

QUESTION:

The high speed 300 series Shinkansen trains of Japan consist of 16 aluminum cars with a combined mass of 7.10×10^5 kg. The reduction in mass from the 100 series trains enables the 300 series to reach a top speed of 270 km/h. What is the magnitude of a 300 series train's momentum at its top speed?

SOLUTION:

Momentum of the train is the product of the mass and velocity of the train

$$p_{\text{train}} = m_{\text{train}} v_{\text{train}}$$

$$v_{\text{train}} = 270 \text{ km/h} = \frac{270}{3.6} = 75 \text{ m/s}$$

$$p_{\text{train}} = 7.10 \cdot 10^5 \cdot 75 = 5.25 \cdot 10^7 \frac{\text{kg} \cdot \text{m}}{\text{s}}$$

ANSWER:

$$p_{\text{train}} = 5.25 \cdot 10^7 \frac{\text{kg} \cdot \text{m}}{\text{s}}$$