

### Answer on Question #49419, Physics, Acoustics

Calculate the percent error made over one mile of distance by the 5 sec. rule for estimating the distance from a lightning strike if the temperature (a) 30 °C (b) 10 °C

#### Solution:

The "5 second rule" says that for every 5 seconds between seeing a lightning strike and hearing the associated sound, the lightning is 1 mile distant. We assume that there are 5 seconds between seeing the lightning and hearing the sound.

(a) At 30°C, the speed of sound is  $[331 + 0.60(30)]\text{m/s} = 349\text{m/s}$ .

The actual distance to the lightning is therefore

$$d = vt = (349\text{m/s})(5\text{s}) = 1745\text{ m.}$$

A mile is 1610 m.

$$\%error = \frac{1745 - 1610}{1745} * 100 = 7.7\% \approx 8\%$$

(b) At 10°C, the speed of sound is  $[331 + 0.60(10)]\text{m/s} = 337\text{m/s}$ .

The actual distance to the lightning is therefore

$$d = vt = (337\text{m/s})(5\text{s}) = 1685\text{ m.}$$

A mile is 1610 m.

$$\%error = \frac{1685 - 1610}{1685} * 100 = 4.45\% \approx 4.5\%$$

**Answer:** a) 8 %; b) 4.5 %.

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