Science Virtual Learning

MPI Physics 240

Thermodynamics 3: Thermal Expansion of Solids

April 24, 2020

Lesson: MPI Thermodynamics 3 – Thermal Expansion of Solids
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Objective: To understand how solids expand when their temperature is increased

This video discusses how solids expand when their temperature is raised, or contract when the temperature is lowered.

https://youtu.be/DMDCrfiJaqk

Video: Thermal Expansion of Solids

This video works out two examples using thermal expansion. See the following slides for a text version of the examples

https://youtu.be/V6F5oNnHBlk

Video: Thermal Expansion Examples

An aluminum thermos has a diameter of 8.00 cm and a volume of 0.700 L at 20.0 °C. It is then filled with coffee at 92.0 °C. How much does the diameter increase? How much does the volume increase?

Expansion of Solids – Example 1

A 0.010-m long steel screw and a 0.030-m long brass screw are arranged so that their ends are only 5.0 µm apart at 27 °C; see diagram. As you raise the temperature, the screws expand, closing the gap between them. At what temperature will the ends of the screws touch?

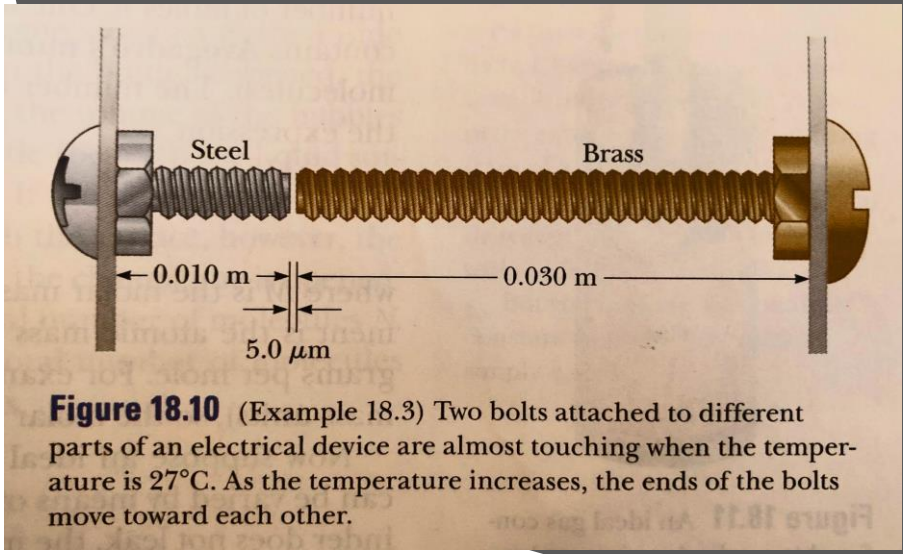

Figure 18.10 (Example 18.3) Two bolts attached to different parts of an electrical device are almost touching when the temperature is 27°C. As the temperature increases, the ends of the bolts move toward each other.

Expansion of Solids – Example 2

Homework 1

1. The Golden Gate Bridge is 1280 m long, and the structure is made of steel. By how much does the length of the bridge expand when the temperature increases from 5.0 °C to 27.0 °C?

- Try to solve the problem yourself, then watch the solution video:
- https://youtu.be/ze_HKcrYrtE

Homework 2

2. A common demonstration of thermal expansion is the “ring and ball”. At 20.0 °C, the inner diameter of the ring is 20.0 mm, while the ball is slightly larger, at 20.1 mm. To what temperature must you heat the ring so that its diameter increases to 20.1 mm, so that the ball can fit through?

- Try to solve the problem yourself, then watch the solution video:
- https://youtu.be/6T7uDpAI15Y

That’s it!