water to 100°C:

all steam
condenses.

$$\Delta Q_{A+W} = (1.4)(900)(82) + (.242)(4186)(82)$$

$$= +186387 \text{ J}$$

$$\Delta Q_s + \Delta Q_{A+W} = 0$$

$$= (.120)(2010)(-45) + m_s(2.26 \times 10^6) + 186387 = 0$$

$$m_s = \frac{175533}{2.26 \times 10^6} = .078 \text{ kg} \quad \text{or} \quad \boxed{78 \text{ g}}$$