

What Are Acoustic Design Principles?

Worksheet

Acoustic design principles use room shape, surface materials, and absorption to control sound reflection and reverberation; the core tool is the Sabine formula: $RT60 = 0.161 V / A$.

Questions

1. What does the Sabine formula $RT60 = 0.161 V / A$ calculate?
 - A) Daylight Factor
 - B) Reverberation time
 - C) Solar heat gain
 - D) Embodied carbon
2. A room has $V = 300$ m and $A = 60$ m sabins. What is $RT60$?
 - A) 0.80 s
 - B) 1.60 s
 - C) 0.40 s
 - D) 5.00 s
3. Adding more absorptive material to a room will:
 - A) Increase $RT60$
 - B) Decrease $RT60$
 - C) Have no effect on $RT60$
 - D) Only affect the room's volume
4. Which space typically wants a SHORT reverberation time?
 - A) Concert hall
 - B) Cathedral
 - C) Classroom
 - D) Opera house
5. A concert hall has a volume of 10,000 m and total absorption of 800 m sabins. Find its reverberation time.
6. A classroom has a volume of 200 m and total absorption of 50 m sabins. Find its reverberation time.
7. A recording studio ($V = 500$ m) needs $RT60$ no longer than 0.5 s. Find the minimum absorption A required.
8. Define: What is acoustic design?
9. Define: What is reverberation time ($RT60$)?
10. Define: What is the Sabine formula?

Answer Key

1. B) Reverberation time - The Sabine equation relates a room's volume and absorption to its reverberation time.
2. A) 0.80 s - $RT60 = 0.161 \cdot 300 / 60 = 48.3/60 = 0.80$ s.
3. B) Decrease RT60 - More absorption (higher A) reduces reverberation time since RT60 is inversely proportional to A.
4. C) Classroom - Classrooms need short RT60 for clear speech intelligibility, unlike music spaces that benefit from longer reverberation.
5. $RT60 = 0.161 \cdot V / A$ $RT60 = 0.161 \cdot 10,000 / 800$ $RT60 = 1,610 / 800$ $RT60 = 2.01$ s
6. $RT60 = 0.161 \cdot 200 / 50$ $RT60 = 32.2 / 50$ $RT60 = 0.64$ s
7. $RT60 = 0.161 \cdot V / A$ $A = 0.161 \cdot V / RT60$ $A = 0.161 \cdot 500 / 0.5$ $A = 80.5 / 0.5 = 161$ m sabins
8. Shaping a room's geometry and surface materials to control sound reflection, absorption, and reverberation for the intended use.
9. The time it takes for sound to decay by 60 decibels after the source stops - a key measure of how 'live' or 'dead' a room sounds.
10. $RT60 = 0.161 \cdot V / A$, where V is room volume (m) and A is total absorption in m sabins.

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