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Chapter 34. Illumination and Sound

Practice Problems

1.

A worker is exposed to a sound level of 85 decibels (dB) for the first 3.5 hr of his 8 hr shift and then exposed to a sound level of 89 dB for the remaining 4.5 hr. Most nearly, the worker's 8 hr time-weighted average (TWA) noise level is

(A)

71 dB

(B)

82 dB

(C)

86 dB

(D)

88 dB

Solutions

1.

Calculate the permissible sound level durations from the initial noise level, L_1, and the time of exposure, C_1.

$$\begin{aligned} T_1 &= \frac{8 \text{ hr}}{2^{(L_1 - 90 \text{ dB})/5 \text{ dB}}} \\ &= \frac{8 \text{ hr}}{2^{(85 \text{ dB} - 90 \text{ dB})/5 \text{ dB}}} \\ &= 16 \text{ hr} \end{aligned}$$

Calculate the permissible sound level durations from the second noise level, L_2, and the time of exposure, C_2.

$$\begin{aligned} T_2 &= \frac{8 \text{ hr}}{2^{(L_2 - 90 \text{ dB})/5 \text{ dB}}} \\ &= \frac{8 \text{ hr}}{2^{(89 \text{ dB} - 90 \text{ dB})/5 \text{ dB}}} \\ &= 9.190 \text{ hr} \end{aligned}$$

Calculate the total noise dose over the work day.

$$\begin{aligned} D &= \left(\frac{C_1}{T_1} + \frac{C_2}{T_2} \right) \times 100\% \\ &= \left(\frac{3.5 \text{ hr}}{16 \text{ hr}} + \frac{4.5 \text{ hr}}{9.190 \text{ hr}} \right) \times 100\% \\ &= 70.84\% \end{aligned}$$

Calculate the TWA.

$$\begin{aligned}\text{TWA} &= (16.61\text{ dB}) \log\left(\frac{D}{100}\right) + 90\text{ dB} \\ &= (16.61\text{ dB}) \log\frac{70.84\%}{100\%} + 90\text{ dB} \\ &= 87.51\text{ dB} \quad (88\text{ dB})\end{aligned}$$

The answer is (D).