Sounds of Music – EXAM

2020 UMD Invitational

Team Number (on your wristband): _____

Team/School Name:_____

Student Names (First & Last): PRINT LEGIBLY

1. _____

2. _____

Total Points Possible (written test): **90**

Total Points Earned:_____

Multiple Choice Questions (1 pt each):

1. Sound waves are
    a. Transverse waves
    b. Longitudinal waves
    c. Surface waves
    d. Beach waves
2. Cymbals are an example of a(n)
    a. idiophone
    b. membranophone
    c. chordophone
    d. aerophone
3. Guzheng is an example of a(n)
    a. idiophone
    b. membranophone
    c. chordophone
    d. aerophone
4. Between a sound wave with a frequency of 20 Hz and a sound wave with a frequency of 40 Hz, which one has the higher pitch?
    a. the sound wave with a frequency of 20 Hz has a higher pitch
    b. the sound wave with a frequency of 40 Hz has a higher pitch
    c. they have the same pitch
    d. not enough information was provided
5. Between a sound wave with a wavelength of 20 m and a sound wave with a wavelength of 40m, which one has the higher pitch?
    a. the sound wave with a wavelength of 20 m has a higher pitch
    b. the sound wave with a wavelength of 40 m has a higher pitch
    c. they have the same pitch
    d. not enough information was provided
6. At STP, a sound wave with a frequency of 7 Hz has a wavelength of
    a. 46 m
    b. 47 m
    c. 48 m
    d. 49 m
7. Humans can only hear sound waves as distinct pitches when the frequency lies between about
    a. 5 Hz and 5 kHz
    b. 10 Hz and 10 kHz
    c. 15 Hz and 15 kHz
    d. 20 Hz and 20 kHz

8. What is the speed of sound when it is moving through air that is at a temperature of 21°C?
   a. 338.2 m/s
   b. 341.5 m/s
   c. 343.6 m/s
   d. 352.6 m/s

9. The average home has a sound intensity level of 40 dB, what is the sound intensity of the average home in watts per meter squared (W/m²)?
   a. 1×10^{-12}
   b. 1×10^{-8}
   c. 1×10^{-4}
   d. 1×10^{-2}

10. A sound with a sound intensity level of 100 dB has an intensity that is ____ times the sound intensity of a sound with a sound intensity level of 10 dB
    a. 1×10^{1}
    b. 1×10^{4}
    c. 1×10^{7}
    d. 1×10^{9}

11. If the starting pitch of an octave is middle C (C′ 256 Hz), how many hertz is the G″ note?
    a. 768 Hz
    b. 1280 Hz
    c. 1792 Hz
    d. 2304 Hz

12. The eardrum is _____ times larger than the oval window of the inner ear, giving an amplification of about _____ compared to if the sound pressure interacted with the oval window alone.
    a. 15, 15
    b. 15, 3
    c. 3, 15
    d. 3, 3

13. What is a common scale used in Eastern music?
    a. Chromatic scale
    b. Heptatonic scale
    c. Pentatonic scale
    d. Octatonic scale

14. How many notes are in a whole-tone scale?
    a. 5
    b. 6
    c. 8
    d. 12

15. Middle Eastern music music has around a dozen basic short scales that are combined to form hundreds of full-octave spanning scales. These scales include: (circle all that apply)
    a. Acoustic scale
    b. Phrygian dominant scale
    c. Hijaz scale
    d. Saba scale

16. You're standing at the corner of two streets waiting to cross the street. An approaching ambulance is heading your way traveling at 35.8 miles per hour. If the frequency of the ambulance siren is 700 Hz, what is the frequency that you hear?
    a. 633.37 Hz
    b. 668.56 Hz
    c. 734.54 Hz
    d. 782.30 Hz

17. What is the temperature of the medium that sound is moving through if the sound is traveling at 360 m/s
    a. 29.0°C
    b. 32.7°C
    c. 40.5°C
    d. 48.3°C

18. In the fixed do system for solfege, C is the only one that can be sung with the syllable "do" and other notes such as C♯ and C♭ are different.
    a. True
    b. False

19. Scales that don't follow the interval patterns of the diatonic or pentatonic scales are called _____ scales.
    a. chromatic
    b. heptatonic
    c. nonpentatonic
    d. nondiatonic

20. A major seventh is made up of _____ half steps.
    a. 4
    b. 7
    c. 9
    d. 11

21. An augmented interval has _____ more half step(s) than a perfect interval.
    a. 1
    b. 3
    c. 5
    d. 6

22. In chordophones, the wavelength created is _____ the length of the string.
    a. the same as
    b. twice
    c. four times
    d. unreliant on

23. The Bernoulli effect refers to systems where an _____ in speed occurs simultaneously with a _____ in pressure.
    a. increase, decrease
    b. increase, increase
    c. decrease, increase
    d. decrease, decrease

24. _____ involves a change in direction of waves as they pass from one medium to another.
    a. Diffraction
    b. Interference
    c. Refraction
    d. Reflection

25. In two or three dimensions, as waves spread out from the source, the amplitude
    a. increases
    b. decreases

26. When an interval is inverted, the lower tone is raised _____ octave(s).
    a. one
    b. two
    c. three
    d. four

27. Idiophones include all percussion instruments apart from
    a. the piano
    b. maracas
    c. the harp
    d. drums

28. A minor interval has one _____ _____ step than a major interval.
    a. less, half
    b. less, whole
    c. more, half
    d. more, whole

29. C to F♯ is a(n) _____ interval.
    a. major
    b. minor
    c. augmented
    d. diminished

30. Which of the following is not a type of chordophone?
    a. Zither
    b. Ghan
    c. Harp
    d. Lyre

Fill In the Blank Questions (2 pts per blank):

1. An equal temperament is a system of _____ in which the frequency interval between every _____ notes has the same ratio.

2. The Eustachian tube is an open tube leading from the middle ear to the _____.

3. For string instruments, a longer string has _____ wavelength and thus, _____ frequency.

4. The eardrum vibrates from incoming sound waves and sends these vibrations to three tiny bones in the middle ear. These bones are called the _____, _____, _____.

5. _____ are hollow chambers that amplify sound when air inside vibrates.

6. _____ _____ is the measure of a material's stiffness or elasticity.

7. In an interval with flats or sharps, if the flat or sharp increases the distance between two pitches, the interval is _____. If it decreases the distance and the interval would otherwise be perfect, it is _____. If it decreases the distance and the interval would otherwise be major, it is _____.

8. The power generated by a sound intensity of 10^{-7} W/m^{-2} over a normal area of 30km² is _____.

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Free Response Questions (Show work to get all credit):

1. You find a violin lying on the ground outside UMD's Computer Science building. Using your big brain, you pluck the instrument, and instantly determine that the length of its A string is 0.1 meters, the linear density of the string is 0.025 kg/meter, and the velocity of the string is 88.1 meters/second:

    a. Find the tension in the string.

    b. What is the frequency of the string played?

    c. What note was played?

    d. Another note is played, creating an augmented fifth interval. What is the second note being played?

    e. Assuming both notes were tuned using standard tuning convention, what is the beat frequency if both notes were played at the same time?

2. Your professor wants you to describe how sound is produced in 5 different instruments. You (begrudgingly) decide to answer his questions.
    a. What type of instrument is a chime and how do they produce sound?

    b. What type of instrument is a kazoo and how do they produce sound?

    c. What type of instrument is a flute and how do they produce sound?

    d. What type of instrument is a synthesizer and how do they produce sound?

    e. What type of instrument is a lyre and how do they produce sound?

3. You and your friend are conducting an experiment to determine the speed of sound in air. You use an old half-filled glass bottle of Coca-Cola to produce music.

   a. Using a tuning system of A4, you play a note that your friend claims is 5 semitones away from your tuning standard. What are the two possible notes you are playing and what are their frequencies?

   b. What is the resonant frequency for your bottle, assuming that the speed of sound in air is 343 m/s, the cross sectional area of the bottle neck is 12.566 cm^2, the volume of the bottle is 12 oz, and the length of the bottle neck is 4 cm?

   c. You realize that the value you calculated in part b is wrong, because you assumed the speed of sound is 343 m/s. The air temperature is actually 17°C. What is the new speed of sound, and the actual resonant frequency for your bottle?

   d. Calculate the percent error for part b, assuming your answer for part c is the actual value.