

This test contains questions that are borrowed from other sources. It was not accepted to the exchange but is included in this folder because it was the only test submitted for this event.

Sounds of Music Test

- 1) Which statement below is true?
 - a) Sound waves are longitudinal waves and they propagate parallel to the transmitting medium
 - b) Sound waves are transverse waves and they propagate perpendicular to the transmitting medium.
 - c) Sound waves can propagate as longitudinal or transverse waves, depending on the temperature.
 - d) Sound waves can propagate as longitudinal or transverse waves, depending on the transmitting medium.

- 2) The speed of sound traveling through a gaseous sample of mixed gases can be affected by: I. Temperature II. Density III. Pressure IV. Composition of the gaseous sample
 - a) One of the above
 - b) Two of the above
 - c) Three of the above
 - d) All of the above

- 3) Ultrasound waves, compared to audible sound waves, have:
 - a) Lower frequencies and shorter wavelengths
 - b) Higher frequencies and longer wavelengths
 - c) Higher frequencies and shorter wavelengths
 - d) Lower frequencies and longer wavelengths

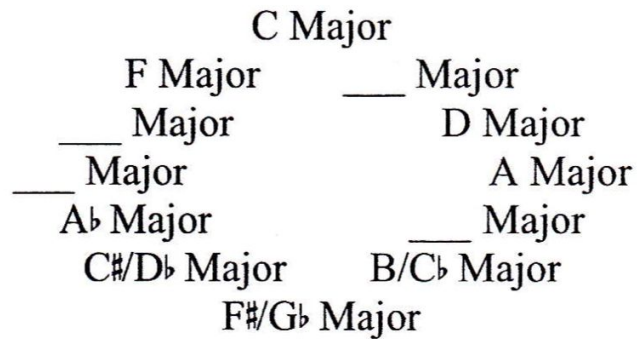
- 4) The length of the ear canal is 2.5 cm and the speed of sound in air is 300 m/s. Which of the following is a reasonable estimate of a frequency that can be heard by the human ear?
 - a) 001 Hz
 - b) 1 Hz
 - c) 10,000 Hz
 - d) 100,000 Hz

- 5) Jasmine and her friend Isabelle are attending a rock concert. Isabelle had special tickets to the VIP area and is standing 10 m from the stage. Using her portable equipment, she determines that the noise in her section is 100 decibels. Jasmine had cheaper tickets and is standing 100 m away. How loud is it where Jasmine is standing? Assume that both girls are far enough back that the concert can be approximated as a point source.
 - a) 80 decibels
 - b) 95 decibels
 - c) 10 decibels
 - d) 90 decibels

- 6) At what temperature is the speed of sound in helium (ideal gas, $\gamma=1.67$, atomic mass = 4.003 u) the same as its speed in oxygen at 0 °C?
- 7) For research purposes a sonic buoy is tethered to the ocean floor and emits an infrasonic pulse of sound. The period of this sound is 71 ms. Determine the wavelength of the sound.
- 8) Argon (molecular mass = 39.9 u) is a monatomic gas. Assuming that it behaves like an ideal gas at 298 K ($\gamma = 1.67$), find (a) the rms speed of argon atoms and (b) the speed of sound in argon.
- 9) Define psychoacoustics.
- 10) For the following major scales, list all flats and sharps.
- a) B:
 - b) D \flat :
 - c) C \flat :
 - d) F#:
- 11) A sound wave is incident on a pool of fresh water (20°C). The sound enters the water perpendicularly and travels a distance of 0.45 m before striking a 0.15-m-thick copper block lying on the bottom. The sound passes through the block, reflects from the bottom surface of the block, and returns to the top of the water along the same path. How much time elapses between when the sound enters and when it leaves the water?

12) What differentiates a single and a double reed instrument?

13) Complete the circle of fifths in the missing keys:



14) Predict how the following changes would affect the pitch of a note.

- a) Increasing the length of the string:
- b) Decreasing the tension of a string:
- c) Increasing the radius of a string:

15) A woman buys a speaker with a P of 300 W. If she stands 1 meter away from the speaker, will her eardrums burst? Show all calculations.

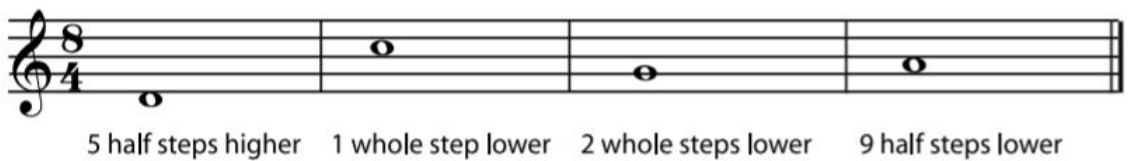
16) Write the name of each note below the note on each staff.



17) When a string player puts a finger down tightly on a string that is already vibrating,

- a) How has the part of the string that vibrates changed?
- b) How does this change the sound waves that the string makes?
- c) How does this change the sound that is heard?

18) Fill in the second note of the interval indicated in each measure.



19) What are the inversions of the following intervals?

- a) Augmented third _____
- b) Perfect fifth _____
- c) Diminished fifth _____
- d) Major seventh _____

- 20) Deep ultrasonic heating is used to promote healing of torn tendons. It is produced by applying ultrasonic sound over the affected area of the body. The sound transducer (generator) is circular with a radius of 1.8 cm, and it produces a sound intensity of $5.9 \times 10^3 \text{ W/m}^2$. How much time is required for the transducer to emit 4800 J of sound energy?
- 21) The process of sound going into the ear so that humans can hear it is a complex process. First, vibrations enter the ear through the _____ canal. The vibrations cause the _____ to vibrate. These vibrations are picked up by 3 tiny bones, called the _____, _____, and _____. The last bone transmits the vibrations to the _____, creating pressure waves in the _____. Tiny hair cells inside the cochlea produce _____ that are sent to the brain through the _____ nerve.
- 22) A hunter is standing on flat ground between two vertical cliffs that are directly opposite one another. He is closer to one cliff than to the other. He fires a gun and, after a while, hears three echoes. The second echo arrives 1.6 s after the first, and the third echo arrives 1.1 s after the second. Assuming that the speed of sound is 343 m/s and that there are no reflections of sound from the ground, find the distance between the cliffs.
- 23) The intensity of a sound is proportional by _____ (example: x^3) to the frequency.
- 24) An explosion occurs at the end of a pier. The sound reaches the other end of the pier by traveling through three media: air, fresh water, and a slender metal handrail. The speeds of sound in air, water, and the handrail are 343, 1482, and 5040 m/s, respectively. The sound travels a distance of 125 m in each medium. (a) Through which medium does the sound arrive first, second, and third? (b) After the first sound arrives, how much later do the second and third sounds arrive?

25)

Write a note **below** and to the right of the given note to form the indicated **descending** melodic intervals.

Ex. dim 5 Major 6 Aug 8 dim 5 minor 2 Perfect 5

26)

Write the time signature represented by these rhythms. Select from these: 2/4, 3/4, 4/4, 6/8, 9/8, 12/8.

_____ $\overset{3}{\text{ eighth notes }} \text{ eighth rest quarter}$ _____ $\text{ quarter eighth rest eighth quarter quarter}$ _____ $\overset{2}{\text{ eighth notes }} \text{ eighth rest eighth}$
 _____ $\text{ quarter eighth rest eighth quarter quarter}$ _____ $\text{ quarter eighth rest eighth quarter quarter eighth rest eighth quarter}$