

Consider two sound waves where the displacement oscillations are described by

$$s = s_{max} \sin(kx - \omega t), \text{ and the pressure difference oscillations by } \Delta P = \Delta P_{max} \sin(kx - \omega t).$$

If $s_{max2} = 2 s_{max1}$, $k_2 = 2 k_1$, and $\omega_2 = 2 \omega_1$, then ΔP_{max2} is

- A) $\Delta P_{max2} = 4 \Delta P_{max1}$.
 - B) $\Delta P_{max2} = \Delta P_{max1}$.
 - C) $\Delta P_{max2} = \frac{1}{4} \Delta P_{max1}$.
 - D) can not be determined.
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$$\begin{aligned} \Delta P &= -B \frac{\partial s}{\partial x}, \\ &= B k s \sin(kx - \omega t), \end{aligned}$$

$$B = \rho v^2, \quad \text{since } v = \sqrt{\frac{B}{\rho}}$$

$$v = \frac{\omega}{k}, \quad \text{so}$$

$$\begin{aligned} \Delta P_{max1} &= \rho v_1^2 k_1 s_{max1} \quad \text{or} \\ &= \frac{\rho \omega_1^2}{k_1} s_{max1} \end{aligned}$$

$$\begin{aligned} \Delta P_{max2} &= \frac{\rho \omega_2^2}{k_2} s_{max2} \\ &= \frac{\rho (2\omega_1)^2}{2k_1} (2 s_{max1}) \\ &= 4 \frac{\rho \omega_1 s_{max1}}{k_1} \\ &= 4 \Delta P_{max1}. \end{aligned}$$

Answer **A**.