PHYSICS

BOOKS - NTA MOCK TESTS

NTA JEE MOCK TEST 108

Physics

1. When an electron jumps from a level $n = 4$ to $n = 1$, the momentum of the recoiled hydrogen atom will be

A. $6.8 \times 10^{-27} \mathrm{kg\ ms}^{-1}$

B. $12.75 \times 10^{-19} \mathrm{kg\ ms}^{-1}$

C. $13.6 \times 10^{-19} \mathrm{kg\ ms}^{-1}$

D. zero

Answer: A

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2. An inductor of inductance $2.0mH$ is connected across a charged capacitor of capacitance $5.0\mu F$ and the resulting $L-C$

circuit is set oscillating at its natural frequency. Let Q denote the instantaneous change on the capacitor and i the current in the circuit. It is found that the maximum value of Q is $200\mu C$.

(a) When $Q = 100\mu C$, what is the value of $|di/dt|$?

(b) When $Q = 200\mu C$, what is the value of i ?

(c)Find the maximum value of i

(d) When i is equal to one-half its maximum value, what is the value of $|Q|$?

A. 10000

B. 1000

C. 100000

D. 100

Answer: A

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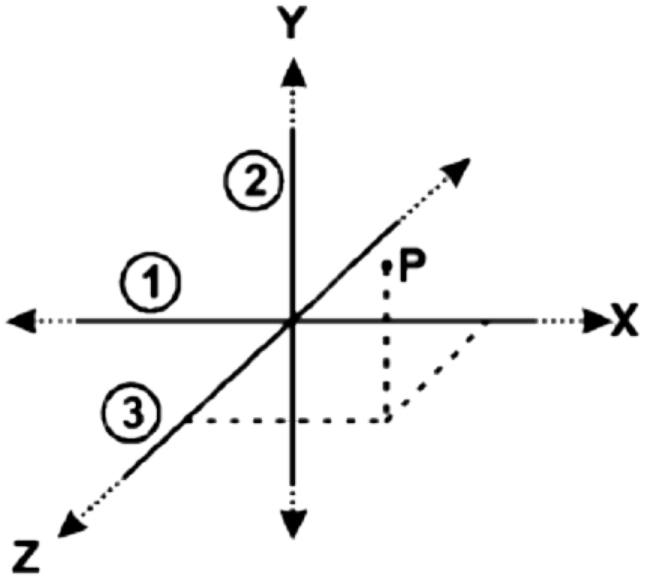
3. The electric field vector at point $P(a, a, a)$ due to three uniformly charged infinite wires 1, 2 and 3 kept the x, y and z - axes, respectively as shown in the shown in figure is (Charge

unit length of each wire is λ)



A. $\frac{\lambda}{3\pi\varepsilon_0 a}\left(\hat{i}+\hat{j}+\hat{k}\right)$

B. $\frac{\lambda}{2\pi\varepsilon_0 a}\left(\hat{i}+\hat{j}+\hat{k}\right)$

C. $\frac{\lambda}{2\sqrt{2}\pi\varepsilon_0 a}\left(\hat{i}+\hat{j}+\hat{k}\right)$

D. $\frac{\sqrt{2}\lambda}{\pi\varepsilon_0 a}\left(\hat{i}+\hat{j}+\hat{k}\right)$

Answer: B

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4. Infinite number of masses, each of $1kg$, are placed along the x-axis at $x = \pm 1m, \pm 2m, \pm 4m, \pm 8m, \pm 16m..$ The gravitational of the resultant gravitational potential in term of gravitaitonal constant G at the origin $(x = 0)$ is

A. G

B. 3G

C. 2G

D. 8G

Answer: C

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5. A black body is at a temperature of 2880 K. The energy of radiation emitted by this object with wavelength between 499 nm and 500 nm isU_1, between 999 nm and 1000 nm is U_2 and

between 1499 nm and 1500 nm is U_3. The Wein's constant $b = 2.88 \times 10^6 \text{nm K}$. Then

A. $U_1 = 0$

B. $U_3 = 0$

C. $U_1 > U_2$

D. $U_2 > U_1$

Answer: D

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6. If 2 moles of diatomic gas and 1 mole of monatomic gas are mixed, then the ratio of specific heats for the mixture is

A. $\frac{7}{3}$

B. $\frac{5}{4}$

C. $\frac{19}{13}$

D. $\frac{15}{19}$

Answer: C

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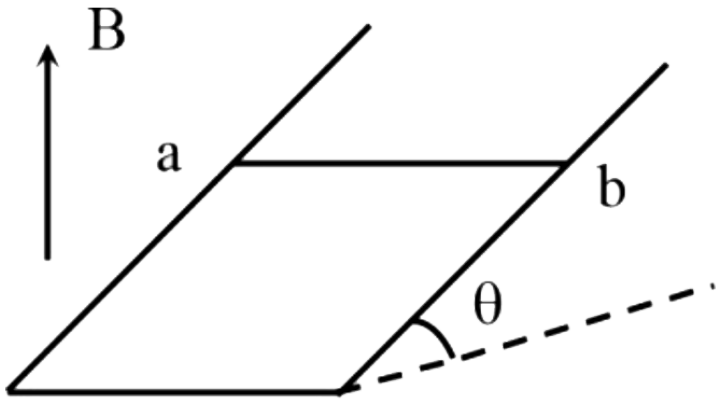
7. A wire ab of length l, mass m and resistance R slides on a smooth thick pair of metallic rails joined at the bottom as shown in fig. The plane of the rails makes an angle θ with the horizontal. A vertical magnetic field B exist in the region. If the wire slides on the rails at a constant speed v, then the value of B is -



A. $\sqrt{\frac{mgR}{vl^2\cos^2\theta}}$

B. $\sqrt{\frac{mgR\cos\theta}{vl^2\sin^2\theta}}$

C. $\sqrt{\frac{mgR}{v^2l^2\sin^2\theta}}$

D. $\sqrt{\frac{mgR\sin\theta}{vl^2\cos^2\theta}}$

Answer: D

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8. A truck is moving with a constant velocity of $54kmh^{-1}$. In which direction (angle with the

direction of motion of truck) should a stone be projected up with a velocity of $20ms^{-1}$, from the floor of the truck of the truck, so as to appear at right angles to the truck, for a person standing on earth ?

A. $\cos^{-2}\left(-\frac{3}{4}\right)$

B. $\cos^{-1}\left(-\frac{1}{4}\right)$

C. $\cos^{-1}\left(\frac{2}{3}\right)$

D. $\cos^{-1}\left(\frac{3}{4}\right)$

Answer: A

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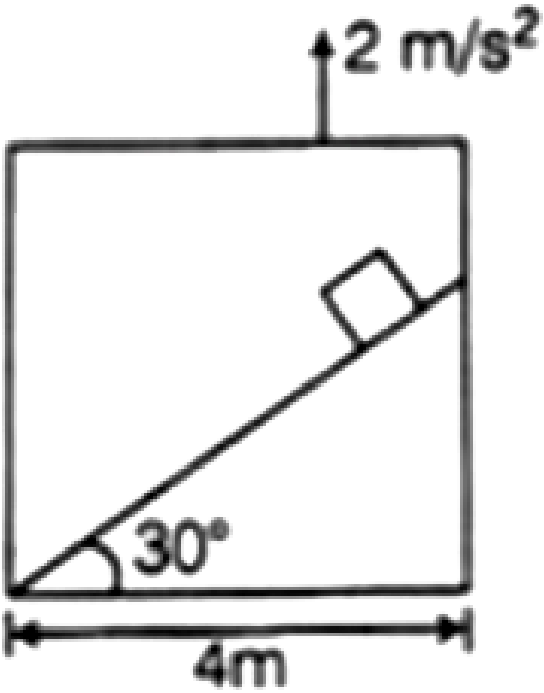
9. A particle slides down on a smooth incline of inclination 30°, fixed in an elevator going up with an acceleration $2m/s^2$. The box of incline has width 4m. The time taken by the

particle to reach the bottom will be



A. $\frac{8}{9}\sqrt{3}s$

B. $\frac{9}{8}\sqrt{3}s$

C. $\frac{4}{3}\sqrt{\frac{\sqrt{3}}{2}}s$

D. $\frac{3}{4}\sqrt{\frac{\sqrt{3}}{2}}s$

Answer: C

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10. Two radiouctive materials X_1 and X_2 have decayconstants 10λ and λ respectively. If initially they have the same number of nuclei, then the ratio of the number of nuclei ofX_1, to that of X_2 will be $\frac{1}{e}$ after a time,

A. $\frac{1}{10\lambda}$

B. $\frac{1}{11\lambda}$

C. $\frac{11}{10\lambda}$

D. $\frac{1}{9\lambda}$

Answer: D

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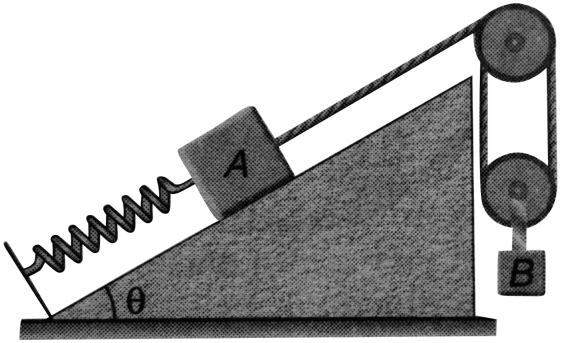
11. Calculate the angular frequency of the system shown in figure. Friction is absent everywhere and the threads, spring and

pulleys are massless. Given that $m_A = m_B = m$.



A. $\sqrt{\frac{2k}{4m}}$

B. $\sqrt{\frac{4k}{5m}}$

C. $\sqrt{\frac{6k}{7m}}$

D. $\sqrt{\frac{8k}{5m}}$

Answer: B

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12. A bucket water filled upto a height = 15 cm. The bucket is tied to a rope which is passed over a frictionless light pulley and the other end of the rope is tied to a weight of mass which is half of that of the (bucket + water). The water pressure above atmospheric pressure at the bottom is

A. 0.5 kPa

B. 1 kPa

C. 5 kPa

D. 20 kPa

Answer: B

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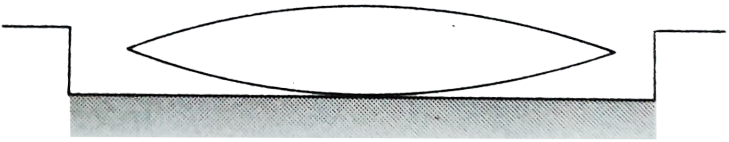
13. A thin equiconvex lens of refractive index $3/2$ is placed on a horizontal plane mirror as shown in figure. The space between the lens and the mirror is filled with a liquid of refractive index $4/3$. It is found that when a

point object is placed 15 cm above the lens on its principal axis, the object coincides with its own image.



Q. If another liquid is filled instead of water, the object and the image coincide at a distance 25 cm from the lens.

Calculate the refractive index of the liquid.

A. 1.6

B. 3.2

C. 0.8

D. 2

Answer: A

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14. An automobile moves on road with a speed of $54km/h$. The radius of its wheel is $0.45m$ and the moment of inertia of the wheel about its axis of rotation is $3kgm^2$. If the vehicle is brought to rest in $15s$, the magnitude of

average torque transmitted by its brakes to the wheel is :

A. $8.58 \ \text{kg m}^2 s^{-2}$

B. $10.86 \ \text{kg m}^2 s^{-2}$

C. $2.86 \ \text{kg m}^2 s^{-2}$

D. $6.66 \ \text{kg m}^2 s^{-2}$

Answer: D

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15. If a carrier wave of 1000 kHz is used to carry the signal, the length of transmitting antenna will be equal to -

A. 3 m

B. 75 m

C. 600 m

D. 300 m

Answer: D

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16. Two containers of equal volume contain the same gas at pressure P_1 and P_2 and absolute temperature T_1 and T_2, respectively. On joining the vessels, the gas reaches a common pressure P and common temperature T. The ratio P/T is equal to

A. $\dfrac{p_1T_2 + p_2T_1}{T_1 \times T_2}$

B. $\dfrac{p_1T_2 + p_2T_1}{T_1 + T_2}$

C. $\dfrac{1}{2}\left[\dfrac{p_1T_2 + p_2T_1}{T_1T_2}\right]$

D. $\dfrac{p_1T_2 - p_2T_1}{T_1 \times T_2}\Bigg]$

Answer: C

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17. If electronic charge e, electron mass m, speed of light in vacuum c and Planck's constant h are taken as fundamental quantities, the permeability of vacuum μ_0 can be expressed in units of :

A. $\left(\frac{mc^2}{he^2}\right)$

B. $\left(\frac{h}{me^2}\right)$

C. $\left(\frac{hc}{me^2}\right)$

D. $\left(\frac{h}{ce^2}\right)$

Answer: D

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18. In Young's double slit experiment, the wavelength of red light is 7800Å and that of blue light is 5200Å. The minimum value of n for which nth bright band due to red light

coincides with $(n+1)^{th}$ bright band due to blue light, is:

A. 1

B. 2

C. 3

D. 4

Answer: B

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19. A source of sound is moving with a velocity of $50ms^{-1}$ towards a stationary observer.The observer measures the frequency of sound as 500 Hz.The apparent frequency of sound as heard by the observer when source is moving away from him with the same speed is (Speed of sound at room temperature 350 ms^{-1}

A. 400 Hz

B. 600 Hz

C. 375 Hz

D. 175.5 Hz

Answer: C

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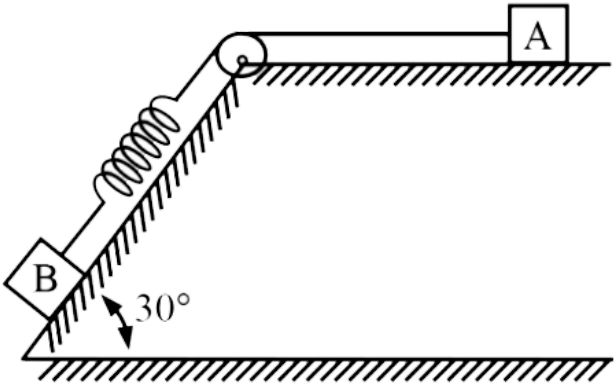
20. A massless string and a spring connect two blocks A and B to each other. Block B slides over a frictionless inclined plane while block A slides over horizontal surface. Coefficient of friction between block a A horizontal surface is $\mu = 0.2$. At the instant shown blocks are

moving with constant speed. Mass of block A and energy stored in spring the respectively.

$$\left[g = 10m/s^2, k = 1000\frac{N}{m}, m_B = 2kg\right]$$



A. 5 kg, 1J

B. 10 kg, 0.05 J

C. 5 kg, 0.05 J

D. 10 kg, 1J

Answer: C

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21. A 5000 kg rocket is set of vertical firing. The exhaust speed is $800 \quad ms^{-1}$. To give an initial upward acceleration of $20ms^{-2}$, the amount of gas ejected per second to supply the needed thrust will be (take, $g = 10ms^{-2}$)

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22. A solid body rotates about a stationary axis accordig to the law $\theta = 6t - 2t^3$. Here θ, is in radian and t in seconds. Find

(a). The mean values of thhe angular velocity and angular acceleration averaged over the time interval between $t = 0$ and the complete stop.

(b). The angular acceleration at the moment when the body stops.

Hint: if $y = y(t)$. then mean/average value of y between t_1 and t_2 is

$$< y \geq \left(\int_{t_1}^{t_2} y(t)dt \right) \frac{)}{t_2 - t_1}$$

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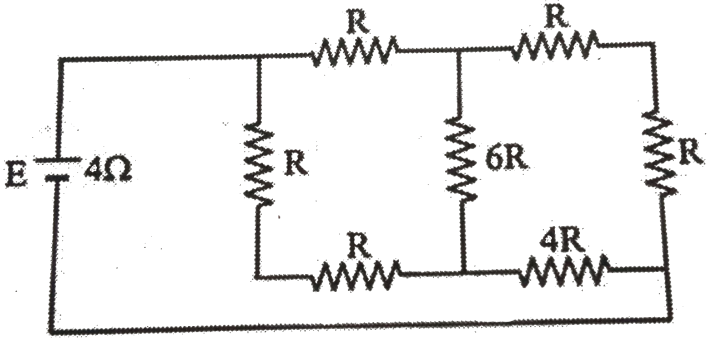
23. A battery of internal resistance 4Ω is connected to the network of resistance as shown. In order to give the maximum power to the network, the value of R should be-



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24. The magnetic needle of a vibration magnetometer makes 12 oscillations per minute in the horizontal component of earth's magnetic field. When an external short bar magnet is placed at some distance along the axis of the needle in the same line it makes 15 oscillations per minute. If the poles of the bar magnet are inter changed, the number of oscillations it takes per minute is

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25. The maximum wavelength of radiation that can produce photoelectric effect in a certain metal is 200 nm . The maximum kinetic energy acquired by electron due to radiation of wavelength 100 nm will be

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