

# Consonance of Harmonics - Just Diatonic Scale

**Explanation:** If two complex tones – e.g. two square or triangle waves and/or two musical tones with integer-related harmonics are superposed/added together – e.g. as unison, 2<sup>nd</sup>, minor 3<sup>rd</sup>, major 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup>, ... octave in the just diatonic scale, the colored boxes in the tables below indicate the overlap of harmonics from the two sounds that will be consonant with each other. Thus, e.g. two complex tones in unison, a fifth apart or an octave apart are quite consonant with each other, whereas two complex tones that are e.g. a 2<sup>nd</sup> or a 7<sup>th</sup> apart are quite dissonant-sounding.

Fundamental Frequency,  $f_0 = 100$  Hz

	Unison	Second	???	???	Minor 3rd	Major 3rd	Fourth	Fifth	Sixth	Seventh	Octave
Harmonic	C-C	D-C	???-C	???-C	E <sub>b</sub> -C	E-C	F-C	G-C	A-C	B-C	C-C
#	1:1	9:8	8:7	7:6	6:5	5:4	4:3	3:2	5:3	15:8	2:1
1	100.0	112.5	114.3	116.7	120.0	125.0	133.3	150.0	166.7	187.5	200.0
2	200.0	225.0	228.6	233.3	240.0	250.0	266.7	300.0	333.3	375.0	400.0
3	300.0	337.5	342.9	350.0	360.0	375.0	400.0	450.0	500.0	562.5	600.0
4	400.0	450.0	457.1	466.7	480.0	500.0	533.3	600.0	666.7	750.0	800.0
5	500.0	562.5	571.4	583.3	600.0	625.0	666.7	750.0	833.3	937.5	1000.0
6	600.0	675.0	685.7	700.0	720.0	750.0	800.0	900.0	1000.0	1125.0	1200.0
7	700.0	787.5	800.0	816.7	840.0	875.0	933.3	1050.0	1166.7	1312.5	1400.0
8	800.0	900.0	914.3	933.3	960.0	1000.0	1066.7	1200.0	1333.3	1500.0	1600.0
9	900.0	1012.5	1028.6	1050.0	1080.0	1125.0	1200.0	1350.0	1500.0	1687.5	1800.0
10	1000.0	1125.0	1142.9	1166.7	1200.0	1250.0	1333.3	1500.0	1666.7	1875.0	2000.0
11	1100.0	1237.5	1257.1	1283.3	1320.0	1375.0	1466.7	1650.0	1833.3	2062.5	2200.0
12	1200.0	1350.0	1371.4	1400.0	1440.0	1500.0	1600.0	1800.0	2000.0	2250.0	2400.0
13	1300.0	1462.5	1485.7	1516.7	1560.0	1625.0	1733.3	1950.0	2166.7	2437.5	2600.0
14	1400.0	1575.0	1600.0	1633.3	1680.0	1750.0	1866.7	2100.0	2333.3	2625.0	2800.0
15	1500.0	1687.5	1714.3	1750.0	1800.0	1875.0	2000.0	2250.0	2500.0	2812.5	3000.0
16	1600.0	1800.0	1828.6	1866.7	1920.0	2000.0	2133.3	2400.0	2666.7	3000.0	3200.0
17	1700.0	1912.5	1942.9	1983.3	2040.0	2125.0	2266.7	2550.0	2833.3	3187.5	3400.0
18	1800.0	2025.0	2057.1	2100.0	2160.0	2250.0	2400.0	2700.0	3000.0	3375.0	3600.0
19	1900.0	2137.5	2171.4	2216.7	2280.0	2375.0	2533.3	2850.0	3166.7	3562.5	3800.0
20	2000.0	2250.0	2285.7	2333.3	2400.0	2500.0	2666.7	3000.0	3333.3	3750.0	4000.0
21	2100.0	2362.5	2400.0	2450.0	2520.0	2625.0	2800.0	3150.0	3500.0	3937.5	4200.0
22	2200.0	2475.0	2514.3	2566.7	2640.0	2750.0	2933.3	3300.0	3666.7	4125.0	4400.0
23	2300.0	2587.5	2628.6	2683.3	2760.0	2875.0	3066.7	3450.0	3833.3	4312.5	4600.0
24	2400.0	2700.0	2742.9	2800.0	2880.0	3000.0	3200.0	3600.0	4000.0	4500.0	4800.0
25	2500.0	2812.5	2857.1	2916.7	3000.0	3125.0	3333.3	3750.0	4166.7	4687.5	5000.0
26	2600.0	2925.0	2971.4	3033.3	3120.0	3250.0	3466.7	3900.0	4333.3	4875.0	5200.0
27	2700.0	3037.5	3085.7	3150.0	3240.0	3375.0	3600.0	4050.0	4500.0	5062.5	5400.0
28	2800.0	3150.0	3200.0	3266.7	3360.0	3500.0	3733.3	4200.0	4666.7	5250.0	5600.0
29	2900.0	3262.5	3314.3	3383.3	3480.0	3625.0	3866.7	4350.0	4833.3	5437.5	5800.0
30	3000.0	3375.0	3428.6	3500.0	3600.0	3750.0	4000.0	4500.0	5000.0	5625.0	6000.0
31	3100.0	3487.5	3542.9	3616.7	3720.0	3875.0	4133.3	4650.0	5166.7	5812.5	6200.0
32	3200.0	3600.0	3657.1	3733.3	3840.0	4000.0	4266.7	4800.0	5333.3	6000.0	6400.0

# Dissonance of Harmonics - Just Diatonic Scale

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Fundamental Frequency,  $f_0 = 100$  Hz

	Unison	Second	???	???	Minor 3rd	Major 3rd	Fourth	Fifth	Sixth	Seventh	Octave
Harmonic	C-C	D-C	???-C	???-C	E <sub>b</sub> -C	E-C	F-C	G-C	A-C	B-C	C-C
#	1:1	9:8	8:7	7:6	6:5	5:4	4:3	3:2	5:3	15:8	2:1
1	100.0	112.5	114.3	116.7	120.0	125.0	133.3	150.0	166.7	187.5	200.0
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7	700.0	787.5	800.0	816.7	840.0	875.0	933.3	1050.0	1166.7	1312.5	1400.0
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12	1200.0	1350.0	1371.4	1400.0	1440.0	1500.0	1600.0	1800.0	2000.0	2250.0	2400.0
13	1300.0	1462.5	1485.7	1516.7	1560.0	1625.0	1733.3	1950.0	2166.7	2437.5	2600.0
14	1400.0	1575.0	1600.0	1633.3	1680.0	1750.0	1866.7	2100.0	2333.3	2625.0	2800.0
15	1500.0	1687.5	1714.3	1750.0	1800.0	1875.0	2000.0	2250.0	2500.0	2812.5	3000.0
16	1600.0	1800.0	1828.6	1866.7	1920.0	2000.0	2133.3	2400.0	2666.7	3000.0	3200.0
17	1700.0	1912.5	1942.9	1983.3	2040.0	2125.0	2266.7	2550.0	2833.3	3187.5	3400.0
18	1800.0	2025.0	2057.1	2100.0	2160.0	2250.0	2400.0	2700.0	3000.0	3375.0	3600.0
19	1900.0	2137.5	2171.4	2216.7	2280.0	2375.0	2533.3	2850.0	3166.7	3562.5	3800.0
20	2000.0	2250.0	2285.7	2333.3	2400.0	2500.0	2666.7	3000.0	3333.3	3750.0	4000.0
21	2100.0	2362.5	2400.0	2450.0	2520.0	2625.0	2800.0	3150.0	3500.0	3937.5	4200.0
22	2200.0	2475.0	2514.3	2566.7	2640.0	2750.0	2933.3	3300.0	3666.7	4125.0	4400.0
23	2300.0	2587.5	2628.6	2683.3	2760.0	2875.0	3066.7	3450.0	3833.3	4312.5	4600.0
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26	2600.0	2925.0	2971.4	3033.3	3120.0	3250.0	3466.7	3900.0	4333.3	4875.0	5200.0
27	2700.0	3037.5	3085.7	3150.0	3240.0	3375.0	3600.0	4050.0	4500.0	5062.5	5400.0
28	2800.0	3150.0	3200.0	3266.7	3360.0	3500.0	3733.3	4200.0	4666.7	5250.0	5600.0
29	2900.0	3262.5	3314.3	3383.3	3480.0	3625.0	3866.7	4350.0	4833.3	5437.5	5800.0
30	3000.0	3375.0	3428.6	3500.0	3600.0	3750.0	4000.0	4500.0	5000.0	5625.0	6000.0
31	3100.0	3487.5	3542.9	3616.7	3720.0	3875.0	4133.3	4650.0	5166.7	5812.5	6200.0
32	3200.0	3600.0	3657.1	3733.3	3840.0	4000.0	4266.7	4800.0	5333.3	6000.0	6400.0