



SCIENCE OLYMPIAD
AT THE
UNIVERSITY OF FLORIDA

Northern Regional: January 19th, 2019

Sounds of Music C Answer Key

Name(s): _____

Team Name: _____

School Name: _____

Team Number: _____

Rank: _____

Score: _____

I. Multiple Choice (1 point each)

- 1) C. Ionian
- 2) D. Flute
- 3) A. True
- 4) D. Bb7
- 5) C. 4/4
- 6) A. Perfect Fifth
- 7) A. Eighth note
- 8) D. Resonance
- 9) A. Crest to Crest
- 10) C. Cochlea
- 11) B. $A = 440 \text{ Hz}$
- 12) B. Active pickups contain a preamp, while passive pickups do not.
- 13) D. $A\flat^7$ ($b^5 \#5 b^9$)
- 14) B. False (compression wave)
- 15) A. One hundred times louder.
- 16) A. Phonation
- 17) D. 4350 Hz ($v=w*f$)
- 18) B. Bb
- 19) C. It remains unchanged.
- 20) D. A min7
- 21) B. $2\pi / L$
- 22) B. 402.300 Hz [$f' = (1 + u/v)f$]
- 23) C. Dodecatonic

II. Fill in the Blank (2 point each- no partial credit)

- 1) Longitudinal
- 2) Transverse
- 3) Properties of the medium
- 4) 47.6190 Hz ($f=1/T$)
- 5) Length, tension (tightness) , and diameter (thickness).
- 6) Major seven (“MAJOR SEVENTH”)
- 7) 20 and 20,000

III. Free Response

- 1) Pickups “are simple transducers, built by wrapping many coils of copper wire around a permanent magnet, usually made of Alnico or Ceramic. The location of the magnet in proximity to the strings causes the strings to magnetise, and become magnets, too. Because of this, when the strings move, they disturb the magnet field and cause an electrical current to pass through the copper wire.”
- a) Through electromagnetic fields **(1 point)**
 - b) The vibrations of the strings cause a disturbance in the magnetic field **(1 point)**
 - c) Causes the pickup to produce an electrical current **(1 point)**

“The signal passes through the tone and volume circuits to the output jack, and through a cable to an amplifier. The current induced is proportional to such factors as string density and the amount of movement over the pickups.”

- d) Signal is passed from pickups through volume and tone potentiometers or signal effects circuits along the wire **(1 point)**
 - e) Signal is passed to an amplifier **(1 point)**
- 2) Typically the dampers rest on the strings of an acoustic piano, muting the strings when a key is released. When a key is pressed, the hammer strikes the strings producing a vibration. For the duration a key is held, the damper is also held up until the key is released, dropping the damper and muting the string. When the sustain pedal is held (far right pedal), all of the dampers on the keys are raised allowing for any notes to be sustained as long as the pedal is held up.
- a) A key is pressed and it makes a hammer strike a string **(1 point)**
 - b) Typically, a damper falls down when a key is released. Can sustain note by holding a key. **(2 points)**
 - c) Sustain pedal raises all the dampers, allowing notes to be sustained as long as it is held down. **(2 points)**
 - d) Sustain pedal is the far-right pedal **(1 point)**

3)

$$f' = \frac{(v + v_0)}{(v - v_s)} f$$

(2 Points)

f = actual frequency of the sound waves

f' = observed frequency

v = speed of the sound waves

v_0 = velocity of the observer

v_s = velocity of the source

- Accept: just “v” in numerator
 - $(V \pm V_s)$ is ok
 - The Doppler effect (or the Doppler shift) is the change in frequency or wavelength of a wave in relation to an observer who is moving relative to the wave source. **(1 point)**
 - Example: **(1 point)**
 - Ambulance (siren)
 - Car horn
 - If source is moving towards the observer: **(1 point)**
 - Each wave takes slightly less time to reach the observer than the previous wave. Hence, the time between the arrival of successive wave crests at the observer is reduced, causing an increase in the frequency. While they are traveling, the distance between successive wave fronts is reduced, so the waves "bunch together".
 - If source is moving away from the observer: **(1 point)**
 - Each wave is emitted from a position farther from the observer than the previous wave, so the arrival time between successive waves is increased, reducing the frequency. The distance between successive wave fronts is then increased, so the waves "spread out".
- 4) “Positive air pressure from the lungs forces them open momentarily **(1 point)**, but the high velocity air produces a lowered pressure by the Bernoulli effect **(1 point)** which brings them back together. The folds themselves have a resonant frequency **(1 point)** which determines voice pitch.”
- 5) There is no medium for the sound to vibrate particles/create changes in pressure needed for longitudinal waves. **(1 point)**
- 6) A) At least 3 notes are correctly transposed **(1 point)**. All of the notes are correctly transposed **(1 point)**. The treble cleff, time signature, and accidental are correctly drawn **(3 points)**.



B) The only correct interval to write is that the line was transposed a major 6th **(1 point)** up **(1 point)**.