

## Thermal Expansion

What happens when an object is heated?  
Cooled?

1

Where do we see this type of expansion?

Doors sticking in the summer

Power lines sag more in the summer because they are longer

Railway rails have to have gaps in them or they buckle under increased heat

Bridges have expansion "teeth" to allow them to move slightly as they heat and cool



Thermal expansion



2

Linear expansion (or contraction) of solids depends on:

$$\Delta L = \alpha L_0 \Delta T$$



Coefficient of linear expansion  $\alpha$

3

**A 4.5 m long piece of concrete is poured for a sidewalk when it is 15 °C. The builders left a gap of 1.5 mm along the edge. What is the maximum temperature the sidewalk can take?**

4

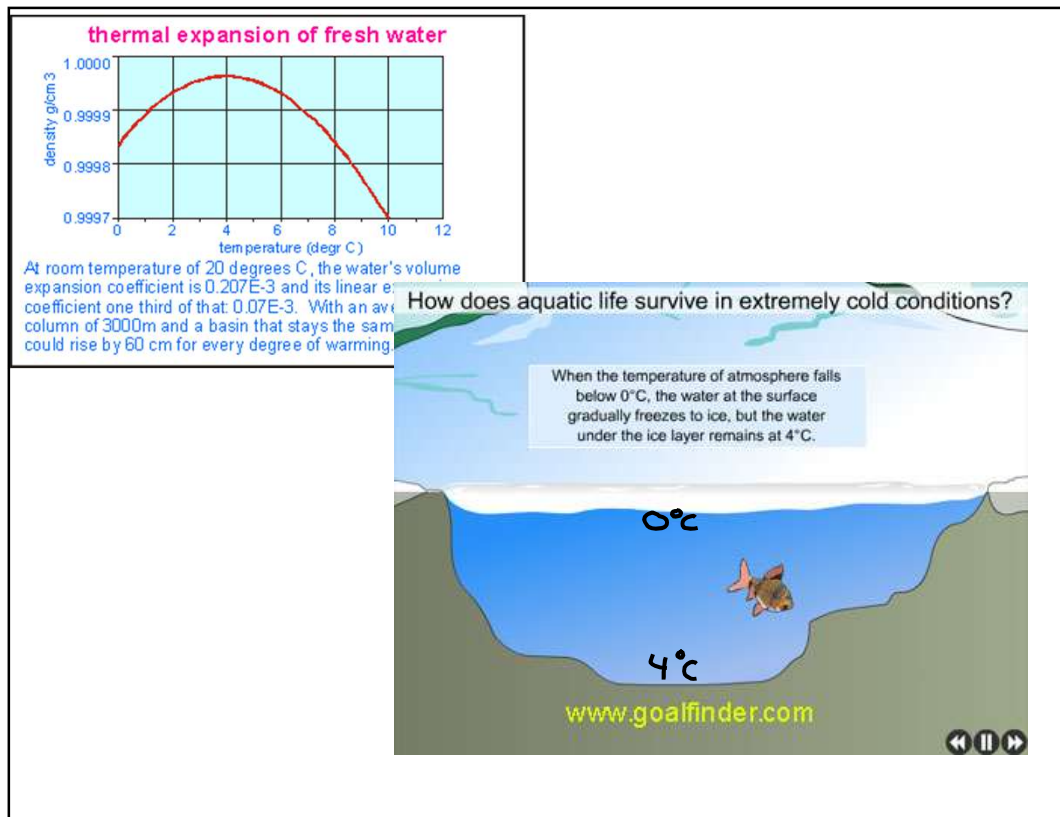
Similarly, volume expansion (or contraction) of liquids depends on:

$$\Delta V = \beta V_0 \Delta T$$



Coefficient of volume expansion  $\beta$

5



6

**A 400.0 mL pyrex (hard glass) bottle is full of ethanol at 288 K. How much spills if the bottle is left out and the temperature increases to 307 K?**

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