

Properties of Reservoir Fluids (PGE 362)

Gasses

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Properties of gases

Three phases of matter

- Solid: Definite shape and volume
 - Liquid: Definite volume, shape of container
 - Gas: Shape and volume of container
- A gas is a collection of molecules that are very far apart on average.
- In air, gas molecules occupy only 0.1% of the total volume.
 - In liquids, molecules occupy ~ 70% of the total space

Properties of gases

- Gases are highly compressible.
 - Volume decreases when pressure is applied.
- Gases form homogeneous mixtures with each other regardless of the identities or relative proportions of the different gases.
 - Water and gasoline
 - Heterogeneous mixture.
 - Water vapor and gasoline vapor
 - Homogeneous mixture.

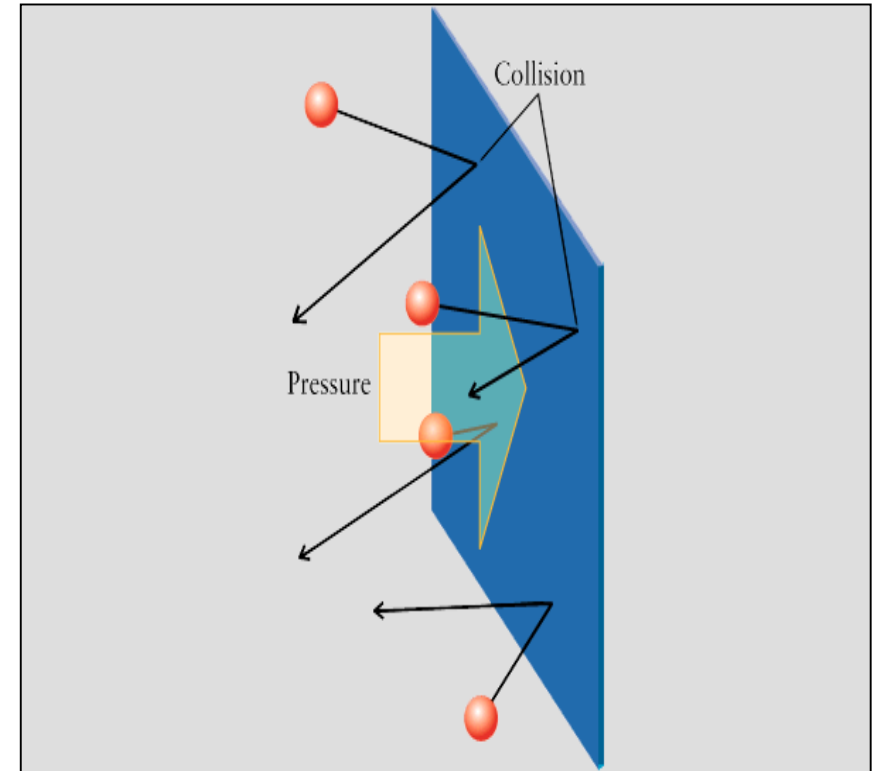
Gas pressure

- Four quantities are commonly needed to describe a gas:
 - Amount of gas
 - Temperature
 - Volume
 - Pressure

Gas pressure

- Gases exerted pressure on the objects in their surroundings
- Pressure is caused by collisions between the gas molecules and objects with which they are in contact.
- Pressure: the force exerted on a unit area

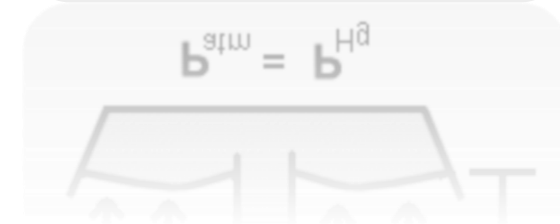
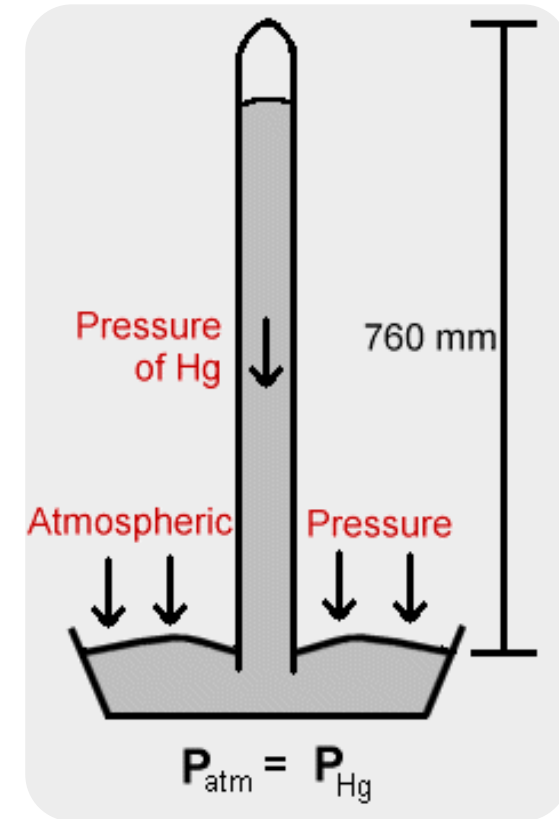
$$P = \frac{F}{A}$$



Gas pressure

➤ Gas pressure units

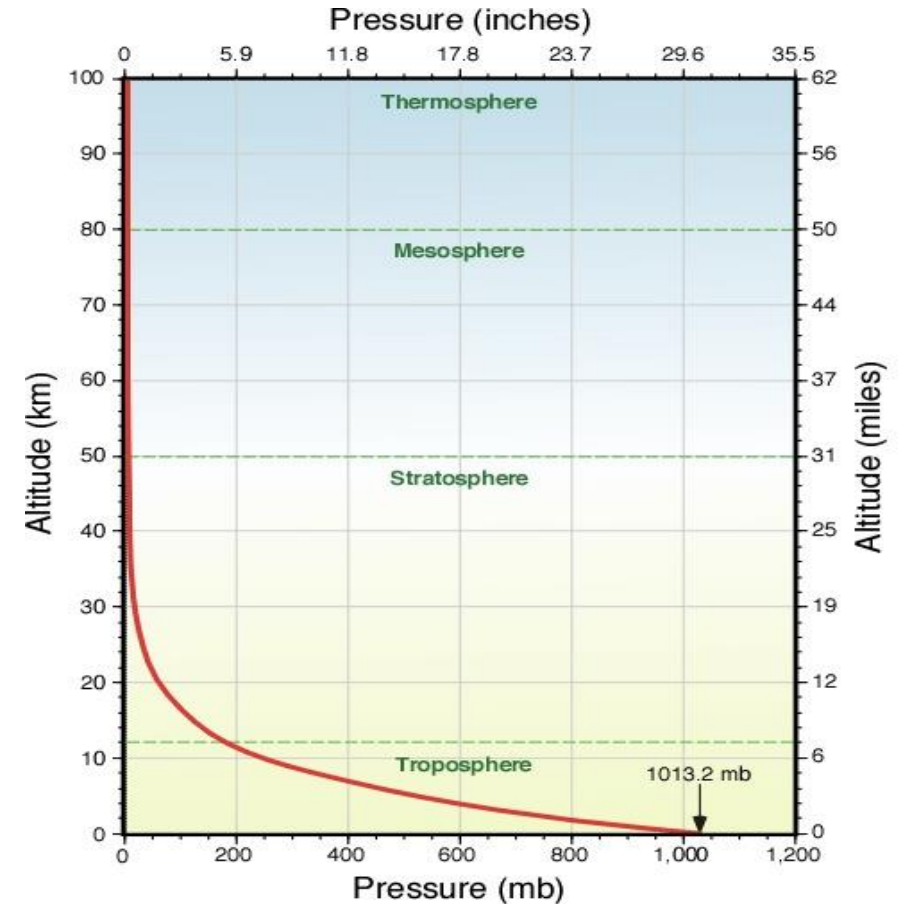
- mm Hg (1 atm = 760 mm Hg)
- in. Hg (= 29.92 in. Hg)
- psi (= 14.7 psi)
- atm
- torr (= 760 torr)
- pa (SI unit) (= 1.01325×10^5 Pa)
- kPa (= 101.325 kPa)



Gas pressure

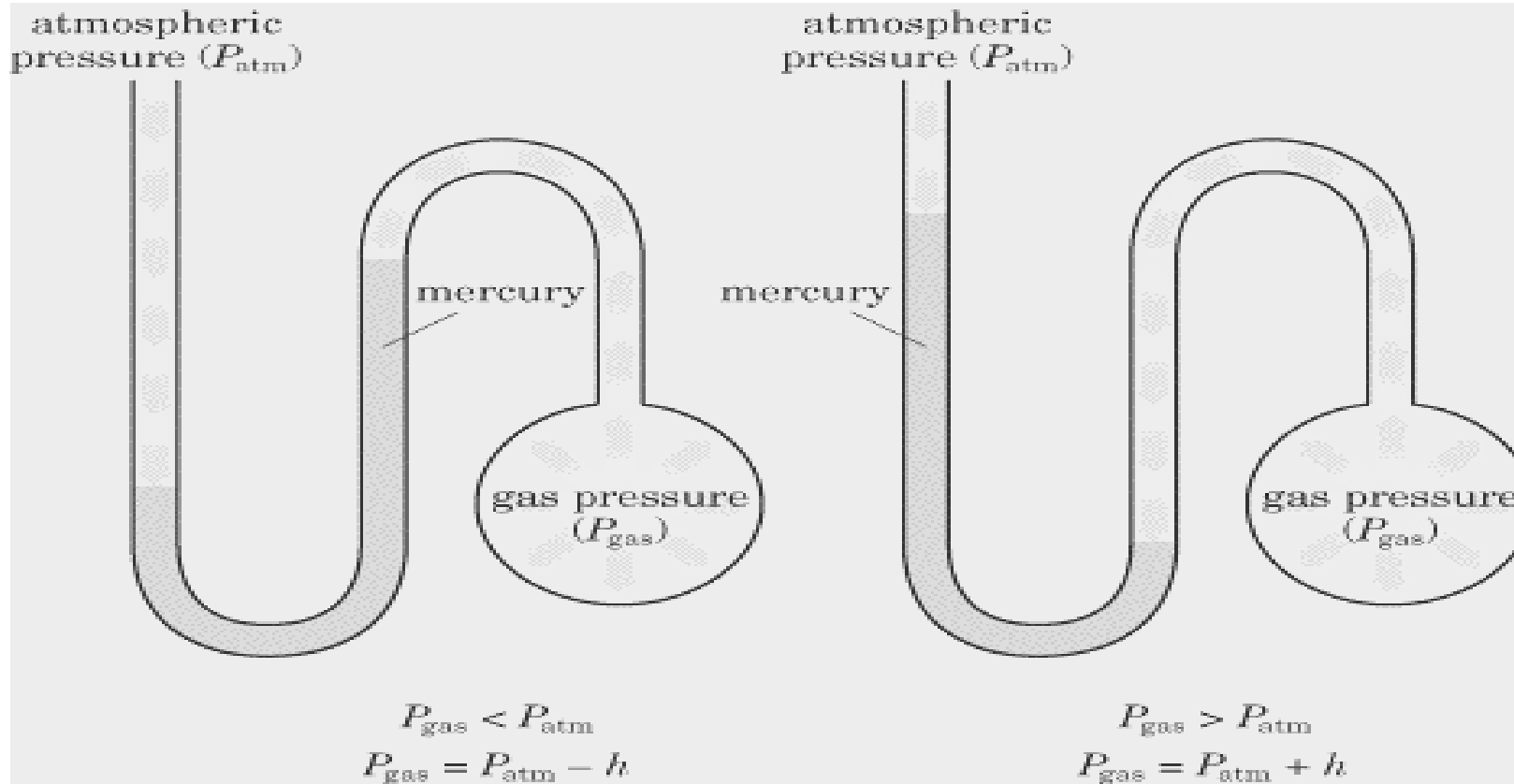
- **Atmospheric pressure:** the pressure exerted by gas molecules in the air on all objects exposed to the atmosphere
- Atmospheric pressure varies with altitude.

Altitude (ft) (above sea level)	Atmospheric Pressure		
	in. Hg	Torr	psi
0	29.92	760	14.65
5000	24.90	632.5	12.23
10,000	20.58	522.7	10.10



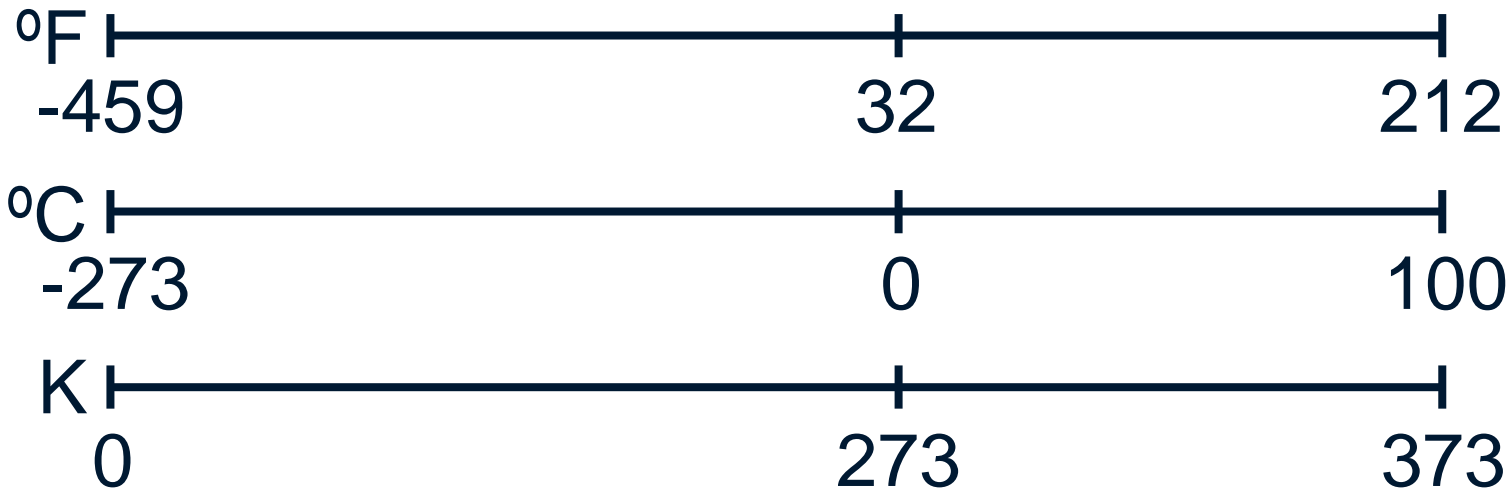
Gas pressure

➤ Gas pressure measurement



Gas temperature

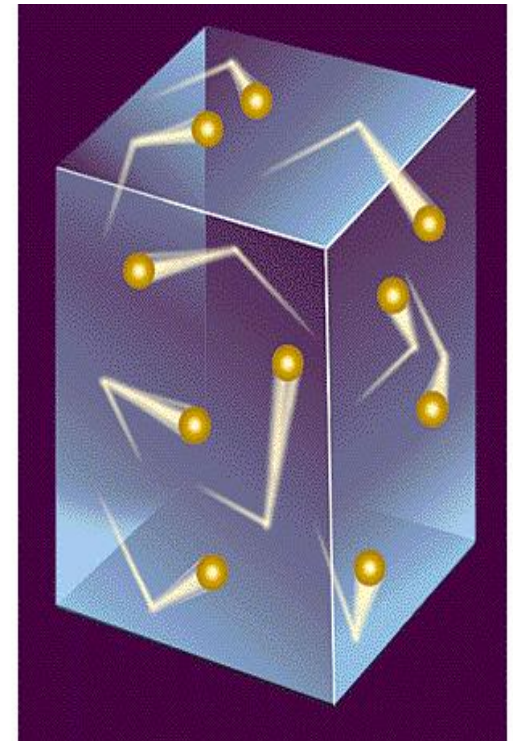
- Always use **absolute temperature** (Kelvin) when working with gases.



$$^{\circ}\text{C} = \frac{5}{9} (^{\circ}\text{F} - 32) \quad K = ^{\circ}\text{C} + 273$$

Kinetic Molecular Theory

- The behavior of gases can be described using **Kinetic Molecular Theory**
 - “Theory of Moving Molecules”
- Molecules Gases consist of large numbers of that are in continuous, random motion.
- The combined volume of all the molecules of the gas is negligible compared to the total volume in which the gas is contained.
 - *i.e.* the molecules are very far apart on average



Kinetic Molecular Theory

- Particles in an ideal gas...
 - have no volume.
 - have elastic collisions.
 - are in constant, random, straight-line motion.
 - don't attract or repel each other.
 - have an avg. KE directly related to Kelvin temperature.
 - At any given temperature all molecules of a gas have the same average kinetic energy.
 - As T (in K) increases, KE increases.

