Announcements for Wednesday, 20NOV2024

- **Next Week: Changes in Designation of Class Days**
  - There **WILL** be recitations next week
  - Monday, 25NOV2024, is Monday Classes
  - Tuesday, 26NOV2024, is ***Thursday Classes***
  - Wednesday, 27NOV2024, is ***Friday Classes***
- Thanksgiving Break
  - Thursday, 28NOV2024 – Sunday, 01DEC2024
  - No classes for the entire university
- Students requiring **ODS accommodations** for Exam 3 and the Final Exam
  - Monday, 25NOV2024, is the deadline to submit requests for final exams and all remaining exams for the Fall semester
- **RE-OPENED:** Week 10 Homework Assignments available on eLearning
  - Graded and Timed Quiz 10 – “Reactions in aqueous solution” due **tonight at 6:00 PM (EST)**

ANY GENERAL QUESTIONS? Feel free to see me after class!

Chapter 10: Gases

Some questions we'll try to answer

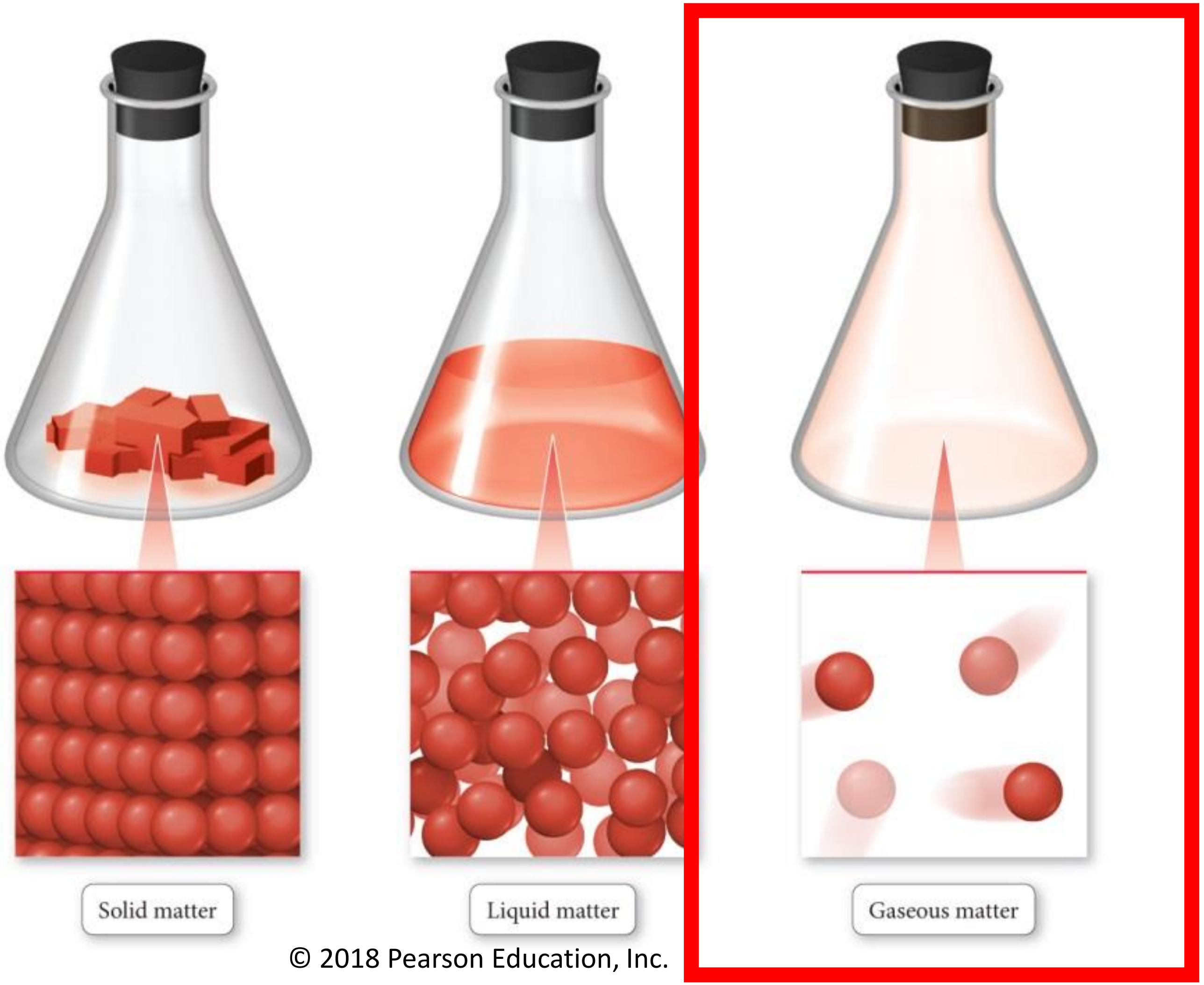
- How and why do gases behave fundamentally different than solids and liquids?
- What is gas pressure caused by and how can it be measured?
- What parameters can be used to describe a gaseous system and how do these parameters relate mathematically to one another?
- What does it mean for a gas to behave ideally?
- How are the properties of a gaseous mixture determined and related to one another?
- How does the Kinetic Molecular Theory account for the properties and behaviors of gases?
- What does temperature actually measure?
- On what does the speed of a gas particle depend?
- How do real gases behave?

RECALL FROM CHAPTER 1: Classifying Matter by State

- based on the strength of interactions that occur between particles making up the substance at a given temperature

- stronger interactions = less space, less mobility, more rigidity, more condensed state

- changing temperature can change the state



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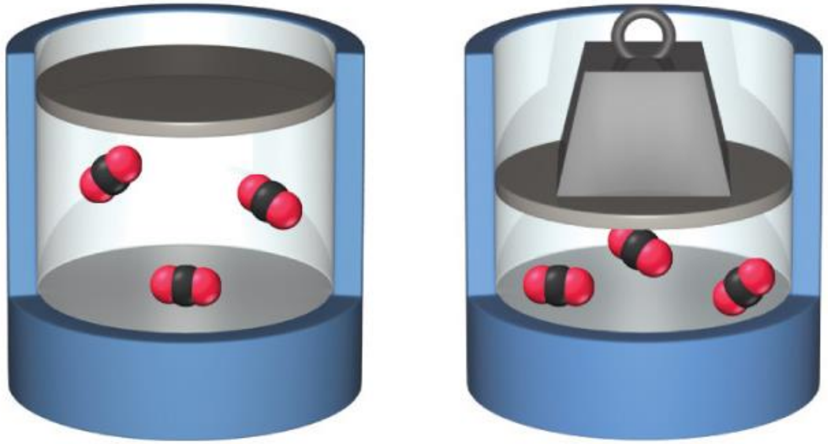
Gases – General Properties

- occupy volume of their container
- lots of empty space between particles
- highly compressible
- lots of mobility
- individual particles interact very little with each other



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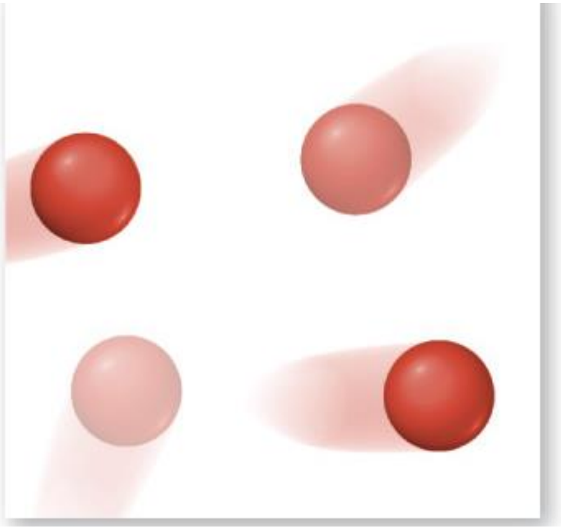
Gas–compressible

<u>important ***interrelated*** properties that completely specify a gaseous system:</u>

1. **pressure (P)**
2. volume (V)
3. amount/moles of gas (n)
4. temperature (T)



constant motion

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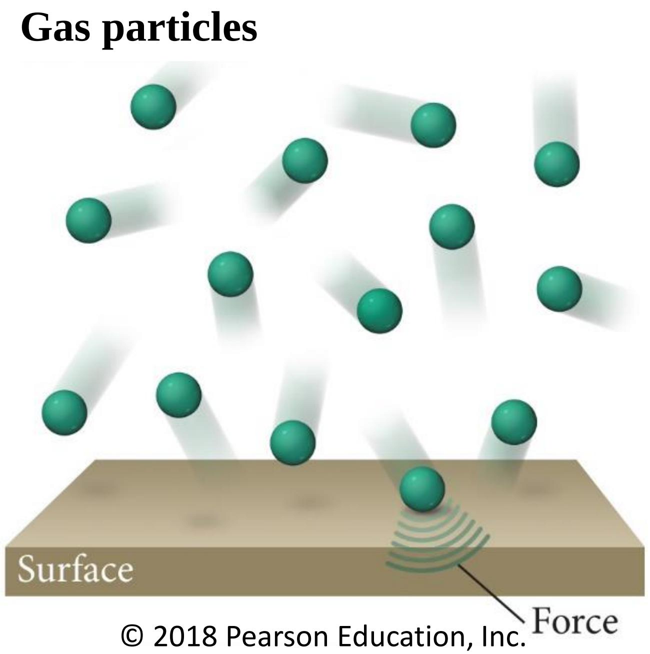
Gas Pressure

- force (F) exerted by gas particles per unit area (A)
  - $P = \frac{F}{A}$
  - proportional to force and inversely proportional to area
  - force resulting from ***collisions*** of gas particles with a surface and/or walls of a container

- anything that increases the frequency and/or force of collisions will cause an increase in gas pressure
  - decreased volume
  - increased speed of particles
  - increased gas amount…



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Pressure Units

- in SI base units: $\mathrm{P} = \dfrac{\mathrm{Force}}{\mathrm{Area}} = \dfrac{\mathrm{N}}{\mathrm{m}^2}$ = pascal (Pa)

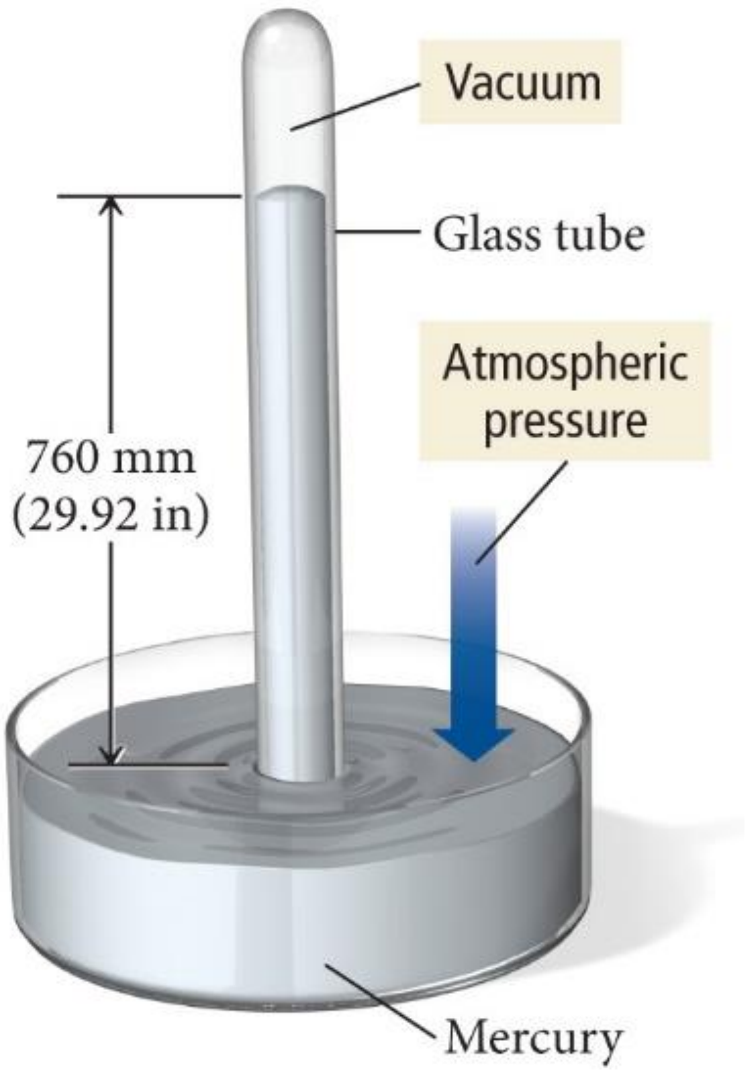
- torr, atmosphere (atm), bar, millimeters of mercury (mmHg), kilopascal (kPa), pounds per square inch (psi)

1.00 atm = 760 mmHg = 760 torr

= 1.013 bar = 101.325 kPa = 14.7 psi

Measuring Atmospheric Pressure

- **barometer =** instrument used for measuring atmospheric pressure (i.e., barometric pressure)
  - inverted tube filled with mercury submerged in a pool of mercury exposed to the atmosphere
  - atmosphere exerts a pressure on the pool of mercury forcing the mercury column to rise in the tube
- $P_{column} = P_{atm}$
  - the atmosphere exerts a pressure equal to pressure exerted by a column of mercury 760 mm tall
- 1 atm = 760 mmHg



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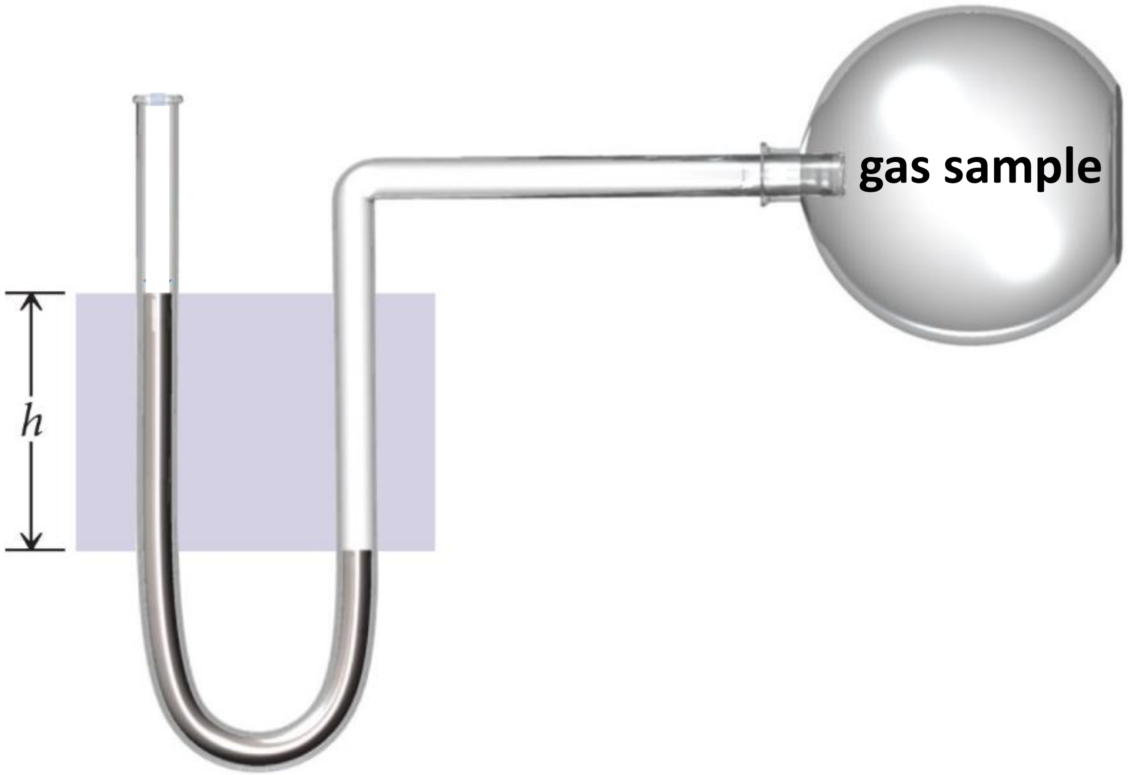
Measuring Gas Pressure in the Laboratory

- **manometer =** U-shaped tube containing mercury used for measuring gas pressure
  - one end open to the atmosphere, the other end is attached to the gas sample

- pressure of gas sample balanced by pressure of the atmosphere and pressure of mercury column



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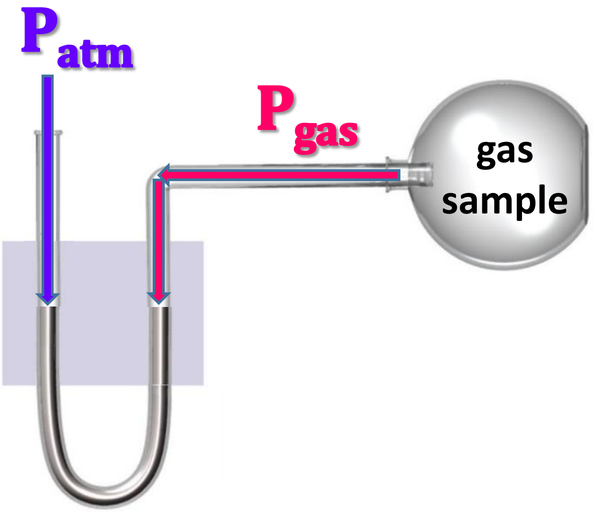
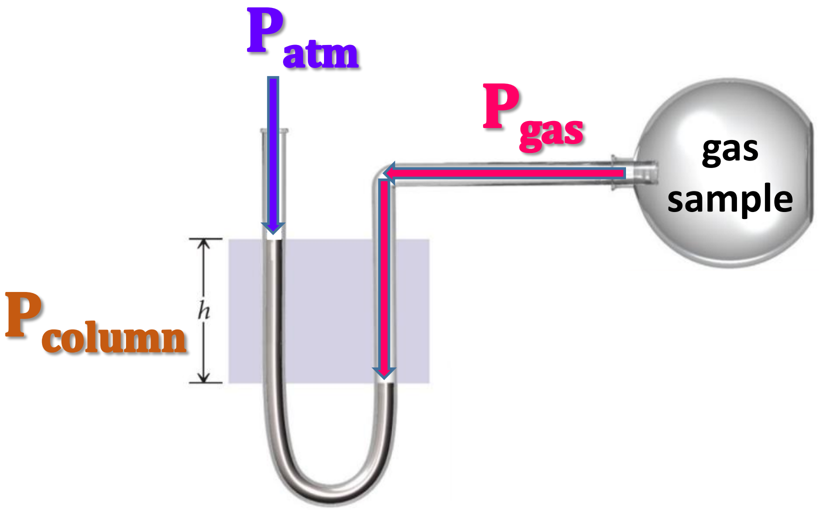
Measuring Gas Pressure in the Laboratory (continued)

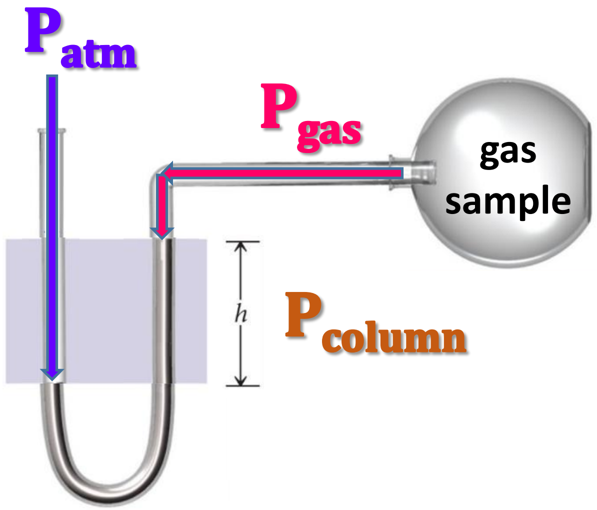


$P_{atm} = P_{gas}$



$P_{atm} < P_{gas}$

$P_{atm} + P_{column} = P_{gas}$



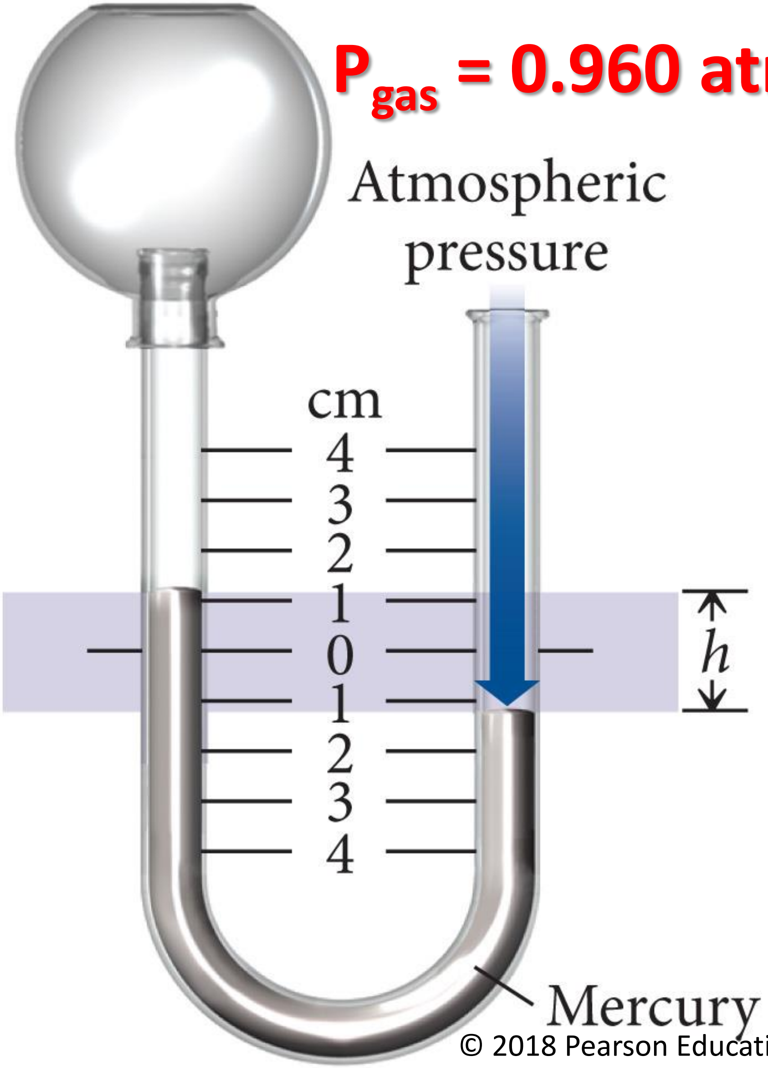
$P_{atm} > P_{gas}$

$P_{atm} = P_{gas} + P_{column}$

Try This

- If the barometric pressure is 751.5 mmHg, what is the pressure, in atm, of the gas sample shown in each illustration?

P_{gas} = 0.960 atm



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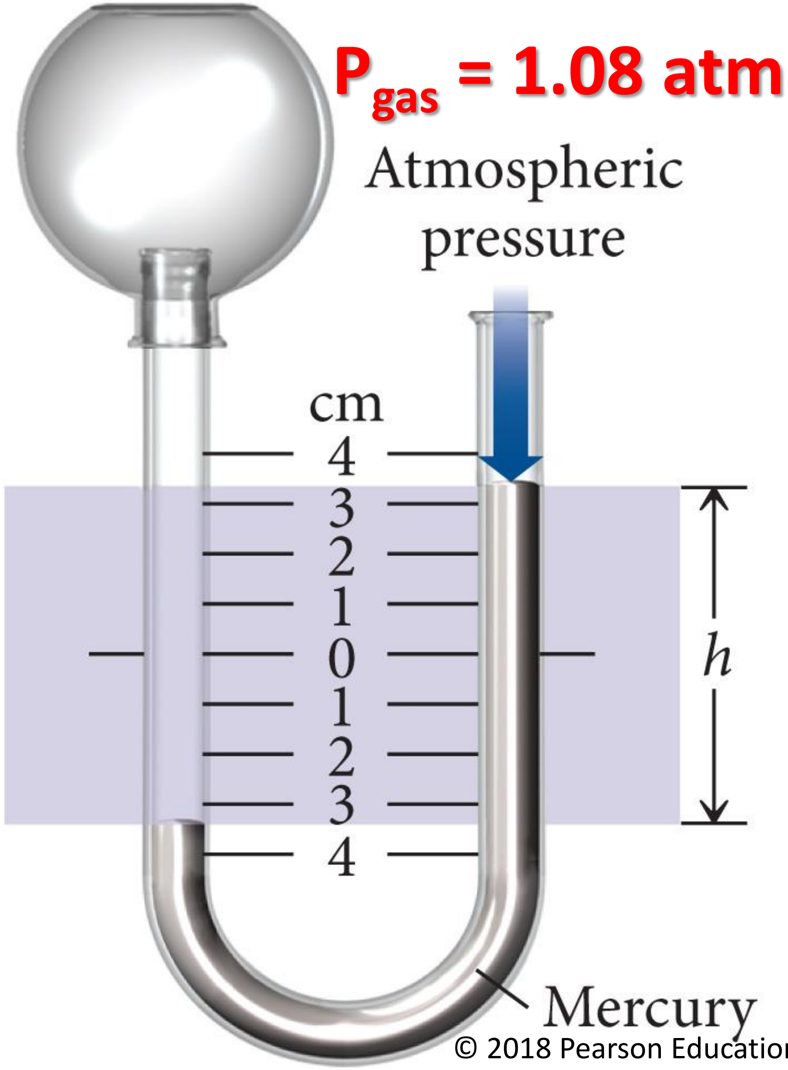
P_{gas} = 1.08 atm



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