

Guitar Course

The Electric Guitar: Learning Objectives

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Learning Objectives:

Upon completion of this topic students will know and understand:

- The basic parts of a guitar and their purposes.
- How a pickup transforms mechanical energy into electrical energy through the process of induction.
- Engineers use the design process to develop new products.

Upon completion of this topic students will be able to do the following:

- Design and fabricate an electric guitar.
- Safely use tools and machines to process a wide variety of materials.

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Example Guitars

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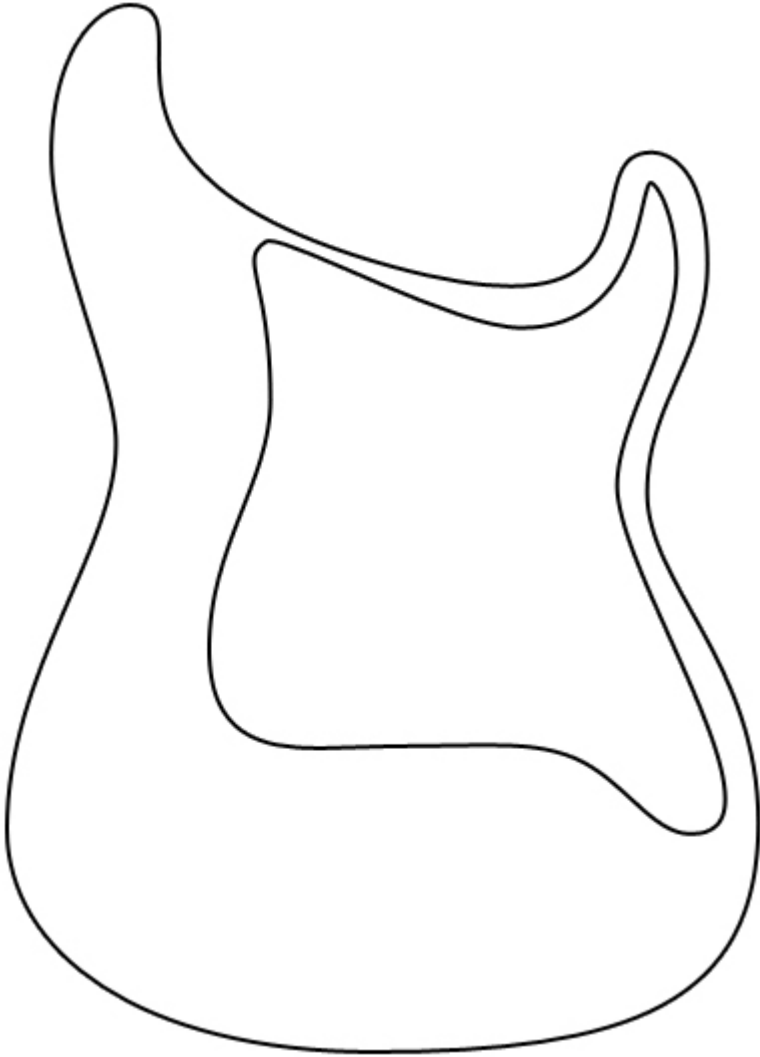


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Guitar Body Template

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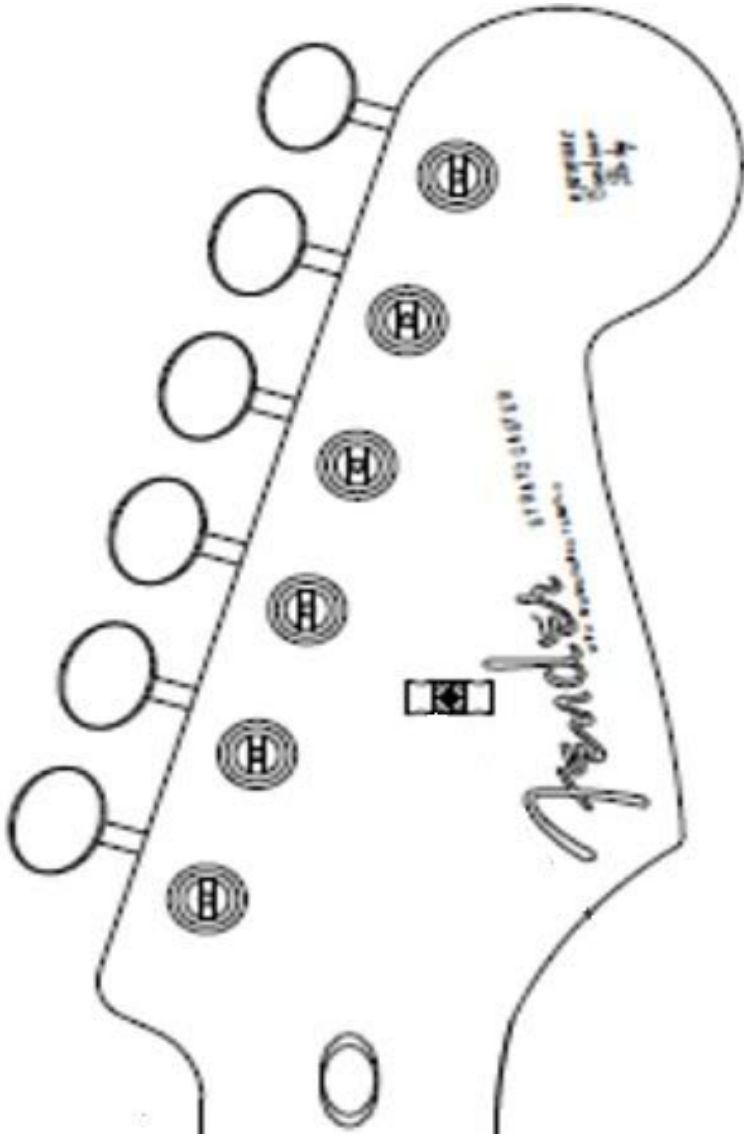


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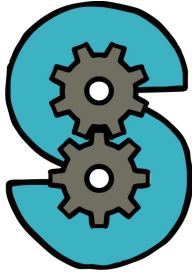
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Guitar Headstock Template

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At STEMy Stuff our main goal is to get as many students as possible to learn as much science, math and fabrication skill as possible making our electric guitars. However, there's plenty of fun and learning that can be had learning to play the finished guitars. We'd be lying if we told you that we were musicians. We're not. However, we know enough to get you started. What follows is a user's guide to a finished STEMy Stuff electric guitar.

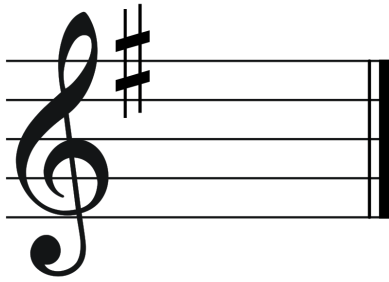
Tuning:

The beautiful thing about a single-string guitar is that it is always in tune. At least, it is always in tune with itself. If you're a solo act, don't worry about what note or frequency your string is tuned to. It doesn't really matter. However, if you're trying to play along with another guitar, another instrument, or with the radio you'll want to tune your string to either Middle C, AKA C_4 (~262 Hz) or Low C, C_3 (~131 Hz) depending on the range in the song you are trying to play. **If you're playing along with a classmate on their STEMy Stuff guitar it doesn't matter what note you're tuned to as long as it is the same note.**

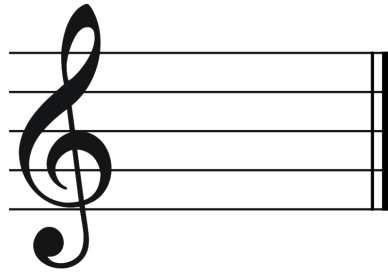
Range and Scales:

If you used our neck template to place your frets then you're guitar is fretted to play a diatonic scale. It is essentially like playing a piano with no black keys and two octaves. You can't play any song you want, however, you can play a pile of songs. Good songs. Old songs and new songs. Lots of songs.

Because you are playing diatonic scale the songs that you want are songs in the key C major. If you're looking up tunes you'll know that they are in C major if the key signature shows no sharps or flats. If the song you want is not in C major it may be possible to transpose it into C major but that's not something we're going to get into here. Ask your music teacher. It may be worth mentioning that a song written in A minor is also in C major. Music theory is weird.



This is the key signature for a song in G major. See that hashtag on the top line? That symbol says that all F notes should be played as F sharp (F#). It also says that this song won't work on your guitar.



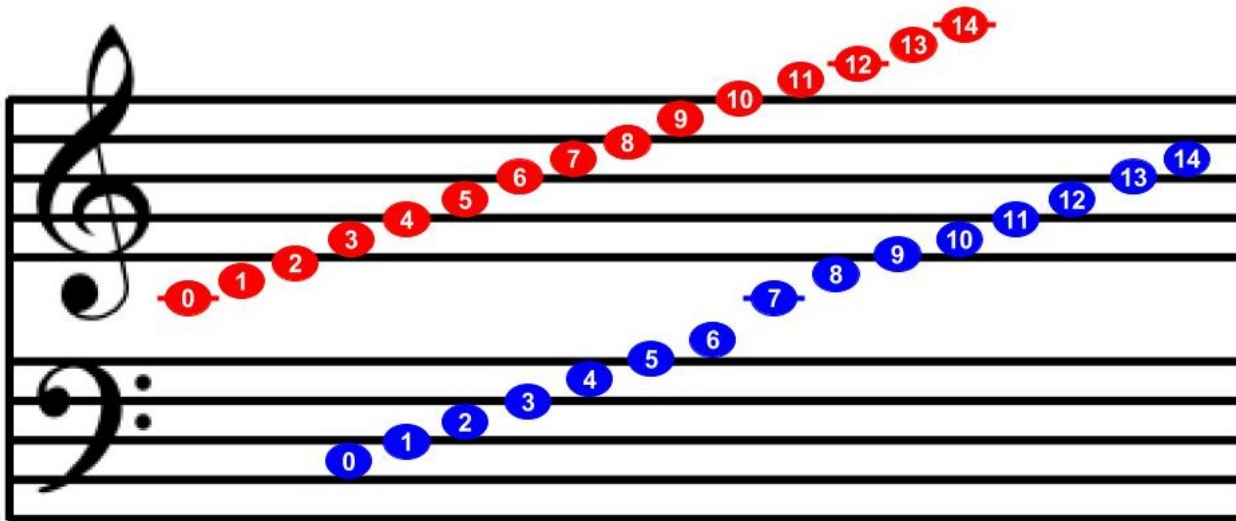
This is the key signature for a song in C major. It's clean.

You're good to go!



See all of those sharp symbols? This song is in C sharp major. It's a no-go.

If you're trying to read the music and play it on your guitar this diagram should help. If the range of your song fits entirely on the treble clef use the red scale. The numbers on the notes indicate which fret on your guitar will play that note. Zero indicates an open string - no fret. Number one means you should pinch the string on the first fret. Number two means pinch on the second fret and so on. If your song includes notes below middle C, then you'd be better off using the blue scale.



Songs:

There are literally thousands of songs that you could play on your STEMy Stuff guitar. To get some ideas search the internet for "songs in C-major". There are a few sites that offer lists of songs by key that are searchable by song title and/or artist. The songs included below are meant to be diverse and just enough get you started. Many of them are not complete but you should be able to finish them. If you figure out another song that you like, send it to us. You might find it in a future version of our song book. Have fun!

When the Saints Come Marching In - Traditional

0 2 3 4 0 2 3 4 0 2 3 4 2 0 2 1 2 2 1 0 0 2 4 4 4 3
0 2 3 4 2 0 1 0

Jingle Bells - Christmas

2 2 2 2 2 2 2 4 0 1 2 3 3 3 3 3 2 2 2 2 1 1 2 1 4
2 2 2 2 2 2 2 4 0 1 2 3 3 3 3 3 2 2 2 2 4 4 3 1 0

The Star Spangled Banner - Francis S. Key

4 2 0 2 4 7 9 8 7 2 3 4 4 4 9 8 7 6 5 6 7 7 4 2 0
4 2 0 2 4 7 9 8 7 2 3 4 4 4 9 8 7 6 5 6 7 7 4 2 0
9 9 9 10 11 11 10 9 8 9 10 10 10 9 8 7 6 5 6 7 2 3 4
4 7 7 7 6 5 5 5 8 10 9 8 7 7 6 4 4 7 8 9 10 11 7 8 9 10 8 7

Stairway to Heaven - Led Zeppelin

5 6 7 6 5 6 5 6 7 8 7 6 5 7 8 9 8 7 6 5 4 4 5 5 (Repeat 4 times)
5 5 5 7 6 5 4 5 5 5 5 7 6 5 6 6 5
5 5 5 9 8 7 6 6 5 5 5 5 9 8 7 6 6 5
5 5 5 7 6 7 5 6 7
7 8 9 8 7 6 7 6 5 4 4 5 5

Piano Man - Billy Joel

11 11 11 11 10 9 10 9 7 5 7 7 7 8 8
9 10 11 11 11 11 10 10 10 9 7 4 5 7 9 10 9 7 7

Let it Be - The Beatles

4 4 4 4 5 2 5 5 7 8 9 9 9 8 8 7 7 9 9 10 9 9 8 9 8 8 7
4 4 4 5 7 4 4 7 8 9 9 9 9 8 7 7 9 9 10 9 9 8 9 8 8 7
9 8 7 9 11 12 11 11 9 8 7 5 4 7 9 9 10 9 9 8 9 8 8 7

The Unforgiven - Metallica

5 6 7 7 6 5 5 6 7 7 5 (repeat)
5 6 7 7 7 7 6 4 6 4 4 5 4 5 6 5 5 6 7 9 9 9 8 6 6 4 4 5 4 5 6 5

On Wisconsin

4 4 5 4 7 6 8 7 9 9 9 9 9 8 7 8 9 7 8 9 7 6 5 6 7 8

4 4 5 4 7 6 8 7 8 7 8 8 9 10 10 7 8 9 10 11 12 9 8 7

Keep on Lovin' You - REO Speedwagon

8 8 9 10 9 8 7 5 8 (Repeat)

10 9 8 7 9 10 9 8 7 9 10 9 9 8 8

Lean on Me - Bill Withers

7 7 8 9 10 10 9 8 7 7 8 9 9 8 7 7 8 9 10 10 9 8 7 7 7 8 9 6 7

Ode to Joy - Beethoven

9 9 10 11 11 10 9 8 7 7 8 9 9 8 8

9 9 10 11 11 10 9 8 7 7 8 9 8 7 7

8 8 9 7 8 9 10 9 7 8 9 10 9 8 7 8 4

9 9 10 11 11 10 9 8 7 7 8 9 8 7 7

Angels We Have Heard On High - Christmas

9 9 9 11 11 10 11 9 8 9 11 9 8 7 9 9 9 11 11 10 9

9 8 9 11 9 8 7 11 12 11 10 9 10 11 10 9 8 9 10 9 8 7 8 4 4

7 8 9 10 9 8 11 12 11 10 9 10 11 10 9 8 9 10 9 8 7 8 4 4

7 8 9 10 9 8 7

Praise God From Whom All Blessings Flow

7 7 6 5 4 7 8 9 9 9 9 8 7 10 9 8 7 8 9 8 7 5 6 7

11 9 7 8 10 9 8 7

God Bless the Broken Road - Rascal Flatts

4 7 7 8 9 8 7 9 4 7 7 6 7

4 7 7 9 8 7 9 8 7 4 7 7 7 6 7

7 6 7 7 7 6 5 4 5 4 4 7 2 1 0

4 7 7 9 8 7 9 8 7 4 7 6 7

7 9 10 11 10 9 7 9 10 11 8 8 7 9

9 10 11 10 9 7 7 8 9 10 9 8

9 10 11 10 9 7 9 10 11 8 8 7 9

9 8 7 8 7 9 8 7

4 7 7 8 7 9 8 7 4 4 7 7 6 7

Heart & Soul - Hoagy Carmichael

7 7 7 7 6 5 6 7 8 9 9 9 9 8 7 8 9 10 7 11 10 9 8 7 6 5 4 3 4 5 6 7 7 7

Silent Night - Christmas

4 5 4 2 4 5 4 2 8 8 6 7 7 4 5 5 7 6 5 4 5 4 2

5 5 7 6 5 4 5 4 2 8 8 10 8 6 7 9 7 4 2 4 3 1 0

Jolly Old St. Nicholas - Christmas

9 9 9 9 8 8 8 7 7 7 7 9 5 5 5 5 4 4 7 8 7 8 9 8
9 9 9 9 8 8 8 7 7 7 7 9 5 5 5 5 4 4 7 8 7 8 9 7

We Three Kings of Orient Are - Christmas

9 8 7 5 6 7 6 5 9 8 7 5 6 7 6 5
7 7 8 8 9 9 11 10 9 8 9 8 7 6 5 6 8
7 7 7 4 7 5 7 7 7 7 4 7 5 7 7 7 8 9 10 9 8 9 7 7 7 4 7 5 7

Away in a Manger - Christmas

11 11 10 9 9 8 7 7 6 5 4 4 4 5 4 4 8 6 5 4 7 9
11 11 10 9 9 8 7 7 6 5 4 4 10 9 8 9 8 7 8 5 6 7

Up on the Housetop - Christmas

8 8 9 8 6 5 4 6 8 9 9 8 6 5 8 8
8 8 9 9 6 5 4 6 8 9 9 9 8 8 6 5 8 4

I Saw The Ships Come Sailing In - Christmas

4 7 7 8 9 11 9 8 10 9 7 7 9 8 6 4
4 7 7 8 9 11 9 8 10 9 7 7 8 9 8 7

Go Tell It on the Mountain - Christmas

9 9 8 7 5 4 7 8 8 8 7 8 9 7 5 4
9 9 8 7 5 4 7 10 9 9 8 7 8 7

O Come, All Ye Faithful - Christmas

7 7 4 7 8 4 9 8 9 10 9 8 7 7 6 5 6 7 8 9 6 5 4 4
11 10 9 10 9 8 9 7 8 6 5 4
7 7 6 7 8 7 4 9 9 8 9 10 9 8 9 10 9 8 7 6 7 10 9 8 7 7

Angels We Have Heard on High - Christmas

9 9 9 11 11 10 9 9 8 9 11 9 8 7 (Repeat)
11 12 11 10 9 10 11 10 9 8 9 10 9 8 7 8 4 4 7 8 9 10 9 8 7

Simple Man - Lynyrd Skynyrd

4 9 8 7 7 5 9 8 8 7 5 4 9 8 8 7 9 8 7 5
5 9 8 8 7 5 9 8 8 7 5 7 9 8 8 7 6 5 5 4 9 8 7 5
9 8 7 7 9 8 7 5 9 8 7 7 5 9 8 8 7 5
5 9 8 8 7 4 9 8 8 7 5 5 9 8 8 7 6 5 5 4 9 8 8 7 5
9 9 9 11 11 8 12 11 9 8 7 5 7 8 7 9 7 9 11 9 11 12 9 8 7 5

9 11 11 9 11 11 8 12 11 9 8 7 5 7 8 7 9 7 9 9 8 9 9 8 7 5

Kiss the Girl - Alan Menken (Little Mermaid)

7 7 8 9 7 7 7 7 8 9 10 10 10 10 7 5 5 7 10 10 11 10 9
11 11 12 13 11 8 9 10 10 9 10 9 10 9 10 9 7

Can't Stop the Feeling - Justin Timberlake

9 8 7 9 7 5 7 7 5 7 7 8 9 8 7 8 9 8 7 7 5
9 8 7 9 11 5 7 7 8 7 5 5 7 8 9 8 7 8 9 8 7 7 5
2 4 5 7 5 7 5 7 5 4 5 7 7 7 7 9
2 4 5 7 5 7 5 7 5 4 5 7 9
4 5 7 5 7 5 7 5 4 5 7 5 7 5 7 9
4 5 7 5 7 5 7 5 4 5 7

The Ballad of Gilligan's Isle - Schwartz & Wyle

9 5 9 9 9 8 6 4 4 5 9 9 9 8 8 5 9 9 9 8 11 11 7 7 6 4 5
9 5 9 9 9 8 6 4 4 5 9 9 9 8 8 5 9 9 9 8 11 11 12 12 13 11 12

Happy Birthday - Traditional

4 4 5 4 7 6 4 4 5 4 8 7 4 4 11 9 7 6 5 10 10 9 7 8 7

We Wish You a Merry Christmas

4 7 7 8 7 6 5 5 5 8 8 9 8 7 6 4 4 9 9 10 9 8 7 5 4 4 5 8 6 7
4 7 7 7 6 6 7 6 5 4 8 9 8 8 7 7 11 4 4 4 5 8 6 7

Songs that we're still working on for you . . .

Our House - Madness

Kokomo - The Beach Boys

Dust in the Wind - Kansas

Baby it's Cold Outside - Christmas

Cecilia - Paul Simon

Learning to Fly - Tom Petty & the Heartbreakers

Hey hey, My my - Neil Young

You're the One that I Want - Olivia Newton John

Love Stinks - The J. Geils Band

Walk on the Wild Side - Lou Reed

Come Sail Away - Styx

Love the One You're With - Crosby, Stills, Nash & Young

Blackbird - The Beatles

Jeremy - Pearl Jam

Home Sweet Home - Motley Crue

You're Gonna Go Far Kid - The Offspring

Hallelujah - Leonard Cohen