

PALM PIPES

Materials:

$\frac{1}{2}$ inch PVC pipe cut to the lengths listed below. The pipes can be marked with permanent marker or fingernail polish. The students hold the pipe in one hand and strike one of the open ends on the palm of the other hand, producing the pitch which corresponds to the length of the pipe.



Note	Length *(cm)	Frequency **(Hz)
A	38.5	220
B b (A#)	36.4	233
B	34.3	247
C	32.3	261.5
C# (D b)	30.5	277
D	28.8	293.5
D# (E b)	27.1	311
E	25.6	329.5
F	24.1	349
F# (G b)	22.7	370
G	21.4	392
A b (G#)	20.2	415.5
A	19.0	440
B b (A#)	17.9	466
B	16.9	494
C	15.9	523
C# (D b)	15.0	554
D	14.1	587
D# (E b)	13.3	622
E	12.5	659
F	11.8	698
F# (G b)	11.1	740
G	10.5	784
A b (G#)	9.8	831

* Lengths of these pipes are based on an air temperature of 20° C and 0.5 in diameter.

** Frequencies taken from <http://ptolemy.eecs.berkeley.edu/eecs20/week8/scale.html>

Adapted and expanded from an activity presented by Hugh Henderson of Plano (Texas) Senior High School at the 2003 AP Physics Institute, Texas A&M University.

MUSICAL SCALES



Tonic	W	Third	Fourth	Fifth	Sixth	H	Tonic
C	D	E	F	G	A	B	C
C#	D#	F	F#	G#	A#	C	C#
D	E	F#	G	A	B	C#	D
D#	F	G	G#	A#	C	D	D#
E	F#	G#	A	B	C#	D#	E
F	G	A	A#	C	D	E	F
F#	G#	A#	B	C#	D#	F	F#
G	A	B	C	D	E	F#	G
G#	A#	C	C#	D#	F	G	G#
A	B	C#	D	E	F#	G#	A
A#	C	D	D#	F	G	A	A#
B	C#	D#	E	F#	G#	A#	B
C	D	E	F	G	A	B	C

Musical scales and chart taken from
<http://www.geocities.com/jayatea.geo/piano.html>

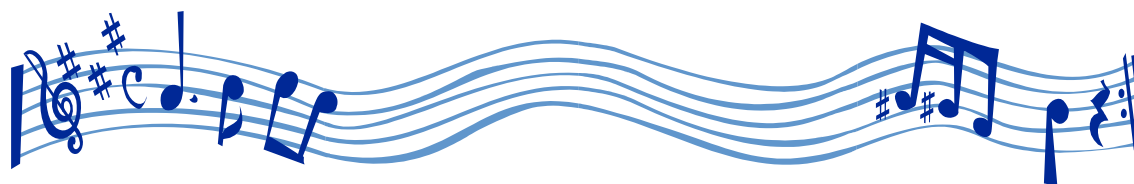
TWINKLE, TWINKLE LITTLE STAR

(Nearly the same tune as the "Alphabet Song")

Twin - kle, twin - kle lit - tle star, How I won - der what you are
Melody: F F C C D D C B \flat B \flat A A G G F
Harmony: C C A A B \flat B \flat A G G F F E E C

Up a - bove the world so high, Like a dia - mond in the sky,
Melody: C C B \flat B \flat A A G C C B \flat B \flat A A G
Harmony: A A G G F F C A A G G F F C

Twin - kle, twin - kle lit - tle star, How I won - der what you are
Melody: F F C C D D C B \flat B \flat A A G G F
Harmony: C C A A B \flat B \flat A G G F F E E C



HAPPY BIRTHDAY

Hap - py birth - day to you, hap - py birth - day to you;
C C D C F E C C D C G F

Hap - py birth - day dear Ein - stein;
C C C A F E D



Hap - py birth - day to you!
B \flat B \flat A F G F

LONDON BRIDGE

Lon - don bridge is fall - ing down, fall - ing down, fall - ing down;
G A G F E F G D E F E F G

Lon - don bridge is fall - ing down, my fair la - dy.
G A G F E F B D G E C

ROW, ROW, ROW YOUR BOAT

Row, row, row your boat gen - tly down the stream;
C C C D E E D E F G

Mer - ri - ly, mer - ri - ly, mer - ri - ly, mer - ri - ly,
C C C G G G E E E C C C

Life is but a dream.
G F E D C

WHERE IS PINKY (POINTER, ETC...)

(or Are You Sleeping?)

“Where is Pin - ky? Where is Pin - key?” “Here I am! Here I am!”
C D E C C D E C E F G E F G

“How are you to - day sir?” “Ver - y well I thank you.”
G A G F E C G A G F E C

Run a - way, run a - way.
C G C C G C



SINGING CHIMES

(adapted from Taylor, Poth, & Portman (1995), *Teaching Physics with TOYS*,
Terrific Science Press: Middleton, Ohio. pp. 275-281)

Chimes cut from 4 five-foot pieces of ½ inch aluminum pipe. Total cost of less than \$8.00 (purchased as 2 ten-foot sections, Lowe’s Home Building Store, December 2003).

Table 1: Chime Lengths

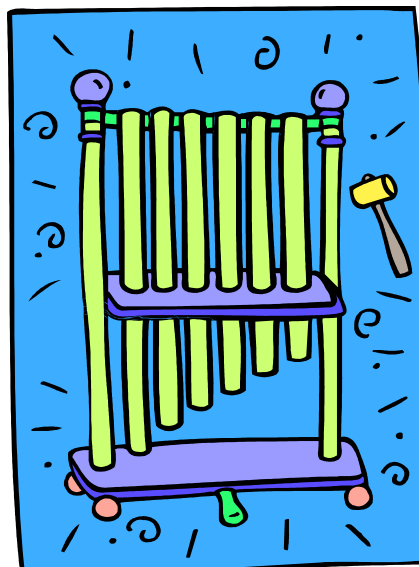
Cut from pipe 1		Cut from pipe 2		Cut from pipe 3		Cut from pipe 4	
Chime #	Length (cm)	Chime #	Length (cm)	Chime #	Length (cm)	Chime #	Length (cm)
1	38.5	5	34.2	8	31.1	13	27.2
2	37.5	6	33.1	9	30.3	14	26.3
3	36.2	7	32.2	10	29.7	15	25.5
4	35.1	17	23.8	11	28.9	16	24.7
		18	23.1	12	28.1	19	22.5
						20	21.8

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Table 2: Chime Frequencies

Chime #	Note	Frequency (Hz)	Chime #	Note	Frequency (Hz)	Chime #	Note	Frequency (Hz)
1	F	175	8	C	262	15	G	392
2	F#	185	9	C#	277	16	G#	415
3	G	196	10	D	294	17	A	440
4	G#	208	11	D#	311	18	A#	466
5	A	220	12	E	330	19	B	494
6	A#	233	13	F	349	20	C	523
7	B	247	14	F#	370			

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SINGING CHIMES SONG SHEET

(musical scores taken from *Teaching Physics with TOYS*, pp 280-281)

MICHAEL ROW THE BOAT ASHORE

Mi - chael row the boat a - shore

10 14 17 14 17 19 17
10 14 10 14 15 14

Hal - le - lu - a

14 17 19 17
10 14 15 14

Mi - chael row the boat a - shore

14 17 17 14 15 14 12
10 14 14 10 12 10 9

Hal - le - lu - u - u - a

10 12 14 5 12 10
7 9 10 9

Mi - chael row the boat a - shore

D F# A F# A B A
D F# D F# G F#

Hal - le - lu - a

F# A B A
D F# G F#

Mi - chael row the boat a - shore

F# A A F# G F# E
D F# F# D E D C#

Hal - le - lu - u - u - a

D E F# A E D
B C# D C#

HAPPY BIRTHDAY

Hap - py birth - day to you, hap - py birth - day to you;

8 8 10 8 13 12 8 8 10 8 15 13
6 8 6 6 8 8
C C D C F E C C D C G F
A# C A# A# C C

Hap - py birth - day dear Ag - gie;

8 8 20 17 13 12 10
17 13 8 8 6
13 8
C C C A F E D
A F C C A#
F C

Hap - py birth - day to you!

18 18 17 13 15 13
13 13 13 8 12 8
10 10 8 8
A# A# A F G F
F F F C E C
D D C C

