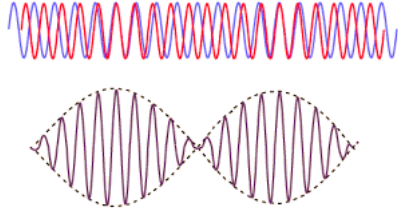glhf :)

---

1. (1.00 pts)   What kind of frequency does the following image show?

Expected Answer: Beats/beat frequency.

---

2. (2.00 pts)   Find the length (in meters) of a closed cylinder air column such that its 3rd harmonic frequency is 540 Hz. Assume the speed of sound is 343 m/s.
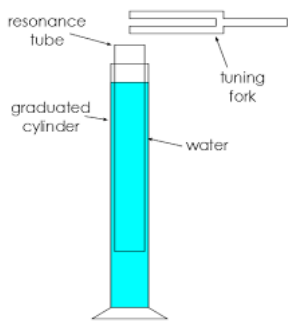
Expected Answer: .476

---

3. (3.00 pts)

If an air column produces a frequency at an arbitrary temperature, and then the temperature is increased by 3 degrees Celsius, how many cents sharp is the frequency at the warmer temperature?

Expected Answer: 9.21; Accepted answer around 9 - as temperature of the air was not specified clearly in the question.

---

4. (2.00 pts)

Given a resonance tube that is 0.5 m long and a 550 Hz tuning fork, at what lengths (m) of the air column above the water will there be resonance? Assume the speed of sound is 34 m/s.

resonance tube
tuning fork
graduated cylinder
water

(Mark **ALL** correct answers)

- ☑ A) .156
- ☐ B) .312
- ☐ C) 1.091
- ☐ D) .624
- ☑ E) .780
- ☐ F) .935

---

5. (3.00 pts)   A clarinet plays a note at 523.3 Hz. Another clarinet is 14 cents sharp. What is the beat frequency?

Expected Answer: 4.25

---

6. (2.00 pts)   If the intensity of a sound is increased by a factor of 100, what is the change in decibels?

Expected Answer: 20

---

7. (1.00 pts)   As a train approaches closer to you, the pitch you hear seems to get higher. Name this phenomenon.

Expected Answer: Doppler effect

---

8. (3.00 pts)
You observe a loud police car with a siren moving away from you as you remain stationary. The siren emits a frequency of 1200 Hz, and the police car is moving at a constant speed of 18 m/s. What is the frequency (Hz) you observe? Assume the speed of sound is 343 m/s.

Expected Answer: 1140

9. (6.00 pts)

You are standing near two speakers. One speaker is 3.75 m directly to your left. The other speaker is 2 m in front of the first speaker. What is the lowest frequency (Hz) in the audible range such that the listener hears a minimum signal? What about the highest frequency in the audible range such that the listener hears a max signal? Assume the speed of sound is 345 m/s.

Expected Answer: 345 Hz 20 kHz or 20,000 Hz

---

10. (3.00 pts)   You measure the intensity of a sound to be 70 dB from 3 m away. What is the measured intensity (dB) at 20 m away?

Expected Answer: 53.52

---

11. (1.00 pts)   An observer hears two sounds, played at 260 Hz and 280 Hz respectively. What is the beat frequency (Hz)?

Expected Answer: 20

---

12. (5.00 pts)

A string with linear density 0.65 g/m is 30 cm long. The string is placed near a speaker that plays a range of frequencies from 500 to 1500 Hz. The string oscillates at 880 Hz and 1320 Hz. Find the tension (N) in the string.

Expected Answer: 45.3

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13. (2.00 pts)   What 2 changes can you make to a guitar string to make it play a higher pitch?

Expected Answer: increase tension decrease linear density

14. (2.00 pts)

A sewing machine needle moves up and down in simple harmonic motion with an amplitude of .0135 m and a frequency of 2.35 Hz. How far does the needle move in one period (m)?

Expected Answer: .054

15. (1.50 pts)   What are the names of the 3 auditory ossicles?

Expected Answer: malleus, incus, stapes

16. (3.00 pts)   Describe the process behind what causes reverberation to occur.

Expected Answer: If sound takes less than 0.1 seconds to reflect, the sound is observed as prolonged. The brain remembers sound in memory for 0.1 seconds, so if the sound is reflected within 0.1 seconds, the sound is perceived to have reverb.

17. (3.00 pts)   Why is it difficult to understand when you are listening to someone speaking underwater?

Expected Answer: Molecules are more closely packed in water than in air, so sound moves faster. A key part of underwater hearing being different is that it bypasses the eardrum and goes directly to the bones in your ear, which affects what frequencies get picked up.

18. (2.00 pts)   Describe what conditions cause an observer to hear beats, and describe what that observer hears.

Expected Answer: Two sound waves of different frequency are observed. Constructive and destructive interference from the waves causes the sound observed to alternate between loud and soft. This alternation is the beats.

19. (4.00 pts) There are two strings with different linear densities (mu). Find the length ratio L_2/L_1 if $mu_1/mu_2 = 5/4$.

Expected Answer: 4 / (3 * sqrt(5)) or .596

20. (3.00 pts) The graph below shows linear density in a sound wave. At what point(s) is the displacement zero?
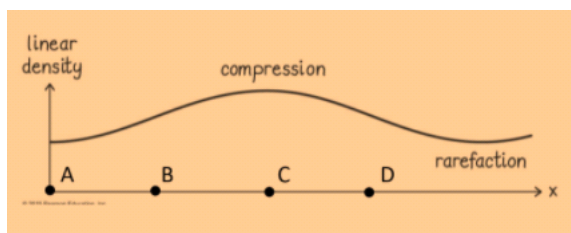
Expected Answer: A, C

21. (3.00 pts)
A very long string carries a traveling wave given by the equation $f(x,t) = a \sin[b(x - ct) + \varphi_i]$, with a = 0.00580 m, b = 33.05 m^{-1}, and c = 215 m/s. What is the simple harmonic period (seconds) of a point on the string?

Expected Answer: 8.84*10^-4 seconds .000884 seconds

22. (3.00 pts)
Two balls of unequal mass are hung from two springs that are not identical. The springs stretch the same distance as the two systems reach equilibrium. Then both springs are compressed and released. Which spring oscillates faster?

- ○ A) The spring with the lighter ball
- ○ B) The spring with the heavier ball
- ● C) The springs oscillate with the same frequency
- ○ D) It is impossible to determine without additional data

23. (2.00 pts)

An oscillator creates period waves on two different strings made of the same material. The tension is the same in both strings. If the strings have different thicknesses, which of the following parameters, if any, will be different in the two strings?

○ A) wave speed

○ B) wavelength

⦿ C) wave speed and wavelength

○ D) wave speed, wavelength, and frequency

○ E) none of the above

---

24. (2.00 pts)
You are standing by an intersection with a marching band coming around the corner. Let's say this marching band only consists of flutes and tubas. Which instruments will you hear first, and why?

○ A) Flutes, because higher instruments are louder.

○ B) Tubas, because lower instruments play notes that last longer.

○ C) Flutes, because shorter wavelength sounds diffract around corners more efficiently.

⦿ D) Tubas, because longer wavelength sounds diffract around corners more efficiently.

---

25. (4.00 pts)   You are tuning a piano and using a baseline of A440. What is the frequency (Hz) of F4 if you are tuning using Pythagorean temperament?
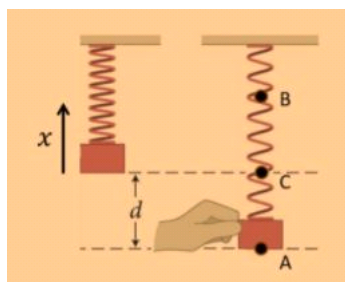
Expected Answer: 348

---

26. (1.00 pts)
A mass attached to a vertical spring is pulled down a distance d from the equilibrium position, as shown. The mass is then released at t = 0 and undergoes simple harmonic motion between points A and B. Using the positive x direction indicated in the drawing, the displacement is x(t) = A sin(ωt + φ_i).

What is φ_i in this example? (Give answer in radians)
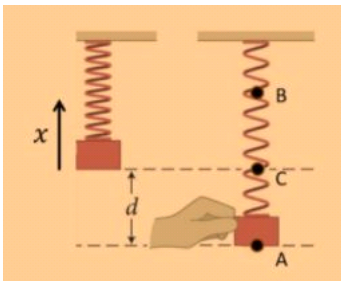
Expected Answer: -pi/2

---

27. (1.00 pts)
A mass attached to a vertical spring is pulled down a distance d from the equilibrium position, as shown. The mass is then released at t = 0 and undergoes simple harmonic motion between points A and B. Using the positive x direction indicated in the drawing, the displacement is x(t) = A sin(ωt + φ_i).

At what displacement is the kinetic energy of the mass half its maximum value? Give answer in terms of A.

**Expected Answer:** (1/sqrt(2))*A or A/sqrt(2)

---

28. (1.00 pts)

When one end of a string is tied to a pole and the other end is move with frequency f, the standing wave pattern shown is produced. What is the smallest frequency at which the string can be moved to produce any standing wave? Give answer in terms of f.
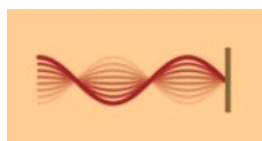
Expected Answer: 1/5*f or f/5

---

29. (1.00 pts)   The figure shows linear density in a sound wave. At which point(s) is the displacement zero?
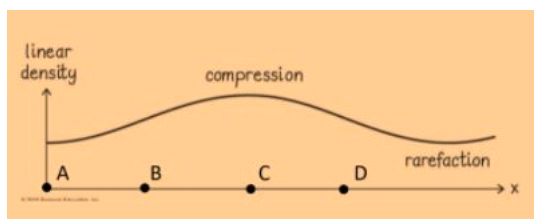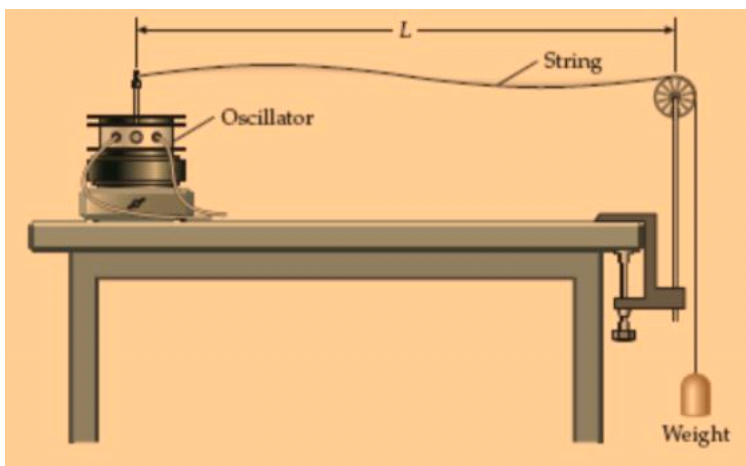

Expected Answer: A and C

---

30. (1.00 pts)

You set up an experiment as shown. A weight of mass m is attached to the end of a string draped over a pulley. The other end of the string is attached to a mechanical oscillator that moves up and down at a frequency f. The length between the oscillator and the pulley is L = 1.0 m. The linear density of the string is mu = 0.75 g/m. The frequency of the oscillator, f, and m and be varied.

If f = 80 Hz, what is the mass of the weight (kg) you need to attach to the string so that the string oscillates at its fundamental frequency? Round to the nearest whole number.

Expected Answer: 2 kg

---

31. (1.00 pts)
Surface waves are generated from two coherent sources, S_1 and S_2 separated by a small distance. The figure shows the crests of the waves from S_1 (gray) and S_2 (black) at an instant. Point A is on a nodal line, and point B is on an antinodal line. Then the frequency of the sources is doubled. After the frequency is doubled are points A and B on nodal lines or antinodal lines?
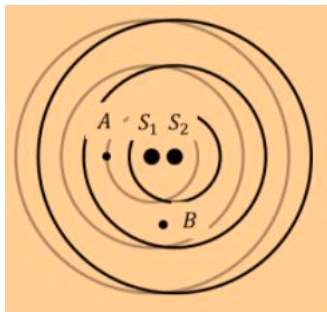
Expected Answer: Now both points are on antinodal lines

---

32. (2.00 pts)   What is the intensity (W/m^2) of a sound that is played at 83 dB?

Expected Answer: 2*10^-4 or 0.0002

33. (2.00 pts)   If c is the speed of sound, and L is the length of an open tube, at what frequencies will standing waves occur?

(Mark **ALL** correct answers)

☐ A) c/4L

☐ B) c/3L

☑ C) c/2L

☐ D) 2c/3L

☐ E) 3c/4L

☑ F) c/L

---

34. (2.00 pts)   The following pendulums are simple pendulums. Pendulum A has a mass m. Pendulum B has a mass 5m. How do the periods of A and B compare to each other?

○ A) Period A is shorter.

○ B) Period B is shorter.

◉ C) The periods are the same.

---

35. (2.00 pts)
The following pendulums are simple pendulums. Pendulum A has length = 1 m. Pendulum B has length = 2 m. The pendulums have identical masses. What is the ratio between the periods (period A / period B)?

○ A) 4

○ B) 2

○ C) sqrt(2)

◉ D) sqrt(2)/2

---

36. (2.00 pts)   In acoustics, what classifies a sound as warm?

Expected Answer: An increase in reverberation time at low frequencies.

---

37. (2.00 pts)   When increasing the warmth of a sound, what decreases?

○ A) fullness

○ B) clarity

◉ C) brilliance

○ D) liveness

---

38. (1.00 pts)   Sound acts in transverse waves through materials.

○ True   ◉ False

---

39. (4.00 pts)

A jet is flying at an altitude of 9 km at a speed of 743 m/s. The speed of sound is 343 m/s. How long (seconds) after the jet is directly overhead, will a stationary observer hear a sonic boom?

Expected Answer: 23.28

40. (6.00 pts)
One source emits a sound at 77 dB from 10 m away. If there are 132 sources that emit a sound simultaneously (assume these sources are all in the same position), at what distance (m) will the sound observed be 85 dB?

Expected Answer: 45.7

41. (3.00 pts)
You are 33 m away from speaker A, and 37 m away from speaker B. Speakers A and B are 10 m away from each other. What is the lowest frequency (Hz) the speakers should play in order for you to observe destructive interference? Assume speed of sound is 343 m/s.

Expected Answer: 42.88

42. (3.00 pts)   Let the frequency of A4 be 442 Hz. Using equal temperament, what is the frequency (Hz) of E4?

Expected Answer: 331 Hz

43. (3.00 pts)   Find the speed of sound (m/s) in concrete, which has a bulk modulus of 11 GPa and a density of 2400 kg/m^3

Expected Answer: 2141

44. (2.00 pts)   Classify a harp using the Sachs-Hornbostel system.

Expected Answer: chordophone

---

45. (2.00 pts) According to the Sachs-Hornbostel classification of instruments, which instrument is a concussion (struck) idiophone?

○ A) maracas

● B) cymbals

○ C) clogs

○ D) washboards

---

46. (5.00 pts)
A Helmholtz resonator is shaped as a spherical air chamber with a cylindrical neck. The spherical chamber has radius 0.05 m. The neck has radius 0.005 m and a length .08 m. Assuming the speed of sound is 343 m/s, find the frequency (Hz) of the Helmholtz resonator.

Expected Answer: 74.75

---

47. (2.00 pts) How can you modify a single bar on a marimba to produce a higher pitch?

(Mark **ALL** correct answers)

☐ A) Increase length of the bar.

☑ B) Decrease length of the bar.

☑ C) Increase the thickness of the bar.

☐ D) Decrease the thickness of the bar.

☐ E) Increase the width of the bar.

☐ F) Decrease width of the bar.

---

48. (1.00 pts) As the bulk modulus of a material increases, the speed of sound through the material also increases.

● True   ○ False

---

49. (2.00 pts) High pitched sounds act at the apex of the cochlea.

○ True   ● False

---

50. (2.00 pts) Which of the following does not belong in the brass family of instruments?

○ A) Flugelhorn

● B) English Horn

○ C) French Horn

○ D) Euphonium

**51. (3.00 pts)** Rank the following tempos from slowest to fastest:

Moderato, Allegro, Lento, Andante, Grave, Vivace, Prestissimo

Expected Answer: grave, lento, andante, moderato, allegro, vivace, prestissimo

---

52. (3.00 pts) If a trumpet player plays an E according to their instrument, what key would have to be pressed on the piano to match the pitch?
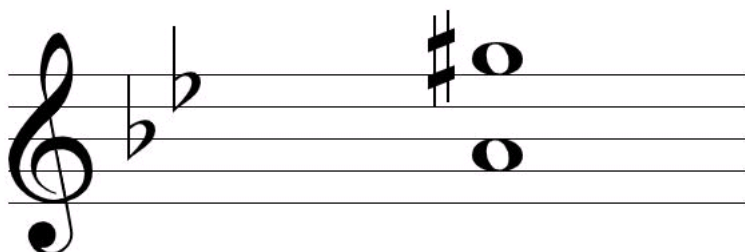
Expected Answer: D
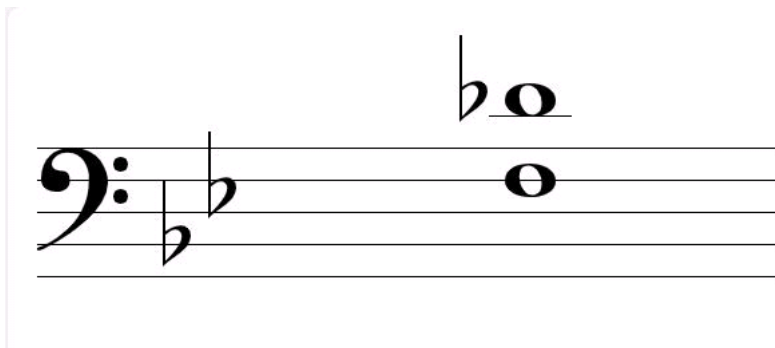
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53. (3.00 pts) Name the interval.
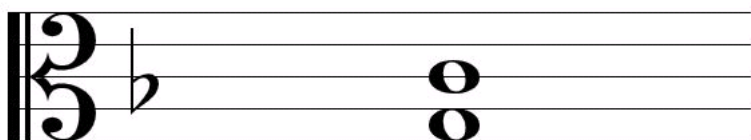
Expected Answer: P4 or perfect fourth

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54. (3.00 pts) Name the interval.

Expected Answer: M7 (case sensitive) or Major 7th

55. (3.00 pts)   Name the interval.

Expected Answer: m6 (case sensitive) or minor 6th

---

56. (2.00 pts)   What scale is represented by the following notes:
B C D E F# G A B

(Mark **ALL** correct answers)

- [ ] A) B minor
- [ ] B) B Locrian
- [ ] C) B Aeolian
- [x] D) B Phrygian
- [ ] E) B Lydian

---

57. (6.00 pts)   Pair up the following terms with the correct definitions.

Terms:

amabile, piu, allargando, cantando, senza, scherzando

Definitions:

pleasant, singing, more, playfully, without, broadening

Expected Answer: amabile = pleasant, piu = more, allargando = broadening, cantando = singing, senza = without, scherzando = playfull