

Chromatic Scale

Notes

A# ₋₁	B ₋₁	C ₀	C# ₀	D ₀	D# ₀	E ₀	F ₀	F# ₀	G ₀	G# ₀	A ₀	A# ₀	B ₀	C ₁	C# ₁
14.57	15.43	16.35	17.32	18.35	19.45	20.60	21.83	23.12	24.50	25.96	27.50	29.14	30.87	32.70	34.65

Hertz

Western music uses 12 notes that are repeated along the continuum. They are represented by the following symbols:

C, C#, D, D#, E, F, F#, G, G#, A, A#, B

You will learn later while these symbols are used as opposed to any other symbol.

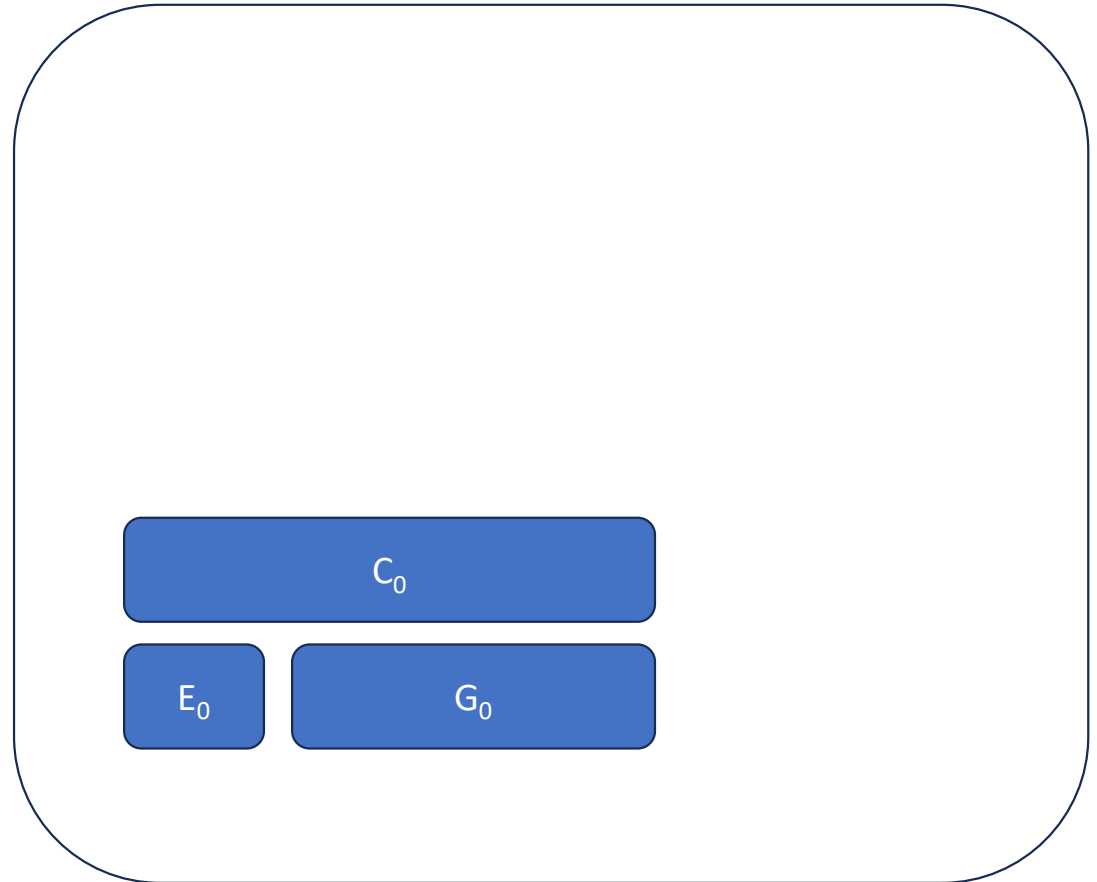
(Hint: it is a useful pattern for writing music)

Because these 12 symbols are repeated, we use a numeric subscript to denote a set. Each set is known as an **octave**.

You will notice that playing these 3 notes on the piano C₀E₀G₀ will sound similar to C₁E₁G₁. We call this **octave substitution** and it works because it is the same pattern, but just played at a different “location”.

Analogy for Octave

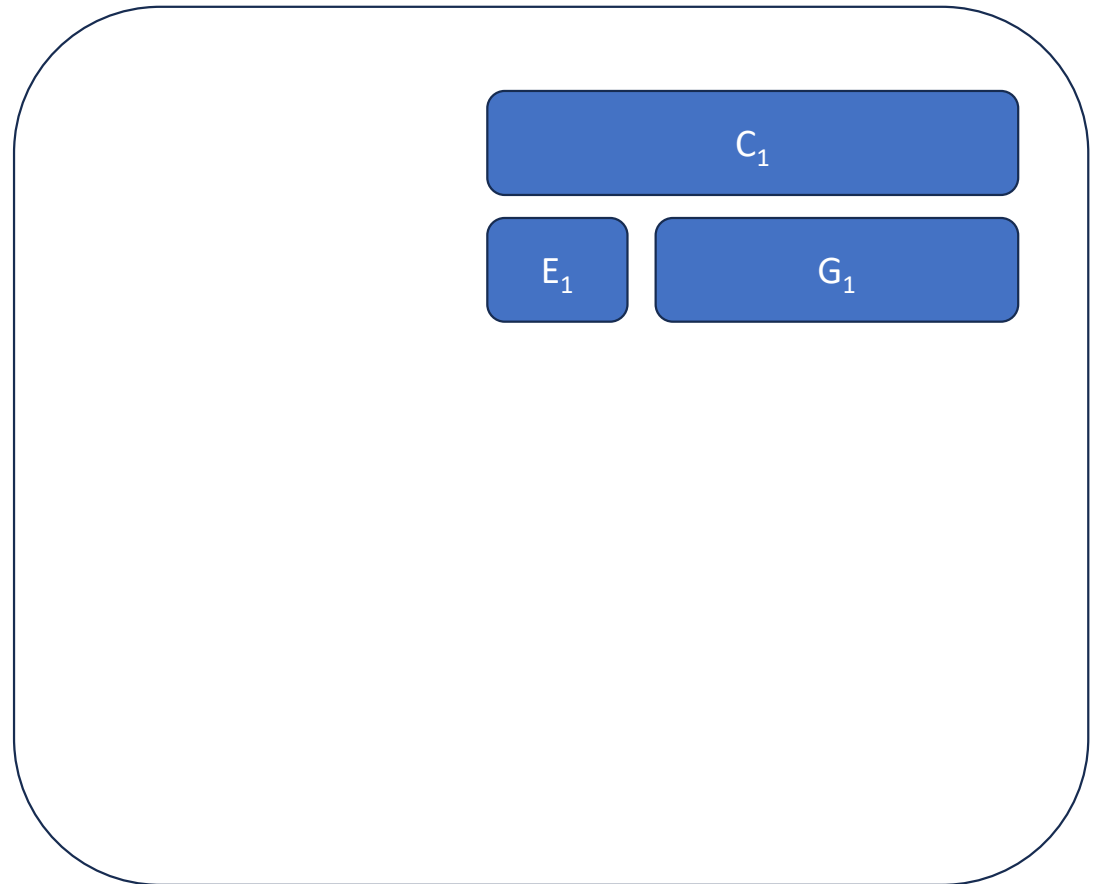
To our **human eyes** we see a pattern of blue squares at the bottom left corner of a bigger white square.



Analogy for Octave

In this example, humans will **visually** recognize the **same pattern** of blue squares, but it is now at the top right corner of the bigger white square.

Each **octave** is the **same pattern**, but our **ears hear** it at a different **audio spectrum** (ie. audio location).



Chromatic Scale

Notes

A# ₋₁	B ₋₁	C ₀	C# ₀	D ₀	D# ₀	E ₀	F ₀	F# ₀	G ₀	G# ₀	A ₀	A# ₀	B ₀	C ₁	C# ₁
14.57	15.43	16.35	17.32	18.35	19.45	20.60	21.83	23.12	24.50	25.96	27.50	29.14	30.87	32.70	34.65

Hertz

This is why people with different vocal ranges can sing the same song at what appears to be a lower range or a higher range. Because they use the **same musical pattern** but at different part of the musical continuum.

Also note in the chart above, each note has an audio frequency in Hertz. Every time you repeat a note in the next octave, it is just **double the frequency**. E.g.

$$2 \times C_0 \approx C_1 \quad (2 \times 16.35 \approx 32.70)$$

$$2 \times C_1 \approx C_2 \quad (2 \times 32.70 \approx 65.4)$$

This mathematical symmetry implies that the Chromatic Scale (and music in general) is basically just **humans noticing mathematical symmetry with our ears!!!**

If you have a physics background, look up videos on **harmonic series** or **standing wave theory**.

Chromatic Scale

Notes

A# ₋₁	B ₋₁	C ₀	C# ₀	D ₀	D# ₀	E ₀	F ₀	F# ₀	G ₀	G# ₀	A ₀	A# ₀	B ₀	C ₁	C# ₁
14.57	15.43	16.35	17.32	18.35	19.45	20.60	21.83	23.12	24.50	25.96	27.50	29.14	30.87	32.70	34.65

Hertz

The distance between any two notes is called a **semitone**.

Going from C₀ to C#₀ is 1 semitone.

Going from C₀ to E₀ is 4 semitones.

Sometimes people say **half step** as a synonym to 1 semitone.

Sometimes people say **whole step** as a synonym to 2 semitones.

Going from C₀ to C#₀ is 1 half step.

Going from C₀ to E₀ is 4 half notes or 2 whole steps.

Heptatonic Scale

A **heptatonic scale** is **any 7-note pattern** from the chromatic scale. These are all considered heptatonic scales.



This heptatonic scale is also known as C Major Scale



This heptatonic scale is also known as G Major Scale



This heptatonic scale is also known as E Minor Scale



This is also a heptatonic scale, but I do not know if it's also known by another name.

Notice these two scales use the exact same notes, but one is called G Major Scale and one is called E Minor Scale.

More on this later...

Diatonic Scale

A **diatonic scale** is when you have 5 whole steps and 2 half steps and each half step is separated from the next note by 2 half steps or 3 half steps. Based on this definition, all diatonic scales are also heptatonic scales (but not all heptatonic scales are diatonic scales).



This diatonic scale is also as C Major Scale



This diatonic scale is also as D Flat Major Scale (ie. C# Major Scale)



This diatonic scale is also as D Major Scale



This diatonic scale is also as E Flat Major Scale (ie. D # Major Scale)



This diatonic scale is also as E Major Scale



This diatonic scale is also as F Major Scale



This diatonic scale is also as G Flat Major Scale (ie. F# Major Scale)



This diatonic scale is also as G Major Scale



This diatonic scale is also as A Flat Major Scale (ie. G# Major Scale)



This diatonic scale is also as A Major Scale



This diatonic scale is also as B Flat Major Scale (ie. A# Major Scale)



This diatonic scale is also as B Major Scale

Diatonic Scale - Major Scale aka Ionian Mode

The **W-W-H-W-W-W-H** pattern is so popular that it has two special names. The most popular name is **The Major Scale**. The second name it is called is the **Ionian Mode of a diatonic scale**. There are **12 possible major scales**. They are all shown below, one for each of the 12 possible notes..

	W		W		H		W		W		W		H
C		D		E	F		G		A		B		

This diatonic scale is also as C Major Scale

D_		E_		F	G_		A_		B_		C		
----	--	----	--	---	----	--	----	--	----	--	---	--	--

This diatonic scale is also as D Flat Major Scale (ie. C# Major Scale)

D		E		F#	G		A		B		C#		
---	--	---	--	----	---	--	---	--	---	--	----	--	--

This diatonic scale is also as D Major Scale

E_		F		G	A_		B_		C		D		
----	--	---	--	---	----	--	----	--	---	--	---	--	--

This diatonic scale is also as E Flat Major Scale (ie. D # Major Scale)

E		F#		G#	A		B		C#		D#		
---	--	----	--	----	---	--	---	--	----	--	----	--	--

This diatonic scale is also as E Major Scale

F		G		A	B_		C		D		E		
---	--	---	--	---	----	--	---	--	---	--	---	--	--

This diatonic scale is also as F Major Scale

	W		W		H		W		W		W		H
G_		A_		B_	C_		D_		E_		F		

This diatonic scale is also as G Flat Major Scale (ie. F# Major Scale)

G		A		B	C		D		E		F#		
---	--	---	--	---	---	--	---	--	---	--	----	--	--

This diatonic scale is also as G Major Scale (ie. G Major Scale)

A_		B_		C	D_		E_		F		G		
----	--	----	--	---	----	--	----	--	---	--	---	--	--

This diatonic scale is also as A Flat Major Scale (ie. G# Major Scale)

A		B		C#	D		E		F#		G#		
---	--	---	--	----	---	--	---	--	----	--	----	--	--

This diatonic scale is also as A Major Scale

B_		C		D	E_		F		G		A		
----	--	---	--	---	----	--	---	--	---	--	---	--	--

This diatonic scale is also as B Flat Major Scale (ie. A# Major Scale)

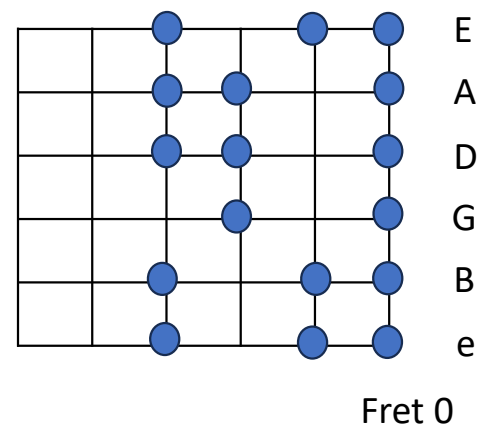
B		C#		D#	E		F#		G#		A#		
---	--	----	--	----	---	--	----	--	----	--	----	--	--

This diatonic scale is also as B Major Scale

Diatonic Scale – Seven Modes

You can transpose any single Ionian Mode 6 times to reveal 6 other diatonic scales. Making a total of **7 modes**. Let's demonstrate the 6 other modes of the C Major Scale.

C		D		E	F		G		A		B
Ionian Mode (aka C Major Scale) - W-W-H-W-W-W-H											
D		E	F		G		A		B	C	
Dorian Mode - W-H-W-W-W-H-W											
E	F		G		A		B	C		D	
Phrygian Mode - H-W-W-W-H-W-W											
F		G		A		B	C		D		E
Lydian Mode - W-W-W-H-W-W-H											
G		A		B	C		D		E	F	
Mixolydian Mode – W-W-H-W-W-H-W											
A		B	C		D		E	F		G	
Aeolian Mode (aka A Minor Scale aka A Natural Minor Scale) - W-H-W-W-W-H-W											
B	C		D		E	F		G		A	
Locrian Mode – H-W-W-H-W-W-W											

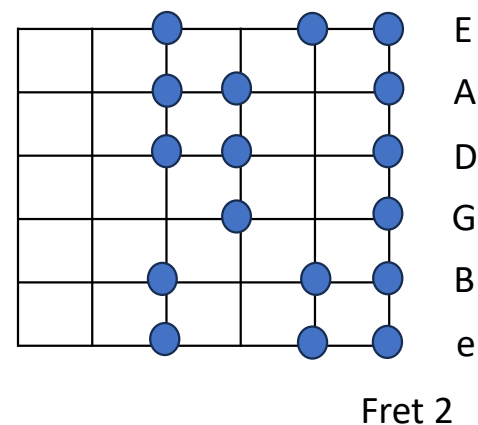


Notice all 7 modes of this diatonic scale uses the exact same notes on your guitar fretboard.

Diatonic Scale – Seven Modes

These are the 7 modes of the D Major Scale. What similarities do you notice with the 7 modes of C Major Scale?

D		E		F#	G		A		B		C#
Ionian Mode (aka D Major Scale) - W-W-H-W-W-W-H											
E		F#	G		A		B		C#	D	
Dorian Mode - W-H-W-W-W-H-W											
F#	G		A		B		C#	D		E	
Phrygian Mode - H-W-W-W-H-W-W											
G		A		B		C#	D		E		F#
Lydian Mode - W-W-W-H-W-W-H											
A		B		C#	D		E		F#	G	
Mixolydian Mode – W-W-H-W-W-H-W											
B		C#	D		E		F#	G		A	
Aeolian Mode (aka B Minor Scale aka B Natural Minor Scale) - W-H-W-W-W-H-W											
C#	D		E		F#	G		A		B	
Locrian Mode – H-W-W-H-W-W-W											

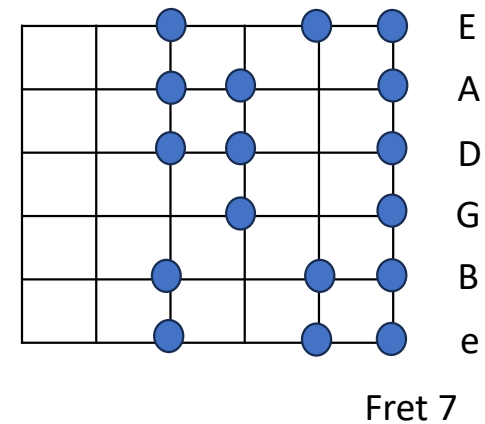


Notice all 7 modes of this diatonic scale uses the exact same notes on your guitar fretboard.

Diatonic Scale – Seven Modes

These are the 7 modes of the G Major Scale. What similarities do you notice with the 7 modes of C Major Scale?

G		A		B	C		D		E		F#
Ionian Mode (aka G Major Scale) - W-W-H-W-W-W-H											
A		B	C		D		E		F#	G	
Dorian Mode - W-H-W-W-W-H-W											
B	C		D		E		F#	G		A	
Phrygian Mode - H-W-W-W-H-W-W											
C		D		E		F#	G		A		B
Lydian Mode - W-W-W-H-W-W-H											
D		E		F#	G		A		B	C	
Mixolydian Mode – W-W-H-W-W-H-W											
E		F#	G		A		B	C		D	
Aeolian Mode (aka E Minor Scale aka E Natural Minor Scale) - W-H-W-W-W-H-W											
F#	G		A		B	C		D		E	
Locrian Mode – H-W-W-H-W-W-W											



Notice all 7 modes of this diatonic scale uses the exact same notes on your guitar fretboard.

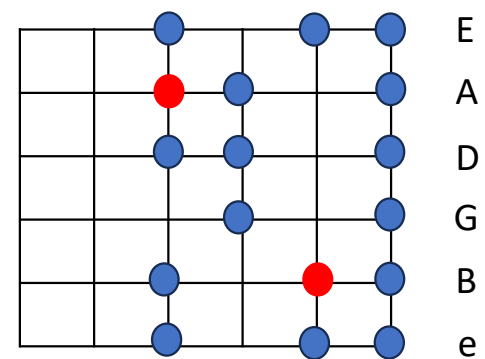
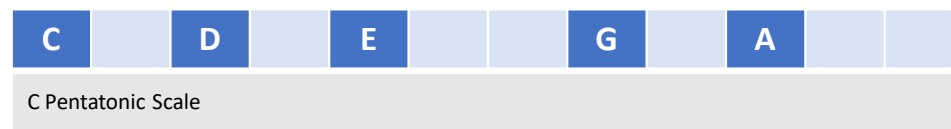
Diatonic Scale

We can summarize the diatonic scale as follows:

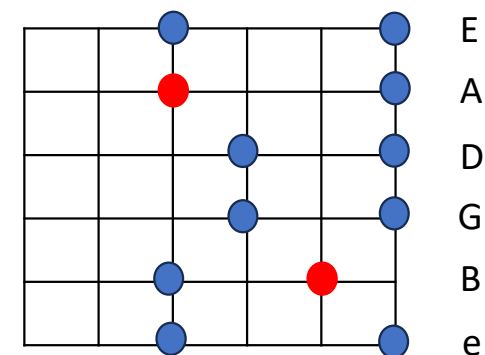
- There are **12 possible Major Scales**, one for each of the 12 notes.
- There are **12 possible Minor Scales**, one for each of the 12 notes.
- There are **7 modes for a single diatonic scale**.
- Each of the 7 modes of a single diatonic scale uses the **same notes**.
- 7 modes x 12 notes means there are a total of **84 diatonic scales**.
- All 84 diatonic scales are played using the same handshapes on your guitar fretboard simply by transposing up or down a few frets (ie. Using a capo).

Pentatonic Scale

The **pentatonic scale** is basically the diatonic scale, but subtract the 3rd and 7th note of a Major Scale.



Fret 0



Chords

A **chord** is 3 or more different notes played together. For example:

$C_0E_0G_0$ – is a chord of 3 notes.

$C_0E_0G_0C_1$ – is also a chord of 3 notes. We regard C_0 and C_1 as basically the same note.

$C_0G_0C_1$ – some argue that this is NOT a chord, because it only has two notes, again C_0 and C_1 are regarded as the same note. However, in pop music and rock, they like to use the term Power Chord, which we will explain later.

Diatonic Chords / Triads

Let's number the notes in a diatonic scale. Using numbers is convenient because we already established all diatonic scales use the same "pattern" on our guitar fretboard.

1		2		3	4		5		6		7
C		D		E	F		G		A		B

Example with C Major Scale

1		2		3	4		5		6		7
G		A		B	C		D		E		F#

Example with G Major Scale

Diatonic Chords / Triads

When you use a diatonic scale and you form a 3-note chord where each note is separated by one other note, then you have the popular **triad chord**. There are 7 triad chords to each diatonic scale. Here's example with the C scale (applies to all 7 modes).

1		2		3	4		5		6		7
C		D		E	F		G		A		B
C		D		E	F		G		A		B
C		D		E	F		G		A		B
C		D		E	F		G		A		B
C		D		E	F		G		A		B
C		D		E	F		G		A		B
C		D		E	F		G		A		B

Note #	Notes	#	Chord Type
135	CEG	I	Major
246	DFA	ii	Minor
357	EGB	iii	Minor
462	FAC	IV	Major
571	GBD	V	Major
624	ACE	vi	Minor
715	BDF	°vii	Diminished

Diatonic Chords / Triads

Here are the triads for the D Major Scale (and all 7 modes).

1		2		3	4		5		6		7
D		E		F#	G		A		B		C#
D		E		F#	G		A		B		C#
D		E		F#	G		A		B		C#
D		E		F#	G		A		B		C#
D		E		F#	G		A		B		C#
D		E		F#	G		A		B		C#
D		E		F#	G		A		B		C#

Note #	Notes	#	Chord Type
135	DF#A	I	Major
246	EGB	ii	Minor
357	F#AC#	iii	Minor
462	GBD	IV	Major
571	AC#E	V	Major
624	BDF#	vi	Minor
715	C#EG	°vii	Diminished

Diatonic Chords / Triads

Here are the triads for the G Major Scale (and all 7 modes).

Notice the similarities between this and the last 2 slides: **patterns are same, chord numbers are the same, chord letters are the same (excluding the flats and sharps)**

1		2		3	4		5		6		7	Note #	Notes	#	Chord Type
G		A		B	C		D		E		F#	135	CEG	I	Major
G		A		B	C		D		E		F#	246	DF#A	ii	Minor
G		A		B	C		D		E		F#	357	EGB	iii	Minor
G		A		B	C		D		E		F#	462	F#AC	IV	Major
G		A		B	C		D		E		F#	571	GBD	V	Major
G		A		B	C		D		E		F#	624	ACE	vi	Minor
G		A		B	C		D		E		F#	715	BDF#	°vii	Diminished

Major Chord – 3 semitones between 1 and 3 and 2 semitones between 3 and 5.

Minor Chord – 2 semitones between 1 and 3 and 3 semitones between 3 and 5