Problem 1
A 1-m³ tank containing air at 10°C and 350 kPa is connected through a valve to another tank containing 3 kg of air at 35°C and 200 kPa. Now the valve is opened, and the entire system is allowed to reach thermal equilibrium with the surroundings, which are at 20°C. The air in the tanks is modeled as an ideal gas.

1- Determine the volume of the second tank
[solution: \( V = 1.33 \text{ m}^3 \)]

2- Calculate the final equilibrium pressure of air
[solution: \( P = 264 \text{ kPa} \)]

Problem 2
A spherical balloon with a diameter \( D = 9 \text{ m} \) is filled with helium at \( T = 27°C \) and \( P = 200 \text{ kPa} \).

1- Determine the mole number and the mass of the helium in the balloon
[solution: \( N = 30.6 \text{ kmol} \)]

2- Using Excel or Matlab, plot the mass of helium contained in the balloon as a function of the balloon diameter for the pressures \( P_1 = 100 \text{ kPa} \) and \( P_2 = 200 \text{ kPa} \). Let the diameter vary from 5 m to 15 m.

Problem 3
Saturated water vapor at 350°C is heated at constant pressure until its volume has doubled. Determine the final temperature using:

1- the ideal gas equation of state
2- the compressibility charts
3- the steam tables