Musical Micro:bit

You can program the micro:bit to play music from simple tunes like Happy Birthday to pieces as complex as Haydn's Trumpet concerto. You could also use the micro:bit to compose music.

What you will learn: This activity is a cross-curricular and will teach students about the physics of making music, musical notation and composition as well as challenging students' coding skills.

Equipment:

- Micro:bit
- Micro:bit music cable (available from ScienceScope)
- Earphones

How it works:

A musical scale has 12 notes, each with a different frequency. The BBC micro:bit can create these frequencies by turning the speaker on and off again very fast.

We have programmed the BBC micro:bit to produce notes at frequencies from the A below middle C to two Cs above middle C. A table (shown below) of all the notes is provided with these instructions labelled from -2 to 25.

Step by Step guide:

1. Choose a musical tune you wish to play. You can either work from a musical score or by trial and error work out the musical note sequence you know. These instructions will show how to programme *Three Blind Mice* the score for which is shown right[1].
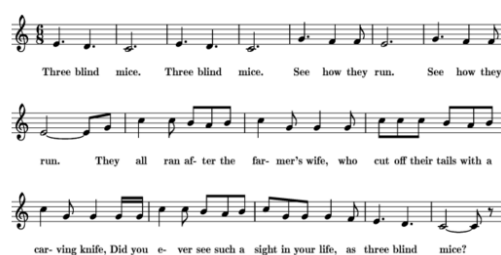
2. Open the Basic Music Script provided at https://www.microbit.co.uk/tjdpzj which plays the first three notes of Three Blind Mice:

```
script Basic music
function main ()
    while true do
        if △ micro:bit → button is pressed(A) then
            ▷ Music_Note(5, 6)
            ▷ Music_Note(3, 6)
            ▷ Music_Note(1, 12)
            basic → pause(100)
        else add code here end if
    end while
end function
```

3. You will see the function 'Play_Note' has been created. The first number in brackets is the note number according to the table below. In this case E4, D4, C4. The second number is the duration in tenths of a second. The line basic→pause(100) causes a pause of 100 milliseconds.

4. You now need to add more notes. To do this click on the line basic→pause(200). You will see two large + signs above and below the line. Click on the + sign below. This creates a new blank

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line in your code. Start typing with an "m" and the function Music_Note will appear on the right hand side. Select it (see below):

```
if △ micro:bit → button is pressed(A) then
  ▷ Music_Note(5, 6)
  ▷ Music_Note(3, 6)
  add
  ▷ Music_Note(1, 12)
  ⊕ basic → pause(100)
  ▷ Music_Note(0), 0)
  ⊕ add code here end if
```

Change the 0,0 to 5,6. You have now added one more note. To add a pause type "basic" and the pause function will appear. Select it and change the delay to the required number. In this case 100.

5. Repeat these additions till you get the following, which is the first line of the music:

```
if △ micro:bit → button is pressed(A) then
  ▷ Music_Note(5, 6)
  ▷ Music_Note(3, 6)
  ▷ Music_Note(1, 12)
  basic → pause(100)
  ▷ Music_Note(5, 6)
  ▷ Music_Note(3, 6)
  ▷ Music_Note(1, 12)
  basic → pause(100)
  ▷ Music_Note(8, 6)
  ▷ Music_Note(6, 4)
  ▷ Music_Note(6, 2)
  ▷ Music_Note(5, 12)
```

If you have time you can carry on to input all three lines of the music score shown above.

6. You can simulate your music on the computer by clicking on run main and then clicking on the A button on the image of the micro:bit. However, the quality of the simulation is not as good as running it on the device itself.

7. To play the music on your micro:bit compile your piece by clicking on compile.

8. A hex file of your music will appear in your downloads folder. Simply drag and drop onto the BBC micro:bit like a memory stick.

9. Once it has copied over the BBC micro:bit will eject itself from the computer and reconnect.

10. Connect your phone headphones to the BBC micro:bit using the cable provided. The 4mm plugs should be connected to pin 0 (red) and the gnd pin (black) on your micro:bit Alternatively you can also connect the micro:bit to a computer microphone or speakers with a standard 3.5mm jack lead.

11. Press the reset button on the back and press button A to play your music.

Note Number	Note	Frequency/Hz	Note Number	Note	Frequency/Hz
-2	A3	219.6			
-1	A3#	232.7			
0	B3	246.5			
1	C4	261.6	13	C5	523.2
2	C4#	277.2	14	C5#	554.3
3	D4	293.6	15	D5	587.3
4	D4#	311.1	16	D5#	622.2
5	E4	329.6	17	E5	659.2

6	F4	349.2	18	F5	698.4
7	F4#	370.0	19	F5#	739.9
8	G4	392.0	20	G5	783.9
9	G4#	415.3	21	G5#	830.5
10	A4	440.0	22	A5	879.9
11	A4#	466.1	23	A5#	932.2
12	B4	493.8	24	B5	987.7
13	C5	523.2	25	C6	1046.4