Chemistry 20 – Lesson 31
Combined gas law

/45

1.

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

since P is constant

/3 $$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$V_2 = \frac{T_2V_1}{T_1} = \frac{0.10\text{L} \times 371\text{K}}{298\text{K}} = \boxed{0.12\text{L}}$$

2.

a.

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

since V is constant

/3 $$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

$$P_2 = \frac{P_1T_2}{T_1} = \frac{225\text{kPa} \times (273 + 45\,\text{K})}{(273 + 18\text{K})} = \boxed{246\,\text{kPa}}$$

b.

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

/3 $$V_2 = \frac{P_1T_2V_1}{P_2T_1} = \frac{225\text{kPa} \times 298\,\text{K} \times 27\,\text{L}}{100\text{kPa} \times (273 + 18\text{K})} = \boxed{62\,\text{L}}$$

3.

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

/3 assume that T is constant

$$P_1V_1 = P_2V_2$$

$$V_2 = \frac{P_1V_1}{P_2} = \frac{100\text{kPa} \times 600\text{mL}}{250\text{kPa}} = \boxed{240\,\text{mL}}$$

4.

/3 $$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$$V_2 = \frac{P_1T_2V_1}{P_2T_1} = \frac{100\text{kPa} \times 308\,\text{K} \times 5.00\,\text{L}}{90\text{kPa} \times 293\text{K}} = \boxed{5.8\,\text{L}}$$

5.

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

since V is constant

/3

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

$$T_2 = \frac{P_2T_1}{P_1} = \frac{250\text{kPa} \times 308\text{K}}{150\text{kPa}} = \boxed{513\text{K or } 240^\circ\text{C}}$$

6.

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

/3

$$T_2 = \frac{P_2V_2T_1}{P_1V_1} = \frac{35.0\text{atm} \times 23.0\text{mL} \times 313\text{K}}{1.00\text{atm} \times 500\text{mL}} = \boxed{504\text{K or } 231^\circ\text{C}}$$

7.

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

/3

$$V_2 = \frac{P_1T_2V_1}{P_2T_1} = \frac{800\text{kPa} \times 298\,\text{K} \times 1.0\,\text{L}}{100\text{kPa} \times 303\text{K}} = \boxed{7.9\,\text{L}}$$

8.

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

/3

$$V_2 = \frac{P_1T_2V_1}{P_2T_1} = \frac{101\text{kPa} \times 240\,\text{K} \times 10000\,\text{L}}{26.6\text{kPa} \times 280\text{K}} = \boxed{32\,546\,\text{L}}$$

9.

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

since V is constant

/3

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

$$P_2 = \frac{P_1T_2}{T_1} = \frac{101\text{kPa} \times 240\text{K}}{280\text{K}} = \boxed{86.6\,\text{kPa}}$$

10.

/2 **Changes in temperature, pressure, and volume do not change the mass of the gas. Therefore, $m_1 = m_2 = 60$ g.**

11.

/5 $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

$$V_2 = \frac{P_1T_2V_1}{P_2T_1} = \frac{101.3\text{kPa} \times 300\,\text{K} \times 20\,\text{L}}{202\text{kPa} \times 273\text{K}} = 11.02\,\text{L}$$

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

$$\text{density} = \frac{40\,\text{g}}{11.02\,\text{L}} = \boxed{3.63\,\text{g/L}}$$

12.

/2 $$v_{H_2} = 7.50\text{mol} \times \frac{24.8\,\text{L}}{1\,\text{mol}} = \boxed{186\,\text{L}}$$

13.

/2 $$n_{SO_2} = 50\,\text{mL} \times \frac{1\,\text{mol}}{24.8\,\text{L}} = \boxed{2.0\,\text{mmol}}$$

14.

/2 $$v_{Ne} = 2.25\text{mol} \times \frac{22.4\,\text{L}}{1\,\text{mol}} = \boxed{50.4\,\text{L}}$$

15.

/2 $$n_{O_2} = (0.20 \times 20.0\,\text{L}) \times \frac{1\,\text{mol}}{22.4\,\text{L}} = \boxed{0.18\,\text{mol}}$$