PHYSICS

BOOKS - NTA MOCK TESTS

NTA JEE MOCK TEST 60

Physics

1. Imagine an atom made up of a proton and a hypothetical particle of double the mass of the electron but having the same charge as the electron . Apply the Bohr atom model and consider

all possible transitions of this hypothetical particle that will be emitted level . The longest wavelength photon that will be emitted has longest wavelength λ (given in terms of the Rydberg constant R for the hydrogen atom) equal to

A. $\frac{9}{5R}$

B. $\frac{36}{5R}$

C. $\frac{18}{5R}$

D. $\frac{4}{R}$

Answer: C

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2. A shell in flight explodes into n equal fragments k of the fragments reach the ground earlier than the other fragments. The acceleration of their centre of mass subsequently will be

A. g

B. (n-k)g

C. $\frac{(n-k)g}{k}$

D. $\frac{(n-k)g}{n}$

Answer: D

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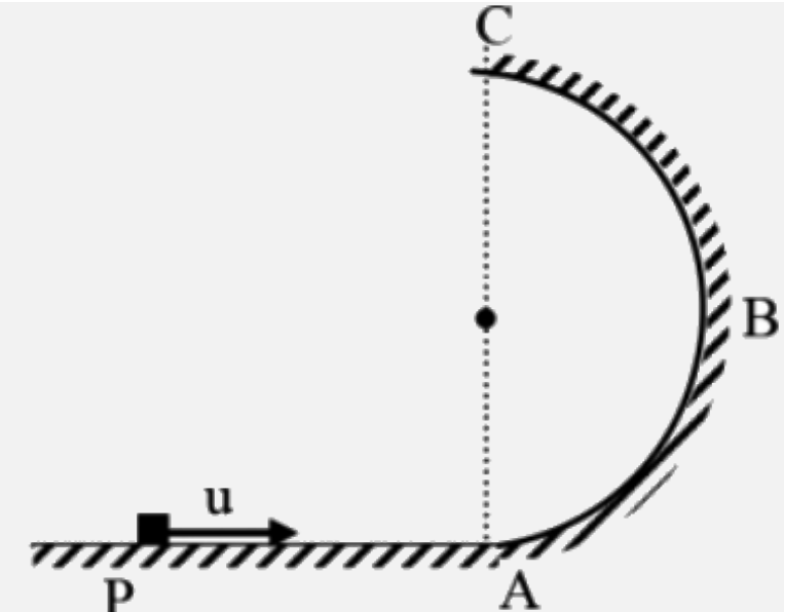
3. A particle is given a horizontal velocity u, from the point P on a smooth horizontal floor which has a vertical circular track at the end. ABC is a semicircular track of radius r in the vertical plane. If the path length PA is $x = 3r$ and the particle returns to point P, then the initial speed of the particle is



A. $u = 5\sqrt{gr}$

B. $u = \frac{5}{2}\sqrt{gr}$

C. $u = 4\sqrt{gr}$

D. $u = \frac{3}{2}\sqrt{gr}$

Answer: B

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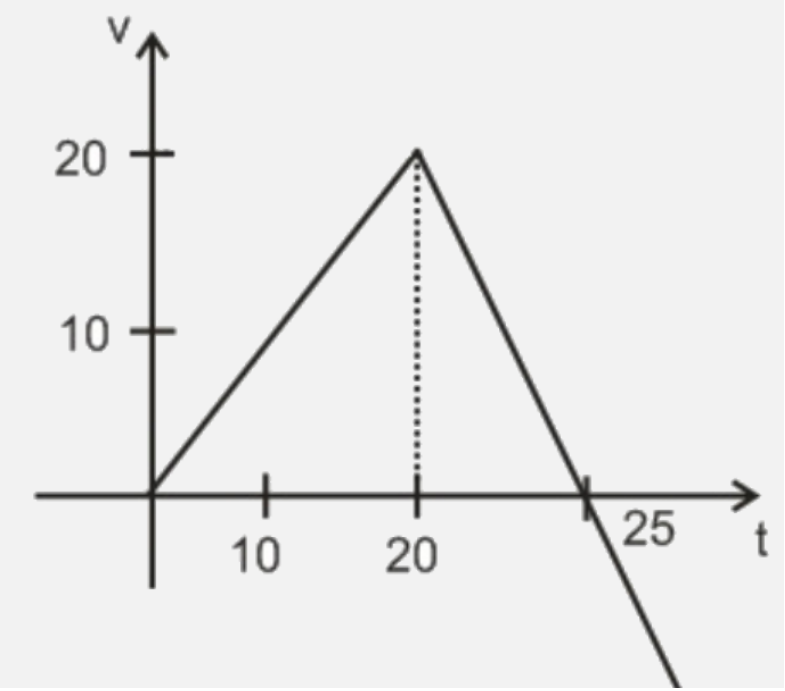
4. The figure shows the $v - t$ graph of a particle moving in a straight line. Starting from rest, the time after which the particle returns to its starting

position is



A. 36. 2 s

B. 40 s

C. 25 s

D. 42.6 s

Answer: A

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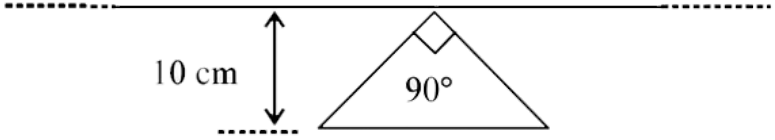
5. A conducting loop in the shape of a right angled isosceles triangle of height 10 cm is kept such that 90° vertex is very close to an infinitely long conducting wire (see the figure). The wire is electrically insulated from the loop. The hypotenuse of the triangle is parallel to the wire. Current in the triangular loop is in counterclockwise direction and increased at a constant rate of $10As^{-1}$. Which of the following

statement(s) is(are) true?



A. $\mu_0\pi$

B. $2\mu_0\pi$

C. $\frac{2\mu_0}{\pi}$

D. $\frac{\mu_0}{\pi}$

Answer: D

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6. Two parallel plate air capacitance of same capacity C are connected in series to a battery of emf E. Then one of the capacitors is completely filled with dielectric material of constant K. The change in the effective capacity of the series combination is

A. $\frac{C}{2}\left[\frac{K-1}{k+1}\right]$

B. $\frac{C}{4}\left[\frac{K-1}{k+1}\right]$

C. $\frac{C}{2}\left[\frac{K+1}{k-1}\right]$

D. $\frac{C}{2}\left[\frac{K-1}{k+1}\right]^2$

Answer: A

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7. A, B, C and D are four particles with each of mass M lying on the vertices of a square of side a. They always move along a common circle with velocity v under mutual gravitational force. Find v so that they always remain on the vertices of the square

A. $\sqrt{\frac{GM\left(2\sqrt{2}+1\right)}{2\sqrt{2}a}}$

B. $\sqrt{\frac{GM\left(\sqrt{2}+1\right)}{2\sqrt{2}a}}$

C. $\sqrt{\frac{GM\sqrt{2}(2+1)}{2\sqrt{2}a}}$

D. none

Answer: A

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8. The root-mean-square (rms) speed of oxygen molecules (O_2) at a certain absolute temperature is v.If the temperature is double and the oxygen gas dissociated into atomic oxygen, the rms speed would be

A. two times

B. three times

C. four times

D. unchanged

Answer: A

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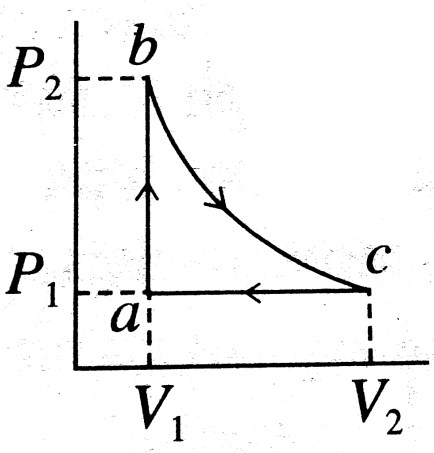
9. Carbon monoxide is carried around a closed cyclic processes abc, in which bc is an isothermal process, as shown in Fig. The gas absorbs $7000J$ of heat as its temperature is increased from $300K$ to

$1000K$ in going from a to b. The quantity of heat ejected by the gas during the process ca is



A. 4200 J

B. 500 J

C. 9000 J

D. 9800 J

Answer: D

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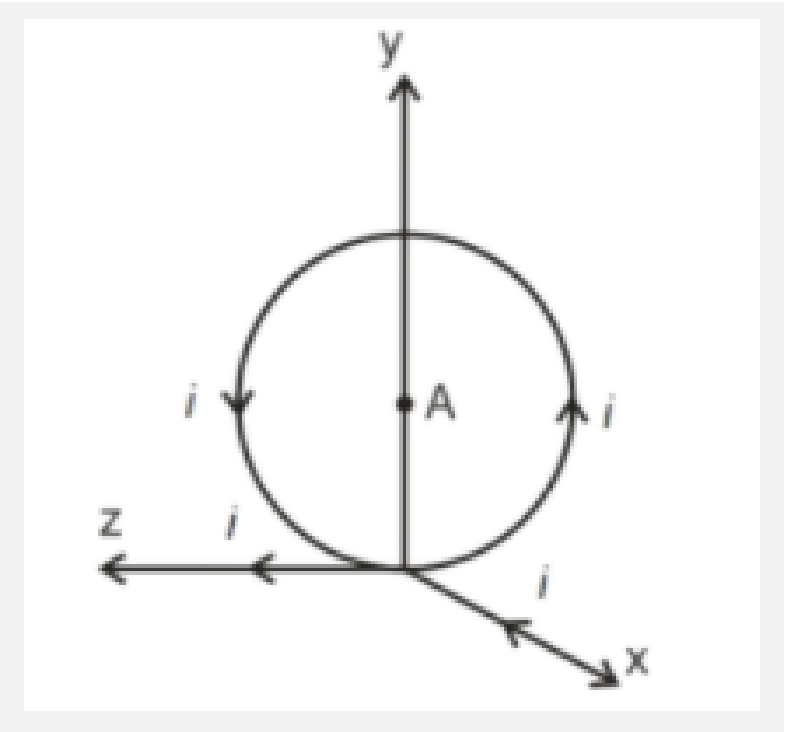
10. A ring of the radius R is placed in the y - z plane and it carries a current i. The conducting wires which are used to supply the current to the ring can be assumed to be vary long and are placed as shown in the figure. The magnitude of the

magnetic field at the centre of the ring A is



A. $\frac{\mu_i i}{4\pi R}\sqrt{2\left(2\pi^2-2\pi+1\right)}$

B. $\frac{\mu_0 i}{4\pi R}\sqrt{3\left(2\pi^2-2\pi+1\right)}$

C. $\frac{\mu_0 i}{4\pi R}\sqrt{3\left(2\pi^2+2\pi-1\right)}$

D. $\frac{\mu_0 i}{3\pi R}\sqrt{3\left(2\pi^2+2\pi+1\right)}$

Answer: A

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11. Two stones are thrown up simultaneously from the edge of a cliff with initial speed v and $2v$. The relative position of the second stone with respect to first varies with time till both the stones strike the ground as.

A. Linearly

B. First linearly then parabolically

C. Parabolically

D. First parabolically then linearly

Answer: B

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12. In radioactive reaction

$$\cdot_{Z}^{A}X \rightarrow \cdot_{Z+1}^{A}X_1 \rightarrow \cdot_{Z+2}^{A}X_2 \rightarrow \cdot_{Z}^{A-4}X_3 \rightarrow \cdot_{Z+1}^{A-4}X_4$$

Successive emission of particles is

A. β^-, β^-, α

B. $\beta^-, \beta^-, \beta^+, \alpha$

C. $\beta^-, \beta^-, \alpha, \alpha$

D. $\beta^-, \beta^-, \alpha, \beta^-$

Answer: D

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13. A $.^7Li$ target is bombarded with a proton beam current of 10^{-4} A for 1 hour to produce $.^7Be$ of activity 1.8×10^8 disintegrations per second.

Assuming that $.^7Be$ radioactive nucleus is produced by bombarding 1000 protons, determine its half-life.

A. 100 days

B. 110 days

C. 150 days

D. 80 days

Answer: A

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14. A particle performs linear S.H.M. At a particular instant, velocity of the particle is u and acceleration is α while at another instant, velocity

is v and acceleration β $(0 < \alpha < \beta)$. The distance between the two position is

A. $\frac{u^2 - v^2}{\alpha + \beta}$

B. $\frac{u^2 + v^2}{\alpha + \beta}$

C. $\frac{u^2 - v^2}{\alpha - \beta}$

D. $\frac{u^2 + v^2}{\alpha - \beta}$

Answer: A

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15. A spherical ball of diameter 1 cm and density $5 \times 10^3 kgm^{-3}$ is dropped gently in a large tank containing viscous liquid of density $3 \times 10^3 kgm^{-3}$ and coefficient of viscosity $0.1 Nsm^{-2}$. The distance that the ball moves n 1 s after attaining terminal velocity is $\left(g = 10 ms^{-2}\right)$

A. $\frac{10}{2}m$

B. $\frac{2}{3}m$

C. $\frac{4}{9}m$

D. $\frac{4}{5}m$

Answer: A

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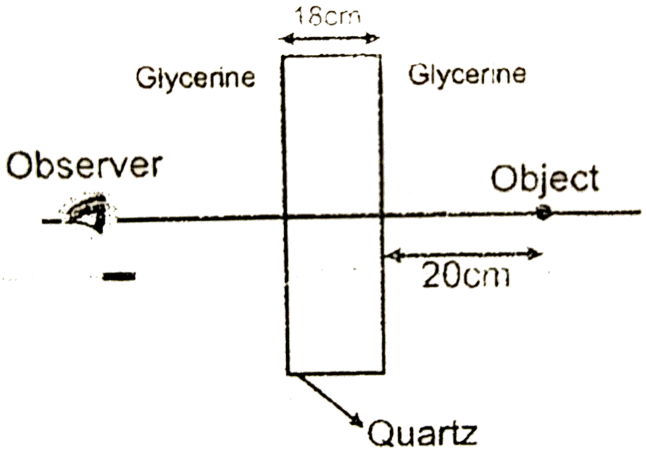
16. Given that, velocity of light in quartz $= 1.5 \times 10^8 m/s$ and velocity of light in glycerine $= \left(9/40 \times 10^8 m/s\right)$. Now a slab made of quartz is placed in glycerine as shown. The shift of the object produced by slab is



A. 6 cm

B. 3.55 cm

C. 9 cm

D. 2 cm

Answer: A

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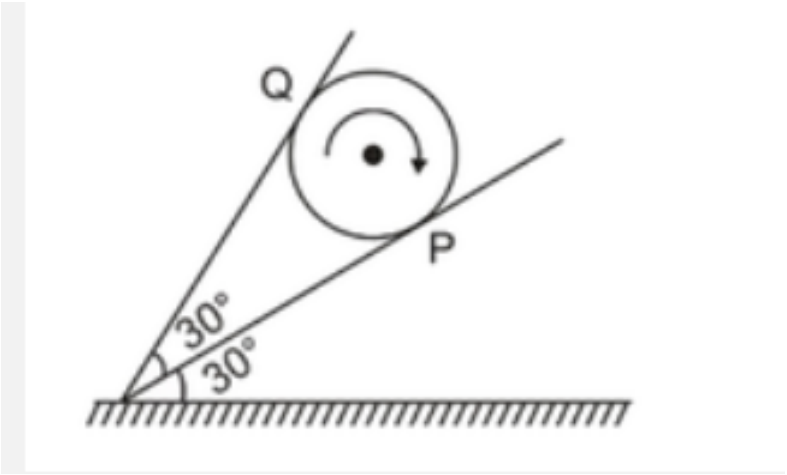
17. A sphere is rotating between two rough inclined walls as shown in figure. Coefficient of friction between each wall and the sphere is $1/3$. If f_1 and f_2 be the frictional forces at P and Q. Then

$\frac{f_1}{f_2}$ is



A. $\frac{4}{\sqrt{3}} + 1$

B. $\frac{1}{\sqrt{3}} + 2$

C. $\frac{1}{2} + \sqrt{3}$

D. $1 + 2\sqrt{3}$

Answer: A

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18. In optical communication system operating at 1200nm, only 2% of the source frequency is available for TV transmission having a bandwidth of 5 MHz. the number of TV channels that can be transmitted is

A. 2 million

B. 10 million

C. 0.1 million

D. 1 million

Answer: D

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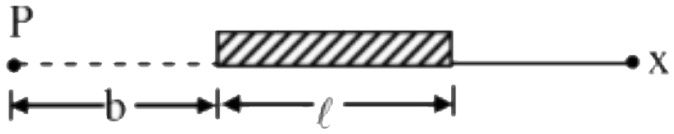
19. A rod of length l is placed along x - axis. One of its ends is at the origin. The rod has a non - uniform charge density $\lambda = \frac{a}{x}$, a being a positive constant. The electric potential at the point P (origin) as shown in the figure is



A. $\frac{a}{4\pi\varepsilon_0}\ln\left(\frac{b+l}{b}\right)$

B. $\frac{a}{4\pi\varepsilon_0}\ln\left(\frac{l}{b}\right)$

C. $\frac{a}{4\pi\varepsilon_0}\ln\left(\frac{b}{l}\right)$

D. zero

Answer: A

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20. Two rigid boxes containing different ideal gases are placed on a table. Box A contains one mole of nitrogen at temperature T_0, while Box contains one mole of helium at temperature $\left(\frac{7}{3}\right)T_0$. The boxes are then put into thermal contact with each other, and heat flows between

them untill the gasses reach a common final temperature (ignore the heat capacity of boxes). Then, the final temperature of the gasses, T_f in terms of T_0 is

A. $T_f = \frac{3}{7}T_0$

B. $T_f = \frac{7}{3}T_0$

C. $T_f = \frac{3}{2}T_0$

D. $T_f = \frac{5}{2}T_0$

Answer: C

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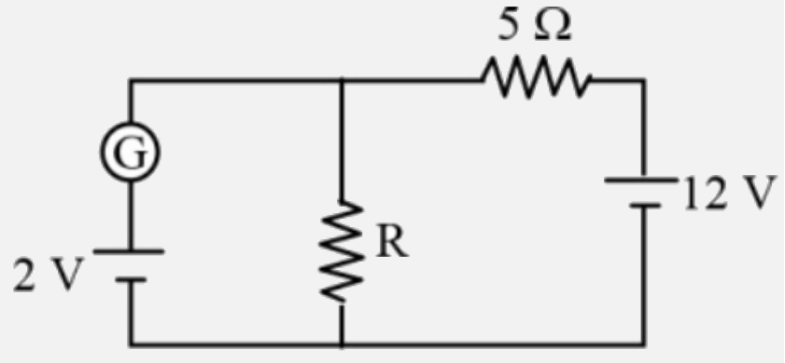
21. For what value of R, (in ohm) the current in galvanometer is zero?



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22. A silver of radius $1cm$ and work function $4.7eV$ is suspended from an insulating thread in free space. It is under continuous illumination of $200nm$ wavelength light. As photoelectron are

emitted the sphere gas charged and acquired a potential . The maximum number of photoelectron emitted from the sphere is $A \times 10^{e} (where 1 < A < 10)$ The value of z is

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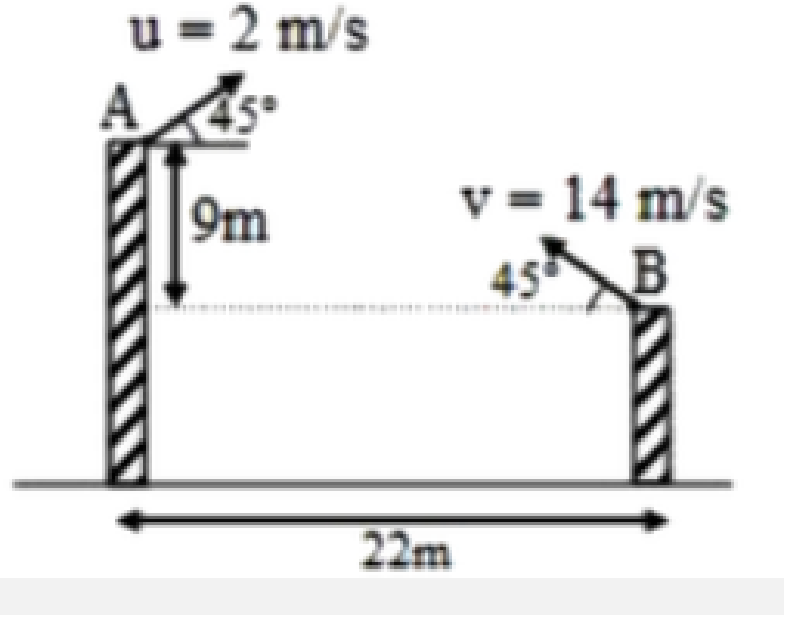
23. Two particles are simultaneously thrown from the top of two towards as shown. Their velocities are $2ms^{-1}$ and $14ms^{-1}$. Horizontal and vertical separations between these particles are 22 m and 9 m respectively. Then the minimum separation between the particles in the process of their

motion in meters is $\left(g = 10ms^{-2}\right)$



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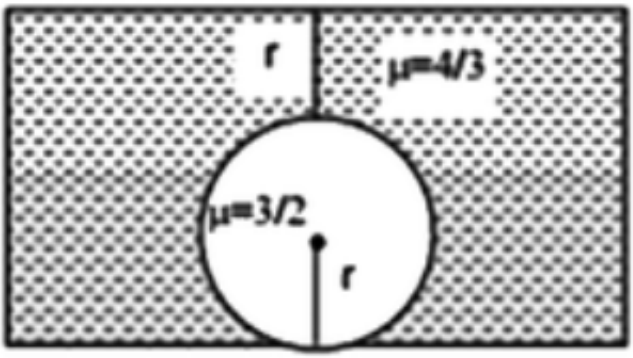
24. A glass sphere having refractive index (3/2) is having a small irregularity at its centre. It is placed in a liquid of refractive index $\frac{4}{3}$ such that the

surface of the liquid is at a distance r above the sphere, where r = 20 cm is radius of the sphere, where r = 20 cm is radius of the sphere. If the irregularity is viewed from above then what is it's distance (in cm) from the centre where eye will observed the irregularity?



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25. When the forward bias voltage of a diode is changed from 0.6 V to 0.7 V the current changes from 5 mA to 15 mA. Then its forward bias resistance is

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