

## 2<sup>nd</sup> Midsemester Test 2020. 04. 21.

### B

1. For air, Avogadro's number of molecules has mass 28.9 g. Calculate the mass of one cubic meter of air at 27.0°C and atmospheric pressure.

- a. 1,17 kg      b. 1,20 kg      c. 1,01 kg      d. 1,28 kg      e. none of them

2. If two adjacent natural frequencies of an organ pipe are determined to be 175 Hz and 225 Hz, calculate the fundamental frequency and length of this pipe. (Use  $v = 340$  m/s.)

- a. 5 Hz      b. 15 Hz      c. 50 Hz      d. 25 Hz      e. none of them

3. A glass tube (open at one ends) of length  $L$  is positioned near an audio speaker of frequency  $f = 520$  Hz. For what values of  $L$  will the tube resonate with the speaker? (Use  $v = 340$  m/s.)

- a. 48 cm      b. 16 cm      c. 32 cm      d. 8 cm      e. none of them

4. The active element of a certain laser is made of a glass rod 50.0 cm long by 2.00 cm in diameter. If the temperature of the rod increases by 40.0°C, what is the increase in its diameter? Assume that the average coefficient of linear expansion of the glass is  $9.00 \cdot 10^{-6} (\text{°C})^{-1}$ .

- a. 7,18  $\mu\text{m}$       b. 6,28  $\mu\text{m}$       c. 9,12  $\mu\text{m}$       d. 8,78  $\mu\text{m}$       e. none of them

5. Calculate the length of a pipe that has a fundamental frequency of 200 Hz if the pipe is open at both ends. (Speed of sound is 340 m/s)

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

6. The Concorde can fly at Mach 1.60, which means the speed of the plane is 1.60 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. 79,5°      b. 85,4°      c. 67,5°      d. 54,6°      e. none of them

7. Suppose that you hear a clap of thunder 5.4 s after seeing the associated lightning stroke. The speed of sound waves in air is 333 m/s, and the speed of light is  $3.00 \cdot 10^8$  m/s. How far are you from the lightning stroke?

- a. 1,6 km      b. 1,8 km      c. 1,8 km      d. 1,1 km      e. none of them

8. A swimming pool has dimensions 20.0 m x 10.0 m and a flat bottom. When the pool is filled to a depth of 3.00 m with fresh water, what is the force caused by the water on the bottom?

- a.  $6,87 \cdot 10^7$  N      b.  $2 \cdot 10^7$  N      c.  $5,866 \cdot 10^6$  N      d.  $2,59 \cdot 10^7$  N      e. none of them

9. In a constant-volume gas thermometer, the pressure at 27.0 °C is 0.980 atm. What is the temperature if the pressure is 0.500 atm?

- a. 11,2 °C      b. 53.98 °C      c. 13.49 °C      d. -120 °C      e. none of them

10. A wave is described by  $y = -(1.50 \text{ cm}) \sin(kx + \omega t)$ , where  $k = 1,4 \text{ rad/m}$ ,  $\omega = 4.8 \text{ rad/s}$ ,  $x$  is in meters, and  $t$  is in seconds. Determine the speed of the wave.

- a. 1,07 m/s      b. 3,43 m/s      c. 0,29 m/s      d. 3,2 m/s      e. none of them

11. A large storage tank, open at the top and filled with water, develops a small hole in its side at a point 20.0 m below the water level. If the rate of flow from the leak is equal to  $12.00 \cdot 10^{-3} \text{ m}^3/\text{min}$ , determine the diameter of the hole.

- a. 2,5 mm      b. 3,4 mm      c. 8,6 mm      d. 1,2 cm      e. none of them

12. What is the pressure of the water at the bottom of a 25 m deep lake?

- a.  $2,6 \cdot 10^7 \text{ N/m}^2$       b. 2,5 atm      c.  $1,25 \cdot 10^6 \text{ N/m}^2$       d.  $3,5 \cdot 10^5 \text{ N/m}^2$       e. none of them

13. Calculate the sound level in decibels of a sound wave that has an intensity of  $4.00 \text{ nW/m}^2$

- a. 36 dB      b. 69 dB      c. 66 dB      d. 33 dB      e. none of them

14. Blaise Pascal duplicated Torricelli's barometer using a red Bordeaux wine, of density  $0,989 \text{ kg/l}$ , as the working liquid. What was the height  $h$  of the wine column for normal atmospheric pressure?

- a. 10,31 m      b. 10,40 m      c. 9,89 m      d. 11,57 m      e. none of them

15. A copper telephone wire has essentially no sag between poles 40.0 m apart on a winter day when the temperature is  $-20.0^\circ\text{C}$ . How much longer is the wire on a summer day when  $T = 40.0^\circ\text{C}$ ?

- a. 4,07 cm      b. 3,27 cm      c. 5,19 cm      d. 4,67 cm      e. none of them

16. Standing at a crosswalk, you hear a frequency of 640 Hz from the siren of an approaching ambulance. After the ambulance passes, the observed frequency of the siren is 615 Hz. Determine the ambulance's speed from these observations. (Use  $v = 340 \text{ m/s}$ .)

- a. 65,2 km/h      b. 49,8 km/h      c. 57,3 km/h      d. 83,7 km/h      e. none of them

17. A cello string vibrates in its first normal mode with a frequency of 205 Hz. The vibrating segment is 80.0 cm long and has a mass of 1.05 g. Determine the frequency of vibration when the string vibrates in five segments.

- a. 620 Hz      b. 1025 Hz      c. 41 Hz      d. 512,5 Hz      e. none of them

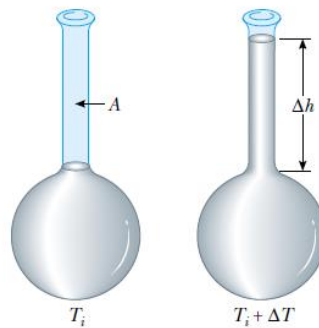
18. What must be the contact area between a suction cup (completely exhausted) and a ceiling if the cup is to support the weight of an 45.0-kg student?

- a. 4,5 cm<sup>2</sup>      b. 0,44 m<sup>2</sup>      c. 541,5 cm<sup>2</sup>      d. 44,15 cm<sup>2</sup>      e. none of them

19. Find the fundamental frequency that could cause standing-wave patterns on a string that is 40.0 m long, has a mass per length of  $9.00 \cdot 10^{-3}$  kg/m, and is stretched to a tension of 40.0 N.

- a. 0,316 Hz      b. 3,333 Hz      c. 0,833 Hz      d. 1,666 Hz      e. none of them

20. A mercury thermometer is constructed as shown in Figure P19.47. The capillary tube has a diameter of 0.003 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 20.0°C.



- a. 4,14 cm      b. 12,25 cm      c. 7,56 cm      d. 3,55 cm      e. none of them