

Consider two sound waves where the displacement oscillations are described by

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

$$\Delta P = \Delta P_{max} \sin(kx - \omega t).$$

If  $s_{max2} = 2s_{max1}$ ,  $k_2 = 2k_1$ , and  $\omega_2 = 2\omega_1$ , then  $\Delta P_{max2}$  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.

$$\begin{aligned}\Delta P &= -B \frac{\partial s}{\partial x}, \\ &= B k s \sin(k x - \omega t),\end{aligned}$$

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

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

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

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

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$$= 4 \Delta P_{max1}.$$

Answer **A**.