PHYSICS

BOOKS - NTA MOCK TESTS

NTA JEE MOCK TEST 104

Physics

1. A boat which has a speed of $5km/hr$ in steel water crosses a river of width $1km$ along

the shortest possible path in 15minutes. The velocity of the river water in km/hr is

A. $1kmh^{-1}$

B. $3kmh^{-1}$

C. $4kmh^{-1}$

D. $\sqrt{41}kmh^{-1}$

Answer: B

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2. A storage battery of emf 0.8 V and internal resistance 0.5Ω is being charged by a 120 V supply using a series resistor of 15.5Ω. What is the terminal voltage of the battery during charging? What is the purpose of having a series resistor in the charging circuit?

A. 11.5 V

B. 20 V

C. 21.5 V

D. 12.3 V

Answer: A

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3. The electric field in a certain region is given by $E = 5\hat{i} - 3\hat{j}kv/m.$ The potential difference $V_B - V_A$ between points a and B having coordinates (4, 0, 3) m and (10, 3, 0) m respectively, is equal to

A. -39 V

B. 11 V

C. 25 V

D. $-25V$

Answer: A

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4. Three concentric spherical shells have radii a, b and $c(a < b < c)$ and have surface charge densities σ, $-\sigma$ and σ respectively. If V_A, V_B and V_C denote the potentials of the three shells, then for $c = q + b$, we have

A. $V_C = V_B \neq V_A$

B. $V_C \neq V_B \neq V_A$

C. $V_C = V_B = V_A$

D. $V_A = V_C > V_B$

Answer: D

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5. If a tuning fork of frequency (f_0) 340 Hz and tolerance $\pm 1\%$ is used in the resonance column method for determining the speed of

sound. If the first and the second resonance are measured at $l_1 = 24.0cm$ and $l_2 = 74.70cm$, then the permissible error in speed of sound is

A. 1.2%

B. 1.8%

C. 1%

D. 0.8%

Answer: A

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6. A body weighs 63 N on the surface of the earth. What is the gravitational force on it due to the earth at a height equal to half the radius of the earth ?

A. 28 N

B. 23 N

C. 12 N

D. 67 N

Answer: A

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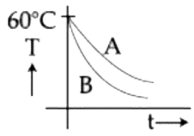
7. Two identical beakers A and B contain equal volumes of two different liquids at $60^{\circ}C$ each and left to cool down. Liquid in A has density of $8 \times 10^{2} kg/m^{3}$ and specific heat of $2000 Jkg^{-1}K^{-1}$ while liquid in B has density of $10^{3} kgm^{-3}$ and specific heat of $4000 Jkg^{-1}K^{-1}$. Which of the following best describes their temperature versus time graph schematically ? (assume the emissivity of both the beakers to be the same)

A.



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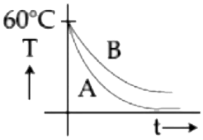

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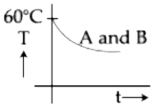
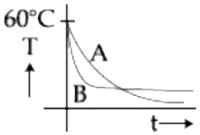


D.



Answer: B

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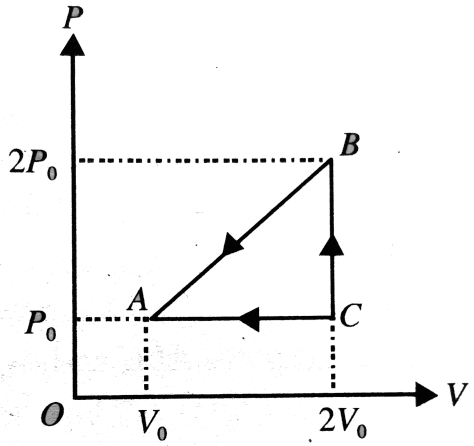
8. One mole of a monatomic gas is taken from a point A to another point B along the path ACB. The initial temperature at A is T_0. Calculate the heat abosrbed by the gas in the process $A \to C \to B$.



A. $\dfrac{11RT_0}{2}$

B. $\frac{7RT_0}{2}$

C. $\frac{5RT_0}{2}$

D. $\frac{13RT_0}{2}$

Answer: A

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9. Find the magnitude of the magnetic field at the center of an equilateral triangular loop of side length 1m which is carrying a current of 10A. (Take $\mu_0 = 4\pi \times 10^{-7} NA^{-2}$)

A. $3\mu T$

B. $1\mu T$

C. $18\mu T$

D. $9\mu T$

Answer: C

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10. A bar has a magnetic moment equal to $5 \times 10^{-5} weber \times m$. It is suspended in a magnetic field which has a magnetic induction

(B) equal to $8\pi \times 10^{-4}$ tesla. The magnet vibrates with a period of vibration equal to 15 sec. The moment of intertia of the magnet is

A. $4.54x10^{4}$ kg m^{2}

B. $4.54x10^{-5}$ kg m^{2}

C. $4.54x10^{-4}$ kg m^{2}

D. $4.54x10^{-4}$ kg m^{5}

Answer: D

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11. Assuming that four hydrogen atom combine to form a helium atom and two positrons, each of mass $0.00549u$, calculate the energy released. Given $m\left({}_1H^1\right) = 1.007825u, m\left({}_2He^4\right) = 4.002604u$.

A. 25.71 MeV

B. 20.71 MeV

C. 22.75 MeV

D. 23.50 MeV

Answer: A

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12. A simple harmonic wave of amplitude 8 units travels along positive x-axis. At any given instant of time, for a particle at a distance of $10cm$ from the origin, the displacement is $+6units$, and for a particle at a distance of $25cm$ from the origin, the displacement is $+4$ units. Calculate the wavelength.

A. 200 cm

B. 230 cm

C. 210 cm

D. 250 cm

Answer: D

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13. A tiny spherical oil drop carrying a net charge q is balanced in still air with a vertical uniform electric field of strength

$\frac{81\pi}{7} \times 10^5 Vm^{-1}$. When the field is switched off, the drop is observed to fall with terminal velocity $2 \times 10^{-3} ms^{-1}$. Given $g = 9.8 ms^{-2}$, viscosity of the air $= 1.8 \times 10^{-5} Nsm^{-2}$ and the denisty of oil $= 900 kgm^{-3}$, the magnitude of q is

A. $1.6 \times 10^{19} C$

B. $3.2 \times 10^{19} C$

C. $4.8 \times 10^{19} C$

D. $8.0 \times 10^{19} C$

Answer: D

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14. A thin glass (refractive index 1.5) lens has optical power of $-5D$ in air. Its optical power in a liquid medium with refractive index 1.6 will be

A. 1 D

B. -1 D

C. 25 D

D. -25 D

Answer: A

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15. From a solid sphere of M and radius R a cube of maximum possible volume is cut. Moment of inertia of cube about an axis passing through its centre and perpendiular to one of its faces is:

A. $\frac{4MR^2}{3\sqrt{3}\pi}$

B. $\frac{MR^2}{32\sqrt{2}\pi}$

C. $\frac{MR^2}{16\sqrt{2}\pi}$

D. $\frac{4MR^2}{9\sqrt{3}\pi}$

Answer: D

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16. The maximum electron density in the ionospherein the mornong is $10^{10}m^{-3}$. At noon time it increases to $2 \times 10^{10}m^{-3}$. Find the ratio of critical frequency at noon and the critical frequency in the morning.

A. 2

B. 2.82

C. 4

D. 1.414

Answer: D

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17. A piece of metal floats on mercury. The coefficients of volume expansion of the metal and mercury are γ_1 and γ_2 respectively. If the

temperatures of both mercury and the metal are increased by an amount ΔT, the fraction of the volume of the metal submerged in mercury changes by the factor.....

A. $\frac{1+\gamma_2\Delta T}{1+\gamma_1\Delta T}$

B. $1+\gamma_2\Delta T$

C. $1+\gamma_1\Delta T$

D. $\frac{1+\gamma_2\Delta T}{1-\gamma_1\Delta T}$

Answer: A

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18. In Young's double-slit experiment, the intensity at a point P on the screen is half the maximum intensity in the interference pattern. If the wavelength of light used is λ and d is the distance between the slits, the angular separation between point P and the center of the screen is

A. $\sin^{-1}\left(\frac{\lambda}{d}\right)$

B. $\sin^{-1}\left(\frac{\lambda}{2d}\right)$

C. $\sin^{-1}\left(\frac{\lambda}{3d}\right)$

D. $\sin^{-1}\left(\frac{\lambda}{4d}\right)$

Answer: D

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19. A motor cycle starts from rest and accelerates along a straight path at $2m/s^2$. At the starting point of the motor cycle there is a stationary electric siren. How far has the motor cycle gone when the driver hears the frequency of the siren at 94% of its value

when the motor cycle was at rest ? (Speed of sound = $330ms^{-2}$)

A. 49 m

B. 98 m

C. 147 m

D. 196 m

Answer: B

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20. A ball is dropped on to a horizontal plate from a height h = 9 m above it. If the coefficient of restitution is e=1/2, the total distance travelled before the ball comes to rest is

A. 10 m

B. 15 m

C. 20 m

D. 25 m

Answer: B

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21. Find the quantum number n corresponding to nth excited state of He^{++} ion if on transition to the ground state the ion emits two photons in succession with wavelength 108.5 nm and 30.4 nm. The ionization energy of the hydrogen atom is 13.6 eV.

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22. A particle of mass m moving in the x direction with speed 2v is hit by another particle of mass 2m moving in they y direction with speed v. If the collision is perfectly inelastic, the percentage loss in the energy during the collision is close to :

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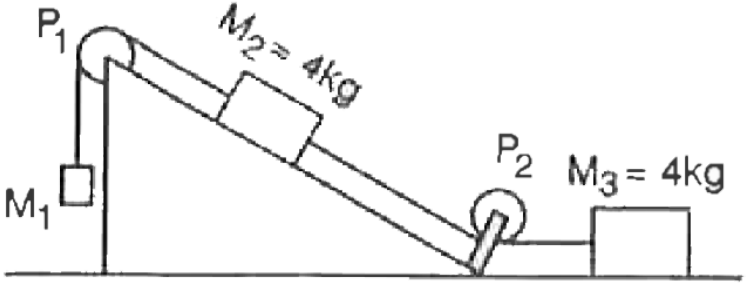
23. Masses M_1, M_2 and M_3 are connected by string of negligible mass which pass over

massless and frictionless pulleys P_1 and P_2 as shown in figure 7.15. The masses move such that the string between P_1 and P_2 is parallel to the incline and the portion of the string between P_2 and M_3 is horizontal. The masses M_2 and M_3 are 4.0 kg each and the coefficient of kinetic friction between the masses and the surfces is 0.25. The inclined plane makes an angle of 37° with the horizontal. If the mass M_1moves downwards with a uniform velocity, find (i) the mass of M_1, (ii) the tension in the horizontal portion.

$\left(g = 9.8ms^{-2}, \sin 37^\circ = \frac{3}{5}\right)$



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24. A concrete sphere of radius R has cavity of radius r which is packed with sawdust. The specific gravities of concrete and sawdust are respectively 2.4 and 0.3 for this sphere to float with its entire volume submerged under

water. Ratio of mass of concrete to mass of sawdust will be

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25. The time period (T) of small oscillations of the surface of a liquid drop depends on its surface tension (s), the density (ρ) of the liquid and it's mean radius (r) as $T = cs^x \rho^y r^z$. If in the measurement of the mean radius of the drop, the error is 2%, the error in the measurement of surface tension and density

both are of 1%. Find the percentage error in measurement of the time period.

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