

PhyzJob:

Felix and Digby Get the Point

and other adventures in thermal expansion



1. Seasonal Sidewalk Scenes

One of the images below shows a sidewalk as it appears in August. The other is the same sidewalk in February. Which is which?



2. Bridge Expansion Joint

One of the images below shows an expansion joint as it appears in August. The other is the same expansion joint in February. Which is which?



3. Felix and Digby Get the Point

Whilst playing in the desert one day, Felix and Digby came across a “NO TRESPASSING” sign that they simply couldn’t resist. Little did they know they were walking into the lair of the mean, mean, Desert Queen. Her friends called her Priscilla, except she had no friends. Just her desert domain. When she came upon the boys, they ran for it. She snagged Felix, but Digby escaped. She lashed Felix to a wall and adjusted a long blade so that its razor-sharp point pressed against his belly button. (Fortunately, Felix had an “inny.”) The blade was fixed at the blunt end and could not be raised, lowered, or rotated.

Without Felix to navigate, Digby got lost and went in circles trying to escape. After nightfall, the Desert Queen caught up with him. She brought Digby back to her prison and bound him as she had Felix.

a. During the next day, who was in greater danger of being impaled: Felix, Digby, or same chances for both? (By the way, Digby had an “inny,” too.) Justify your answer in detail!

b. Suppose Felix were knife bound outside and Digby were knife bound deep in a cave. Who faces greater danger and why?

c. Suppose Felix were bound at the end of a short blade and Digby were bound at the end of a long (but otherwise identical) blade. Who faces greater danger and why?

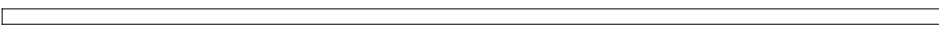
d. Suppose Felix were bound at the end of an aluminum blade and Digby were bound at the end of an equal-sized steel blade. Who faces greater danger and why?

4. Freeing the Lid of the Peanut Butter Jar

Before the Plastic Age, peanut butter came in a glass jar with a steel screw-top lid. Due to a good vacuum seal at the factory, the lids were extremely difficult to loosen upon first opening. Some people used to run hot water over the lids before trying to open them. Was this a wise practice or a wife's tale in practice? Justify your answer!

5. Bimetallic Brain-Bogglers

a. Consider two 30.00 cm strips of metal at room temperature. One is aluminum, the other is steel. Both are then heated to 1000° C. The steel at high temperature is shown; sketch the aluminum at high temperature.

Al (R.T.) 

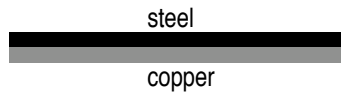
Fe (R.T.) 

Al (Hot)

Fe (Hot) 

b. Suppose the two strips of metal were cooled to room temperature and then joined as to form a two-metal or *bimetallic* strip. What would happen to the strip as it was heated to 1000° C (assuming the bond between the metals holds)?

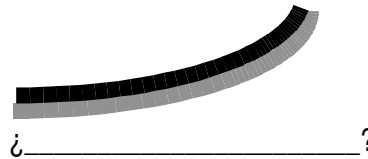
c. Several “bimetallic strips” are shown below. One metal on each is copper. Identify as best you can what the other metal might be. Pay close attention to the differences in the diagrams. Details, details!



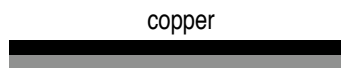
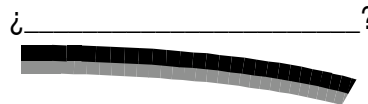
→ heated 200 K →



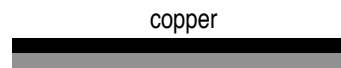
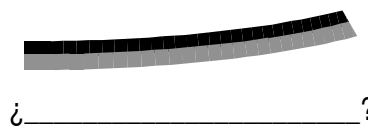
→ heated 200 K →



→ heated 200 K →



→ cooled 200 K →



→ cooled 200 K →

