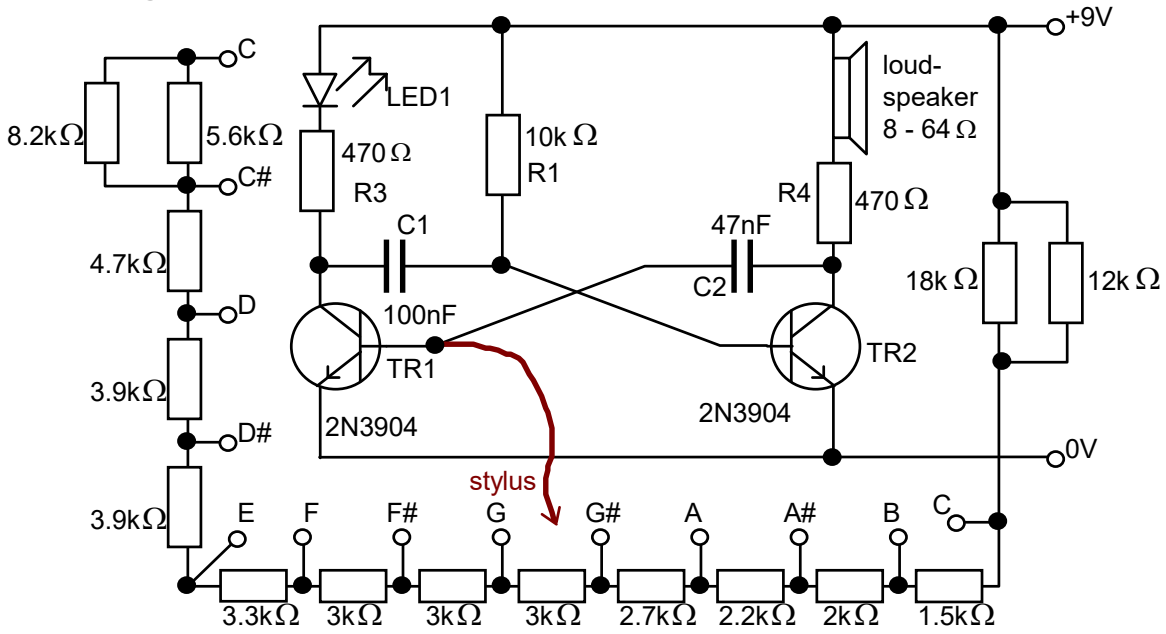
# Stylophone.

## Specification

Operates from a 6 - 12V supply.
Produces an octave of notes from C to C (522Hz to 1044Hz).
Notes are selected using a stylus.-

## Circuit Diagram




## How it works

This circuit works in the same way as the LED Flasher circuit, just many times faster.
In this circuit the values of C1 and C2 have been reduced to 100nF, and 47nF to provide the correct pitch (frequency) for the notes.
R2 has been replaced with a long string of resistors - the different notes are produced by touching the stylus onto the junction between the resistors in the chain.
A loudspeaker has replaced LED2 in the flasher circuit, so that the tone can be heard.
LED1 has been kept in order to retain the relationship with the LED flasher circuit.
The resistors for the resistor chain were selected to produce approximately the correct pitch of the musical notes. The pitch is dependent (to some extent) on the supply voltage and the resistors were selected for a 9V supply.
When there was not a preferred value that was near enough to the value required, two resistors have been used in parallel to give the correct value.

The circuit is constructed on two terminal strips, the astable on one and the resistor chain on the second.

### The stylus

This is made from a piece of stranded wire, one end connected to the terminal strip and the other connected to a 4mm plug. The plastic part of the plug is held and the metal part touched onto the wires entering the terminal strip.

# Music scale and frequency.

Based on A = 440Hz

| Music Note | Frequency (Hz) |
|---|---|
| C | 523 |
| C# | 554 |
| D | 587 |
| D# | 622 |
| E | 660 |
| F | 698 |
| F# | 740 |
| G | 784 |
| G# | 831 |
| A | 880 |
| A# | 932 |
| B | 988 |
| C | 1046 |
| | |

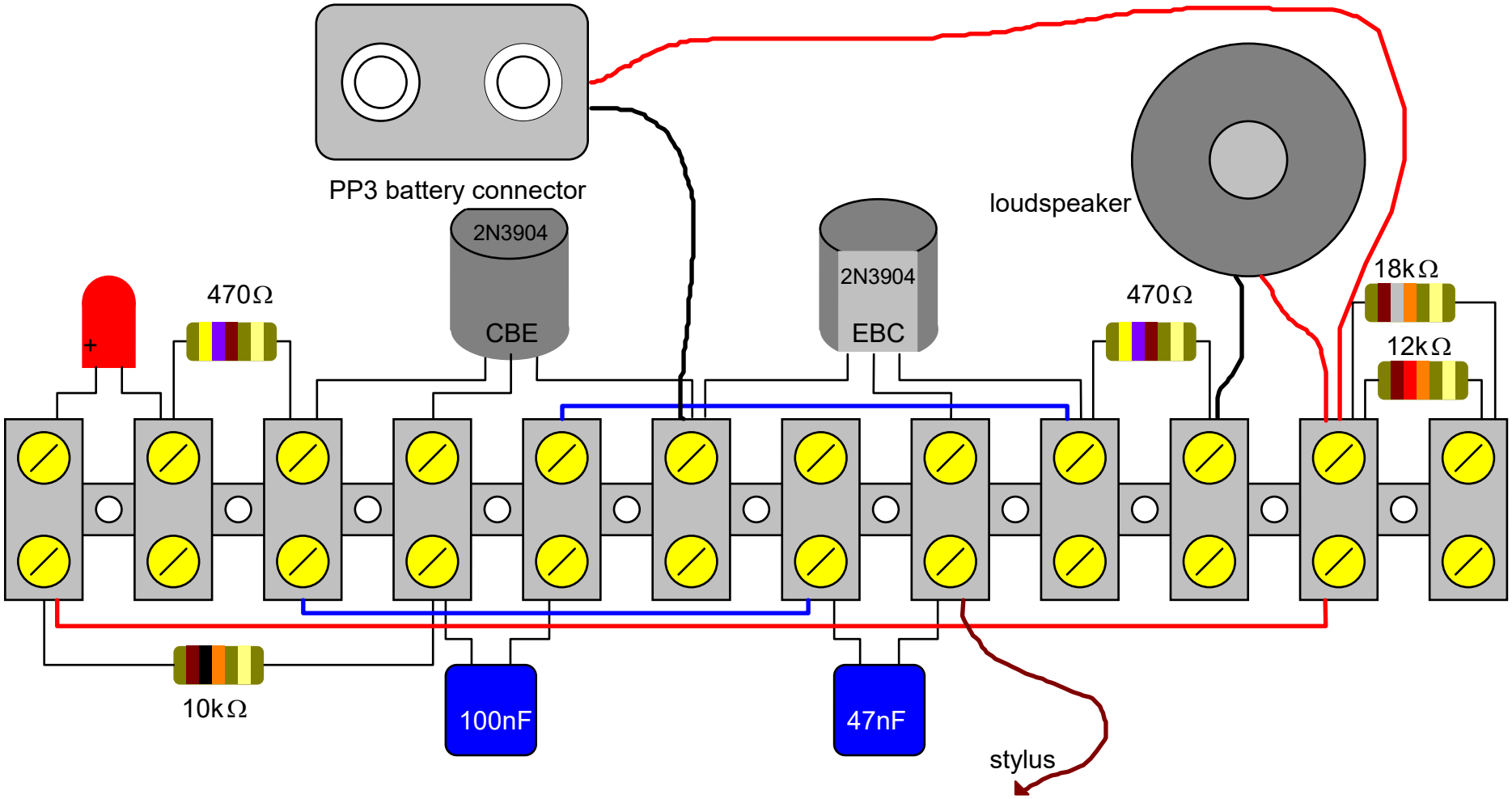
Note that the two C notes are linked by a factor of 2, the higher pitch C is twice the frequency of the lower pitched C.
The notes form an octave and all octaves are related by a factor of 2.
The next lower octave has its lower C at a pitch of 261.5Hz, which is middle C on a piano.

The frequency of the notes can be determined mathematically, as each note is linked to the next by a factor of $2^{1/12}$.
So if A is 880Hz then A# will be $880 \times 2^{1/12} = 932.33$Hz, and B will be $880 \times 2^{2/12} = 987.77$Hz etc

To calculate lower frequencies, then the index of 2 is made negative,
so G# will have a frequency of $880 \times 2^{-1/12} = 830.61$Hz etc

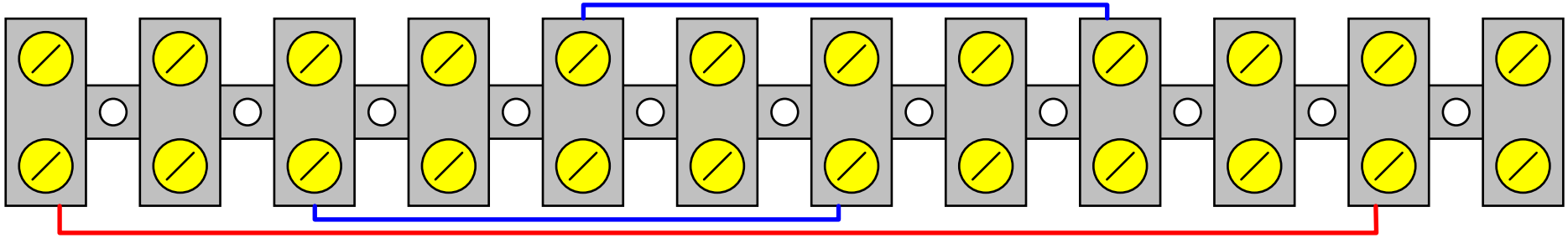
In this way, any the frequency of any note on the music scale can be calculated.

## Terminal Strip Layout - Astable

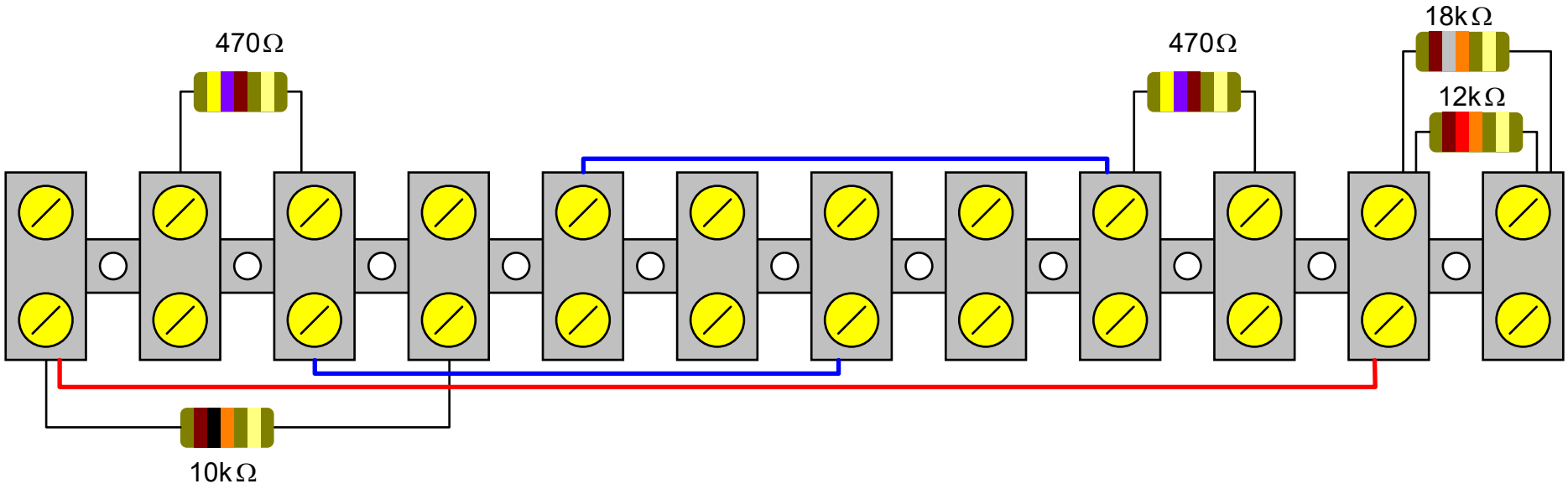


## Step by step construction.

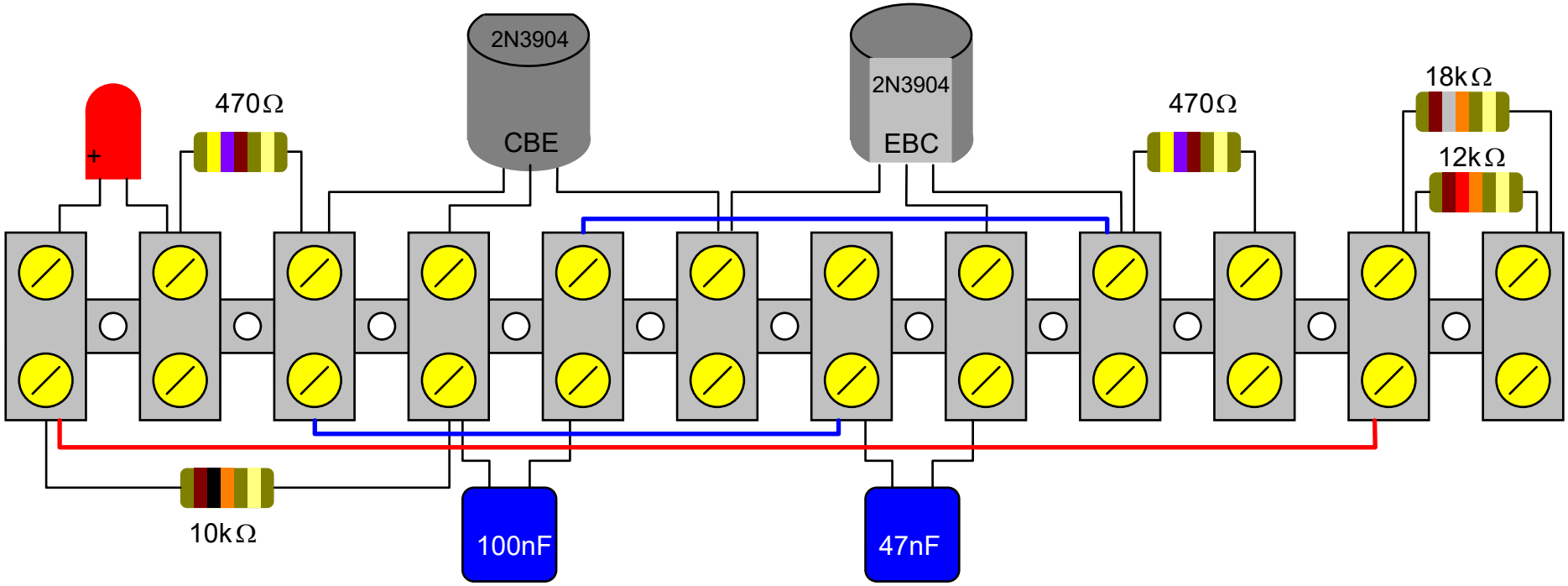
1). Cut two pieces of insulated wire approximately 5cm long and strip both ends. Bend the ends of the wires so that they will fit where the blue wires are in the diagram below. Cut a piece of insulated wire approximately 10cm long and strip both ends. Bend the ends of the wire so that it will fit where the red wire is in the diagram below.



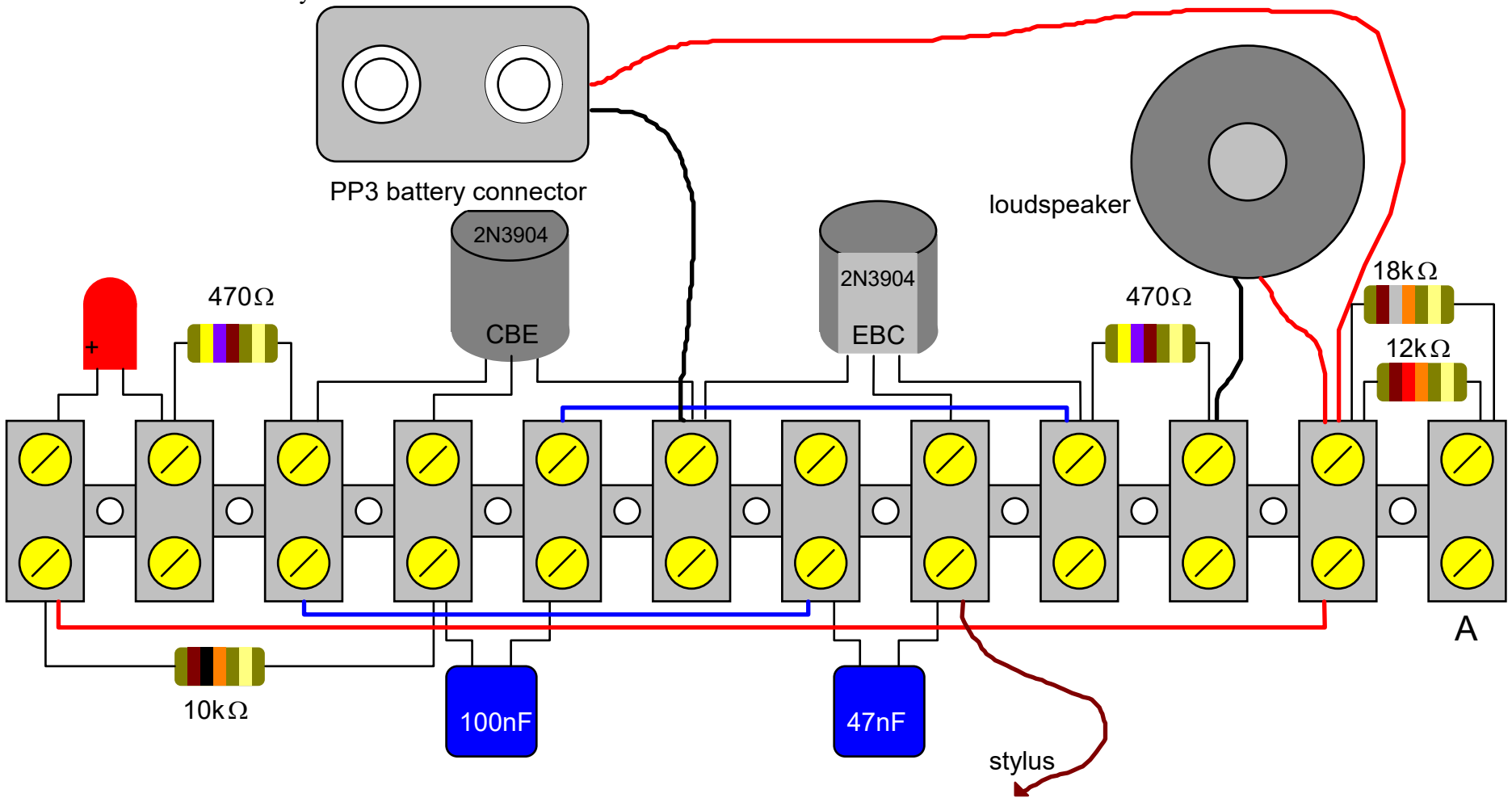
2). Take the two 470Ω resistor (yellow, violet, brown and gold), the 10kΩ resistor (brown, black, orange and gold), the 12kΩ resistor (brown, red, orange and gold) and the 18kΩ resistor (brown, grey, orange and gold) . Carefully bend the leads so that they will fit as in the diagram below. Trim the leads if necessary. It does not matter which way round they are connected.



3). Take the two 2N3904 transistors - carefully spread out the leads so that it will fit as in the diagram below. Trim the leads if necessary.
Ensure that the transistors are connected the correct way round.
Take the LED - carefully spread out the leads so that it will fit as in the diagram below. Trim the leads if necessary.
Ensure that the LED is connected the correct way round - the flat on the side of the LED body is the negative side.
Take the 100nF and 47nF capacitors. Carefully bend the leads so that they will fit as in the diagram below. Trim the leads if necessary.
It does not matter which way round they are connected.

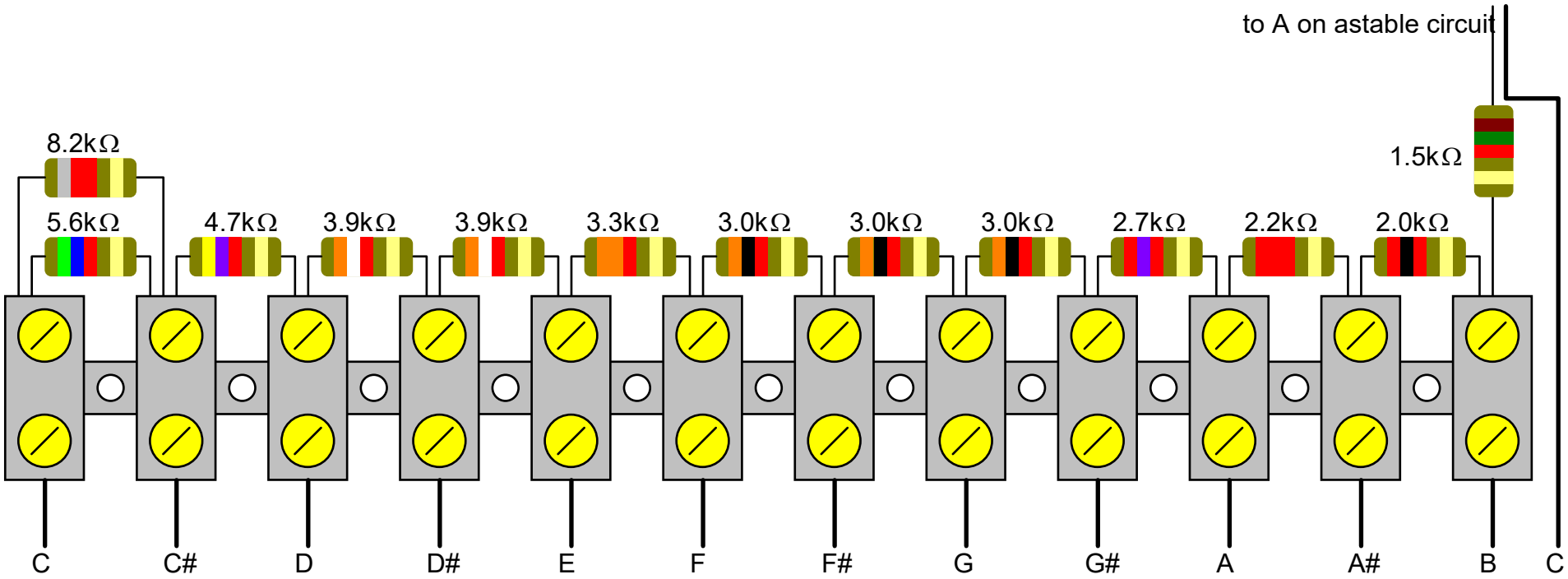


4). Finally connect the battery connector - ensure that the red and black wires are connected to the correct terminals.
Connect the loudspeaker - it does not matter which way round it is connected.
Connect the wire for the stylus.

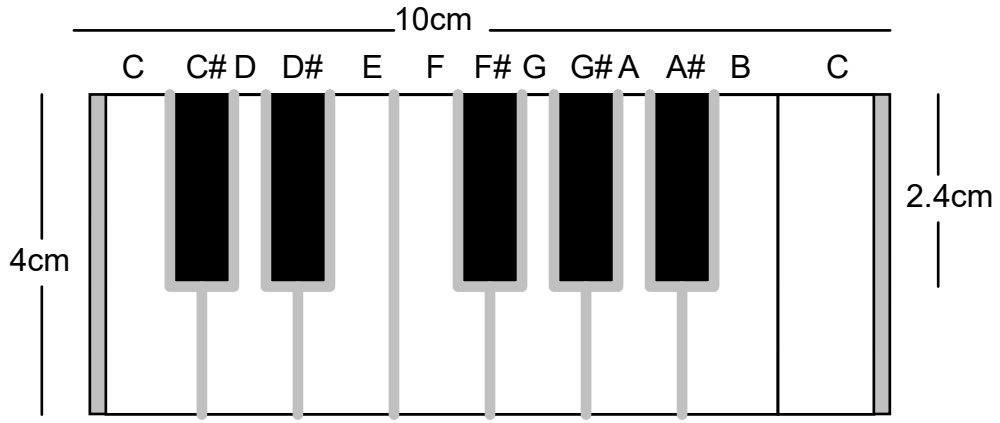



Connect the battery. If all is well, nothing will happen! Touch the stylus onto terminal A and a tone should be heard from the loudspeaker and the LED should light. If it does not, then check your wiring for errors and also check that all of the wires are being held by the screws in the terminal strip.

## Terminal Strip Layout - 'Keyboard'



## Keyboard




The keyboard can be made from a piece of wood (MDF or hardboard) 4cm by 10cm.
The wood has a piece of aluminium foil stuck to its front surface. When the aluminium foil is secure, the keys can be marked onto the foil using a felt tiped pen. A sharp knife and a ruler is then used to cut out the shape of the keys, by cutting away a thin piece of the foil between the keys. The amount actually cut away does not matter just as long as there is no electrical connection between the keys.
Wires can then be used to join the keyboard to the terminal strip keyboard. A piece of strong adhesive tape can be used secure the wires onto the aluminium foil.