Questions on Thermal Expansion

For data on thermal expansion coefficients see the following web sites

- http://physics.info/expansion/ The left data table contains solid materials ($\alpha$ $(10^{-6}$ $\text{K}^{-1})$), the right data table contains liquids ($\beta$ $(10^{-6}$ $\text{K}^{-1})$)
- http://www.engineeringtoolbox.com/linear-expansion-coefficients-d_95.html These materials are all solids. Use the numbers in the second column, with units of $10^{-6}$ m/m K.

1. A steel ball has a circular hole drilled through the center. If the temperature of the ball is raised then the ball gets larger. What happens to the hole?

2. The oil pipeline from the northern shores of Alaska (Prudhoe Bay) to the southern coast is not straight, but purposely zig-zags across the state. Why do you think it was designed this way?

3. Referring to the previous question, what would happen if it had been built perfectly straight?

4. Suppose you have a liquid which does not expand or contract when the temperature changes. It is placed in glass beaker, which is then placed in an oven at 350 °F. What happens to the level of the liquid in the beaker?

5. A brass rod is 3 m long at 20 °C. What will be its length at 200 °C?

6. A pool of mercury at 25 °C has a volume of 45 cm$^3$. What is its volume at 0 °C?

7. A platinum rod is 19.97 mm long at 20 °C. To what temperature will you have to heat to get a length of exactly 20 mm?