Examples Chapter three

1-Thermal expansion results in

1. increase in length
2. increase in breadth
3. increase in thickness
4. all of above

2-Fractional increase in length per Kalvin rise in temperature is

1. linear expansion
2. coefficient of linear expansion
3. volume expansion
4. coefficient of volume expansion

3-When liquid is heated there is change in volume of

1. liquid only
2. container only
3. both A and B
4. none of above

4- A brass rod is 1m long at 0°C, if coefficient of expansion is 1.9 \* 10-5 K-1 then length at 30°C is:

1. 1.00057 m
2. 1.0057 m
3. 1.057 m
4. 15.7 m

5- Water from 4°C to 0°C

1. Contracts B. expands
2. starts to turn in to ice D. none of above

6- Which of the following is used in thermostats?

A. mercury C. bimetallic strip

B. heat engine D. refrigerator

6- The main span of San Francisco’s Golden Gate Bridge is 1275 m long at its coldest. The bridge is exposed to temperatures ranging from –15ºC to 40ºC. What is its change in length between these temperatures? Assume that the bridge is made entirely of steel. (α of steel= 1210 × -6 $ ℃$-1).

$$∆L=αL∆T$$

 = 1210 × -6 (1275) (40 - (-15 ))

 = 0.84m

7- Suppose your 60.0 L steel gasoline tank is full of gas, so both the tank and the gasoline have a temperature of 15.0ºC. How much gasoline has spilled by the time they warm to 35.0ºC? ($βgas=$ 950$×$ 10-6, $βsteel=$ 35$×$ 10-6 $℃$ -1).

$$∆V=V0β∆T$$

8- What pressure would be created in the gasoline tank considered in Example 7, if the gasoline increases in temperature from 15.0ºC to 35.0ºC without being allowed to expand? (Assume that the bulk modulus B for gasoline is 1.00 × 109 N/m2.)

 The pressure P = F/A= $∆V/V×β$



9- Concrete blocks are laid out next to each other on a highway without any space between them, so they cannot expand. The construction crew did the work on a winter day when the temperature was 5 oC. Find the stress in the blocks on a hot summer day when the temperature is 38 oC. The compressive Young’s modulus of concrete is Y=20×109 N/m2. ($∝$ concrete = 12×10 -6 $/℃).$

 10- A glass container with volume of 4 liters filled with water, then heated until the increase in temperature is 20oC. Some water spilled. The coefficient of linear expansion for glass = 9 x 10-6 oC-1; the coefficient of volume expansion for water = 2.1 x 10-4 oC-1. Determine the volume of spilled water.

The change in volume of the glass container :

ΔV = γ Vo ΔT = (27 x 10-6)(4)(20) = 2160 x 10-6 = 2.160 x 10-3 = 0.002160 liters

The change in volume of the water :

ΔV = γ Vo ΔT = (2.1 x 10-4)(4)(20) = 168 x 10-4 = 0.0168 liters

*The change in volume of the water is greater than the glass container, so some water spills.*

The volume of spilled water :

0.0168 liters – 0.002160 liters = 0.01464 liters = 0.015 liters