

Station 7A

Problem 2

Graham's Law: gases with smaller molar masses effuse faster, and gases with larger molar masses effuse slower.

N_2 : 28 g/mol ← faster

O_2 : 32 g/mol ← slower

BONUS:

$$\frac{\text{rate } N_2}{\text{rate } O_2} = \sqrt{\frac{MM_{O_2}}{MM_{N_2}}}$$

$$= \sqrt{\frac{32}{28}} = 1.07$$

N_2 will effuse at 1.07 times the rate of O_2

Station
7A

Problem 1

Dalton's Law: $P_{\text{total}} = P_1 + P_2 + P_3 \dots$

$$\begin{aligned} P_{\text{total}} &= 35 \text{ atm} + 5 \text{ atm} + 25 \text{ atm} \\ &= \boxed{65 \text{ atm}} \end{aligned}$$

Station 6A

Problem 2

$$V_1 = 28 \text{ L}$$

$$T_1 = 45^\circ\text{C} = 318 \text{ K}$$

$$P_1 = ?$$

$$V_2 = 34 \text{ L}$$

$$T_2 = 35^\circ\text{C} = 308 \text{ K}$$

$$P_2 = 2.0 \text{ atm}$$

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$P_1 = \frac{P_2 V_2 T_1}{T_2 V_1} = \frac{(2.0 \text{ atm})(34 \text{ L})(318 \text{ K})}{(308 \text{ K})(28 \text{ L})}$$

$$= \boxed{2.5 \text{ atm}}$$

Station 6A

Problem 1

$$P_1 = 12 \text{ atm}$$

$$V_1 = 23 \text{ L}$$

$$T_1 = 200. \text{ K}$$

$$P_2 = 14 \text{ atm}$$

$$T_2 = 300. \text{ K}$$

$$V_2 = ?$$

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$V_2 = \frac{P_1 V_1 T_2}{T_1 P_2}$$

$$= \frac{(12 \text{ atm})(23 \text{ L})(300. \text{ K})}{(200. \text{ K})(14 \text{ atm})}$$

$$= \boxed{30. \text{ L}}$$

Station SA

Problem 2

$$n = 17 \text{ mol}$$

$$T = 67^\circ\text{C} = 340. \text{K}$$

$$V = 88.89 \text{ L}$$

$$P = ? \text{ atm}$$

$$PV = nRT$$

$$P = \frac{nRT}{V} = \frac{(17 \text{ mol}) \left(\frac{0.0821 \text{ L}\cdot\text{atm}}{\text{mol}\cdot\text{K}} \right) (340. \text{K})}{88.89 \text{ L}}$$
$$= \boxed{5.3 \text{ atm}}$$

Station 5A

Problem 1

$$P = 1.2 \text{ atm}$$

$$V = 31 \text{ L}$$

$$T = 87^\circ\text{C} = 360. \text{ K}$$

$$n = ?$$

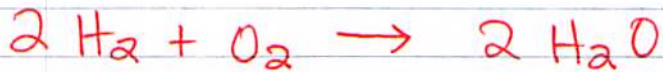
$$PV = nRT$$

$$n = \frac{PV}{RT} = \frac{(1.2 \text{ atm})(31 \text{ L})}{\left(\frac{0.0821 \text{ L}\cdot\text{atm}}{\text{mol}\cdot\text{K}}\right)(360. \text{ K})}$$

$$= \boxed{1.3 \text{ moles}}$$

Station 4A

Problem 2



$$\frac{55 \text{ g } \cancel{\text{O}_2}}{1} \times \frac{1 \text{ mol } \cancel{\text{O}_2}}{32.00 \text{ g } \cancel{\text{O}_2}} \times \frac{2 \text{ mol } \cancel{\text{H}_2\text{O}}}{1 \text{ mol } \cancel{\text{O}_2}} \times \frac{22.4 \text{ L } \cancel{\text{H}_2\text{O}}}{1 \text{ mol } \cancel{\text{H}_2\text{O}}}$$

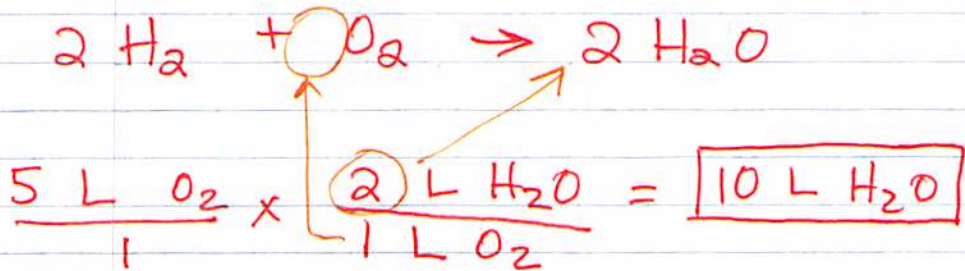
$$\boxed{77 \text{ L } \text{H}_2\text{O}}$$

↑
1 mol of
any gas at
STP has a
volume of
22.4 L

Station 4A

Problem 1

Since temperature and pressure are constant, we can use the mole-to-mole ratios from the B.C.E. to convert volumes.



Station 3A
Problem 2

$$V_1 = 5.00 \text{ L}$$

$$T_1 = 22.0^\circ\text{C} = 295 \text{ K}$$

$$P_1 = 745.0 \text{ mm Hg}$$

$$P_2 = ?$$

$$T_2 = 273 \text{ K}$$

$$V_2 = 5.00 \text{ L}$$

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

$$P_2 = \frac{P_1 T_2}{T_1} = \frac{(745.0 \text{ mm Hg})(273 \text{ K})}{295 \text{ K}}$$

$$= \boxed{689 \text{ mm Hg}}$$

Station 3A

Problem 1

$$V_1 = 10.0 \text{ L}$$

$$P_1 = 97.0 \text{ kPa}$$

$$T_1 = 25.0^\circ\text{C} = 298 \text{ K}$$

$$T_2 = ?$$

$$P_2 = 101 \text{ kPa (STP)}$$

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

$$T_2 = \frac{P_2 T_1}{P_1} = \frac{(101 \text{ kPa})(298 \text{ K})}{97.0 \text{ kPa}}$$

$$T_2 = 310. \text{ K} = \boxed{37^\circ\text{C}}$$

Problem 2

Station 2A

$$V_1 = 250. \text{ mL}$$

$$T_1 = 19^\circ \text{ C} = 292 \text{ K}$$

$$T_2 = 60^\circ \text{ C} = 333 \text{ K}$$

$$V_2 = ?$$

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

$$V_2 = \frac{V_1 T_2}{T_1} = \frac{(250. \text{ mL})(333 \text{ K})}{292 \text{ K}} = \boxed{285 \text{ mL}}$$

Station 1A
Problem 1

$$V_1 = 1.00 \text{ L}$$

$$P_1 = 1.00 \text{ atm (STP)}$$

$$V_2 = 473 \text{ mL} = 0.473 \text{ L}$$

$$P_2 = ?$$

$$P_1 V_1 = P_2 V_2$$

$$P_2 = \frac{P_1 V_1}{V_2} = \frac{(1.00 \text{ atm})(1.00 \text{ L})}{0.473 \text{ L}}$$

$$= \boxed{2.11 \text{ atm}}$$

Problem 2

Station 1A

$$V_1 = 2.00 \text{ L}$$

$$P_1 = 1.00 \text{ atm}$$

$$P_2 = 6.00 \times 10^4 \text{ atm}$$

$$V_2 = ?$$

$$P_1 V_1 = P_2 V_2$$

$$V_2 = \frac{P_1 V_1}{P_2} = \frac{(1.00 \text{ atm})(2.00 \text{ L})}{6.00 \times 10^4 \text{ atm}}$$

$$= \boxed{3.33 \times 10^{-5} \text{ L}}$$

Station 2A

Problem 1

$$T_1 = 22^\circ\text{C} = 295\text{ K}$$

$$V_1 = 0.5\text{ L}$$

$$T_2 = 40^\circ\text{C} = 277\text{ K}$$

$$V_2 = ?$$

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

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

$$= \frac{(0.5\text{ L})(277\text{ K})}{295\text{ K}}$$

$$= 0.47\text{ L}$$