2nd Midsemester Test 2020. 04. 21.

A

1. Find the number of moles in one cubic meter of an ideal gas at 27.0°C and atmospheric pressure:

a. 41,6 b. 8,31 c. 42,6 d. 3,88 e. none of them

2. Calculate the length of a pipe that has a fundamental frequency of 200 Hz if the pipe is closed at one end. (Speed of sound is 340 m/s)

a. 340 cm b. 85 cm c. 170 cm d. 42,5 cm e. none of them

3. Calculate the sound level in decibels of a sound wave that has an intensity of 8.00 $\mu W/m^2$

a. 57 dB b. 69 dB c. 33 dB d. 66 dB e. none of them

4. A cello A-string vibrates in its first normal mode with a frequency of 220 Hz. The vibrating segment is 70.0 cm long and has a mass of 1.20 g. Determine the frequency of vibration when the string vibrates in three segments.

a. 1320 Hz b. 210 Hz c. 73,3 Hz d. 660 Hz e. none of them

5. In a constant-volume gas thermometer, the pressure at 20.0°C is 1.000 atm. What is the pressure at 45.0°C?

a. 2,25 atm b. 1,068 atm c. 0,986 atm d. 0,976 atm e. none of them

6. If two adjacent natural frequencies of an organ pipe are determined to be 75 Hz and 105 Hz, calculate the fundamental frequency of this pipe. (Use v =340 m/s.)

a. 30 Hz b. 40 Hz c. 15 Hz d. 25 Hz e. none of them

7. Standing at a crosswalk, you hear a frequency of 520 Hz from the siren of an approaching ambulance. After the ambulance passes, the observed frequency of the siren is 490 Hz. Determine the ambulance's speed from these observations. (Use v =340 m/s.)

a. 67 km/h b. 112 km/h c. 87 km/h d. 75 km/h e. none of them

8. Blaise Pascal duplicated Torricelli's barometer using a red Bordeaux wine, of density 0,979 kg/ℓ, as the working liquid. What was the height ***h*** of the wine column for normal atmospheric pressure?

a. 12,86 m b. 9,85 m c. 10,40 m d. 13,12 m e. none of them

9. A glass tube (open at both ends) of length ***L*** is positioned near an audio speaker of frequency f = 440 Hz. For what values of L will the tube resonate with the speaker? (Use v =340 m/s.)

a. 44 cm b. 32,8 cm c. 16,5 cm d. 38,6 cm e. none of them

10. A copper telephone wire has essentially no sag between poles 50.0 m apart on a winter day when the temperature is -20.0°C. How much longer is the wire on a summer day when T = 35.0°C?

a. 9,76 cm b. 3,27 cm c. 1,56 cm d. 4,67 cm e. none of them

11. Find the fundamental frequency that could cause standing-wave patterns on a string that is 10.0 m long, has a mass per length of $9.00 \cdot 10^{-3}$ kg/m, and is stretched to a tension of 1000.0 N.

a. 13,43 Hz b. 8,33 Hz c. 16,7 Hz d. 33,3 Hz e. none of them

12. A swimming pool has dimensions 25.0 m x 8.5 m and a flat bottom. When the pool is filled to a depth of 2.00 m with fresh water, what is the force caused by the water on the bottom?

a. $2{,}545 \cdot 10^{7}$ N b. $4{,}25 \cdot 10^{6}$ N c. $2{,}12 \cdot 10^{7}$ N d. $2{,}54 \cdot 10^{6}$ N e. none of them

13. What is the pressure of the water at the bottom of a 50 m deep lake?

a. $6 \cdot 10^{5}$ N/m^2 b. $5{,}1 \cdot 10^{7}$N/m^2 c. $5 \cdot 10^{6}$ N/m^2 d. 5 atm e. none of them

14. What must be the contact area between a suction cup (completely exhausted) and a ceiling if the cup is to support the weight of an 60.0-kg student?

a. 58.86 cm^2 b. 598,4 cm^2 c. 17,06 cm^2 d. 0,589 m^2 e. none of them

15. The active element of a certain laser is made of a glass rod 40.0 cm long by 1.30 cm in diameter. If the temperature of the rod increases by 60.0°C, what is the increase in its length? Assume that the average coefficient of linear expansion of the glass is $9.00 \cdot 10^{-6}$ $(°C)^{-1}$.

a. 1,76 mm b. 2,06 mm c. 2,16 mm d. 1,33 mm e. none of them

16. Suppose that you hear a clap of thunder 14.8 s after seeing the associated lightning stroke. The speed of sound waves in air is 343 m/s, and the speed of light is 3.00 10^{8} m/s. How far are you from the lightning stroke?

a. 5, 076 km b. 4,875 km c. 4,933 km d. 1,029 km e. none of them

17. A large storage tank, open at the top and filled with water, develops a small hole in its side at a point 16.0 m below the water level. If the rate of flow from the leak is equal to $2.00 \cdot 10^{-3}$ m^3/min, determine the speed at which the water leaves the hole.

a. 18,2 m/s b. 14,5 m/s c. 8,0 m/s d. 15,5 m/s e. none of them

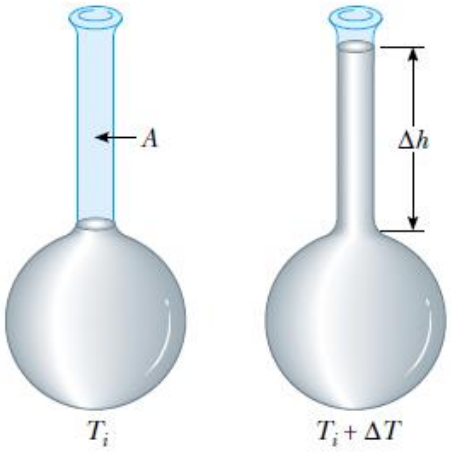
18. A wave is described by **$y = (2.00\ \text{cm}) \sin(kx - \omega t)$**, where k = 2,5 rad/m, ω = 3.8 rad/s, x is in meters, and t is in seconds. Determine the speed of the wave.

a. 7,6 m/s b. 0,65 m/s c. 1,90 m/s d. 1,52 m/s e. none of them

19. The Concorde can fly at Mach 1.40, which means the speed of the plane is 1.40 times the speed of sound in air. What is the angle between the direction of propagation of the shock wave and the direction of the plane's velocity?

a. 79,5º b. 85,4º c. 54,6º d. 34,2º e. none of them

20. A mercury thermometer is constructed as shown in Figure P19.47. The capillary tube has a diameter of 0.002 cm, and the bulb has a diameter of 0.250 cm. Neglecting the expansion of the glass, find the change in height of the mercury column that occurs with a temperature change of 30.0°C.



a. 15,12 cm b. 12.05 cm c. 14,20 cm d. 3,55 cm e. none of them