P.99

2.4.6 Relation between the pressure and the quantity of gas expressed in number of moles

49. *1. Calculation of* n_2*:*

$n_2 = 28\ \text{mol} + 7\ \text{mol} = 35\ \text{mol}$

2. Calculation of the pressure:

$$\frac{P_1}{n_1} = \frac{P_2}{n_2}$$

$$\frac{150\ \text{kPa}}{28\ \text{mol}} = \frac{P_2}{35\ \text{mol}}$$

$$P_2 = \frac{150\ \text{kPa} \cdot 35\ \cancel{\text{mol}}}{28\ \cancel{\text{mol}}} = 187.5\ \text{kPa}$$

Answer: The air pressure in the tire is 190 kPa.

50.

$$\frac{P_1}{n_1} = \frac{P_2}{n_2}$$

$$\frac{235\ \text{mm Hg}}{57\ \text{mol}} = \frac{100\ \text{mm Hg}}{n_2}$$

$$n_2 = \frac{57\ \text{mol} \cdot 100\ \cancel{\text{mm Hg}}}{235\ \cancel{\text{mm Hg}}} = 24.26\ \text{mol}$$

Answer: It would take 24 mol of gas.

51. Since the rubber ball is elastic, the volume can increase. If the volume increases, the pressure will not increase. In the propane tank, the volume is necessarily constant, so the pressure will increase.

52. *a)*

$$\frac{P_1}{n_1} = \frac{P_2}{n_2}$$

$$\frac{P_1}{1.75\ \text{mol}} = \frac{202\ \text{kPa}}{2.35\ \text{mol}}$$

$$P_1 = \frac{1.75\ \cancel{\text{mol}} \cdot 202\ \text{kPa}}{2.35\ \cancel{\text{mol}}} = 150\ \text{kPa}$$

b)

$$\frac{P_1}{n_1} = \frac{P_2}{n_2}$$

$$\frac{79.8\ \text{kPa}}{n_1} = \frac{145\ \text{kPa}}{6.72\ \text{mol}}$$

$$n_1 = \frac{79.8\ \cancel{\text{kPa}} \cdot 6.72\ \text{mol}}{145\ \cancel{\text{kPa}}} = 3.70\ \text{mol}$$

52. *c)*

$$\frac{P_1}{n_1} = \frac{P_2}{n_2}$$

$$\frac{100\ \text{kPa}}{0.003\,50\ \text{mol}} = \frac{P_2}{0.002\,50\ \text{mol}}$$

$$P_1 = \frac{100\ \text{kPa} \cdot 0.002\,50\ \cancel{\text{mol}}}{0.003\,50\ \cancel{\text{mol}}} = 71.4\ \text{kPa}$$

d)

$$\frac{P_1}{n_1} = \frac{P_2}{n_2}$$

$$\frac{300\ \text{kPa}}{25.8\ \text{mol}} = \frac{P_2}{13.6\ \text{mol}}$$

$$P_2 = \frac{300\ \text{kPa} \cdot 13.6\ \text{mol}}{25.8\ \text{mol}} = 158\ \text{kPa}$$

e)

$$\frac{P_1}{n_1} = \frac{P_2}{n_2}$$

$$\frac{85.3\ \text{kPa}}{200\ \text{mol}} = \frac{74.5\ \text{kPa}}{n_2}$$

$$n_2 = \frac{200\ \text{mol} \cdot 74.5\ \cancel{\text{kPa}}}{85.3\ \cancel{\text{kPa}}} = 175\ \text{mol}$$