C - Sounds of Music (C) - Rickards Invitational Div. C - 12-05-2020

Here is the Rickards Science Olympiad Invitational Sound of Music Test!

Good Luck!

1. (1.00 pts) Which is the third mode of a major scale?

- A) Mixolydian
- B) Superlocrian
- C) Phrygian
- D) Aeolian

2. (1.00 pts) What is the speed of sound in air at 30 degrees celsius?

- A) 349.08 m/s
- B) 343 m/s
- C) 406.5 m/s
- D) 440 m/s

3. (1.00 pts)
A violin in an orchestra is an entire whole step flat. If the orchestra is tuning to a C4 and the violin attempts to match it, what is the beat frequency that a listener would perceive?

- A) 28.55 Hz
- B) 440 Hz
- C) 14.69 Hz
- D) 494.71 Hz

4. (1.00 pts) While standing 3 meters from a speaker, you perceive a volume of 81 decibels. What volume would you perceive standing 9 meters from the speaker?

- A) 81 dB
- B) 10 dB
- C) 3 dB
- D) 9 dB

5. (1.00 pts) What is the frequency of the Stuttgart pitch?

- A) 261.63 Hz
- B) 220.00 Hz
- C) 440.00 Hz
- D) 110.00 Hz

6. (1.00 pts)
At the end of a measure of a conducted choir piece, I see this symbol over the note D#3:  . If the piece is in 4/4 time and the tempo is 87 beats per minute, how many seconds must I hold the note D#3?

- A) 4 seconds
- B) 12 seconds
- C) 5.8 seconds
- D) As long as the conductor wants

7. (1.00 pts) Which most closely matches the meaning of sforzando?

- A) Always more, a constant increase in volume
- B) Sharply accented or forceful
- C) An immediate drop in volume
- D) An abrupt shift from head voice to whistle register

8. (1.00 pts) Which form of seismic wave most closely resembles a sine wave?

- A) S waves
- B) P waves
- C) Love waves
- D) Rayleigh waves

9. (1.00 pts) How many antinodes are in the third harmonic of an open-ended air column?

- A) 2
- B) 3
- C) 4
- D) 5

10. (1.00 pts) In concert C, what key would a french horn play in?

- A) G
- B) C
- C) A
- D) D

11. (1.00 pts) What is the function of the Eustacian tube?

- A) To produce sound
- B) To equalize the pressure on both sides of the eardrum
- C) To vibrate and convert sound to electrical impulses
- D) To allow fluid to flow out of the ear

12. (1.00 pts) What notes make up the hypothetical C*dimsus4add9* chord?

- A) C, E, F, Ab
- B) C, D, Eb, F, Ab
- C) C, E, F#, A#
- D) E, F, C, Bb

13. (1.00 pts) What type of musical temperament is generally used amongst Western instruments?

- A) Tonal Temperament
- B) Schismatic Temperament
- C) Pythagorean Tuning
- D) Equal Temperament

14. (1.00 pts) Which of the following is an electrophone?

- A) Electric guitar
- B) Flute
- C) Erhu
- D) Theremin

15. (1.00 pts) Which of the following is an idiophone?

- A) Piano
- B) Theremin
- C) Marimba
- D) Djembe

16. (1.00 pts) What is the tri-tone of C?

- A) Gb
- B) Cb
- C) G
- D) E

17. (1.00 pts) What is a dyad?

- A) Three notes played each a whole step apart
- B) A scale in which each note is 2 whole steps apart
- C) A chord containing two notes
- D) Two scales for which their major and minor keys contain the same notes

18. (1.00 pts) What is the period of the note A4?

- A) 440 Hz
- B) 220 Hz
- C) 1/440^2 Hz
- D) 1/440 Hz

19. (1.00 pts) Which of the following is an aerophone?

- A) Jaw harp
- B) Violin
- C) Theremin
- D) Saxophone

20. (1.00 pts) Which of the following is a chordophone?

- A) Bagpipe
- B) Lyre
- C) Flute
- D) Snare drum

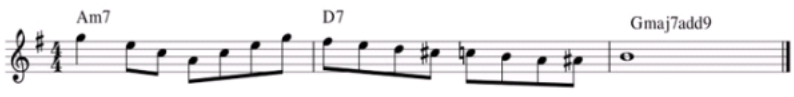
21. (1.00 pts) Which of the following is a membranophone?

- A) Comb and waxed paper
- B) Cymbal
- C) Guitar
- D) Djembe

22. (1.00 pts) What is the Hornbostel-Sachs classification number for a scraped/rasped idiophone?

- A) 111
- B) 112.2
- C) 112.1
- D) 101.2

For 23 - 28 reference the following musical passage:



23. (1.00 pts) What concert key would this phrase be if it was read on alto clarinet?

- A) C

B) G
C) Bb
D) Ab

24. (1.00 pts) What is the following chord progression?

A) i - v - ii
B) ii - iv - i
C) i - iv - iii
D) ii - v - i

25. (1.00 pts) What general style of music most likely incorporates this chord progression?

A) 12-bar Blues
B) 3-bar Pop
C) Classical Overture
D) Symphonic March

26. (1.00 pts) What degree is the first note in the phrase relative to the chord?

A) Major 3rd
B) Minor 3rd
C) Dominant 7th
D) Major 7th

27. (1.00 pts) What would the second chord be read as on a baritone saxophone?

A) B7
B) G7
C) C#7
D) F7

28. (1.00 pts) What would the final note in the phrase be on a sousaphone?

A) G#
B) Eb
C) Db
D) B

29. (1.00 pts) What notes make up a C whole tone scale?

A) C D E F# G# A# C

B) C D E F G A B C

C) C C# E E# B B# C

D) C D D# F F# G# A B# C

30. (1.00 pts) What intervals make up an octatonic scale (W = whole step, H = half step)?

A) WWHWWWH

B) WWWWWWW

C) WHWHWHWH

D) WHWWHWHW

31. (1.00 pts) In air, what is the approximate speed of sound at 273 K?

A) 3232 m/s

B) 331 km/s

C) 3310 dm/s

D) 349 cm/s

32. (1.00 pts)
You are making an instrument called the “Pipe-percussion” (An instrument played by hitting the ends of open-ended PVC Pipes). The highest note on the instrument is an A6. Assuming the diameter of the pipes used is 5.5 inches, what does the length of the shortest pipe have to be?

A) 10.36 inches

B) 6.56 inches

C) 17.97 inches

D) 3.35 inches

33. (1.00 pts)
The same instrument in the previous question has a B0 as its lowest note. Assuming the instrument was tuned with Verdi tuning standard, what is the length of the PVC pipe a minor 3rd above G#1?

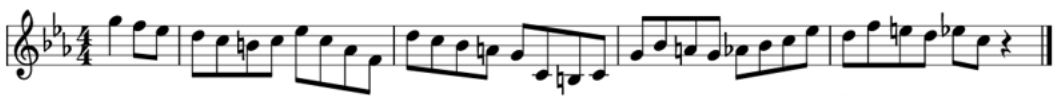
A) 218.84 centimeters

B) 218.83 inches

C) 293.42 inches

D) 239.24 centimeters

For 34 - 36 reference the following musical passage:



34. (1.00 pts)
Assuming the tempo is set to adagio (quarter note = 60), approximately how much time does it take to play up to the “and-of-two” of the second measure from beat three in the first measure?

- (◉) A) 4.0 seconds
- ( ) B) 2.2 seconds
- ( ) C) 4.5 seconds
- ( ) D) 2.2 milliseconds

35. (1.00 pts) Assuming the tempo remains the same as in the previous question, what is the concert key of the musical passage if it were read on a c-melody saxophone?

- ( ) A) F Minor
- ( ) B) Eb Minor
- (◉) C) Eb Major
- ( ) D) F Major

36. (1.00 pts) Relative to the key of the passage, what would the first inversion of the “iv chord” be?

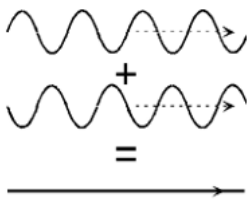
- ( ) A) Ab - C - Eb
- ( ) B) Eb - Ab - C
- (◉) C) C - Eb - Ab
- ( ) D) Ab - Eb - C

37. (1.00 pts) What is it called when someone is able to identify a note accurately with reference to another note and the interval they share?

- ( ) A) Tonal Pitch
- ( ) B) Perfect Pitch
- (◉) C) Relative Pitch
- ( ) D) Acoustic Pitch

38. (1.00 pts)

What best describes the interaction occurring in the image to the right?



- ( ) A) Constructive Interference
- ( ) B) Linear Diffraction
- (◉) C) Destructive Interference
- ( ) D) Linear Reflection

39. (1.00 pts) If the tempo on a passage of music was marked as “larghetto,” what would be the best estimate of the tempo?

- ( ) A) 65 bps
- ( ) B) 50 bps
- ( ) C) 75 bpm

◉ D) 60 bpm

40. (1.00 pts) What best describes destructive interference?

○ A) A difference in frequency resulting from two notes played simultaneously
○ B) An transformation from a sine wave to a cosine wave from two notes played simultaneously
◉ C) Two waves in opposite phase creating a decrease in sound intensity
○ D) Two waves in an uneven phase creating a varying volume as the notes are played

41. (1.00 pts) What best differentiates destructive and constructive interference?

○ A) Constructive interference increases sound intensity while destructive maintains a constant intensity
○ B) Constructive interference involves the waves being in skewed phase while destructive involves both being in the same phase
○ C) Constructive only applies to P waves while destructive can apply to S waves
◉ D) Constructive increases sound intensity while destructive decreases sound intensity

42. (1.00 pts) The fundamental wave in an open-ended pipe has how many antinodes?

◉ A) 2
○ B) 1
○ C) 3
○ D) 6

43. (1.00 pts) A string 2 meters long with a mass of 100 g plays a C0 note. How much tension is it under?

◉ A) 53.4645
○ B) 108.9290
○ C) 213.8580
○ D) 50.4126

44. (1.00 pts) A C4 and an A4 are played simultaneously. What is the beat frequency?

○ A) 440 Hz
◉ B) 178.37 Hz
○ C) 701.63 Hz
○ D) 329.63 Hz

45. (1.00 pts) On what fret lies the first harmonic of a guitar string?

○ A) 5th fret
○ B) 20th fret
○ C) 10th fret

◉ D) 12th fret

46. (1.00 pts) What unit is sound intensity measured in?

○ A) Decibels per linear density
○ B) Amps per hertz
◉ C) Watts per meters squared
○ D) Joules per decibel

47. (1.00 pts) Given there are 32 cents between an A4 tuned in equal temperament and an A4 tuned in Verdi pitch, what is the ratio between their frequencies?

◉ A) 54:55
○ B) 54:110
○ C) 225:216
○ D) 3:2

48. (1.00 pts)
A woman is walking 1.5 m/s and she sees a train coming towards her at 20 m/s exhibiting a sound. She is a very talented musician herself, and she is able to determine that the sound coming from the train is the note Cb5. Assuming all environmental conditions are stable, approximately what is the perceived pitch of sound from the train by a person who is sitting at rest?

○ A) 1012 Hz
○ B) 988Hz
○ C) 832 Hz
◉ D) 1049 Hz

49. (1.00 pts) Sound waves are transverse.

○ True ◉ False

50. (1.00 pts) The pitch of a real tube is higher than the pitch predicted by end correction.

○ True ◉ False

51. (1.00 pts) Temperature is the only factor which affects the speed of sound.

○ True ◉ False

52. (1.00 pts) It is impossible to determine the speed of sound through solids.

○ True ◉ False

53. (1.00 pts) Sound waves can take the form of sine waves, sawtooth waves, or even square waves.

◉ True ○ False

54. (1.00 pts) The electric guitar is an electrophone.

○ True ◉ False

55. (1.00 pts) The original solfege scale, created over a thousand years ago, contained only 5 notes.

○ True ◉ False

56. (1.00 pts) Harmonics always follow an octave pattern (first harmonic - E4, second - E5, etc.).

○ True ◉ False

57. (1.00 pts) Alla breve means cut time.

◉ True ○ False

58. (1.00 pts) An upright bass and a cello are tuned to the same notes on each string.

○ True ◉ False

59. (7.00 pts) Name all the modes and identify all their scale degrees

- Must include first, third, and fifth scale degree as well as others altered in the mode)
- Hint: For accidentals, use “b” and “#” to identify flats and sharps, respectively
- For example, to identify a mode with a flat 3, sharp 4, and major 7 would look like:
  “Mode Name”: 1 - 2 - b3 - #4 - 5 - 6 - 7

Expected Answer: Ionian: 1 - 2 - 3 - 4 - 5 - 6 - 7 Dorian: 1 - 2 - b3 - 4 - 5 - #6 - b7 Phyrgian: 1 - b2 - b3 - 4 - 5 - b6 - b7 Lydian: 1 - 2 - 3 - #4 - 5 - 6 - 7 Mixolydian:1 - 2 - 3 - 4 - 5 - 6 - b7 Aeolian: 1 - 2 - b3 - 4 - 5 - b6 - b7 Locrian: 1 - b2 - b3 - 4 - b5 - b6 - b7

60. (4.00 pts)
A closed pipe is 83 cm long and an open pipe is 69 cm long. They both have an unknown diameter, d. They are sounding their first overtone in unison. Determine the diameter and the end correction of the pipes (round to 3 significant figures and include units).

Expected Answer: Diameter: 416 cm End Correction: 62.5 cm

For 61 and 62 please reference the following sentence and fill in the blank.

End correction in a resonance tube can be described as when a(n) _____ 61 forms at the surface end, and a(n) _____ 62 forms at a certain distance from the open end of a tube.

61. (2.00 pts)

Expected Answer: Node

62. (2.00 pts)

Expected Answer: Antinode

Congratulations! You have finished the Rickards Invitational Sounds of Music Test!

Now delight yourself to this masterpiece: