35.4 The background noise in a factory prior to any equipment turning on has a sound pressure level of $40dB$. Once the equipment is operating, the sound pressure level is $46dB$. What is the sound pressure level attributable to the machinery only?

A. $6dB$

B. $41dB$

C. $43dB$

D. $45dB$

Refer to the table for Combining Two Sound Levels. The process for combining sound levels involves adding up to $3dB$ to the *highest* source, depending on the difference in sound level between the two sources. In this case, it is not immediately clear whether the background noise or the machinery is the louder source. Since the most that could be added to arrive at the combined sound pressure level is $3dB$, it can be inferred that the background noise is not as loud at the machinery, as combining two $40dB$ sources would result in a combined level of only $43dB$. Therefore, the machinery must be louder.

Test values for the machinery between $41dB$ and $45dB$.

$$SPL_{machinery} = 41dB \rightarrow Difference = 1dB \rightarrow Combined\,SPL = 41dB + 3dB = 44dB \neq 46dB$$

$$SPL_{machinery} = 42dB \rightarrow Difference = 2dB \rightarrow Combined\,SPL = 42dB + 2dB = 44dB \neq 46dB$$

$$SPL_{machinery} = 43dB \rightarrow Difference = 3dB \rightarrow Combined\,SPL = 43dB + 2dB = 45dB \neq 46dB$$

$$SPL_{machinery} = 44dB \rightarrow Difference = 4dB \rightarrow Combined\,SPL = 44dB + 2dB = 46dB = 46dB$$

$$SPL_{machinery} = 45dB \rightarrow Difference = 5dB \rightarrow Combined\,SPL = 45dB + 1dB = 46dB = 46dB$$

Note there are two viable answer choices, $44dB$ and $45dB$. However, only $45dB$ is an answer choice.

Answer D