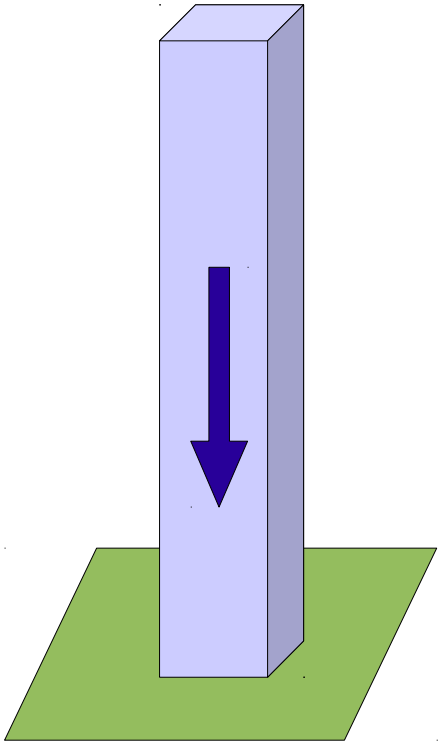
Units of Pressure (English)



- Remember: pressure in the atmosphere is due to the air above you, weighing down
- Not surprisingly, the English measure of pressure is a unit of weight (per unit area)

psi: Pounds per Square Inch

- On average, a one inch by one inch column of air, extending from the ground to the top of the atmosphere, weighs 14.7 pounds
- So.....the standard atmospheric pressure in the English system is 14.7 psi

Units of Pressure (metric)

- The unit of pressure in the metric system is also a measure of weight (per unit area): the Pascal (Pa)

$$1 \text{ Pa} = 1.45 \times 10^{-4} \text{ psi}$$

(Remember: $1.45 \times 10^{-4} = 0.000145$)

- Since the Pa is so small, we usually measure pressure in units of 100 Pa, or hectopascal (hPa)

$$1 \text{ hPa} = 100 \text{ Pa}$$

- In metric units, the standard atmospheric pressure is about 1013 hPa

Units of Pressure (bar and mb)

- A unit closely related to the Pascal is the bar

1 bar = 100,000 Pa = 1000 hPa

- But since the bar is so big, we usually measure pressure in units of 1/1000 bar, or millibar (mb)

1 mb = 0.001 bar = 1 hPa

- As scientists, we usually measure pressure in hPa, but on weather maps the more common unit is mb

Luckily, mb and hPa are the same thing!

- For this class, we'll try to stick to mb

Units of Pressure (inches of Hg)

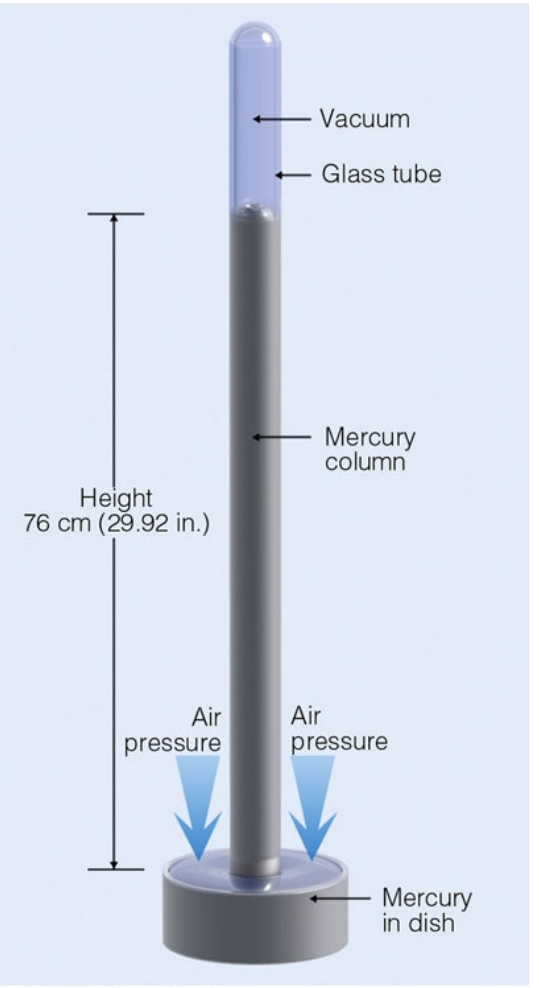
- Finally, old school weather folks measure pressure in terms of the weight of a column of mercury (per unit area)--i.e., in terms of inches of mercury, or in. Hg

1 in. Hg = 33.86 mb

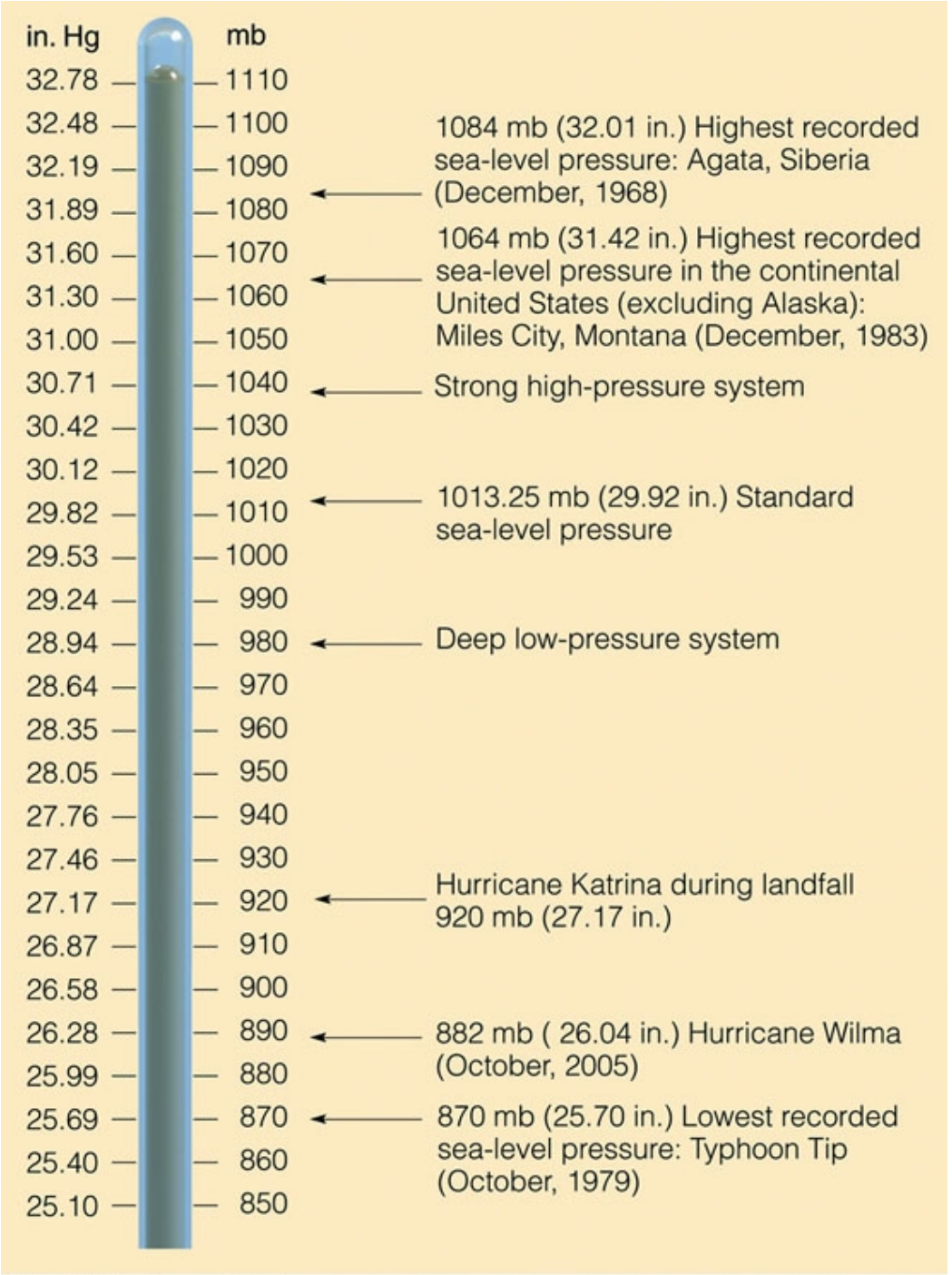
  - As it turns out, the weight of a column of air (from ground to top of atmosphere) is the same as the weight of a column of mercury 29.92 inches high

  - So the standard atmospheric pressure in inches of mercury is 29.92 in. Hg

1013 mb = 29.92 in. Hg



Equivalence between mb and in. Hg



Scales of Temperature

- The most common ways to measure temperature are based on the freezing and boiling points of water

The Fahrenheit scale

boiling point: 212 °F
freezing point: 32 °F
} Range of 180 °F

The Celsius scale

boiling point: 100 °C
freezing point: 0 °C
} Range of 100 °C

- To convert between the two, remember that

a range of 100 °C = a range of 180 °F

Celsius and Farhenheit Conversion

- Since a range of 180 °F equals 100 °C, and 180/100 = 9/5, we must have 9 °F for every 5 °C
- The conversion from Celsius to Farhenheit must then be

$$°F = 32 + \frac{9}{5}\,°C$$

freezing point

conversion factor

amount above freezing

- The other way around must be

$$°C = \frac{5}{9}(°F - 32)$$

conversion factor

amount above freezing

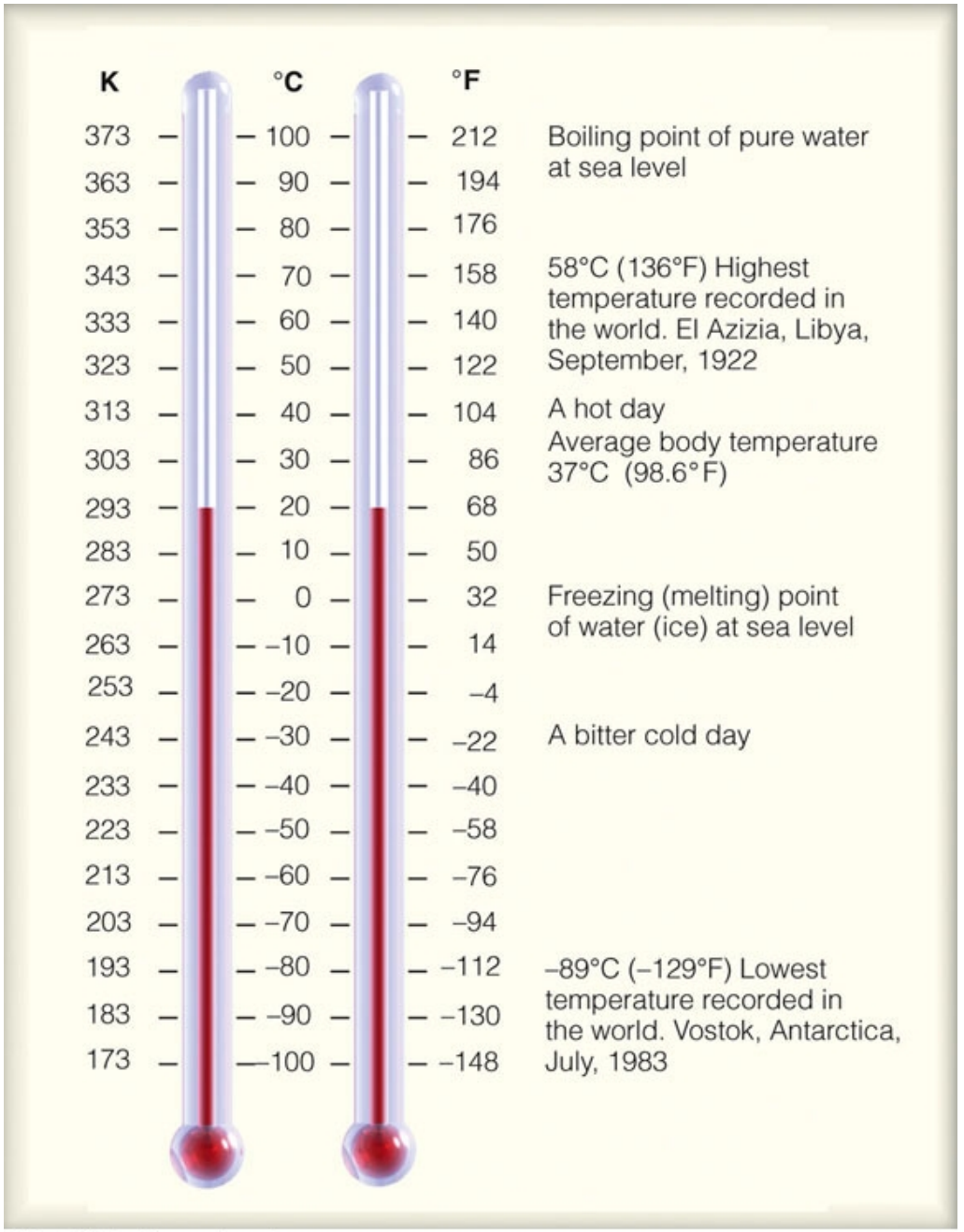
Equivalence between °F and °C

$$°F = 32 + \frac{9}{5}\,°C$$

freezing point

above freezing

conversion factor



Temperature Scales: The Kelvin Scale

- One final temperature scale is the Kelvin scale (denoted K), which sets the zero point at absolute zero, the temperature at which all molecular motion stops:

absolute zero = - 273 °C = 0 K

- Apart from the zero point, the Celsius and Kelvin scales are the same: one degree of Celsius equals one degree of Kelvin
- The freezing point of water must then be 273 K
- To convert from Celsius to Kelvin, we just add 273

$$K = 273 + {}^{\circ}C$$

freezing point

amount above freezing