

**Acoustique spécifique et facture instrumentale**  
**Jean-Louis Migeot**  
**Conservatoire Royal de Liège et Université de Liège**  
**Examen pour l'année académique 2020/2021**

**Guidelines :**

1. Your answers must be sent by email ([jean-louis@migeot.eu](mailto:jean-louis@migeot.eu)) **BEFORE MAY 31st at midnight**. I will not send reminders.
2. I will send an acknowledgement of receipt to each student. If you do not receive an e-mail confirming that I have indeed received your answers, please contact me.
3. Answers may be written manually or typewritten.
4. You can add pages if it is useful or necessary.
5. Accuracy, completeness, relevance, style, cleanliness, readability and spelling of your answers will be assessed. A correct spelling is an element of politeness ; mine is not perfect but I strive to eliminate most mistakes !
6. Each question is marked on 10 points, the total is brought back to 20 points.
7. Students who have sent samples of their instruments, as requested in December 2020, will get a bonus on the total mark. This bonus will be of one, two or three points depending on the quality of the samples received :
  - a. one : a recording was done but is incomplete or unusable
  - b. two : a recording was done and the quality was sufficient
  - c. three : the recording was of high quality, originality or usefulness.

**Your personal data :**

Last name :

First name :

e-mail :

Student of the Conservatoire :

Student of ULiège :

I sent musical samples before March 31st, 2021 :

Yes

No

**Question 1 – The musical sound**

What are the physical parameters characterizing (1) pitch, (2) level and (3) timber of a musical note played by an instrument ?

## Question 2 – Temperaments

Consider an A whose frequency is 440 Hz (standard diapason).

What is the frequency of the F placed a major second **below** the A ?

- In Pythagoras temperament (think in terms of the number of fifth and octaves separating the two notes) :

Number of ascending fifth :

Number of descending fifth :

Number of ascending octaves :

Number of descending octaves :

Frequency ratio of the interval :

Frequency of the F :

- In Zarlino's temperament (think of the natural interval separating the two notes).

A-F Interval :

Frequency ratio of the natural interval :

Frequency of the F :

- In the equal temperament (think in terms of the number of semitones separating these two notes)

Number of ascending semitones in the interval :

Number of descending semitones in the interval :

Frequency ratio of the A-F interval in the equal temperament :

Frequency of the F :

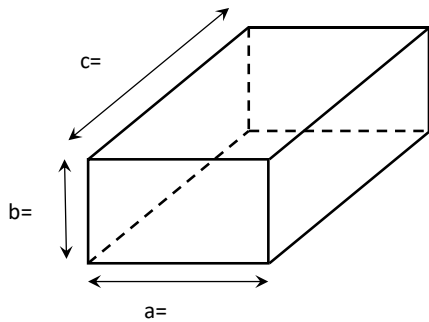
**Justify each answer by a computation.**

**Question 3 – Physics of musical instruments**

What is your usual instrument ? Explain with your own words by which mechanisms this instrument produces sound.

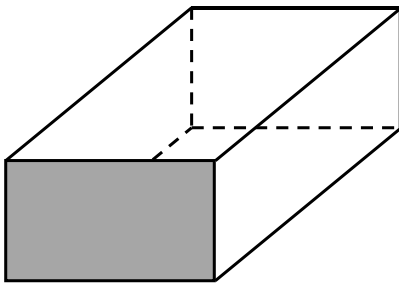
**Question 4 – Room acoustics**

Choose the dimensions of the box-shaped room; mark the chosen dimensions on the sketch below :

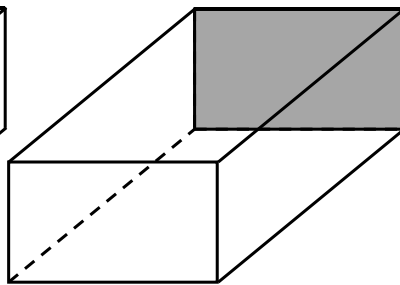


Materials	Absorption coefficients by frequency (Hz)	
Acoustic tile (ceiling)	.90	
Brick	.03	
Carpet over concrete	.60	
Heavy curtains	.55	
Marble	.01	
Painted concrete	.06	
Plaster on concrete	.08	
Plywood on studs	.15	
Smooth concrete	.01	
Wood floor	.10	

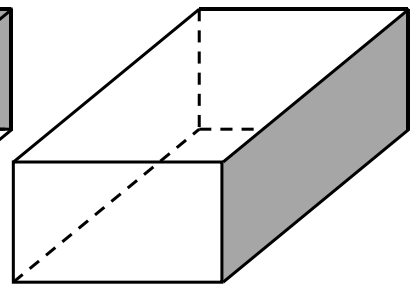
Decide which material you place on each wall (see table above) and complete the sketch below :



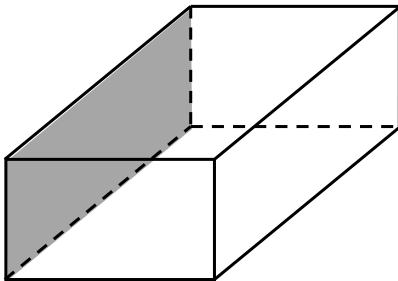
Material:  
Absorption coeff.:



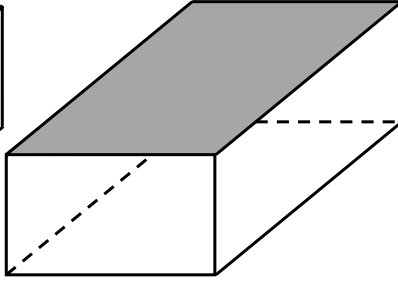
Material:  
Absorption coeff.:



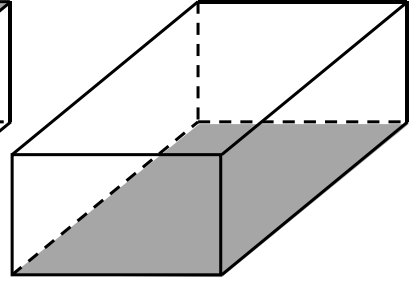
Material:  
Absorption coeff.:



Material:  
Absorption coeff.:



Material:  
Absorption coeff.:



Material:  
Absorption coeff.:

Calculate the reverberation time of your room using the Sabine formula :

### Question 5 – Sound engineering

Listen, at home and in good audio conditions, the samples from Vivaldi's Nisi Dominus available at the very bottom of page <https://lasonotheque.org/dossier-2-qualite-audio.html>.

From what data transfer rate do you consider (you yourself, subjectively) that the quality is sufficient ? In other words, what is the data transfer rate beyond which you do not perceive a further quality increase ? Comment.

**Question 6 – Hearing**

Write in the boxes (you can overstep !) the name of the various parts of the ear **in your own mother language** (please tell me which language it is !).

