Consider two sound waves where the displacement oscillations are described by

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

$\triangle P = \triangle P_{max} \sin(k\,x - \omega\,t)$.

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

A) $\triangle P_{max2} = 4\,\triangle P_{max1}$.

B) $\triangle P_{max2} = \triangle P_{max1}$.

C) $\triangle P_{max2} = \frac{1}{4}\,\triangle P_{max1}$.

D) can not be determined.

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

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

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

$$\begin{aligned}
\triangle P_{max1} &= \rho\,v_1^2\,k_1\,s_{max1} \quad \text{or} \\
&= \frac{\rho\,{\omega_1}^2}{k_1}\,s_{max1} \\
\triangle P_{max2} &= \frac{\rho\,{\omega_2}^2}{k_2}\,s_{max2} \\
&= \frac{\rho\,(2\,\omega_1)^2}{2\,k_1}\,(2\,s_{max1}) \\
&= 4\,\frac{\rho\,\omega_1\,s_{max1}}{k_1} \\
&= 4\,\triangle P_{max1}\,.
\end{aligned}$$

Answer **A**.