2-80 The average temperature of the atmosphere is expressed as T_{atm} = 288.15 – 6.5z where z is altitude in km. The temperature outside an airplane cruising at 12,000 m is to be determined.

Analysis Using the relation given, the average temperature of the atmosphere at an altitude of 12,000 m is determined to be

$$T_{atm} = 288.15 - 6.5z$$

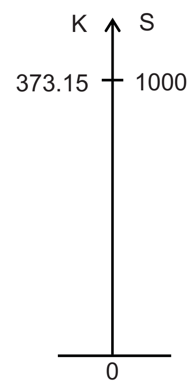
$$= 288.15 - 6.5\times 12$$

$$= \mathbf{210.15\ K} = \mathbf{-63°C}$$

Discussion This is the "average" temperature. The actual temperature at different times can be different.

2-81 A new "Smith" absolute temperature scale is proposed, and a value of 1000 S is assigned to the boiling point of water. The ice point on this scale, and its relation to the Kelvin scale are to be determined.

Analysis All linear absolute temperature scales read zero at absolute zero pressure, and are constant multiples of each other. For example, T(R) = 1.8 T(K). That is, multiplying a temperature value in K by 1.8 will give the same temperature in R.



The proposed temperature scale is an acceptable absolute temperature scale since it differs from the other absolute temperature scales by a constant only. The boiling temperature of water in the Kelvin and the Smith scales are 315.15 K and 1000 K, respectively. Therefore, these two temperature scales are related to each other by

$$T(S) = \frac{1000}{373.15}T(K) = \mathbf{2.6799\ T(K)}$$

The ice point of water on the Smith scale is

$$T(S)_{ice} = 2.6799\ T(K)_{ice} = 2.6799\times 273.15 = \mathbf{732.0\ S}$$