Engineering Daily 16 [Home Practice] EV

Waves + Ideal Gas and Kinetic Theory of Gases

Total Marks: 50 **Negative Marks:** 0.25 **Time:** ১ ঘণ্টা

MCQ 50 marks

1. A closed vessel of volume 10 L contains 16 g of oxygen gas at 300 K. How many grams of nitrogen gas must be added to the same vessel at the same temperature so that the total pressure doubles?

(A) 18 g (B) 32 g (C) 16 g (D) 14 g

2. The pressure of a gas at 0°C is 3×10^5 Pa. Keeping the volume constant, what will be its pressure at 60°C?

(A) 3.66×10^5 Pa (B) 2.66×10^5 Pa

(C) 4.66×10^5 Pa (D) 5.67×10^5 Pa

3. A balloon filled with 20 g of helium gas has a volume of 0.12 m^3. The gas pressure inside the balloon is 1.5×10^5 Nm^{-2}. What is the temperature of the gas inside the balloon?

(A) 500 K (B) 273 K

(C) 433.00 K (D) 300 K

4. An air conditioner draws in outdoor air at 40°C and 75% relative humidity and converts it into air at 20°C and 54% relative humidity. How much water vapour condenses per cubic metre in this process? (The saturated vapour densities at 40°C and 20°C are 45 gm^{-3} and 17 gm^{-3} respectively.)

(A) 33.75 gm^{-3} (B) 24.57 gm^{-3}

(C) 9.18 gm^{-3} (D) 12.50 gm^{-3}

5. At a place, the dry bulb reading of a hygrometer is 24°C and the dew point is 11.5°C. If Glaisher's factor at 24°C is 1.72, what is the wet bulb reading? Also, if the saturated vapour pressures at 24°C, 12°C and 11°C are 22.38×10^{-3} m Hg, 10.52×10^{-3} m Hg and 9.90×10^{-3} m Hg respectively, what is the relative humidity of that place?

(A) Wet bulb reading 16.73°C and relative humidity 45.62%

(B) Wet bulb reading 14.50°C and relative humidity 40.12%

(C) Wet bulb reading 18.20°C and relative humidity 52.30%

(D) Wet bulb reading 16.73°C and relative humidity 50.00%

6. At constant pressure, a gas of volume 4×10^{-3} m^3 is heated from 0°C to 68.25°C, and its volume increases by 1×10^{-3} m^3. Based on this data, what is the value of absolute zero on the Centigrade scale?

(A) Absolute zero is −270°C

(B) Absolute zero is −268°C

(C) Absolute zero is −273°C

(D) Absolute zero is −280°C

7. The depth of a pond is 6 m. The atmospheric temperature is 27°C, and inside the water the temperature decreases by 0.5°C per metre of depth. Neglecting changes in the density of water, what will be the percentage change in volume of a bubble formed at the bottom of the pond by the time it reaches the surface?

(A) The volume will decrease by 59.6%

(B) The volume will increase by 35.2%

(C) The volume will increase by 42.5%

(D) The volume will increase by 59.6%

8. A room measures 12 m × 9 m × 8 m. In the morning the temperature inside the room was 20°C. In the afternoon the temperature inside rises to 32°C while the atmospheric pressure remains constant. What percentage of the initial air in the room will escape to the outside due to this temperature rise?

(A) 2.50% of the air will escape

(B) 3.93% of the air will escape

(C) 4.10% of the air will escape

(D) 6.20% of the air will escape

9. When a person inhales, the lungs can hold 5.5 L of air at a body temperature of 37°C and a pressure of 1 atm . If air contains 21% oxygen by volume, how many oxygen molecules are contained in the lungs? ($R = 0.0821$ $Latmmol^{-1}K^{-1}$, $N_A = 6.023 \times 10^{23}$ mol^{-1})

(A) Number of oxygen molecules 1.301×10^{23}

(B) Number of oxygen molecules 5.420×10^{21}

(C) Number of oxygen molecules 6.023×10^{23}

(D) Number of oxygen molecules 2.733×10^{22}

10. What is the total kinetic energy of 4 mol of a non-linear polyatomic gas (degrees of freedom f = 6) at 27°C? ($R = 8.314$ $Jmol^{-1}K^{-1}$)

(A) 29.93 kJ (B) 44.90 kJ

(C) 9.98 kJ (D) 14.96 kJ

11. A vertical container holds 1 mol of a monatomic ideal gas enclosed by a frictionless piston of mass 20 kg and cross-sectional area 0.02 m^2. Atmospheric pressure is 1.0×10^5 Pa. During expansion the gas pressure varies with volume as $P(V) = P_0 - \alpha V$, where $P_0 = 4.0 \times 10^5$ Pa and $\alpha = 5.0 \times 10^7$ Pa m^{-3}. When the volume expands from $V_1 = 0.001$ m^3 to $V_2 = 0.003$ m^3, what is the net mechanical work gained by the piston, and at what gas volume is the piston's speed maximum within this range of expansion? ($g = 9.8$ m s^{-2})

(A) 380.4 J, 0.005804 m^3 (B) 400.0 J, 0.003 m^3

(C) 380.4 J, 0.003 m^3 (D) 600.0 J, 0.003 m^3

12. The temperature of a room is 30°C and its relative humidity is 70%. The saturated vapour pressure at 30°C is 31.8 mm Hg. If the room temperature is lowered to 20°C, where the saturated vapour pressure is 17.5 mm Hg, what mass of water condenses per cubic metre? ($R = 8.314\ J mol^{-1} K^{-1}$, molar mass of water $M = 18\ g mol^{-1}$)

(A) $1.25\ g m^{-3}$ (B) $14.30\ g m^{-3}$

(C) $3.97\ g m^{-3}$ (D) $8.50\ g m^{-3}$

13. 1 mol of a monatomic ideal gas ($M = 4\ g mol^{-1}$) expands in a process where the pressure varies with volume as $P(V) = P_0(1 - \beta V)$. If $P_0 = 1.0 \times 10^5$ Pa and $\beta = 100\ m^{-3}$, what is the maximum root mean square speed ($c_{rms,max}$) reached by the gas molecules during this expansion? ($R = 8.314\ J mol^{-1} K^{-1}$)

(A) $250.00\ m s^{-1}$ (B) $433.01\ m s^{-1}$

(C) $612.37\ m s^{-1}$ (D) $300.00\ m s^{-1}$

14. A cylindrical container of radius 0.2 m contains nitrogen gas ($M = 28\ g mol^{-1}$) at 300 K. If the cylinder rotates about its central axis with an angular velocity of $1000\ rad s^{-1}$, what is the ratio $\frac{P(R_0)}{P_0}$ of the pressure at the outer wall to that on the central axis? And if the central axis pressure is $P_0 = 1.0 \times 10^5$ Pa, what is the pressure gradient $\frac{dP}{dr}$ at the outer wall? ($R = 8.314\ J mol^{-1} K^{-1}$)

(A) Pressure ratio 1.800 and pressure gradient $3.500 \times 10^5\ Pa m^{-1}$

(B) Pressure ratio 2.500 and pressure gradient $5.400 \times 10^5\ Pa m^{-1}$

(C) Pressure ratio 1.050 and pressure gradient $1.200 \times 10^5\ Pa m^{-1}$

(D) Pressure ratio 1.252 and pressure gradient $2.810 \times 10^5\ Pa m^{-1}$

15. For an ideal gas at a given temperature T in a closed vessel, what is the ratio of the speeds c_{rms}, c_{avg} and c_{mp}? If the gas expands isothermally so that its volume doubles, how will the total kinetic energy of the molecules and the ratio $c_{rms} : c_{avg} : c_{mp}$ change?

(A) $\sqrt{3} : \sqrt{\frac{8}{\pi}} : \sqrt{2}$; remain unchanged

(B) $\sqrt{2} : \sqrt{\frac{8}{\pi}} : \sqrt{3}$; the kinetic energy halves

(C) 1.5 : 1.2 : 1.0; the kinetic energy quadruples

(D) 1 : 1 : 1; the kinetic energy doubles

16. How does the mean free path (λ) of ideal gas molecules vary with the absolute temperature T at constant pressure P and at constant volume V?

(A) $P = \text{const} \Rightarrow \lambda \propto \frac{1}{T}$; $V = \text{const} \Rightarrow \lambda \propto T$

(B) $\lambda \propto \sqrt{T}$

(C) $P = \text{const} \Rightarrow \lambda \propto T$; $V = \text{const} \Rightarrow \lambda = \text{const}$

(D) $\lambda \propto T^2$

17. The density of an ideal gas is $1.2\ kg m^{-3}$ at a pressure of 1.0×10^5 Pa and a certain temperature. What are the root mean square speed (c_{rms}), average speed (c_{avg}) and most probable speed (c_{mp}) of the gas molecules?

(A) $c_{rms} = 350.50\ m s^{-1}$, $c_{avg} = 300.00\ m s^{-1}$, $c_{mp} = 250.00\ m s^{-1}$

(B) $c_{rms} = 408.25\ m s^{-1}$, $c_{avg} = 500.00\ m s^{-1}$, $c_{mp} = 460.66\ m s^{-1}$

(C) $c_{rms} = 500.00\ m s^{-1}$, $c_{avg} = 460.66\ m s^{-1}$, $c_{mp} = 408.25\ m s^{-1}$

(D) $c_{rms} = 600.00\ m s^{-1}$, $c_{avg} = 520.00\ m s^{-1}$, $c_{mp} = 450.00\ m s^{-1}$

18. Which of the following statements regarding the basic postulates of the kinetic theory of ideal gases is incorrect?

(A) Volume of molecules $\ll$ volume of the container

(B) Collisions are perfectly inelastic

(C) Time of collision $\ll$ time between collisions

(D) Intermolecular force = 0

19. A cylinder contains an ideal gas at 20 atm pressure and 27°C. If the safety valve of the cylinder opens at a pressure of 30 atm, what is the maximum temperature to which the cylinder can be heated?

(A) 200°C (473 K) (B) 150°C (423 K)

(C) 300°C (573 K) (D) 177°C (450 K)

20. A vessel contains a mixture of equal masses of nitrogen ($M_1 = 28\ g mol^{-1}$) and oxygen ($M_2 = 32\ g mol^{-1}$). If the total pressure of the mixture is 300 kPa, what is the partial pressure of nitrogen?

(A) 150 kPa (B) 160 kPa

(C) 140 kPa (D) 180 kPa

21. For a fixed mass of an ideal gas at constant temperature (isothermal), the plot of P versus $\frac{1}{V}$ is a straight line through the origin. What is the slope of this line equal to?

(A) $\frac{P}{T}$ (B) $\frac{nR}{T}$ (C) $\frac{V}{T}$ (D) nRT

22. At 25°C the relative humidity of air is 60%. If the air temperature is lowered to 15°C, which is the dew point of that air, what will be the relative humidity of the air at 15°C?

(A) 85% (B) 60% (C) 100% (D) 40%

23. A container holds nitrogen gas ($M = 28\ g\ mol^{-1}$, $d = 3.7 \times 10^{-10}$ m) at 300 K and 1.0×10^5 Pa. The gas is compressed at constant temperature until its pressure becomes 2.0×10^5 Pa. What is the mean time between two successive collisions (τ) of the molecules? ($k = 1.38 \times 10^{-23}\ J K^{-1}$, $R = 8.314\ J\ mol^{-1} K^{-1}$)

(A) 7.15×10^{-11} s (B) 3.29×10^{-11} s

(C) 6.58×10^{-11} s (D) 9.87×10^{-11} s

24. What is the total translational kinetic energy of the helium gas molecules ($M = 4\,\text{g mol}^{-1}$) contained in a 1 L vessel at 27°C and a pressure of 1.013×10^5 Pa? ($R = 8.314\,\text{J mol}^{-1}\text{K}^{-1}$)

Ⓐ 151.95 J Ⓑ 303.90 J

Ⓒ 253.25 J Ⓓ 101.30 J

25. Under identical conditions of temperature and pressure, the rate of effusion of an unknown gas X is 0.5 times that of oxygen ($M_{O_2} = 32\,\text{g mol}^{-1}$). What are the molar mass M_X of the gas and the ratio of rms speeds $\frac{c_{rms,X}}{c_{rms,O_2}}$ at the same temperature?

Ⓐ $M_X = 128\,\text{g mol}^{-1}$, $\frac{c_{rms,X}}{c_{rms,O_2}} = 0.5$

Ⓑ $M_X = 64\,\text{g mol}^{-1}$, $\frac{c_{rms,X}}{c_{rms,O_2}} = 0.707$

Ⓒ $M_X = 256\,\text{g mol}^{-1}$, $\frac{c_{rms,X}}{c_{rms,O_2}} = 0.25$

Ⓓ $M_X = 16\,\text{g mol}^{-1}$, $\frac{c_{rms,X}}{c_{rms,O_2}} = 2.0$

26. A train moving at 30 ms^{-1} towards a vertical cliff sounds a whistle of frequency 600 Hz. Wind is blowing from the cliff towards the train at 30 ms^{-1}. If the speed of sound in still air is 330 ms^{-1}, what is the frequency of the echo heard by the driver of the train?

Ⓐ 700 Hz Ⓑ 660 Hz

Ⓒ 722.22 Hz Ⓓ 720 Hz

27. In a resonance tube experiment using a tuning fork of frequency 500 Hz, the first and second resonances are observed at tube lengths of 0.16 m and 0.50 m respectively. What are the speed of sound in air and the end correction of the tube?

Ⓐ 340 ms^{-1}, 0.02 m Ⓑ 340 ms^{-1}, 0.01 m

Ⓒ 350 ms^{-1}, 0.01 m Ⓓ 330 ms^{-1}, 0.02 m

28. The speed of sound in air at 0°C is 332 ms^{-1}. At what temperature of the air will the difference in wavelengths of two sound waves of frequencies 400 Hz and 408 Hz be 0.0175 m?

Ⓐ 50.00°C Ⓑ 35.50°C

Ⓒ 27.00°C Ⓓ 42.7°C

29. Two coherent point sources S_1 and S_2 separated by $d = 5$ m emit sound waves of wavelength $\lambda = 2$ m in phase. An observer walks along the line drawn perpendicular to S_1S_2 at S_1. Excluding the point S_1 itself, at what minimum distance from S_1 will the observer experience destructive interference (minimum intensity)?

Ⓐ 2.67 m Ⓑ 4.00 m

Ⓒ 12.00 m Ⓓ 1.50 m

30. Two waves $y_1 = 0.04\sin(500\pi t)$ and $y_2 = 0.03\sin(506\pi t)$ (SI units) superimpose at a point. What are the beat frequency and the ratio of maximum to minimum intensity ($\frac{I_{max}}{I_{min}}$)?

Ⓐ 6 Hz, 14 Ⓑ 3 Hz, 49 Ⓒ 3 Hz, 7 Ⓓ 6 Hz, 49

31. A closed organ pipe of length $L = 0.85$ m resonates in its fundamental mode with a tuning fork at 27°C. If the end correction is $e = 0.02$ m and the speed of sound at 0°C is 332 ms^{-1}, what is the frequency of the tuning fork?

Ⓐ 95 Hz Ⓑ 110 Hz Ⓒ 105 Hz Ⓓ 100 Hz

32. At a given location the sound intensity levels from three independent sources are 80 dB, 83 dB and 85 dB respectively. What will be the total sound intensity level when all three sources operate together?

Ⓐ 87.89 dB Ⓑ 248.00 dB

Ⓒ 89.50 dB Ⓓ 84.00 dB

33. Two strings with linear mass densities $\mu_1 = 0.01\,\text{kgm}^{-1}$ and $\mu_2 = 0.09\,\text{kgm}^{-1}$ are joined together. If a wave of amplitude $A_i = 0.10$ m travels along the first string towards the junction, what are the amplitude of the reflected wave, the amplitude of the transmitted wave, and the phase change of the reflected wave?

Ⓐ 0.02 m, 0.08 m, 180° Ⓑ 0.10 m, 0.05 m, 90°

Ⓒ 0.05 m, 0.05 m, 180° Ⓓ 0.05 m, 0.15 m, 0°

34. A submarine moving underwater at 10 ms^{-1} towards a stationary vertical cliff emits an ultrasonic signal of frequency 100 kHz. If the speed of sound in water is 1500 ms^{-1}, what are the frequency of the echo received by the submarine's sonar and the beat frequency?

Ⓐ 102.000 kHz, 2000 Hz Ⓑ 101.342 kHz, 1342 Hz

Ⓒ 100.671 kHz, 671 Hz Ⓓ 101.000 kHz, 1000 Hz

35. Two simple harmonic oscillations of the same frequency, $y_1 = 6\sin(100\pi t)$ and $y_2 = 8\cos(100\pi t)$, are superimposed on a particle (displacement in cm). What are the amplitude and initial phase angle of the resultant oscillation?

Ⓐ 14 cm, 0° Ⓑ 2 cm, 90°

Ⓒ 10 cm, 36.87° Ⓓ 10 cm, 53.13°

36. The equation of a stationary wave is $y = 10\sin(\frac{\pi x}{3})\cos(40\pi t)$ (where x, y are in cm and t is in s). What is the distance between two consecutive nodes, and what is the amplitude of the particle at position $x = 1.5$ cm?

Ⓐ 3 cm, 10 cm Ⓑ 6 cm, 5 cm

Ⓒ 1.5 cm, 0 cm Ⓓ 3 cm, $5\sqrt{2}$ cm

37. Two tuning forks A and B sounded together produce 5 beats per second. The frequency of B is 256 Hz. When some wax is attached to a prong of A to increase its mass, the beat frequency decreases to 3 beats per second. What was the original frequency of A?

Ⓐ 265 Hz Ⓑ 251 Hz

Ⓒ 261 Hz Ⓓ 246 Hz

38. A point sound source emits spherical waves. At a distance $r_1 = 4\ m$ from the source the sound intensity is $I_1 = 10^{-4}\ Wm^{-2}$. At a distance $r_2 = 20\ m$, what are the sound intensity level (in dB) and the ratio of the wave amplitudes $(\frac{A_2}{A_1})$? $(I_0 = 10^{-12}\ Wm^{-2})$

(A) 60.00 dB, 0.16 (B) 70.00 dB, 0.25

(C) 80.00 dB, 0.04 (D) 66.02 dB, 0.20

39. A wire of length $L = 2\ m$ and mass $M = 0.02\ kg$ is fixed at both ends under a tension $T = 100\ N$. If it vibrates in its 4th harmonic (3rd overtone), what are the frequency, the distance between a node and the adjacent antinode, and the maximum particle velocity at an antinode? (The amplitude at the antinode is 0.01 m.)

(A) 200 Hz, 0.25 m, $6.28\ ms^{-1}$

(B) 50 Hz, 0.50 m, $3.14\ ms^{-1}$

(C) 100 Hz, 0.25 m, $6.28\ ms^{-1}$

(D) 100 Hz, 0.50 m, $12.57\ ms^{-1}$

40. A stretched wire of length $L = 0.5\ m$ and linear mass density $m = 0.01\ kgm^{-1}$, vibrating in its fundamental mode under tension $T_1 = 100\ N$, produces 4 beats per second with a tuning fork A. When the tension is increased by 16.64%, it again produces 4 beats per second with fork A. What is the frequency of fork A ? And what is the sound intensity level (β) at a distance of 10 m from a source of power $P = 12.566\ W$ emitting sound of the same frequency? $(I_0 = 10^{-12}\ Wm^{-2})$

(A) 104 Hz, 100 dB (B) 104 Hz, 120 dB

(C) 96 Hz, 80 dB (D) 96 Hz, 100 dB

41. The equation of a progressive wave on a stretched string is $y = 0.08\sin(120\pi t - 4\pi x)$ (in SI units). If the linear mass density of the string is $m = 0.02\ kgm^{-1}$, what are the maximum particle speed $(v_{p,max})$, maximum particle acceleration $(a_{p,max})$, wave velocity (v) and average power transmitted by the wave (P_{avg})?

(A) $12\pi\ ms^{-1}$, $1440\pi^2\ ms^{-2}$, $15\ ms^{-1}$, $27.648\pi^2\ W$

(B) $4.8\pi\ ms^{-1}$, $576\pi^2\ ms^{-2}$, $30\ ms^{-1}$, $13.824\pi^2\ W$

(C) $9.6\pi\ ms^{-1}$, $1152\pi^2\ ms^{-2}$, $30\ ms^{-1}$, $27.648\pi^2\ W$

(D) $9.6\pi\ ms^{-1}$, $1152\pi^2\ ms^{-2}$, $60\ ms^{-1}$, $55.296\pi^2\ W$

42. An open organ pipe of length $L_o = 0.80\ m$ and a closed organ pipe of length $L_c = 0.42\ m$ sound in air where the speed of sound is $v = 336\ ms^{-1}$. What is the beat frequency (N) between their fundamental modes? And by how much must the length of the closed pipe be changed (ΔL_c) so that its fundamental frequency equals that of the open pipe?

(A) 10 Hz, +2.0 cm

(B) 10 Hz, −2.0 cm

(C) 20 Hz, −4.0 cm

(D) 5 Hz, −1.0 cm

43. The equation of a stationary wave on a stretched string is $y = 0.10\sin(\pi x)\cos(50\pi t)$ (in SI units). What are the distance between two consecutive nodes (d), the distance between a node and the adjacent antinode (b), the maximum particle speed at $x = 0.5\ m$ $(v_{p,max})$, and, by integration, the total mechanical energy (E) in a segment of length $L = 2\ m$? (Linear mass density $m = 0.04\ kgm^{-1}$)

(A) 0.5 m, 0.25 m, $5\ ms^{-1}$, $0.5\pi^2\ J$

(B) 2.0 m, 1.0 m, $10\ ms^{-1}$, $\pi^2\ J$

(C) 1.0 m, 0.5 m, $2.5\ ms^{-1}$, $0.25\pi^2\ J$

(D) 1.0 m, 0.5 m, $5\pi\ ms^{-1}$, $0.5\pi^2\ J$

44. Two open organ pipes of lengths 1.0 m and 1.02 m sounded together in their fundamental modes produce 4 beats per second. What is the speed of sound in that medium?

(A) $332\ ms^{-1}$ (B) $408\ ms^{-1}$

(C) $416\ ms^{-1}$ (D) $340\ ms^{-1}$

45. Three independent sound sources produce intensity levels of 80 dB, 80 dB and 86 dB respectively at a distance $r_1 = 10\ m$. What are the combined intensity level (β_{total}) at that spot, the new intensity level (β_{new}) if the observer moves back to $r_2 = 20\ m$, and the sound pressure amplitude (P_{max}) at the new position? $(\varrho = 1.29\ kgm^{-3}, v = 340\ ms^{-1}, I_0 = 10^{-12}\ Wm^{-2})$

(A) 87.77 dB, 81.75 dB, $0.362\ Nm^{-2}$

(B) 87.77 dB, 81.75 dB, $0.256\ Nm^{-2}$

(C) 84.00 dB, 78.00 dB, $0.123\ Nm^{-2}$

(D) 87.77 dB, 84.76 dB, $0.494\ Nm^{-2}$

46. Two wires A and B have density ratio $\varrho_A : \varrho_B = 1 : 2$, radius ratio $r_A : r_B = 2 : 1$ and length ratio $L_A : L_B = 1 : 2$. If they are under tensions $T_A = 200\ N$ and $T_B = 100\ N$ respectively, what is the ratio of their fundamental frequencies $(\frac{f_A}{f_B})$? If wire A has length $L_A = 0.5\ m$, radius $r_A = 1.0\ mm$ and material density $\varrho_A = 8000\ kgm^{-3}$, what is the value of f_A?

(A) 4.0, 89.21 Hz (B) 2.0, 178.41 Hz

(C) 2.0, 89.21 Hz (D) 1.0, 178.41 Hz

47. In a resonance tube experiment using a tuning fork of frequency $f = 512\ Hz$, the 1st and 2nd resonances occur at air column lengths $L_1 = 0.15\ m$ and $L_2 = 0.48\ m$ respectively. What are the speed of sound in air (v), the end correction (e), the length required for the 3rd resonance (L_3), and the new 1st resonance length (L_1') if the speed of sound increases by 5% with a rise in temperature?

(A) $340.00\ ms^{-1}$, 0.010 m, 0.81 m, 0.150 m

(B) $337.92\ ms^{-1}$, 0.015 m, 0.99 m, 0.173 m

(C) $330.00\ ms^{-1}$, 0.020 m, 0.80 m, 0.165 m

(D) $337.92\ ms^{-1}$, 0.015 m, 0.81 m, 0.158 m

48. Two progressive waves of the same frequency travelling in the same direction are given by $y_1 = 0.06\sin(100\pi t - 2\pi x)$ and $y_2 = 0.08\sin(100\pi t - 2\pi x + \frac{\pi}{3})$ (in SI units). What are the resultant amplitude (A_R), initial phase (δ), maximum particle velocity ($v_{p,max}$) and maximum particle acceleration ($a_{p,max}$)?

Ⓐ 0.140 m, 60.00°, 43.98 ms^{-1}, 13817 ms^{-2}

Ⓑ 0.122 m, 34.72°, 38.22 ms^{-1}, 12007 ms^{-2}

Ⓒ 0.100 m, 0.00°, 31.42 ms^{-1}, 9870 ms^{-2}

Ⓓ 0.122 m, 45.00°, 38.22 ms^{-1}, 6003 ms^{-2}

49. A tuning fork A of unknown frequency produces 5 beats per second with a tuning fork B of frequency 320 Hz. Attaching wax to a prong of A increases the beat frequency to 8 beats per second. What was the original frequency of A (f_A)? If the unwaxed fork A is in resonance with the fundamental mode of a wire of length $L = 0.8$ m under tension $T = 160$ N, what is the linear mass density (μ) of the wire?

Ⓐ 315 Hz, 6.30×10^{-4} kgm^{-1}

Ⓑ 325 Hz, 6.30×10^{-4} kgm^{-1}

Ⓒ 325 Hz, 3.15×10^{-4} kgm^{-1}

Ⓓ 315 Hz, 1.26×10^{-3} kgm^{-1}

50. A factory machine emits sound uniformly in all directions with total power $P = 8\pi$ W. The maximum permissible sound intensity level for worker safety is $\beta_{limit} = 90$ dB. What are the minimum safe distance (r_{min}) from the machine, the sound intensity (I) at that point, and the sound pressure amplitude (P_{max})? ($\rho = 1.29\ kgm^{-3}$, $v = 340\ ms^{-1}$, $I_0 = 10^{-12}\ Wm^{-2}$)

Ⓐ 20.00 m, 10^{-3} Wm^{-2}, 0.331 Nm^{-2}

Ⓑ 44.72 m, 10^{-3} Wm^{-2}, 0.662 Nm^{-2}

Ⓒ 44.72 m, 10^{-3} Wm^{-2}, 0.937 Nm^{-2}

Ⓓ 44.72 m, 10^{-4} Wm^{-2}, 0.209 Nm^{-2}