3 A sealed steel canister is being used to store neon gas (atomic mass = 20.2 u). The mass of the steel canister alone is 12.0 kg, and it has an interior volume of 8.0 litres (8.0×10^{-3} m^3). There are 4.50 moles of neon gas in the canister, and the temperature of the entire system is 300 K.

Reference information:

Specific heat capacity of steel $c_s = 448 \text{ J kg}^{-1} \text{ K}^{-1}$

Molar heat capacity of neon = C_n = 12.5 J mol^{-1} K^{-1}

Specific heat capacity of water $c_w = 4186 \text{ J kg}^{-1} \text{ K}^{-1}$

Specific latent heat of fusion of water l_f = 3.33×10^5 J kg^{-1}

Density of water ρ_w = 1.00×10^3 kg m^{-3}

Density of ice ρ_i = 917 kg m^{-3}

(a) Determine the pressure within the canister.

Pressure = ………………… N m^{-2} [3]

The sealed canister is now placed in a large tank containing a mixture of ice and water at 273 K. You may neglect any change in the volume of the canister.

(b) Determine the pressure of the neon gas after the cylinder and its contents have reached thermal equilibrium with the ice-water mixture.

P = ………………… N m^{-2} [3]

(c) Determine the mass of ice that melts during the equilibration of the canister. Explain clearly how you arrived at your answer.

M = ……………… kg [4]