PHYSICS

BOOKS - KVPY PREVIOUS YEAR

MOCK TEST 3

Exercise

1. A musician using and open flute of length 50 cm produces second harmonic sound waves. A person runs towards the musician from

another end of a hall at a speed of 10 km/h. If the wave speed is 330 m/s, the frequency heard by the running person shall be close to :

A. 666 Hz

B. 753 Hz

C. 500 Hz

D. 333 Hz

Answer:

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2. A diatomic molecule is made of two masses m_1 and m_2 which are separated by a distance r. If we calculate its rotational energy by applying Bohr's rule of angular momentum quantization, its energy will be given by (n is an integer)

A. $\frac{(m_1+m_2)^2 n^2 h^2}{2m_1^2 m_2^2 r^2}$

B. $\frac{n^2 h^2}{2(m_1+m_2)r^2}$

C. $\frac{2n^2 h^2}{(m_1+m_2)r^2}$

D. $\frac{(m_1+m_2)n^2 h^2}{2m_1 m_2 r^2}$

Answer:

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3. In an experiment of calibartion of voltmeter, a standard cell of emf $1.1V$ is balanced against $440cm$ of potentiometer wire. The potentilal difference across the ends of a resistance is found to balance against $220cm$ of the wire. The corresponding reading of voltmeter is 0.5 volt. Find the error in the reading of voltmeter.

A. -0.15 volt

B. 0.15 volt

C. 0.5 volt

D. -0.05 volt

Answer:

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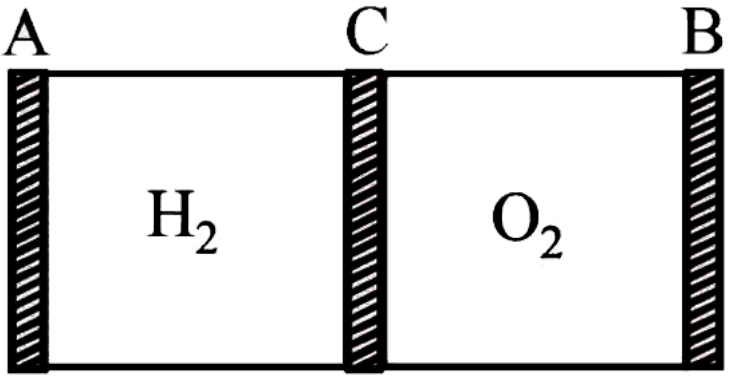
4. AB is a cylinder of length $1m$ fitted with a thin flexible diaphragm C at the middle and other thin flexible diaphragms A and B at the

ends. The portions AC and BC contain hydrogen and oxygen gases respectively. The diaphragms A and B are set into vibrations of same frequency. What is the minimum frequency of these vibrations for which diaphragms C is a node? (Under the conditions of experiment $v_{H_2=1100m/s}$, v_{0_2} = $300m/s$).



A. 1650 Hz

B. 1560 Hz

C. 650 Hz

D. 560 Hz

Answer:

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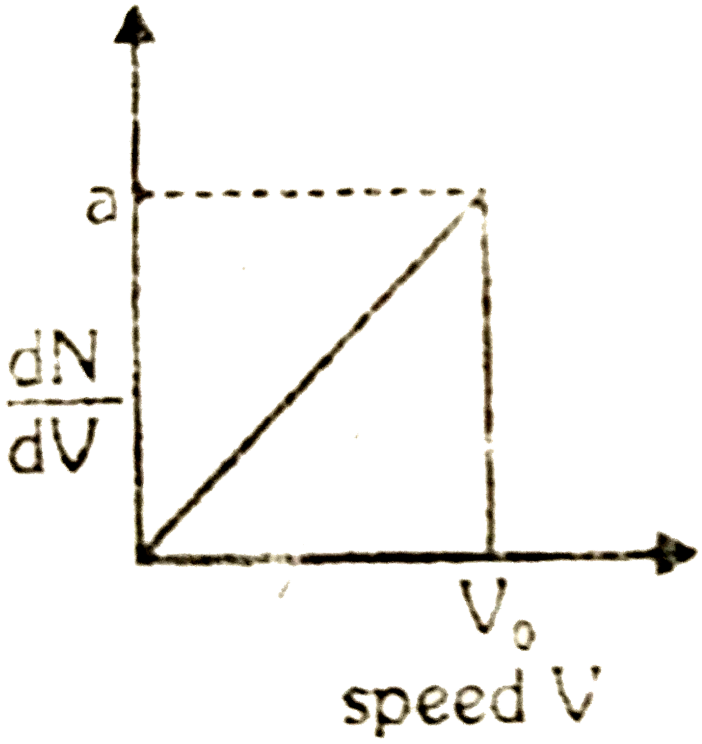
5. Graph shows a hypothetical speed distribution for a sample of N gas particle :-

(for$V > V_0$, $\frac{dN}{dV} = 0$)



A. The value of av_0 is 2N

B. The ratio v_{avg} / v_0 is equal to 2/3

C. v_{rms} / v_0 is equal to $1 / \sqrt{2}$

D. All of the above

Answer:

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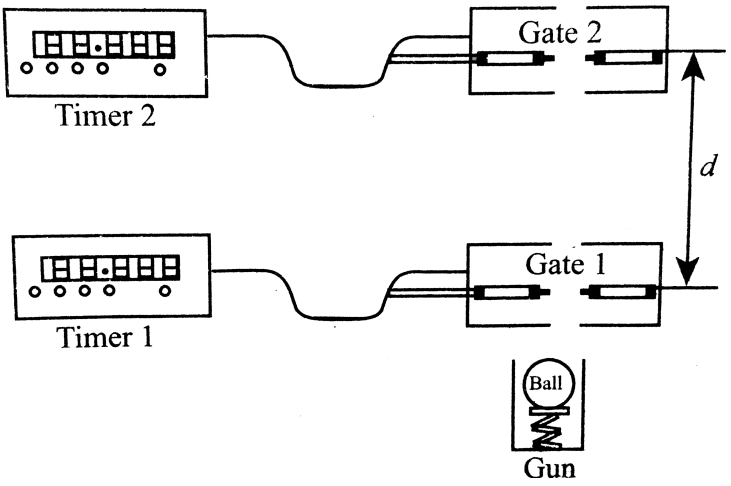
6. Figure shows a method for measuring the acceleration due to gravity. The ball is projected upward by a gun. The ball pases the electronic gates 1 and 2 as it rises and again as it falls. Each gate is connected to a separate timer. The first passage of the ball through

each gate stars the corresponding timer, and the second passage through the same gate stops the timer. the time intervals $\triangle t_1$ and $\triangle t_2$ are thus measured. The vertical distance between the two gates is d. If $d = 5m,\ \triangle t_1 = 3s,\ \triangle t_2 = 2s,$ then find the measured value of acceleration due to gravity (in m/s^2)



A. $8ms^{-2}$

B. $4ms^{-2}$

C. $2ms^{-2}$

D. $1ms^{-2}$

Answer:

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7. A long plying record revolves with a speed of $33\frac{1}{3}\text{rev min}^{-1}$, and has a radius of 15 cm. Two coins are placed at 4 cm and 14 cm away from

the centre of the record. If the coefficient of friction between the coins and the record is 0.15, which of the two coins will revolve with the record ? Take $g = 9.8ms^{-2}$.

A. Coin A will revolve but B will not revolve

B. B will revolve but A will not revolve

C. None of the coins will revolve

D. Both coins will revolve

Answer:

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8. In an experiment to determine the acceleration due to gravity g, the formula used for the time period of a periodic motion is $T = 2\pi\sqrt{\left(7\frac{R-r}{5g}\right.}$. The values of R and r are measured to be $(60 \pm 1)mm$ and $(10 \pm 1)mm$, repectively. In five successive measurment, the time period is found to be $0.52s, 0.56s, 0.57s, 0.54s$ and $0.59s$. the least count of the watch used for the measurement

of time period is $0.01s$. Which of the following satement (s) is (are) true?

A. The error in the measurement of r is 10%

B. The error in the determined value of g is 11%

C. The error in the measurement of T is 3.75%

D. None of these

Answer:

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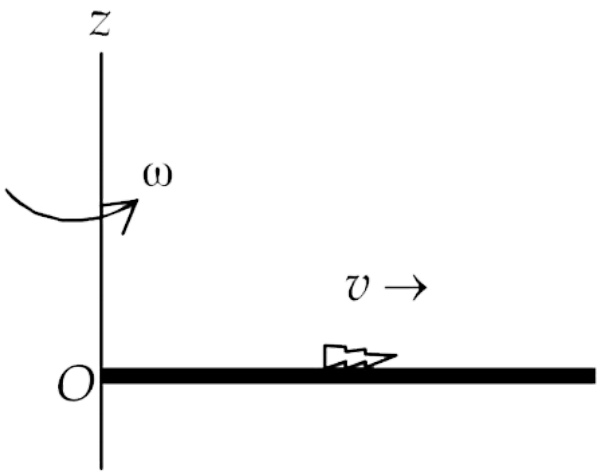
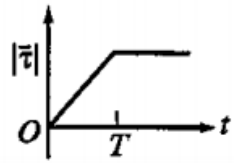
9. A thin uniform rod, pivoted at O, is rotating in the horizontal plane with constatn angular speed ω, as shown in the figure. At time t = 0, a small insect starts from O and moves with constant sped v, with respect to the rod towards the other end. It reaches the end of the rod at t =T and stops. The angular speed of the system remains ω throughout. The magnitude of the torque $\left(\left|\overrightarrow{\pi}\right|\right)$ about O, as a function of time is best represented by which

plot?

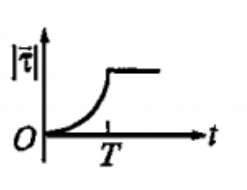


A.

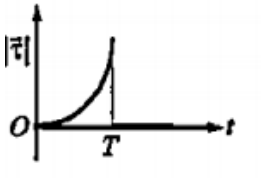


B.

C.



D.



Answer:

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10. Two mirrors, one concave and the other convex, are placed 60 cm apart with their reflecting surfaces facing each other. An object is placed 30 cm from the pole of either of them on their axis. If the focal lengths of both the mirrors are 15 cm, the position of the image formed by reflection, first at the convex and then at the concave mirror, is:

A. 19.09 cm from the pole of the concave mirror

B. 19.09 cm from the pole of the convex mirror

C. 11.09 cm from the pole of the concave mirror

D. 11.09 cm from the pole of the convex mirror

Answer:

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11. Ionization potential of hydrogen atom is 13.6 eV. Hydrogen atoms in the ground state are excited by monochromatic radiation of photon energy 12.1 eV. According to Bohr's theory, the spectral lines emitted by hydrogen will be

A. one

B. two

C. three

D. four

Answer:

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12. A bar magnet of dipole moment $1A - m^2$ and moment of inertia $10^{-5}kg - m^2$ when suspended freely has a time period of $\sqrt{10}s$ at a certain place. Then the earth's magnetic field at that place in angle of dip is 60° will be (Take $\pi^2 = 10$)

A. $0.2 \times 10^{-4}tesla$

B. $0.4 \times 10^{-4} tesla$

C. $0.6 \times 10^{-4} tesla$

D. $0.8 \times 10^{-4} tesla$

Answer:

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13. A cylindrical vessel of area of cross section A is filled with a liquid up to a height H. A very small hole of area of cross section a is

made at the bottom of the vessel. Find the time taken by the vessel to become empty.

A. $\frac{2A}{\pi a^2}\sqrt{\frac{h}{g}}$

B. $\frac{\sqrt{2}A}{\pi a^2}\sqrt{\frac{h}{g}}$

C. $\frac{2\sqrt{2}A}{\pi a^2}\sqrt{\frac{h}{g}}$

D. $\frac{A}{\sqrt{2}\pi a^2}\sqrt{\frac{h}{g}}$

Answer:

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14. An asteroid of mass m is approaching earth, initially at a distance $10R_E$ with speed v_i. It hits earth with a speed v_f (R_E and M_E are radius and mass of earth),. Then

A. $v_f^2 = v_i^2 + \frac{2Gm}{M_e R}\left(1 - \frac{1}{10}\right)$

B. $v_f^2 = v_i^2 + \frac{2GM_e}{R_e}\left(1 + \frac{1}{10}\right)$

C. $v_f^2 = v_i^2 + \frac{2GM_e}{R_e}\left(1 - \frac{1}{10}\right)$

D. $v_f^2 = v_i^2 + \frac{2GM}{R_e}\left(1 - \frac{1}{10}\right)$

Answer:

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15. Two polaroids are placed in the path of unpolarized beam of intensity I_0 such that no light is emitted from the second polarid. If a third polaroid whose polarization axis makes an angle θ with the polarization axis of first polaroid, is placed between these two polariods then the intensity of light emerging from the last polaroid will be

A. $\left(\frac{I_0}{8}\right)\sin^2 2\theta$

B. $\left(\frac{I_0}{4}\right)\sin^2 2\theta$

C. $\left(\frac{I_0}{2}\right)\cos^4\theta$

D. $I_0\cos^4\theta$

Answer:

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16. An infinite cylinder of radius r with surface charge density σ is rotated about its central axis with angular speed ω. Then the magnetic field at any point inside the cylinder is

A. $\mu_0 \sigma \omega r^2$

B. $\frac{\mu_0 \omega r}{\sigma}$

C. $\mu_0 \sigma \omega r$

D. $\mu_0 \sigma \omega^2 r$

Answer:

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17. A glass sinker has a mass M in air, When weighed in a liquid at temperature t_1, the apparent mass is M_1 and when weighed in the

same liquid at temperature t_2, the apparent mass is M_2. If the coefficient of cubical expansion of the glass is γ_g, then the real coefficient of expansion of the liquid is :

A. $\gamma_g + \left(\frac{M_2 - M_1}{M - M_2}\right) \cdot \frac{1}{(t^2 - t_1)}$

B. $\gamma_g - \left(\frac{M_2 - M_1}{M - M_2}\right) \cdot \frac{1}{(t^2 - t_1)}$

C. $\gamma_g - \left(\frac{M - M_2}{M_2 - M_1}\right) \cdot \frac{1}{(t^2 - t_1)}$

D. $\gamma_g + \left(\frac{M_2 - M_1}{M_2 + M_1}\right) \cdot \frac{1}{(t^2 - t_1)}$

Answer:

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18. A radioactive material decays by simultaneous emission of two particle with respective half-lives 1620 and 810 years. The time (in years) after which one-fourth of the material remains is

A. 1080

B. 2430

C. 3240

D. 4860

Answer:

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19. Calculate the rate of loss of heat through a glass window of area $1000cm^2$ and thickness 0.4 cm when temperature inside is $37^\circ C$ and outside is $-5^\circ)C$. Coefficient of thermal conductivity of glass is $2.2 \times 10^{-3} cals^{-1} cm^{-1} K^{-1}$.

A. 450 cal s-1

B. 231 cal s-1

C. 439 cal s-1

D. 650 cal s-1

Answer:

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20. from the following combinations of physical constants (expressed through their as usual symbols) the only combination, that

would have the same value in different systems of units, is:

A. $\frac{ch}{2\pi\varepsilon_0^2}$

B. $\frac{e^2}{2\pi\varepsilon_0 G m_e^2}$)($m_e$=mass of electron)

C. $\frac{\mu_0\varepsilon_0 G}{c^2 h e^2}$

D. $\frac{2\pi\sqrt{\mu_0\varepsilon_0}}{ce^2}\frac{h}{G}$

Answer:

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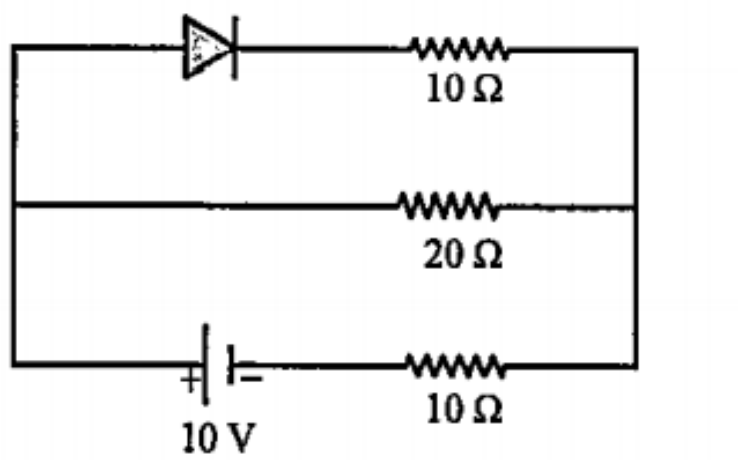
21. The voltage drop across a forward biased diode is 0.7 volt. In the following circuit, the voltages across the 10 ohm resistance in series with the diode and 20 ohm resistance are :



A. 0.70 V, 4.28 V

B. 3.58 V,4.28 V

C. 5.35 V ,2.14V

D. 3.58V,9.3V

Answer:

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22. A gas is a mixture of two parts by volume of hyprogen and part by volume of nitrogen at STP. If the velocity of sound in hydrogen at $0^\circ C$ is $1300 m/s$. Find the velocity of sound in the gaseous mixure at $27^\circ C$.

A. 951 m/sec

B. 159 m/sec

C. 591 m/sec

D. 519 m/sec

Answer:

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