TOPIC
Strength of Materials – Section VIII – Question 2

QUESTION
Knowing that a continuous steel railroad track, with a coefficient of thermal expansion of 12×10^{-6} m/m/°C, and Young's modulus of 200 GPa, was placed on and secured to railroad ties in the winter when the temperature was –10°C. The stress in MPa in the rail when the temperature reaches 90°C in the hot sun during summer most nearly is

    (A) 192 (tensile)
    (B) 200 (compressive)
    (C) 240 (compressive)
    (D) 120,000 (tensile)

HINT
The change in temperature is a positive 100°C
The railroad track goes into compressive stress.

SOLUTION
$$\Delta T = 100°C$$
$$\sigma_{thermal} = E\varepsilon_{thermal}$$
$$= E\alpha\Delta T$$
$$= (200 \times 10^9)(12 \times 10^{-6})(100)$$
$$= 240 MPa$$

ANSWER
(C)

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