

Absolute Pressure

- ▶ **Absolute pressure**: Pressure with respect to the zero pressure of a complete vacuum.
- ▶ **Absolute pressure** *must* be used in thermodynamic relations.
- ▶ **Pressure-measuring devices** often indicate the *difference* between the absolute pressure of a system and the absolute pressure of the atmosphere outside the measuring device.

Gage and Vacuum Pressure

► When system pressure is greater than atmospheric pressure, the term **gage pressure** is used.

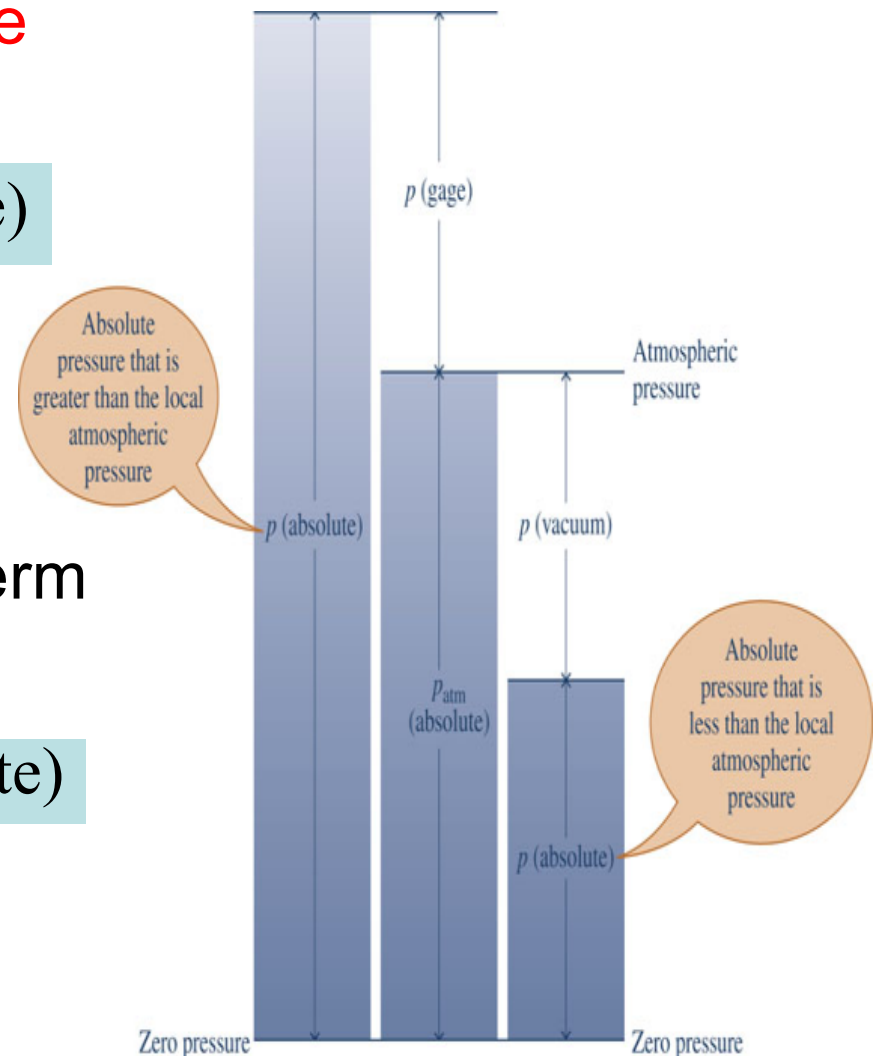
$$p(\text{gage}) = p(\text{absolute}) - p_{\text{atm}}(\text{absolute})$$

(Eq. 1.14)

► When atmospheric pressure is greater than system pressure, the term **vacuum pressure** is used.

$$p(\text{vacuum}) = p_{\text{atm}}(\text{absolute}) - p(\text{absolute})$$

(Eq. 1.15)



Temperature (T)

- ▶ If two blocks (one warmer than the other) are brought into contact and isolated from their surroundings, they would **interact thermally** with changes in observable properties.
- ▶ When all changes in observable properties cease, the two blocks are in **thermal equilibrium**.
- ▶ **Temperature** is a physical property that determines whether the two objects are in thermal equilibrium.

Thermometers (1 of 2)

- ▶ Any object with at least one measurable property that changes as its temperature changes can be used as a **thermometer**.
- ▶ Such a property is called a **thermometric property**.
- ▶ The substance that exhibits changes in the thermometric property is known as a **thermometric substance**.

Thermometers (2 of 2)

► **Example:** Liquid-in-glass thermometer

► Consists of glass capillary tube connected to a bulb filled with liquid and sealed at the other end. Space above liquid is occupied by vapor of liquid or an inert gas.

► As temperature increases, liquid expands in volume and rises in the capillary. The length (L) of the liquid in the capillary depends on the temperature.

► The **liquid** is the **thermometric substance**.

► L is the **thermometric property**.

► Other types of thermometers:

► Thermocouples

► Thermistors

► Radiation thermometers and optical pyrometers

