

Musical Scales

By G8MNY

(Correction Apr 10)

(8 Bit ASCII graphics use code page 437 or 850, Terminal Font)

Not at all musical myself, but if you're working on musical instruments this may help.

Scales are not all the same, initially 7 notes ABCDEFG (white keyboard notes) per octave (doubling in frequency) were used & later gaps were filled in (black sharp & flat notes) to give 12. In the east, 20 notes are used, making the music sound strange to the western ear.

DIATONIC SCALE

This is a mathematically true scale & sounds perfect, it is used for solo string & wind instruments.

C Ref	1	9/8	5/4	4/3	3/2	5/3	15/8	2							
Note	C	D	E	F	G	A	B	C							
Ratio	└	9/8	└	10/9	└	16/15	└	9/8	└	10/9	└	9/8	└	16/15	└

9/8 & 9/10 are whole tones, 16/15 are semitone.

Other intervals & Ratios

- 2/1 e.g. from C' to C is an octave,
- 3/2 e.g. from G to C is a 5th
- 4/3 e.g. from C' to G is a 4th
- 5/4 e.g. from A to F is a 3rd.

Music can be played in different keys from which it was written, but it will not work well with this scale. Also it is not possible to tune a multi-octave keyboard instrument to this true scale & still do shifts in "the key", so...

EQUAL TEMPERED SCALE

The tuning problem was initially solved a long time ago by Pythagoras(?). It uses  $12\sqrt{2}$  (1.05956) intervals between all notes in the octave. So to go from one note to the next just multiple or divide by 1.05946. Now musical can be shifted up & down notes (KEYS) (to fit singer's range for example) & it still works.

PITCH

Any instrument can be tuned to itself, but several are to play together they will need to be up tuned together. This lead to a common standard of 256Hz for middle C now called the "old physical pitch" and gave a Diatonic A of 426.67Hz.

INTERNATIONAL ORCHESTRAL PITCH

This has A' set at exactly 440Hz & used the Equal Tempered Scale..

```

A BC D EF G A BC D EF G A BC D EF G A BC D E---Note
-----111111111111222222233---
22333334444555666778899011233456789023467912---\
79024681369158159374728306208654456703617319--- Hz
.....---/
51977792730903743484350806586968600701962727---

```

```

F G A BC D EF G A BC D EF G A BC D EF G A BC---Note
-----1111111111112222222333334--
33344445556667788990112334567890234679135791-- \
47914692582594838364074198666679158796322358-- Hz
90250633572980400277955970810563809340630016-- /
.....---/
2004029344334007048-----

```

All electronic keyboard instruments should have the above scale built in & any pitch tuning will fine tune the whole set.

Comment from Kevin VK2YPZ...

"While Bach is not accredited as creator of the Equal Tempered Scale, he was the first to publish a work that used it. This is certainly much later than Pythagoras' time."

Why don't U send an interesting bul?

73 De John, G8MNY @ GB7CIP