Liquid Air

A mixture of oxygen and nitrogen gas is stored in a closed container equipped with a piston on one end at a temperature of $T = 77.4$ K. The total amount of the gas mixture is 1.1 mole and its initial pressure is 0.5 atm. With the help of the piston the gas mixture is slowly compressed at constant temperature.

Using plausible assumptions, plot the pressure of the system as a function of its volume until one tenth of the initial volume, if the ratio of the number of moles of oxygen to the number of moles of nitrogen is

a) $\dfrac{n_{O_2}}{n_{N_2}} = \dfrac{1}{9}$.

b) $\dfrac{n_{O_2}}{n_{N_2}} = \dfrac{2}{9}$.

c) $\dfrac{n_{O_2}}{n_{N_2}} = \dfrac{1}{4}$.

Find the pressure and volume at distinctive points of these isothermal curves.

You can use the following data:

- Boiling point of liquid nitrogen at 1 atmosphere: 77.4 K
- Boiling point of liquid oxygen at 1 atmosphere: 90.2 K
- Heat of vaporization of oxygen: 213 J/g.