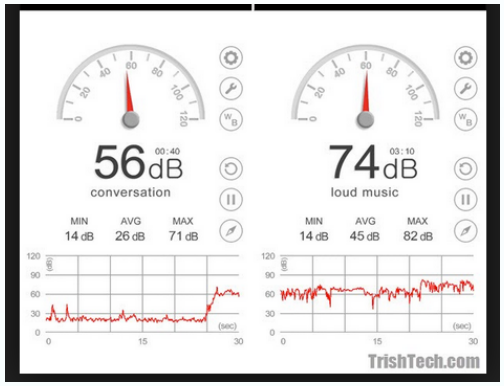
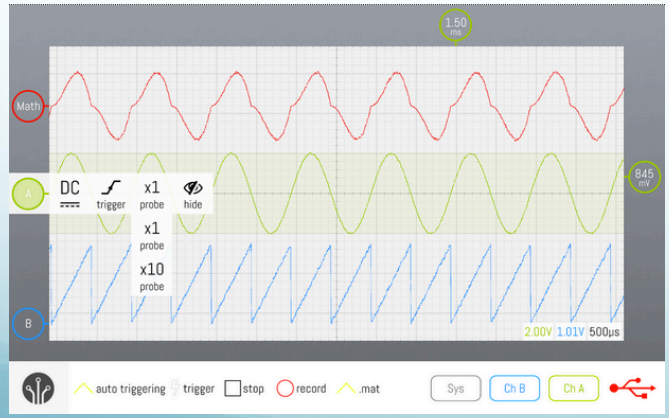
Investigaciones sobre ondas con móvil



El móvil como instrumento de medida en el laboratorio de Física

GEEF



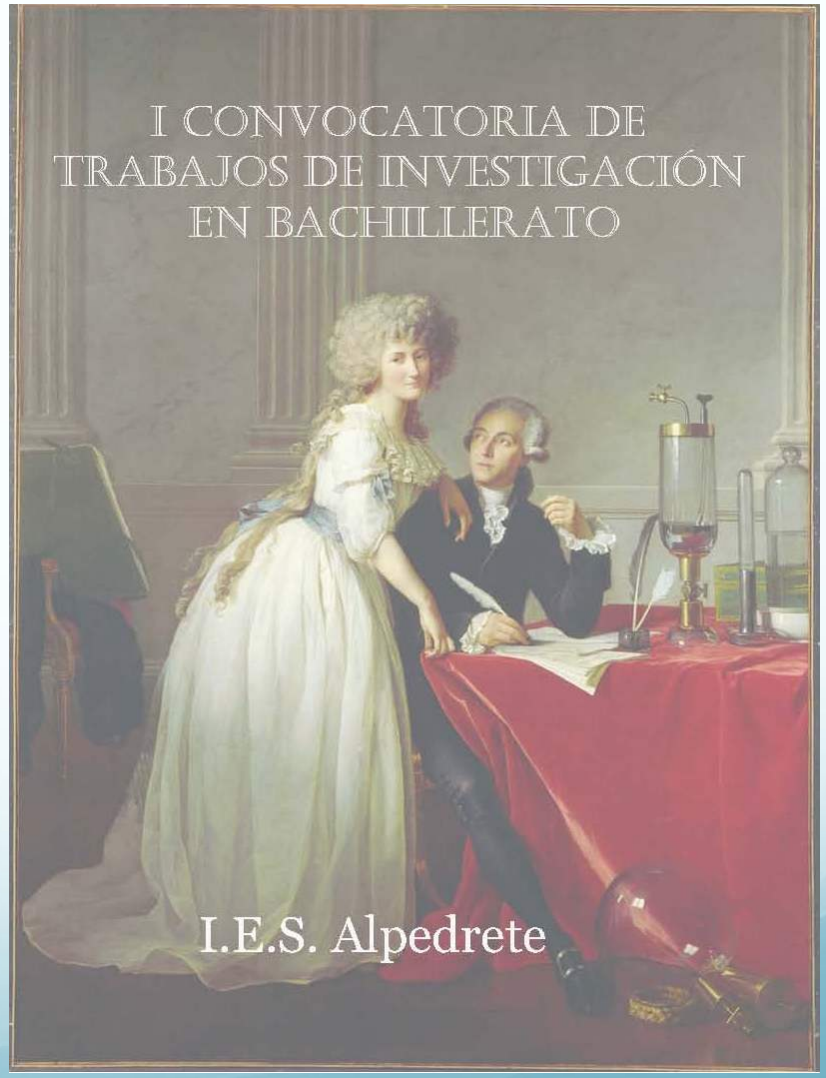
Real Sociedad Española de Física
R.S.E.F.

Facultad de Físicas UCM

Jueves 30 de Noviembre de 2017

1. Introducción

- **Investigación vs. Búsqueda bibliográfica**
- Método científico
  - Pregunta de investigación
  - Variables: independiente / dependiente / controlada
  - Establecimiento de hipótesis
  - Experimentación
  - Procesamiento de datos
  - Representación gráfica
  - Conclusiones

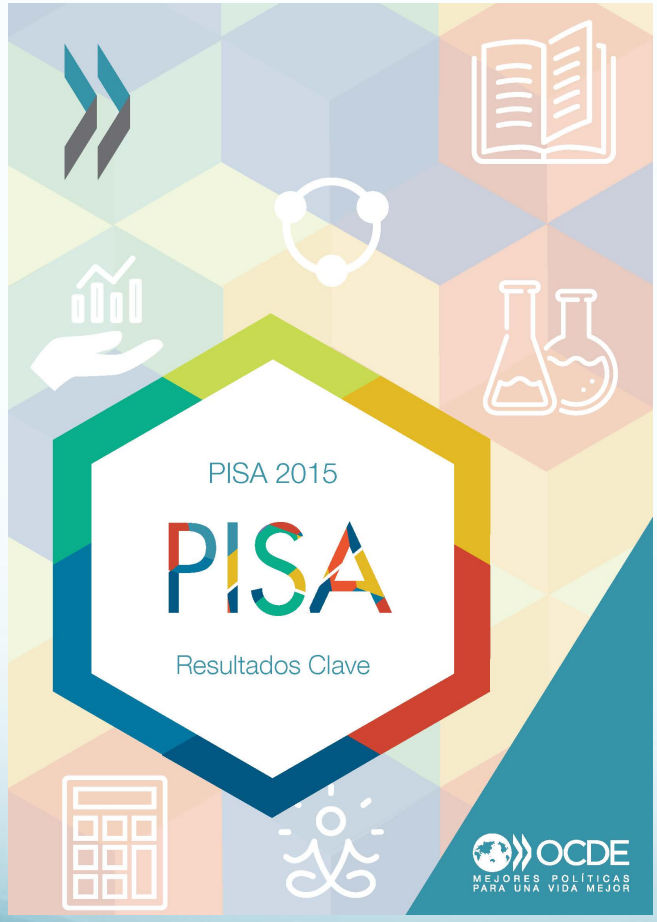


1. Introducción

LOMCE (4º ESO)

Contenidos	Criterios de evaluación	Estándares de aprendizaje evaluables
• El método científico • Proyecto de investigación	• Analizar el proceso que debe seguir una hipótesis para ser aceptada • Realizar e interpretar gráficas a partir de tablas de datos • Elaborar y defender un proyecto de investigación	• Calcula e interpreta el error absoluto y relativo de una medida • Representa gráficamente los valores experimentales de dos magnitudes relacionadas infiriendo la relación matemática • Elabora y defiende un proyecto de investigación

1. Introducción



Competencia científica

(PISA, 2015)

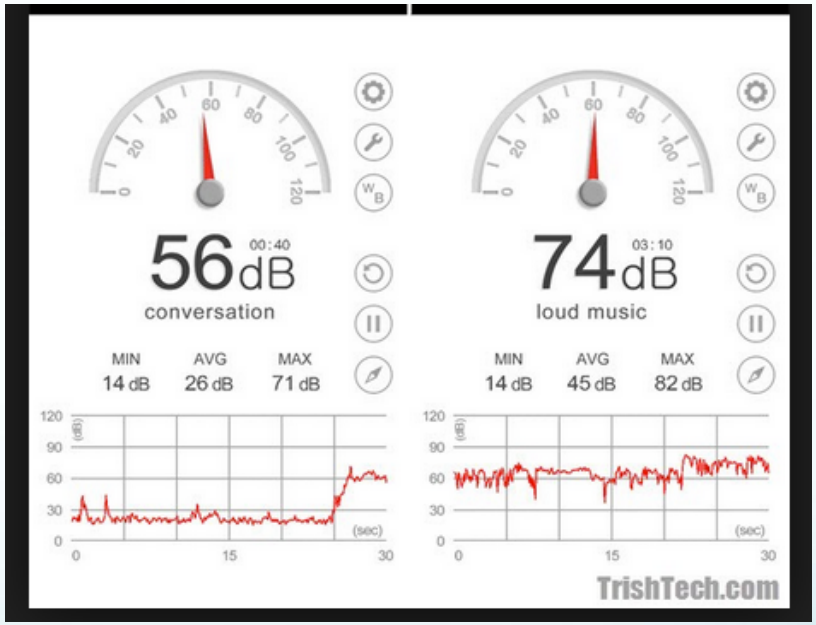
- Explicar fenómenos científicamente
- Evaluar y diseñar investigaciones científicas
- Interpretar datos y pruebas científicamente

Aprender a aprender

Aprender a hacer ciencia

2. Sonoridad

- Sonómetros
- **Sonómetro Smart Tools**
- Funcionalidades:
  - Calibrado
  - Modo gráfico
  - Rango: hasta 100 dB
- Alternativas:
  - **Sonómetro softinventions**
  - **Physics toolbox**



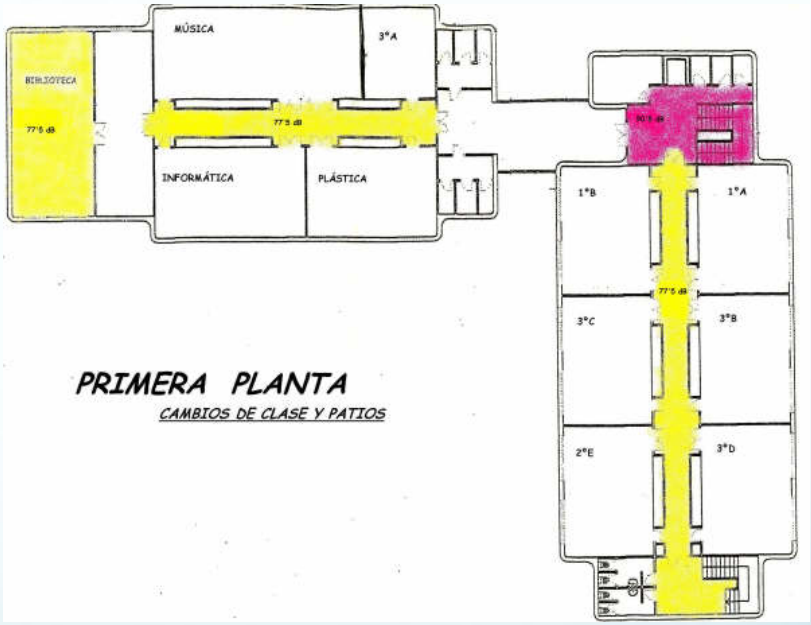
2. Sonoridad

- Calibrado: errores sistemáticos
- Ámbito (2º / 4º ESO)
- Énfasis en el cálculo de incertidumbres

© contaminacionacustica.net

2. Mapas de ruido

- Estudio del nivel de intensidad sonora de un punto a lo largo del tiempo
- Sonómetro
- Variables :
  - **Independiente**: Tiempo / posición
  - **Dependiente**: nivel de intensidad sonora
  - **Controladas:**
    - Posición / tiempo
    - Distancia al foco
    - Ángulo



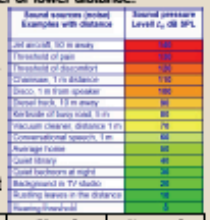
NOISE MAP IN PINAR DE CHAMARTÍN

Pablo Ginés López-Oliver Domínguez

BACKGROUND

Sound is any vibration in the air human ear can hear: Pitch, Speed, Loudness: property by which a sound can be heard at a greater or lower distance.

Noise is a annoying sound . And noise pollution refers to the noise made by the human activities (traffic jams, industries, etc.), that produce negative effects over hearing and mental health of humans and living beings in general.
A noise map is the assessment and interpretation of the noise levels of a specific zone in a certain period of time.



These are the maximum decibels the current legislation tolerates in each part of the day:

	Diurnal	Nocturnal
Type I	60	50
Type II	65	55
Type III	70	60
Type IV	75	70

Type II is the type of zone with the characteristics that fit in with the "Pinar de Chamartín" neighborhood .

PROYECT

- To determine which places are the most noisy ones and explain why.
- To compare the noise levels, assessing workable and festive days.
- To analyze the evolution of noise along the day.
- To determine the different noise sources and their intensities.
- To determine if the legislation in force is obeyed in the measured area.
- To compare the places between them, analyzing when are they most transited, when the least, depending on the time of the day, the type of day (workable and festive), and how do the nearby areas affect the noise levels.
- To make conclusions out of the analyses of the noise levels in the area.

METODOLOGY

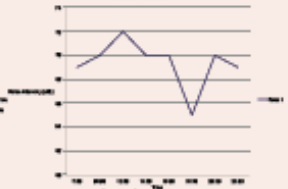
Measurement places:

The measurements were made during a week, from the Friday 19 to the Thursday 25 of December of 2014, taking advantage of the school vacations. Workable days are the 19, 22, and 23; the festive are: Sunday 20 and Thursday 25 (Christmas); meanwhile days 19 and 24 are intermediate because most people don't work on the afternoon and some have it free all day.
The way of taking the measurements is methodic: 8 diary measurements will be taken between 7:00 and 23:00 h.

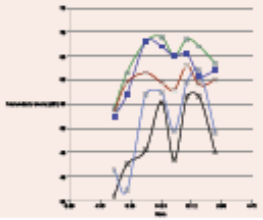
RESULTS

Level of noise intensity

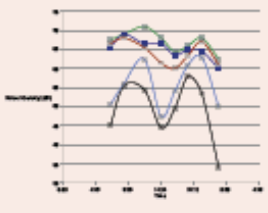
Level of noise intensity in point 1, 22/12/14



Noise intensity in working days



Noise intensity in weekend days



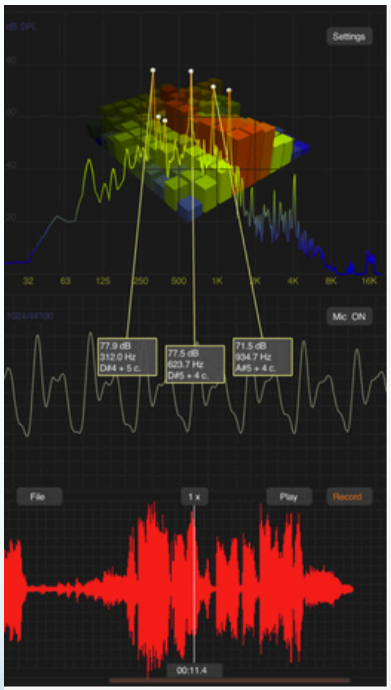
CONCLUSIONS

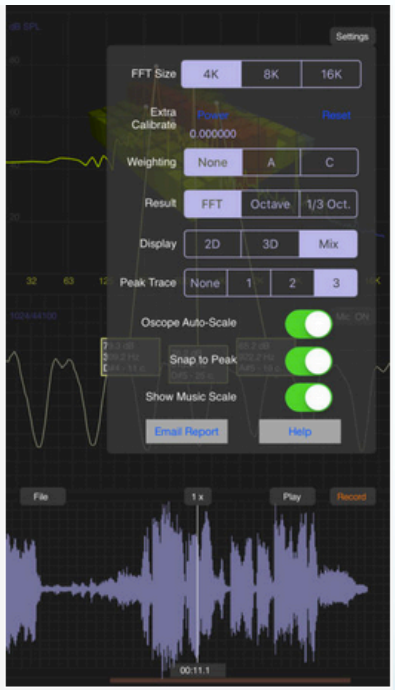
- The noise intensity in points 4 and 5 have more exaggerated maximums and minimums and present more fluctuations than points 1, 2 and 3.
- The noise intensity is, in general, higher noise levels in points 1, 2 and 3 than in points 4 and 5.
- The workable days are noisier than festives or intermediate.
- All noise levels are due to the noise sources that change depending on time, day and place, the noise intensity the automobiles produce is higher and more constant than the one of the passers.
- The noise level limits in the current law are infringed continuously, specially on workable days and in streets with car traffic.

Future improvements: To determine how isolated noises influence an average. To make noise level measurements during the whole day during more days.

© Pablo G. López

2. Aplicaciones para iPhone





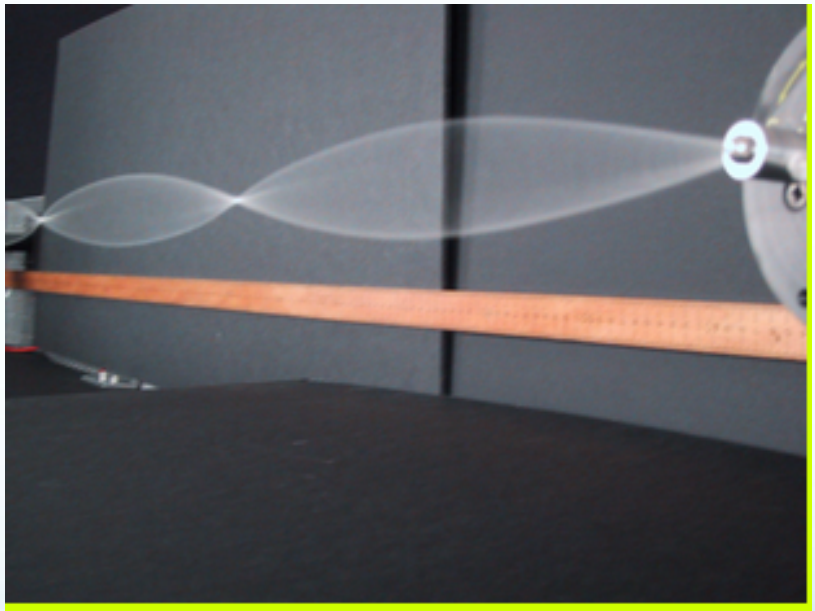
- **iAnalizer**: aplicación de pago. Características profesionales
- **Decibel 10th**: versión gratuita

3. Tono

- Registro de la frecuencia
- Afinador **Gstrings** Cohortor.org
- Rango: escala musical
- Ámbito (4º ESO / Bachillerato)

3. Tono: cuerdas vibrantes

- Estudio de la frecuencia de una cuerda vibrante
- Variables :
  - **Independiente**: longitud / Tensión (masa) / grosor
    Dependiente: frecuencia
  - **Controladas:**
    - Longitud / Tensión (masa) / grosor
    - Distancia a la cuerda
    - Ángulo
- Otros sistemas vibrantes: copas, tubo, …



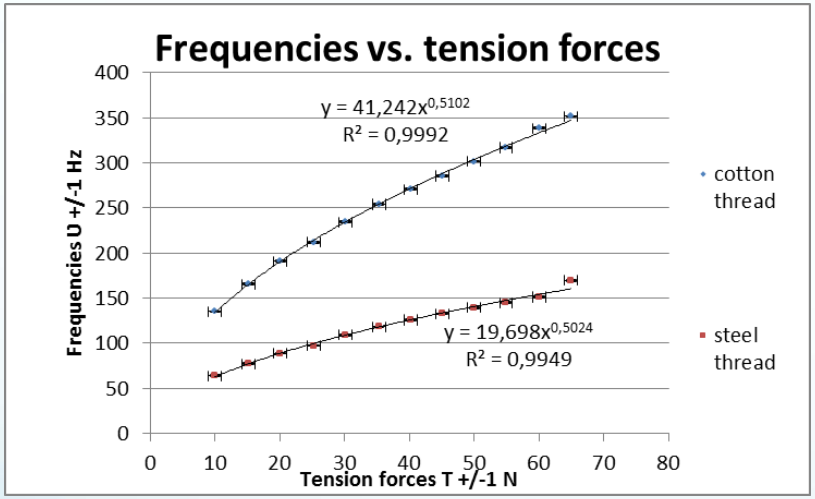
© Union College

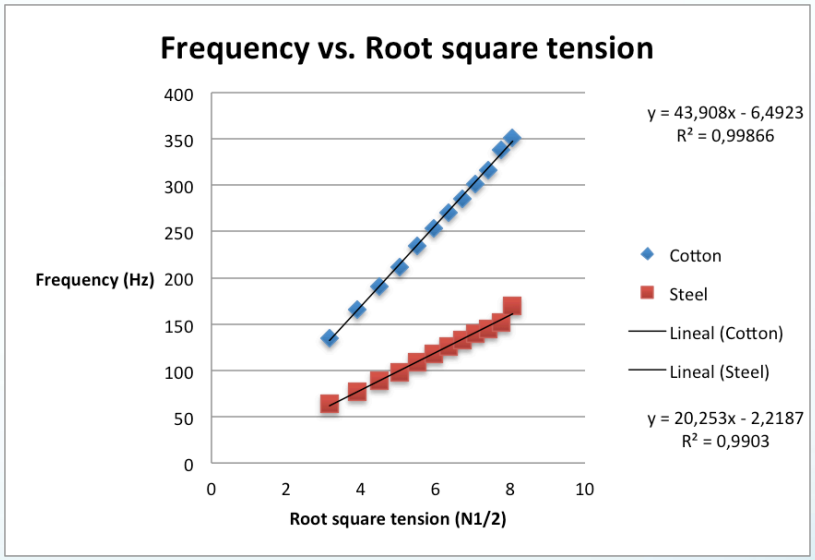
3. Cuerdas vibrantes

Frequencies emitted by different diameter steel strings:												
Diameter d (mm)			Frequency U1 (Hz)			Frequency U2 (Hz)			Frequency U3 (Hz)			Average frequency U (Hz)		
0,475	±	0,001	109,2	±	0,1	109,4	±	0,1	109,4	±	0,1	109,3	±	0,1
0,406	±	0,001	116,5	±	0,1	116,7	±	0,1	116,8	±	0,1	116,7	±	0,1
0,356	±	0,001	133,3	±	0,1	133,5	±	0,1	133,5	±	0,1	133,4	±	0,1
0,305	±	0,001	153,8	±	0,1	153,9	±	0,1	154,0	±	0,1	153,9	±	0,1
0,254	±	0,001	185,6	±	0,1	185,7	±	0,1	185,7	±	0,1	185,7	±	0,0
0,203	±	0,001	230,3	±	0,1	230,3	±	0,1	230,4	±	0,1	230,3	±	0,0

Frequencies emitted by cotton and steel threads under different tension forces:												
Mass m (kg)			Tension T (N)			Average cotton frequency U (Hz)			Average steel frequency U(HZ)			
1,025	±	0,001	10,06	±	0,01	135,1	±	0,1	63,9	±	0,1	
1,550	±	0,001	15,21	±	0,01	165,5	±	0,1	77,1	±	0,1	
2,050	±	0,001	20,11	±	0,01	190,8	±	0,1	88,9	±	0,1	
2,575	±	0,001	25,26	±	0,01	211,9	±	0,1	97,4	±	0,1	
3,075	±	0,001	30,17	±	0,01	234,3	±	0,1	109,3	±	0,1	
3,600	±	0,001	35,32	±	0,01	253,9	±	0,1	118,2	±	0,1	
4,100	±	0,001	40,22	±	0,01	270,6	±	0,1	125,8	±	0,1	
4,600	±	0,001	45,13	±	0,01	285,6	±	0,1	132,7	±	0,1	
5,100	±	0,001	50,03	±	0,01	301,5	±	0,1	139,5	±	0,1	
5,600	±	0,001	54,94	±	0,01	316,6	±	0,1	144,8	±	0,1	
6,125	±	0,001	60,09	±	0,01	338,3	±	0,1	151,4	±	0,1	
6,625	±	0,001	64,99	±	0,01	351,4	±	0,1	169,7	±	0,1	

3. Cuerdas vibrantes





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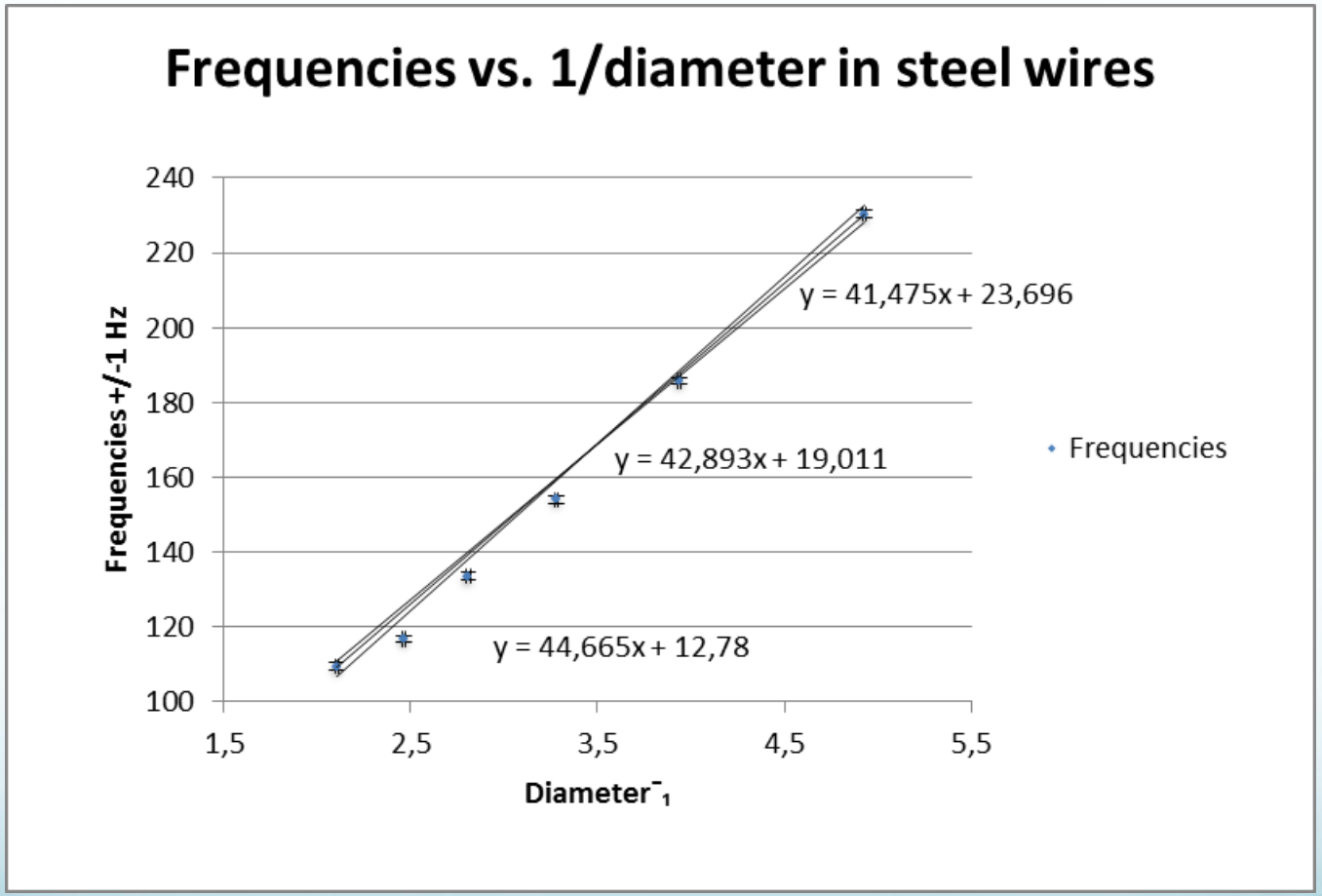
3. Cuerdas vibrantes



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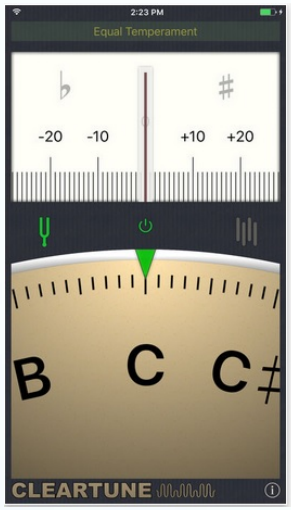
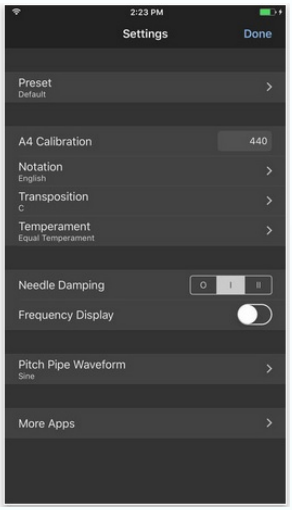
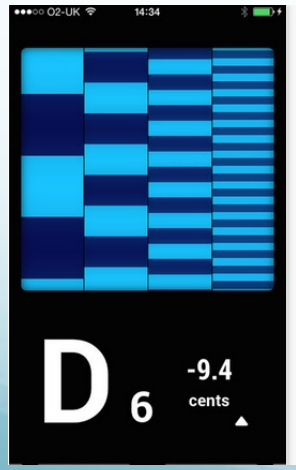
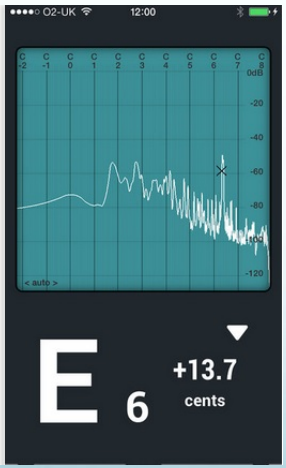
3. Aplicaciones para iPhone

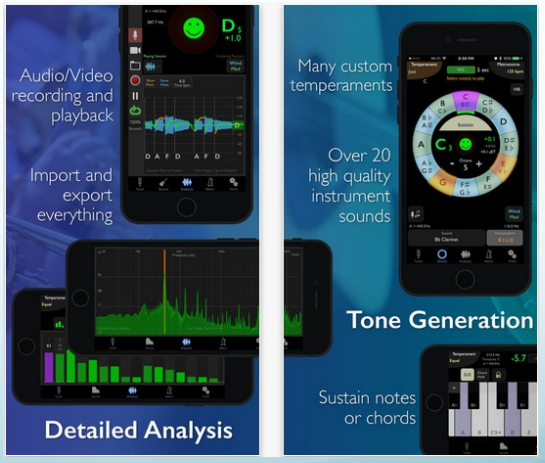




- Cleartune
- iStrobosoft
- TonalEnergy

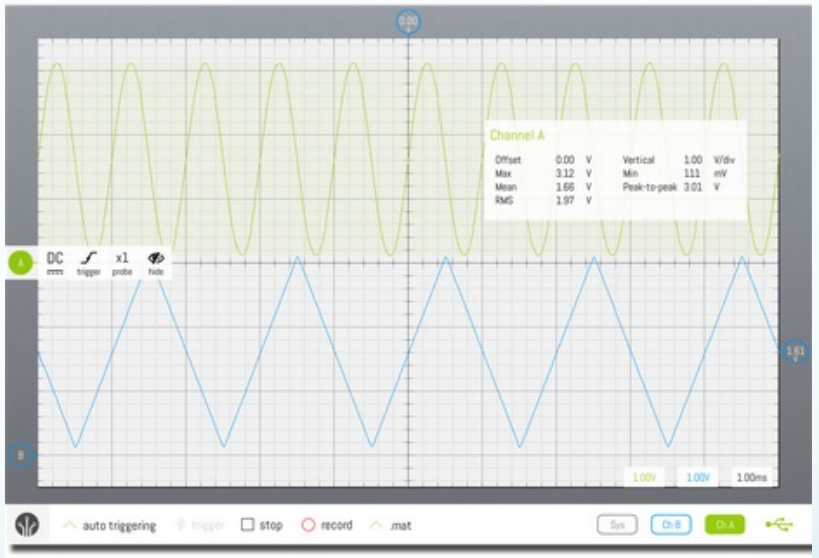






4. Timbre

- **SmartScope** app LabNation
- Registro
- Grabación / exportación a fichero csv
- Dos canales
- Registro analógico o digital



Muchas gracias por su atención