Question 1
What is the speed of sound in air when the air temperature is 31° C
    A) 0.313 km/s
    B) 0.362 km/s
    C) 0.35 km/s
    D) 0.332 km/s

$$V = V_0 \sqrt{\frac{T}{T_0}} = 331 \sqrt{\frac{273+31}{273}} \approx \boxed{0.35 \ km/s}$$

Question 2
A sound has an intensity of 5.0 x 10-7 W/m2. What is the intensity level?
    A) 57 dB
    B) 5.0 x 106 dB
    C) 6.99 dB
    D) 50 dB

$$\beta = 10 \log \frac{I}{I_0} = 10 \log \frac{5 \times 10^{-7}}{10^{-12}} = \boxed{57 \ dB}$$

Question 3
A locomotive moving at 30.0 m/s approaches and passes a person standing beside the track. Its whistle is emitting a note of frequency 2.00 kHz. What frequency will the person hear (a) as the train approaches and (b) as it recedes? The speed of sound is 340 m/s.
    A) (a) 1.84 kHz (b) 2.19 kHz
    B) (a) 2.19 kHz (b) 1.84 kHz
    C) (a) 2.18 kHz (b) 1.82 kHz
    D) (a) 1.82 kHz (b) 2.18 kHz

a) $f_0 = \dfrac{f_s}{1 - v_s/v} = \dfrac{2000 \ Hz}{(1 - \frac{30}{340})} = 2190 \ Hz$

b) $f_0 = \dfrac{f_s}{1 + v_s/v} = \dfrac{2000}{(1 + 30/340)} = 1.84 \ KHz$

Question 4
Determine the length of the shortest air column in a cylindrical jar that will strongly reinforce the sound of a tuning fork having a vibration rate of 512 Hz. Use u=340 m/s for the speed of sound in air.
    A) 16.6 cm
    B) 33.2 cm
    C) 37.6 cm
    D) 266 cm

$L = \frac{\lambda}{4} \rightarrow$ we need λ. $\quad \lambda = \frac{V}{f} = \frac{340}{512} = 0.66 \, m$

$L = \frac{0.66^m}{4} = \frac{66 \ cm}{4} = \boxed{16.6 cm}$

Question 5
A long, narrow pipe closed at one end does not resonate to a tuning fork having frequency of 300 Hz until the length of the air column reaches 28 cm. (a) What is the speed of sound in air at the existing room temperature? (b) What is the next length of column that will resonate to the fork?
    A) (a) 0.17 km/s, (b) 56 cm
    B) (a) 0.27 km/s, (b) 14 cm
    C) (a) 0.34 km/s, (b) 84 cm
    D) (a) 0.13 km/s, (b) 7.3 cm

a) $f = 300 \quad L = 28 \ cm$

$L = \frac{\lambda}{4} \rightarrow \lambda = 4L = 4(28) = 112 \ cm = 1.12^m$

$V = \lambda f = (1.12)(300) = 336 \ m/s \approx \boxed{0.34 \ km/s}$

b) $L = 3\lambda/4 = 3/4 \times 1.12 = 0.84 m = \boxed{84 \ cm}$

Question 6
A certain organ pipe is tuned to emit a frequency of 196.00 Hz. When it and the G string of violin are sounded together, ten beats are heard in a time of exactly 8 s. The beats

become slower as the violin string is slowly tightened. What was the original frequency of the violin string?

A) 194.75 Hz
B) 197.25 Hz
C) 186.00 Hz
D) 206.00 Hz

Question 7
A trombone and a bassoon play notes of equal loudness with the same fundamental frequency. The two sounds differ primarily in

A) pitch.
B) intensity level.
C) amplitude.
D) timbre.
E) wavelength.

Question 8
A moving van and a small car are traveling in the same direction on a two-lane road. The van is moving at twice the speed of the car and overtakes the car. The driver of the car sounds his horn, frequency = 440 Hz, to signal the van that it is safe to return to the lane. Which is the correct statement?

A) The car driver and van driver both hear the horn frequency as 440 Hz.
B) The car driver hears 440 Hz, but the van driver hears a lower frequency.
C) The car driver hears 440 Hz, but the van driver hears a higher frequency.
D) Both drivers hear the same frequency and it is lower than 440 Hz.

Question 9
The three lowest resonant frequencies of a system are 50 Hz, 150 Hz, and 250 Hz. The system could be

A) a tube of air closed at both ends.
B) a tube of air open at one end.
C) a tube of air open at both ends.
D) a vibrating string with fixed ends.

Question 10
The intensity of a sound wave is directly proportional to

A) the frequency.
B) the amplitude.
C) the square of the amplitude.
D) the square of the speed of sound.
E) none of the above.