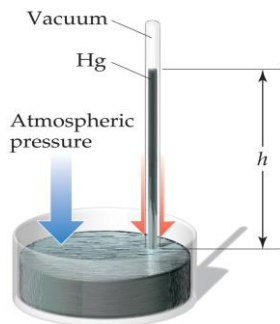
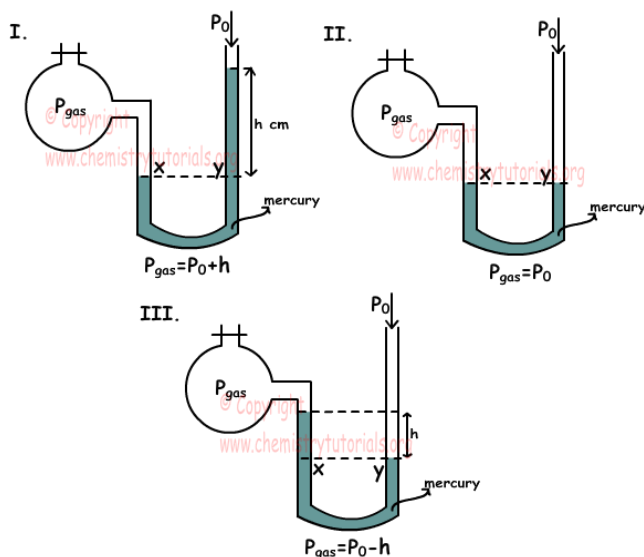


HANDOUT: Ch 13 - Kinetic Molecular Theory (KMT) & Manometers

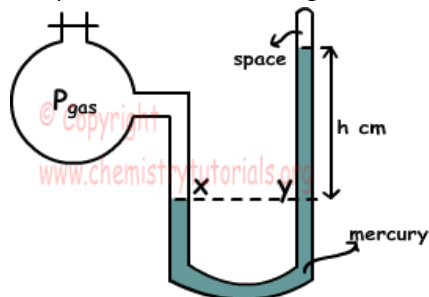
- **Barometer** – Used to measure atmospheric pressure.
 - Mercury (Hg) column rises and falls with changes in atmospheric pressure → DIRECT relationship.
 - Units are typically mm Hg (SI) or in Hg (English).



- **Manometer** – Measures atmospheric pressure and gas pressure differences in an open-end or closed-end U-tube manometer.
 - An unknown pressure is the **sum** or **difference** of the atmospheric pressure and the column height of the gas.
 - **Open-End Manometer** – One end of manometer is open to the gas and other end is open to the atmosphere. U-tube is filled with liquid Mercury (Hg).
 - **Three** possible scenarios can arise from an open-end manometer:



- **Closed-End Manometer** – One end of manometer is open to the gas and other end is closed to the atmosphere.
 - “x” and “y” points are at the same level, thus pressures acting on these points are equal.
 - Pressure at point “x” is the pressure of gas and the pressure at point “y” is the pressure of the mercury (Hg) at “h” height.
 - The pressure of the overall gas is the **same** pressure as height “h” pressure in a closed-end manometer.



MANOMETER EXAMPLE PROBLEMS

The first thing you must realize is that, in the diagram shown on the right, the pressure of the neon (Ne) gas is less than the pressure of the atmosphere, because the atmosphere is pushing on the mercury (Hg) with more force than the neon is.

The difference in the levels of mercury is 8. cm (80. mm):

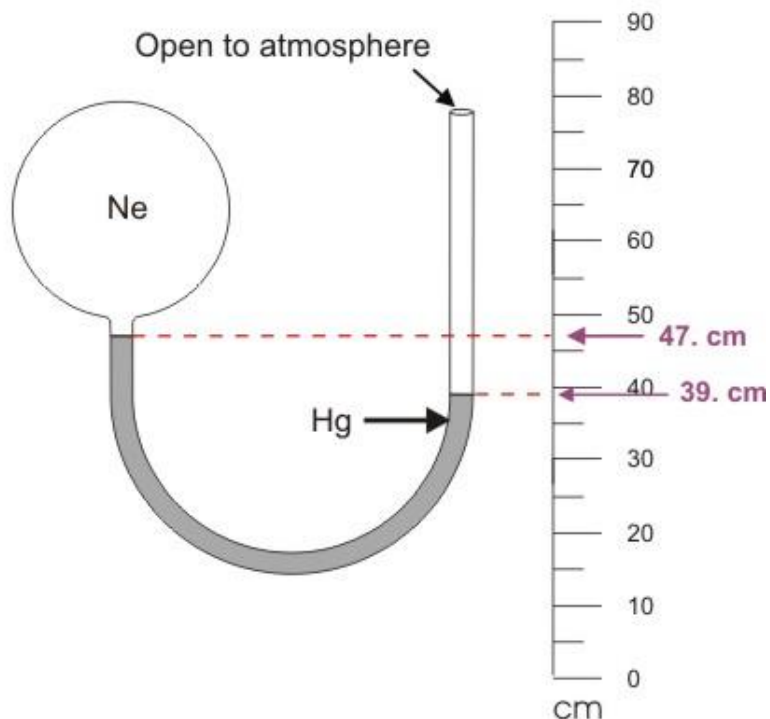
$$47. \text{ cm} - 39. \text{ cm} = 8. \text{ cm} = 80. \text{ mm}$$

Therefore, the atmosphere is not only supporting the pressure of the neon, it is also supporting a column of mercury that is 8. cm (80. mm) high. Therefore:

$$P_{\text{Ne}} = P_{\text{atm}} - P_{\text{Hg}}$$

$$\begin{aligned} P_{\text{Ne}} &= 650. \text{ mmHg} - 80. \text{ mmHg} \\ &= 570. \text{ mmHg} = 570. \text{ torr} \end{aligned}$$

Atmospheric Pressure = 650. torr



The column of mercury (Hg) is 35. cm high (54. cm - 19. cm = 35. cm), or 350. mmHg high.

The atmosphere is pushing down on the mercury with a pressure of 725. mm of mercury (725. torr). If there were no gas in the space above the mercury, the column of mercury would be 725 mm (72.5 cm) high, thereby indicating the pressure of the atmosphere.

In this case, the atmosphere (725. mmHg) is supporting the pressure of the krypton (Kr) gas plus the pressure of the column of mercury:

$$P_{\text{atm}} = P_{\text{Kr}} + P_{\text{Hg}}$$

Rearranging:

$$\begin{aligned} P_{\text{Kr}} &= P_{\text{atm}} - P_{\text{Hg}} \\ &= 725. \text{ mmHg} - 350. \text{ mmHg} \\ &= 375. \text{ mmHg} = 375. \text{ torr} \end{aligned}$$

