

DRAFT --- SOUNDS OF MUSIC EVENT SUPERVISOR/TOURNAMENT DIRECTOR GUIDELINES

Venue

It is very important that this event be run using two rooms, one for the exam and one for instrument testing. The instrument testing room should be away from outside noise that might interfere with measuring the pitch and volume of the instrument. A music practice room might work very well for instrument testing, but they are very small and may not accommodate three persons (one student, and the ES and a judge, and it may need to fit both students if both are needed to play the instrument) room. Remember that Science Olympiad has a "Never Alone" policy, so two adults need to be present in each room of the event.

The instrument testing room must be quiet. Please find a place in which no air handling equipment or HVAC is running to keep it quiet since it will affect measurements. Electric power should be available for the ES to plug in his/her phone and computer since they are used throughout the event.

Instrument Review

Please make sure no commercial parts are used in the instrument construction, except strings are permitted. They may use 3D printed parts that look like commercial parts, e.g., mouthpiece, valves, and other printed parts.

ESs are encouraged to ask questions about the instrument construction to insure the student actually made the device.

The ES may want to build a box to quickly check the dimensions of the instrument before assembly.

Instrument Pitch Testing

The ES will need a chromatic tuner that shows a digital value for the measured frequency. There are many cellphone apps that can be used. I recommend the Accord Chromatic Tuner for android phones. I also recommend that the ES upgrade to the pro version for a few dollars to unlock extra features. These extra features allow the ES to change the settings. The In Tune Precision should be set to 5 cents. I also recommend the Readings Source should be set to the average value. Lastly, the Average Duration should be set to 5 seconds. This will give an overall average measure of the pitch for the five second test window.

Another good option is the Google Science Journal app (this is free). This works on both Android and iPhone. Open the app and choose the 2nd symbol from the left (it looks like an oscilloscope trace of a sine wave). Choose the note option to open the pitch tester. Push the red button to start measuring the note (you will have to start after the student starts playing to avoid including extraneous sounds). Stop the tester and it displays the average pitch along with the minimum and maximum pitch. Review the displayed graph to see if it includes any obviously extraneous sounds (it should be relatively flat if the student played a single note). Record the average pitch for the 5 second window.

Most chromatic tuners used by musicians do not display an average and cannot be used for pitch testing. You may use any app that displays a digital average value of the pitch.

The student should indicate what note he/she will play first. When that note is played, the tuner will automatically check to see how in tune it is to the closest true value. However, this closest true value may not be the note the student stated would be played. That is why the measured frequency must be used to score each note instead of the cents. For example, a student states he/she will play A4. The tuner may think the note is closer to G4 and indicate the cents with respect to G4 instead of A4. So the cents measurement is not valid, but the measured frequency is. If the tuner measures the cents with respect of A4, then the cents measurement is valid, and so is the measured frequency. Therefore, I recommend always using the measured frequency.

In order to know which note should be played in sequence, the ES should know the major scales. See attached examples. The scoresheet has this feature built in, but if you want to check by hand, you must use the appropriate correct frequency.

The chromatic tuner should be positioned one meter away but may be moved closer if the volume is too low to register correctly. In the Accord Chromatic Tuner, the measured frequency is shown on the same level as the cents and to the left of the cents. The assumed target frequency (assumed by the tuner) is at the top of the display. The assumed target frequency should not be used. The chromatic tuner must be positioned so the student cannot see the reading and be able to make adjustments to improve the pitch.

The student should progress up or down to the next note in the major scale. I recommend that the ES either know the frequencies of the notes or print out the frequencies of all major scales that may be played (see attached, but only notes between and including F octave 2 and F octave 5 may be played for competition). The student must indicate if he/she is ascending or descending the scale so the ES knows the correct frequency of the next note. Continue for 8 notes total. The student must be ready to play the next note quickly to keep the event moving on time. Allow changes to be made but this should take the student less than one minute for each change.

The scoresheet will do much of the work for you, although having the frequency table printed out for reference can be useful. The ES will enter the starting note (choose the appropriate letter) of the scale and whether the scale will be played ascending or descending. The scoresheet will look up all the frequencies for the expected scale notes. The ES will then enter the measured frequency for each of the eight notes. The scoresheet will convert that into cents and calculate the score. The scoresheet can be downloaded from www.soinc.org.

The penalty for the student failing to put his/her tuner being away is called a construction violation instead of a competition violation because it results in a greater penalty. This is the intent of the Physics Committee. This gets recorded as a construction violation that is corrected (yes). When the ES notices this, he/she should warn the student. If the tuner is not put away for the first note, the ES gives the construction violation and then requires the student to put the tuner away or all other notes will be scored as skipped.

Any student who in the opinion of the ES attempts to play more than one pitch should be warned and given another attempt to play a single pitch. Sliding through a bunch of notes is a violation of the spirit of this event. This can be determined by the pitch measurement app displaying more than one note value. If the student repeats this same thing a second time, the score for that note should be zero (like if it is skipped). Students may not use vibrato or any pitch altering process and must attempt to play a single note for each of the eight notes in pitch testing.

Instrument Volume Testing

The ES needs a way of measuring the volume. I recommend either the Vernier Sound Level Sensor (and accompanying hardware) or the Decibel X app for android or iOS. The Vernier Sound Level Sensor can be plugged into a LabQuest or something similar that displays a graph of the measured volume over the five second window. Use statistics to find the maximum volume during the window. The Decibel X app should be upgraded to the pro version for a few dollars to access the settings. The Decibel X app frequency weighting should be set to A weighting. The response time should be set to slow. The Decibel X Standard should be set to OSHA. Record the maximum volume during the five second window.

The Google Science Journal app also includes a decibel measuring function. However, there are no options to choose the frequency weighting or time response. I find that this app measures lower decibel readings compared to the Decibel X app. It must be based on a different frequency weighting. Since the Decibel X app works on both Android and iPhone platforms, I recommend it over the Google Science Journal for volume testing.

The student may pick any one of the previously played notes in the pitch testing to play for the volume test. The student plays this note again for volume testing (it is not done during the pitch testing since its pitch may change as the note is played louder). There is no pitch measurement during the volume test, so closeness to the correct pitch is not a factor in the volume test.

The sound level measuring device must be placed as close to 1.0 meter away from the closest part of the instrument. You may want to measure the distance between the instrument and the measuring device throughout the five second test window to make sure the distance is no closer than one meter. A meter stick or tape measure may work fine for this. This may require the measuring device to be mounted to some hardware during the testing. The student may choose what part of the instrument is closest to the 1.0 meter distance as long as no part of the instrument is closer than 1.0 meters (for example hanging over a drum to reach the middle of the drum violates the 1.0 meter distance, however the drum may be played sideways to have the middle closest to the 1.0 meter distance). However, the ES should put the open end of a percussive instrument nearest the measurement device so it checks of the volume of the note instead of the volume of the strike. The instrument cannot touch the meter stick so that it transmits sound through it. I plan to put a meter stick on a music stand to support it. Then I can adjust the height of the meter stick as needed by raising and lowering the music stand. I will place the chromatic tuner on a portable music stand that is not solid so the stand will not reduce the sound coming from the instrument. The meter stick will be close to but not touching the tuner and the instrument.

Ear protection may be a good idea for this test!

Written Exam

The written exam must include at least three questions from each of the five content areas listed in the rules. These questions do not have to have equal value but may if the ES wants. However, the values may not skew the scores in such a way to significantly de-value any one of the content areas.

I recommend that students be given the whole 50-minute time period for the exam and pull students out of the exam for instrument testing. One student may continue to work on the exam while the other student tests the instrument. If this process is used, the written exam should have more than the

minimum required number of questions, but each content area should be covered approximately equally.

Scoring

Any skipped notes are given a score of zero. If there is no instrument, then all notes are skipped and the volume should be scored as zero db. The scoresheet does this for you automatically when you choose Yes for No Device. Students are not allowed to hum or sing into the instrument. If they do, score each such note as a skipped note. If this is done for the volume test, score it as 0 db. You have to enter skipped for each note, but do not check Yes for No Device. This gives a better score since they attempted to make a device but could not play according to the rules.

You should check to make sure all pages are in the rings of the notebook. No loose pages are allowed. Any loose pages may be put into the rings. If the students fail to do so, confiscate the loose pages. Pages may be removed for use during the written test once the notebook is checked by the ES.

The box for Construction Violations Corrected must have a Y or an N in order to get the PS score to calculate.

Log Scoring

1. Complete list of all materials used in the instrument. Review and ask questions to insure the list is complete and accurate. Assign two points for a complete list. Assign one point if any item is missing from the list. Assign zero points if there is no list of materials.
2. Pitch accuracy tuning and adjustment. Review to see the history of how the instrument tuning was achieved for only one note. The ES may choose which note if more than one is recorded. The log must include data to show pitch accuracy using a chromatic tuner and the measured pitch for various trials and designs. Assign two points for adequate records. Assign one point for inadequate records of the tuning mechanism and design changes. Assign zero points for no record of any pitch accuracy tuning or design changes.
3. Data for five trials. This refers to the pitch testing and there must be at least five trials of pitch accuracy testing recorded. Assign two points for five trials. Assign 1 point for 1-4 trials. Assign zero points for zero trials.
4. Proper labeling. All pages of the log must include appropriate titles, team name, team number, and correct units. Each section of the log must clearly identify one of required log components (however, pitch accuracy testing and the five data points may be included in one section. That means the log must include three sections: (1) list of materials, (2) discussion of pitch accuracy tuning and design changes, and (3) figures(s) showing figuring and/or how the instrument is used to play different pitched notes. Assign two points if all the above is included. Assign one point if anything is missing. Assign zero points if none of the above is included in the log.
5. Diagrams. The log must include at least one diagram/picture that is labelled to indicate how different pitched notes are played. A figuring chart is adequate in most cases. Assign two points for a complete diagram/picture that shows how all 8 notes are played. Assign one point if any note is missing or it is not clear how each note is played. Assign zero points if no diagram/picture is included in the log.

Note Frequency Chart

	Octave 0	Octave 1	Octave 2	Octave 3	Octave 4	Octave 5	Octave 6	Octave 7	Octave 8
C	16.35	32.70	65.41	130.81	261.63	523.25	1046.50	2093.00	4186.01
C#	17.32	34.65	69.30	138.59	277.18	554.37	1108.73	2217.46	4434.92
D	18.35	36.71	73.42	146.83	293.66	587.33	1174.66	2349.32	4698.64
D#	19.45	38.89	77.78	155.56	311.13	622.25	1244.51	2489.02	4978.03
E	20.60	41.20	82.41	164.81	329.63	659.26	1318.51	2637.02	5274.04
F	21.83	43.65	87.31	174.61	349.23	698.46	1396.91	2793.83	5587.65
F#	23.12	46.25	92.50	185.00	369.99	739.99	1479.98	2959.96	5919.91
G	24.50	49.00	98.00	196.00	392.00	783.99	1567.98	3135.96	6271.93
G#	25.96	51.91	103.83	207.65	415.30	830.61	1661.22	3322.44	6644.88
A	27.50	55.00	110.00	220.00	440.00	880.00	1760.00	3520.00	7040.00
A#	29.14	58.27	116.54	233.08	466.16	932.33	1864.66	3729.31	7458.62
B	30.87	61.74	123.47	246.94	493.88	987.77	1975.53	3951.07	7902.13

Sample Major Scales (just change the number for the starting note to agree with the student's choice, and then change all of the other numbers by the same amount).

C Major Scale



C4 D4 E4 F4 G4 A4 B4 C5

D \flat Major Scale



D \flat 4 E \flat 4 F4 G \flat 4 A \flat 4 B \flat 4 C5 D \flat 5

D Major Scale



D4 E4 F \sharp 4 G4 A4 B4 C \sharp 5 D5

E \flat Major Scale



E \flat 4 F4 G4 A \flat 4 B \flat 4 C5 D5 E \flat 5

E Major Scale



E4 F \sharp 4 G \sharp 4 A4 B4 C \sharp 5 D \sharp 5 E5

F Major Scale

F4 G4 A4 B \flat 4 C5 D5 E5 F5

F# Major Scale

F#4 G#4 A#4 B4 C#5 D#5 E#5 F#6

G Major Scale

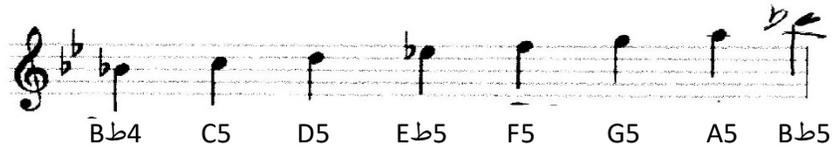
G4 A4 B4 C5 D5 E5 F#5 G5

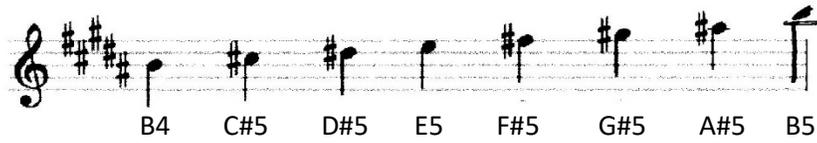
A \flat Major Scale

A \flat 4 B \flat 4 C5 D \flat 5 E \flat 5 F5 G5 A \flat 5

A Major Scale

A4 B4 C#5 D5 E5 F#5 G#5 A5

Bb Major Scale

B Major Scale

If you have questions, contact Dave Moyer at 610-751-1500.