Physics by fiziks

Learn Physics in Right Way

TIFR Physics

Question Paper -2023

Be Part of Disciplined Learning

Tata Institute of Fundamental Research

Graduate School Admissions (GS-2023)

INSTRUCTIONS FOR ALL CANDIDATES APPEARING FOR THE PHYSICS PH.D. OR INTEGRATED Ph.D. TEST

PLEASE READ THESE INSTRUCTIONS CAREFULLY BEFORE YOU ATTEMPT THE QUESTIONS

• You may NOT keep with you any books, papers, mobile phones or any electronic devices which can be used to calculate or get/store information. For a calculator, click the icon on the top right of the question frame on your screen.

• This test consists of TWO sections.

• **SECTION A comprises 25 questions, numbered Q.1-Q. 25.** These are questions on basic topics.

• **SECTION B comprises 15 questions, numbered Q. 1-Q. 15.** These may require somewhat more thought/knowledge.

• ALL questions are Multiple-Choice Type. In each case, ONLY ONE option is correct. Answer them by clicking the radio button next to the relevant option.

•If your calculated answer does not match any of the given options exactly, you may mark the closest one if it is reasonably close.

• The **grading scheme** will be as follows:

Section A: **+3** marks if correct; **-1** mark if incorrect; **0** marks if not attempted Section B: **+5** marks if correct; **0** marks if incorrect or not attempted, i.e. NO negative marks.

• The invigilators will supply you with paper sheets for rough work.

• **Do NOT ask the invigilators for clarifications regarding the questions.** They have been instructed not to respond to any such queries. In case a correction/clarification is deemed necessary, it will be announced in the examination hall.

• You can get a list of **useful physical constants** by clicking on the link **Useful Data.** Make sure to use only these values in answering the questions, especially where the options are numerical, unless instructed otherwise in the question itself.

Section-A

Q1. The pulse train at the output of an XNOR gate with the three inputs

A = 00011011

B = 10100011

C = 00101110

will be

(a) 01101001 (b) 10010110

(c) 01010111 (d) 10101000

Ans.: (a)

Q2. Consider a symmetric matrix $M = \begin{pmatrix} 1/3 & 0 & 2/3 \\ 0 & 1 & 0 \\ 2/3 & 0 & 1/3 \end{pmatrix}$

An orthogonal matrix O which can diagonalize this matrix by an orthogonal transformation $O^T MO$ is given by O =

(a) $\begin{pmatrix} 1/\sqrt{2} & 0 & 1/\sqrt{2} \\ 0 & 1 & 0 \\ 1/\sqrt{2} & 0 & -1/\sqrt{2} \end{pmatrix}$ (b) $\begin{pmatrix} \sqrt{2/3} & 0 & \sqrt{1/3} \\ 0 & 1 & 0 \\ \sqrt{1/3} & 0 & -\sqrt{2/3} \end{pmatrix}$

(c) $\begin{pmatrix} 1/\sqrt{2} & 0 & i/\sqrt{2} \\ 0 & 1 & 0 \\ 1/\sqrt{2} & 0 & -i/\sqrt{2} \end{pmatrix}$ (d) $\begin{pmatrix} \sqrt{1/3} & 0 & \sqrt{2/3} \\ 0 & 1 & 0 \\ \sqrt{2/3} & 0 & -\sqrt{1/3} \end{pmatrix}$

Ans.:(a)

Q3. An electromagnetic wave is described by the following expression

$$\vec{E}(z,t) = E_0 \sin kz \left\{ \hat{i} \cos \omega t + \hat{j} \cos\left(\omega t - \frac{\pi}{2} \right) \right\}$$

Which of the following correctly describes this waveform?

(a) A left circular-polarised standing wave along the positive z-axis.

(b) A right circular-polarised travelling wave along the positive z-axis.

(c) A left circular-polarised travelling wave along the positive z-axis.

(d) A right circular-polarised standing wave along the positive z-axis.

Ans.:(a)

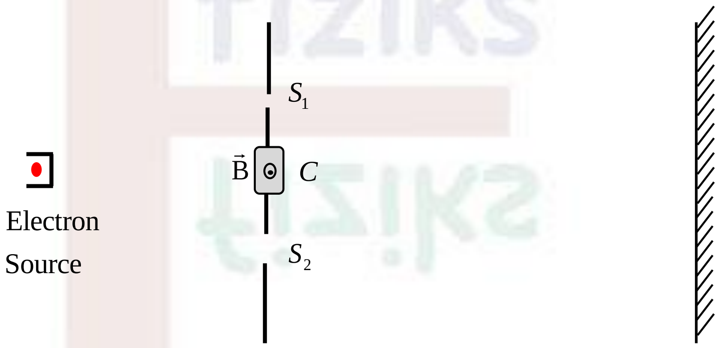
Q4. A particle is executing simple harmonic motion in a straight line. When the distance of the particle from the equilibrium position is x_1 and x_2, the corresponding values of its velocity v_1 and v_2 respectively. The time period of oscillation is given by

(a) $2\pi\dfrac{x_2 - x_1}{v_1 - v_2}$ (b) $2\pi\dfrac{x_2 - x_1}{v_2 - v_1}$

(c) $2\pi\sqrt{\dfrac{x_2^2 - x_1^2}{v_1^2 - v_2^2}}$ (d) $2\pi\sqrt{\dfrac{x_2^2 - x_1^2}{v_2^2 - v_1^2}}$

Ans.:(c)

Q5. Consider an electron double slit experiment as shown in the figure below, with slits S_1 and S_2.



If now, within the shaded region marked C, a constant uniform magnetic field pointing outside the page is turned on, the fringe pattern

(a) will become dimmer

(b) will disappear

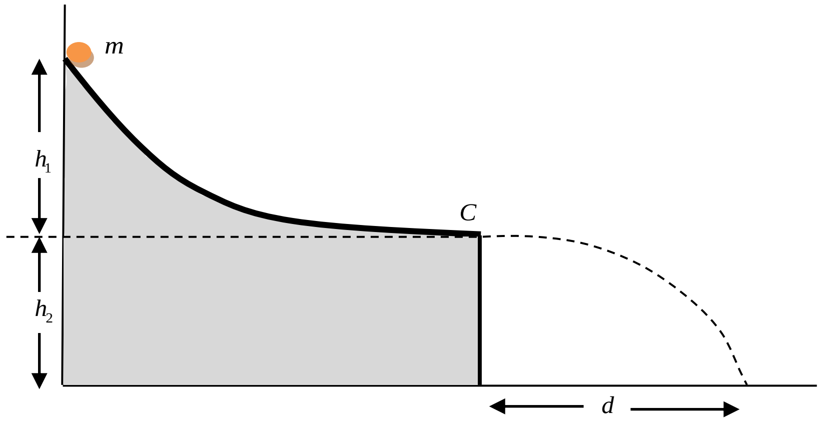
(c) will remain unchanged

(d) will get shifted

Ans.:(d)

Q6. A small body of mass m is released from rest at the top of a frictionless curved surface as shown in the figure, and permitted to slide down the curve. At the endpoint C, the tangent to the curve is horizontal. The mass then falls on the ground at a distance d as shown in the figure below when the experiment is carried out on the surface of the Earth. The height h_1 and h_2 are also shown in the figure.

H.No. 40-D, G.F., Jia Sarai, Near IIT, Hauz Khas, New Delhi-16
Phone: 011-26865455/+91-9871145498, Website: www.physicsbyfiziks.com, Email: fiziks.physics@gmail.com



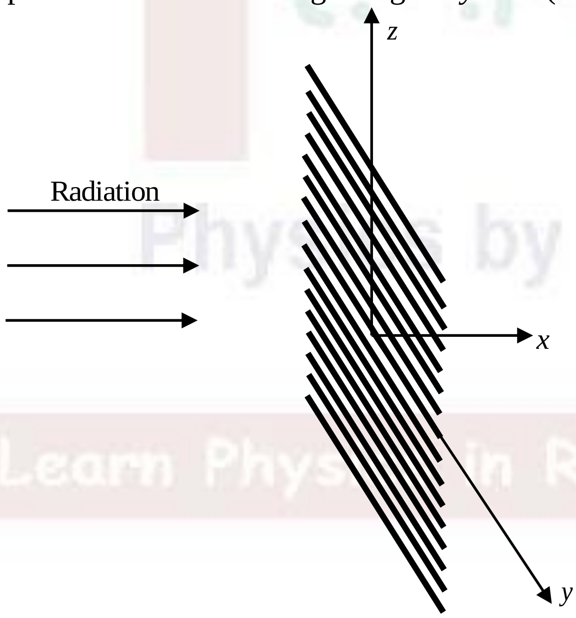
Suppose the same experiment is repeated on the surface of the Moon, where the acceleration due to gravity is $g' = g/6$, where g is the value on Earth. The corresponding distance d' at which the mass will fall on the ground in the Moon is

(a) $6d$ (b) d

(c) dependent on the shape of the curve (d) $d\sqrt{h_1/h_2}$

Ans.:(b)

Q7. A beam of unpolarized microwave radiation is incident along the x-axis on a grid of metal wires in the yz-plane with wires running along the y-axis (see figure below).



If the width of each wire and the spacing between the adjacent wires is less than the wavelength of the microwave the observation would be that

(a) no wave will pass through as the spacing is smaller than the wavelength.

(b) the transmitted wave would be polarized along the y-axis.

(c) the transmitted wave would be unpolarized.

(d) the transmitted wave would be polarized along the z-axis.

Ans.:(d)

Q8. A surface is given by

$$4x^2y-2xy^2+3z^3=0$$

Which of the following is a vector normal to it at the point (2,3,1)?

(a) $15\hat{i}-4\hat{j}+18\hat{k}$ (b) $30\hat{i}-8\hat{j}-9\hat{k}$

(c) $30\hat{i}+8\hat{j}-9\hat{k}$ (d) $30\hat{i}-8\hat{j}+9\hat{k}$

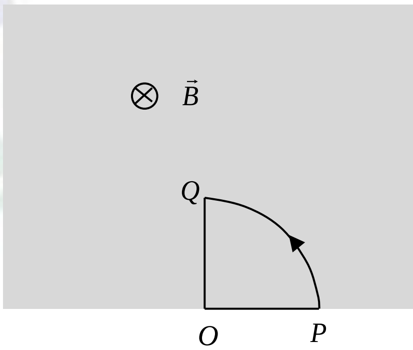
Ans.:(d)

Q9. Five identical bosons are distributed in energy levels E_1 and E_2 with degeneracy of 2 and 3, respectively. Find the number of microstates if there are three bosons in the energy level E_1 and two bosons in the energy level E_2.

(a) 1024 (b) 6 (c) 120 (d) 24

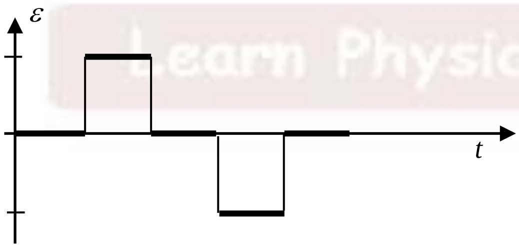
Ans. (d)

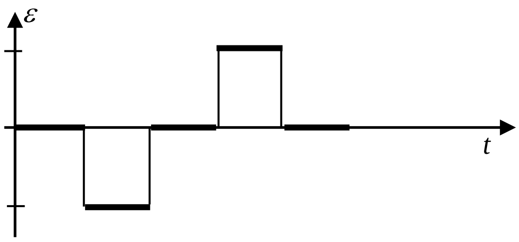
Q10. Consider the following situation. A uniform magnetic field $\vec{B}$ pointing into the plane of the paper is present everywhere inside the rectangular region shown shaded in the adjoining figure. Outside the rectangular region, there is no magnetic field.



A closed loop of conducting wire is placed inside the rectangular region as shown in the figure at time $t=0$. The loop is then rotated counterclockwise with a uniform angular velocity ω about an axis perpendicular to the paper passing through the point *O*.

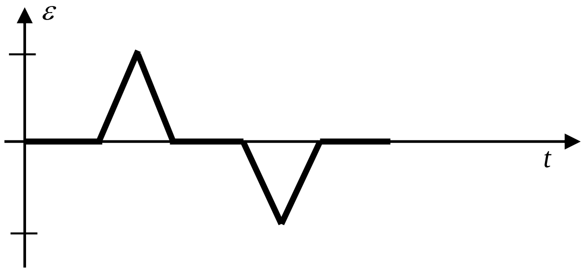
If the direction along *PQOP* is taken to be positive, then a correct graph for the EMF ε generated in the loop is

(a)


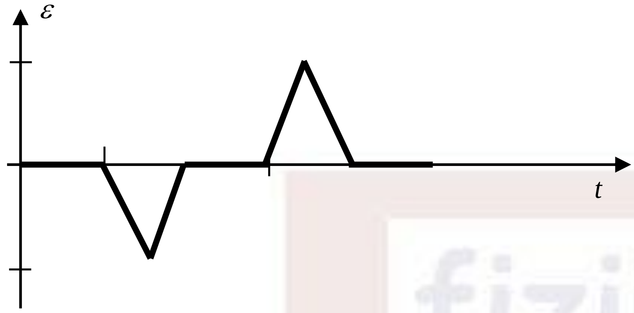
(b)


H.No. 40-D, G.F., Jia Sarai, Near IIT, Hauz Khas, New Delhi-16
Phone: 011-26865455/+91-9871145498, Website: www.physicsbyfiziks.com, Email: fiziks.physics@gmail.com

(c)

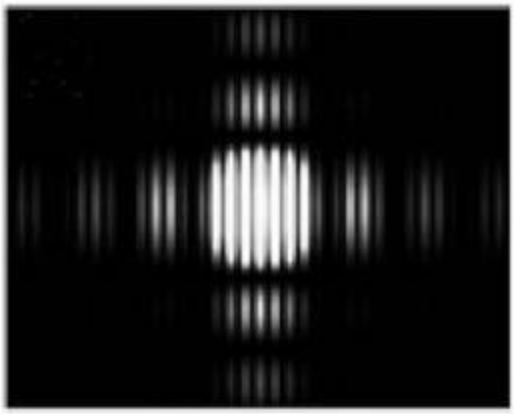


(d)



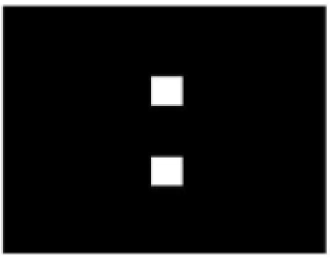
Ans.:(b)

Q11. The following Fraunhofer diffraction pattern was observed in an experiment.

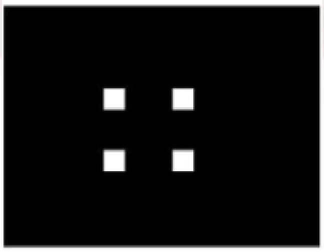


The aperture arrangement that would yield such a fringe pattern is

(a)



(b)



(c)

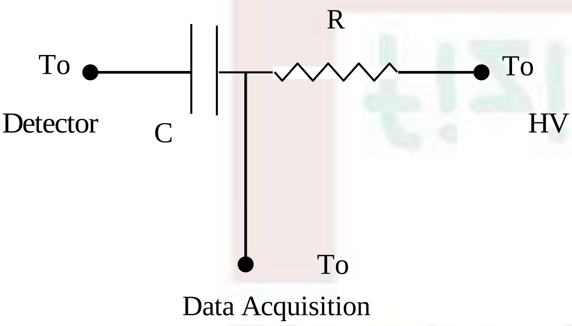
(d)

Ans.:(c)

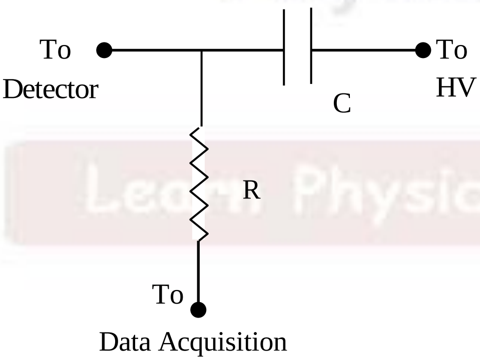
Q12. In an experimental setup, positively charged particles are detected by a detector which requires a negative DC high voltage of -2000 V. Every time a charged particle is detected by the detector, it gives a transient pulse of height 10 mV.

The data collection system used for the experiment needs to detect this pulse; however, it cannot operate at -2000V. Which of the following circuits can be used to connect the data collection system to the detector to obtain these pulses?

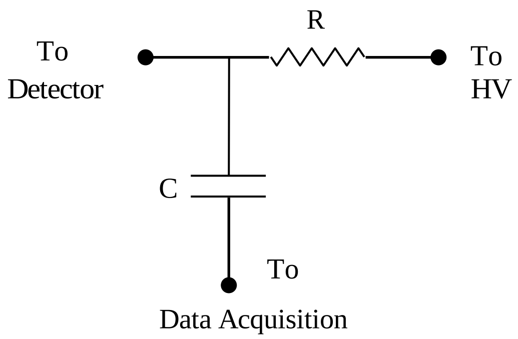
(a)



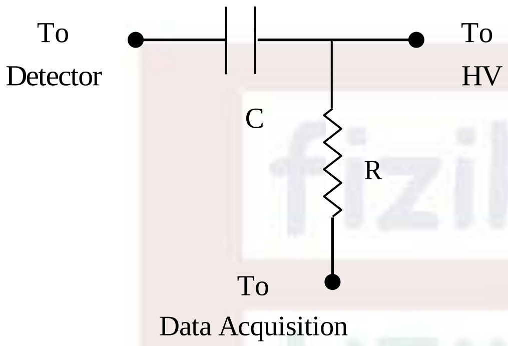
(b)



(c)

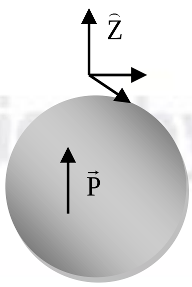


(d)



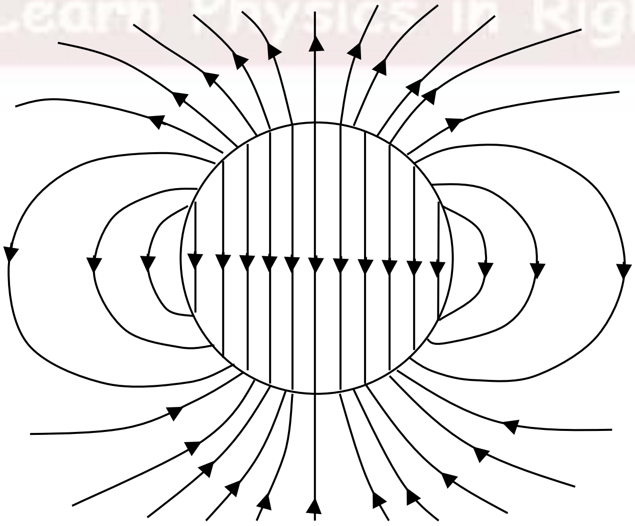
Ans.:(c)

Q13. The electric field lines due to a uniformly polarized dielectric sphere (polarization along the positive *z*-axis as shown in the figure)

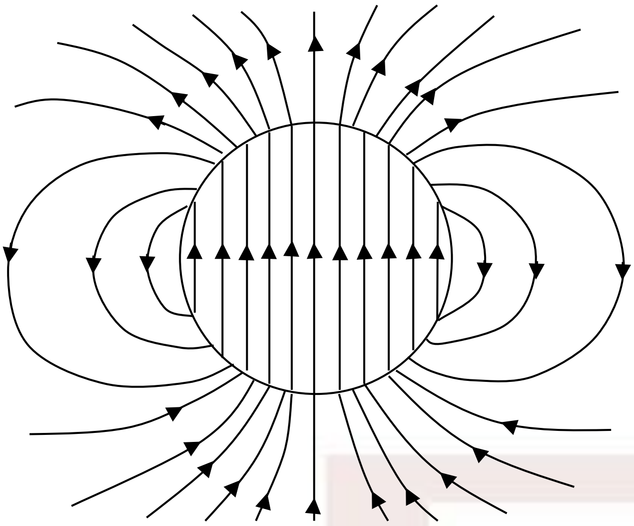


will look like

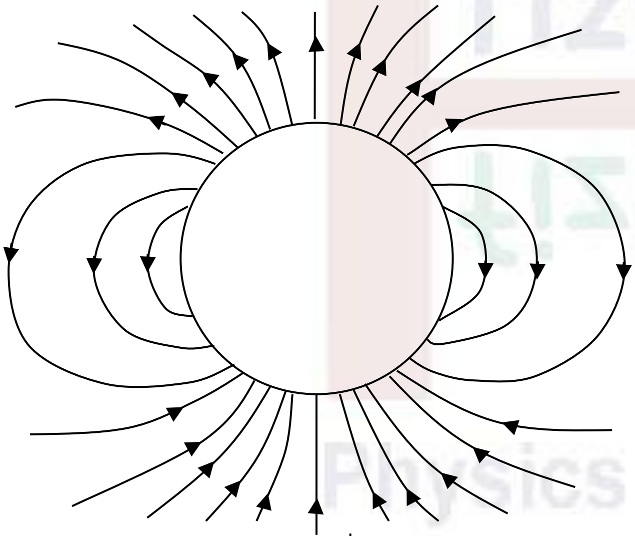
(a)



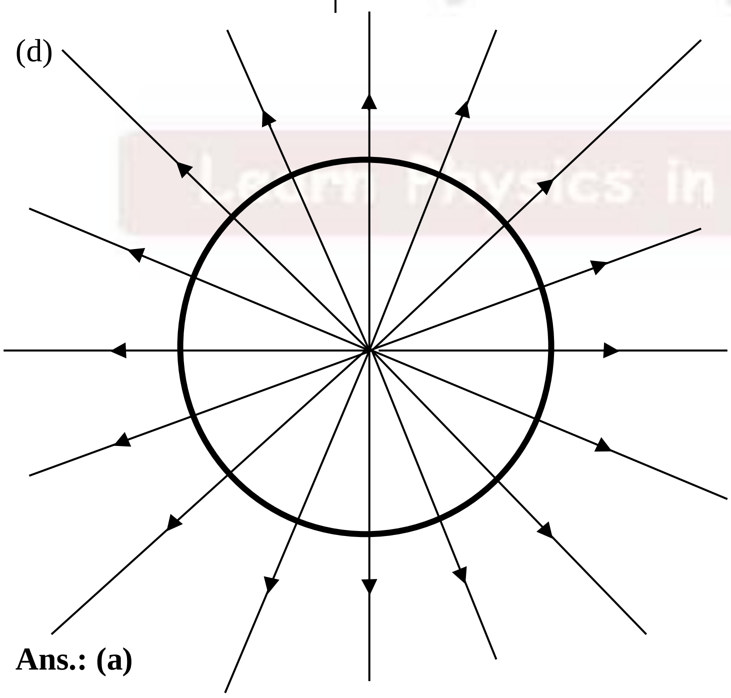
(b)



(c)



(d)



Ans.: (a)

Q14. The minimum energy required to dissociate a hydrogen molecule (H_2) into two atoms is 4.5 eV. If the electron affinity of the hydrogen atom is 0.75 eV, the minimum energy required to dissociate the hydrogen molecule into H^+ and H^- would be

(a) 14.35 eV (b) 17.35 eV

(c) 18.85 eV (d) 5.25 eV

Ans.:(b)

Q15. A faint star is known to emit light of a given frequency at an average rate of 10 photons per minute. An astronomer plans to measure this rate using a photon-counting detector. If she wants to measure the rate to an accuracy of 5%, approximately how long should be the exposure time?

(a) 40 minutes (b) 20 minutes

(c) 1 hour (d) 10 minutes

Ans.: (a)

Q16. An atom of mass M at rest emits or absorbs a photon of frequency ν and recoils with a momentum p. The frequency of the internal transition of electronic levels is ν_0 without accounting for recoil. Assuming the process is non-relativistic, the fractional differences between the photon frequency for emission and absorption $(\nu-\nu_0)/\nu$, respectively, are given by

(a) $-\dfrac{2h\nu_0}{Mc^2}(\text{emission}),+\dfrac{2h\nu_0}{Mc^2}(\text{absorption})$

(b) $+\dfrac{2h\nu}{Mc^2}(\text{emission}),-\dfrac{2h\nu}{Mc^2}(\text{absorption})$

(c) $+\dfrac{h\nu_0}{2Mc^2}(\text{emission}),-\dfrac{h\nu_0}{2Mc^2}(\text{absorption})$

(d) $-\dfrac{h\nu}{2Mc^2}(\text{emission}),+\dfrac{h\nu}{2Mc^2}(\text{absorption})$

Ans.:(d)

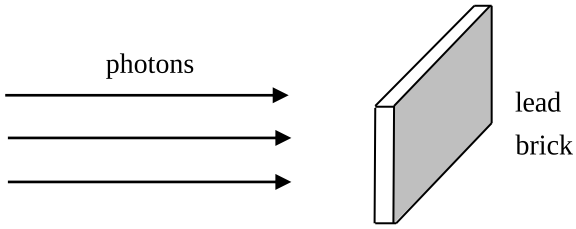
Q17. The value of the first derivative of the function

$$f(x)=\frac{2}{\sqrt{3}}e^{-\sqrt{3}x^2|x|}$$

at $x=0$ is $f'(0)=$

(a) 2 (b) $2/\sqrt{3}$ (c) undefined (d) 0

Q18. A beam of photons of 1 MeV energy each is shot at a 10 mm thick lead brick (see figure).



Given that the density of lead is 11.29 g-cm^{-3}, its atomic mass is 207.2 a.m.u., and also that the interaction cross-section for these photons with a lead atom is 10^{-23} cm^{2}, the fraction of the incident photons that will cross the brick without losing any energy is

(a) 72% (b) 67% (c) 28% (d) 33%

Ans.:(a)

Q19. Consider an electron with mass m_e, charge -e and spin 1/2, whose spin angular momentum operator is given by

$$\hat{\vec{S}} = \frac{\hbar}{2}\vec{\sigma}$$

This electron is placed in a magnetic field $\vec{B} = B_x\hat{i} + B_y\hat{j} + B_z\hat{k}$, where all three components $\left(B_x, B_y, B_z\right)$ are nonvanishing.

At time $t = 0$, the electron is at rest in the $S_z = \hbar/2$ state. The earliest time when the state of the spin will be orthogonal to the initial state is

(a) infinity, i.e. it will never be orthogonal.

(b) $\dfrac{4m_e}{ge\left|\vec{B}\right|}$

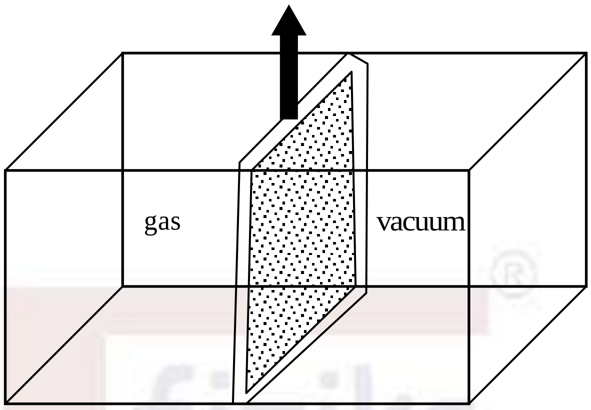
(c) $\dfrac{2m_e}{ge\left|\vec{B}\right|}$

(d) dependent on the direction of the magnetic field $\vec{B}$

Ans.:(b)

H.No. 40-D, G.F., Jia Sarai, Near IIT, Hauz Khas, New Delhi-16
Phone: 011-26865455/+91-9871145498, Website: www.physicsbyfiziks.com, Email: fiziks.physics@gmail.com

Q20. Consider a sealed but thermally conducting container of total volume V, which is in equilibrium with a thermal bath at temperature T. The container is divided into two equal chambers by a thin partition, which is thermally conducting but impermeable to particles. One of the chambers contains an ideal gas, while the other is a vacuum.



If the partition is removed suddenly and the ideal gas is allowed to expand and fill the entire container, then, once equilibrium has been reached, the entropy per molecule will increase by an amount

(a) $-k_B \ln 2$ (b) $\frac{1}{2}k_B \ln 2$ (c) $+k_B \ln 2$ (d) $2k_B$

Ans.:(d)

Q21. The binding energy ε_b of a nuclide ${}_A^Z X$ with atomic number Z and mass number A is given by the semi-empirical formula

$$\varepsilon_b = a_V A - a_S A^{2/3} - a_C \frac{Z(Z-1)}{A^{1/3}} + a_A \frac{(A-2Z)^2}{A}$$

where the constant parameters and source of effect for each term are

Volume term	Surface term	Coulomb term	Asymmetry term
a_V	a_S	a_C	a_A
15.56 MeV	17.8 MeV	0.7 MeV	23.29 MeV

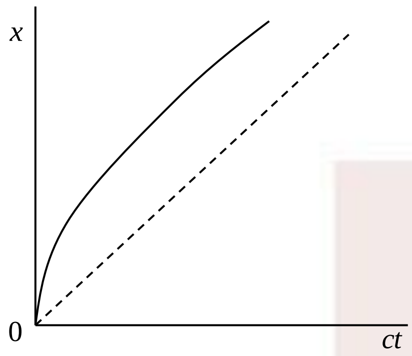
What is the mass difference between the two-mirror nuclei ${}_6^{13}C$ and ${}_7^{13}N$? It is known that both of them are spherical in shape and have a uniform charge distribution.

(a) 1.84 MeV (b) 3.40 MeV (c) 2.62 MeV (d) 0.78 MeV

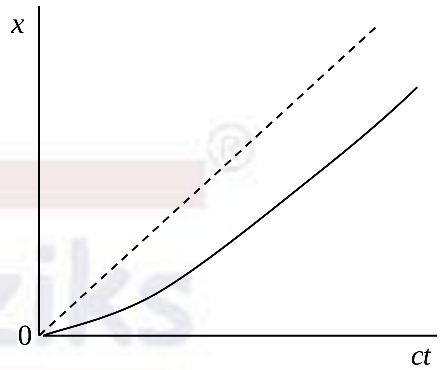
Ans.:(c)

Q22. A relativistic particle, moving in one dimension x, starts from rest at $x=0$ and is subjected to a uniform and constant force field along the positive x-direction. If the dashed line corresponds to $x=ct$, which of the following curves (red line) would best represent the position $x(t)$ of the particle?

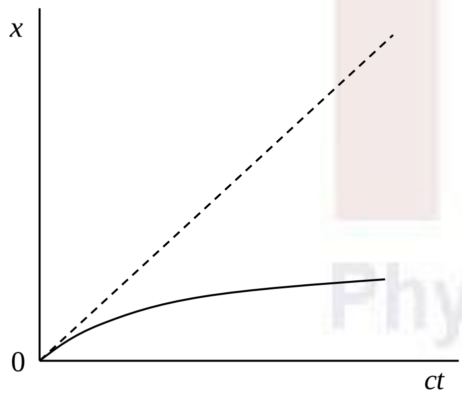
(a)



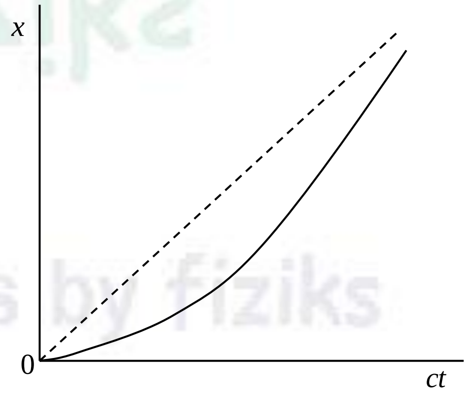
(b)



(c)



(d)



Ans.:(b)

Q23. In a mercury vapour lamp an electric arc passing through mercury vapour produces light. When the lamp is switched on, the arc is struck, and the liquid mercury starts evaporating as the temperature gradually increases.

In a certain experiment, a Michelson interferometer is set up with a mercury vapour lamp as the light source, and the lamp is switched on. Which of the following effects will be observed?

(a) No fringes will be observed as the source is incoherent and has many frequencies.

(b) Initially, fringes will appear with high contrast but low intensity, which will be reduced in contrast over the period of time as the light intensity builds up.

H.No. 40-D, G.F., Jia Sarai, Near IIT, Hauz Khas, New Delhi-16
Phone: 011-26865455/+91-9871145498, Website: www.physicsbyfiziks.com, Email: fiziks.physics@gmail.com

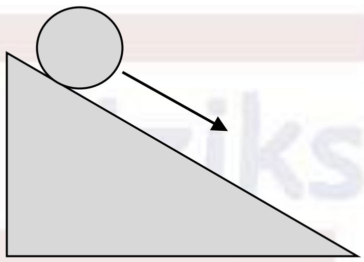
(c) High contrast fringes will appear as soon as the lamp is switched on and will remain thus so long as the lamp is on.

(d) Initially, no fringes will be observed, but then fringes will emerge with high contrast as the lamp heats up.

Ans.:(b)

Q24. A solid cylinder of uniform mass density rolls down a fixed inclined plane without slipping (see figure).

The fraction of the total kinetic energy of the cylinder associated with its rotation about its centre of mass is



(a) ¼ (b) 1/6 (c) 1/3 (d) 1/2

Ans.:(c)

Q25. A two-level system with zero ground state energy is in equilibrium at a nonzero finite temperature. If α is defined as the ratio

$$\alpha = \frac{\langle E^2 \rangle}{\langle E \rangle^2}$$

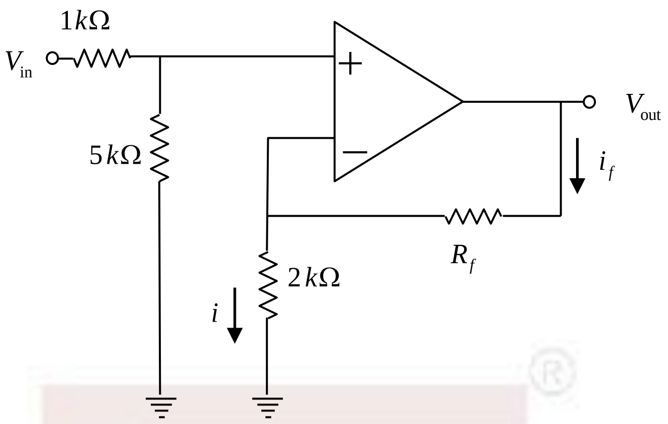
where $\langle E \rangle$ denotes the mean energy and $\langle E^2 \rangle$ denotes the mean squared energy, then

(a) $\frac{1}{2} < \alpha < 1$ (b) $2 < \alpha < \infty$ (c) $1 < \alpha \leq 2$ (d) $0 < \alpha < \frac{1}{2}$

Ans.:(b)

Section-B

Q1. At what value of R_f will the ideal op-amp shown in the figure provide a gain of 6?



(a) 12.4 kΩ (b) 14.4 kΩ (c) 22.5 kΩ (d) 19.5 kΩ

Ans.:(a)

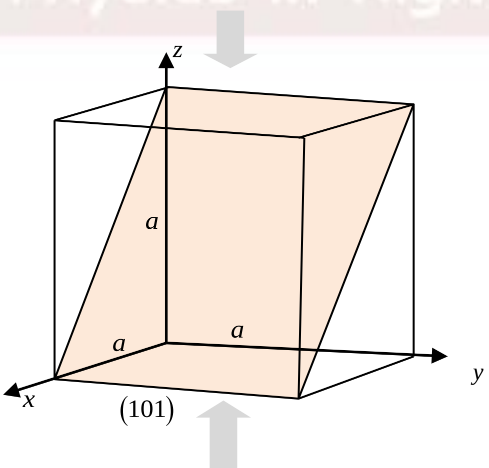
Q2. A particle is in ground state of a one-dimensional box $-\frac{L}{2} \le x \le +\frac{L}{2}$. The uncertainty product $\Delta x \Delta p$ for this state satisfies

(a) $\frac{3\hbar}{2} < \Delta x \Delta p \le 2\hbar$ (b) $\hbar < \Delta x \Delta p \le \frac{3\hbar}{2}$

(c) $\frac{\hbar}{2} < \Delta x \Delta p \le \hbar$ (d) $\Delta x \Delta p = \frac{\hbar}{2}$

Ans.:(b)

Q3. A X-ray of wavelength λ, when incident on the (101) plane of a cubic lattice with lattice constant a produces first-order Bragg's reflection at $\theta = 30^\circ$ (θ is measured from the lattice plane). Suppose this cubic lattice is compressed along the z axis such that its lattice parameters along the x and y axes remain the same while that along the z axis becomes $\frac{1}{\sqrt{3}}a$ (see figure).



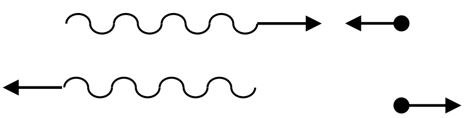
H.No. 40-D, G.F., Jia Sarai, Near IIT, Hauz Khas, New Delhi-16
Phone: 011-26865455/+91-9871145498, Website: www.physicsbyfiziks.com, Email: fiziks.physics@gmail.com

The first-order reflection for the (101) plane of the compressed lattice occurs at:

(a) $\theta = 30°$ (b) $\theta = 15°$ (c) $\theta = 45°$ (d) $\theta = 60°$

Ans.:(c)

Q4. A photon of frequency ν_i collides "head on" with an electron of mass m having speed u_i and the photon scatters off in a direction exactly opposite to its initial momentum (see figure).



It is found that the frequency of the scattered photon is the same as that of the incident photon. Which of the following conditions must hold for this to happen?

(a) The initial energy of the electron is $E_i^e = h\nu_i$

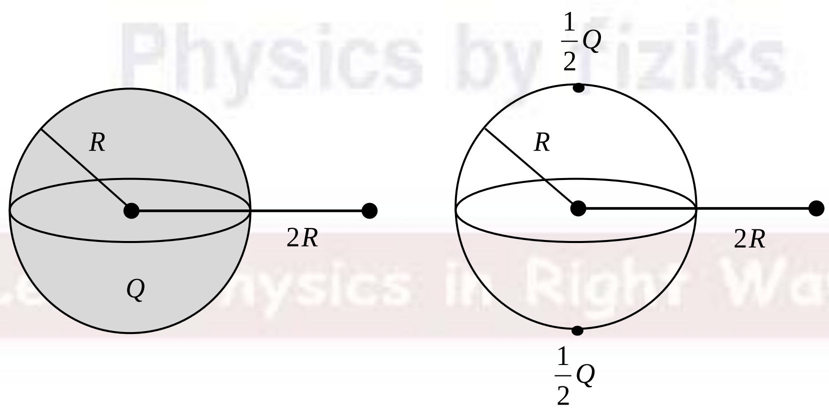
(b) The initial energy of the electron is $E_i^e = 2h\nu_i$

(c) The magnitude of the initial momentum of the electron is $p_i^e = 2h\nu_i / c$

(d) The magnitude of the initial momentum of the electron is $p_i^e = h\nu_i / c$

Ans.:(d)

Q5. Consider a solid sphere of radius R with a total charge Q distributed uniformly throughout its volume (see figure, left). The electric field measured at a distance $x = 2R$ from the centre of the sphere along the equatorial plane is found to be E_1.



Next, the same charge is distributed differently, such that Q/2 is concentrated at the north pole, and the remaining Q/2 is concentrated at the south pole (see figure, right). The electric field is measured again at the same point on the equatorial plane and found to be E_2.

The value of E_2/E_1 is

(a) $\frac{4}{5}$ (b) $\frac{2}{\sqrt{5}}$ (c) $\frac{8}{5\sqrt{5}}$ (d) 1

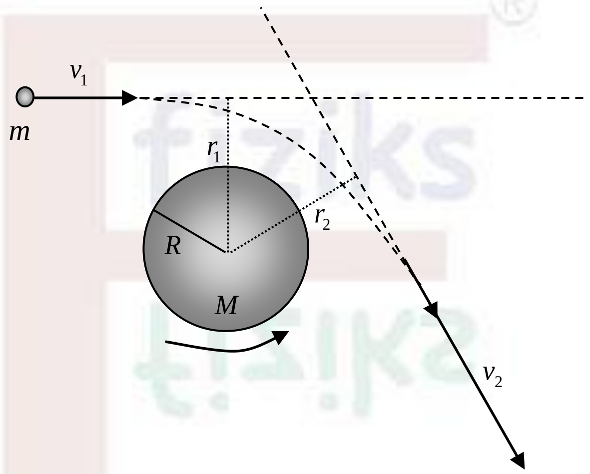
Ans.:(c)

Q6. A diffraction grating spectrograph is used to resolve the two sodium D lines (589 and 589.6 nm) in the first order of diffraction. If the width of the grating is 2 cm and the focal length of the spectrograph camera is 20 cm, what the linear separation at the focal plane of the two D lines will be about

(a) 6 μm (b) 60 μm (c) 6 mm (d) 60 nm

Ans.:(a)

Q7. A spherical planet of mass M, radius R and uniform density is rotating anticlockwise about an axis passing through its centre, which, in the figure below, is normal to the plane of the paper. The duration of a 'day' on this planet is T.



A small asteroid of mass m approaches the above planet from far away with a uniform speed v_1 along straight line at a perpendicular distance r_1 from the centre of the planet (see figure). This path gets distorted by the gravitational field of the planet, and the asteroid leaves with a final uniform speed v_2 along a straight line at a perpendicular distance r_2 from the centre of the planet. It is observed that after the passage of the asteroid, the length of the day on the planet has changed by δT =

(a) $\frac{5}{4\pi}\frac{MR^2}{m(v_2r_1 - v_1r_2)}$ (b) 0

(c) $\frac{4\pi}{5}\frac{MR^2}{m(v_2r_2 - v_1r_1)}$ (d) $\frac{5T^2}{4\pi}\frac{m(v_2r_2 - v_1r_1)}{MR^2}$

Ans.:(d)

H.No. 40-D, G.F., Jia Sarai, Near IIT, Hauz Khas, New Delhi-16
Phone: 011-26865455/+91-9871145498, Website: www.physicsbyfiziks.com, Email: fiziks.physics@gmail.com

Q8. The number of hyperfine states found in the ^{3}He atom for the electronic configuration

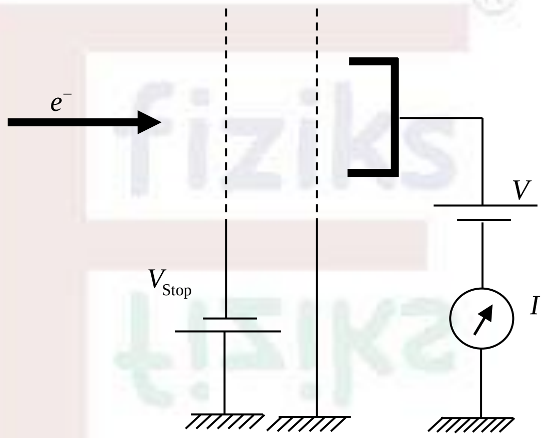
$$1s^1 2s^0 2p^1$$

would be

(a) 4 (b) 1 (c) 2 (d) 7

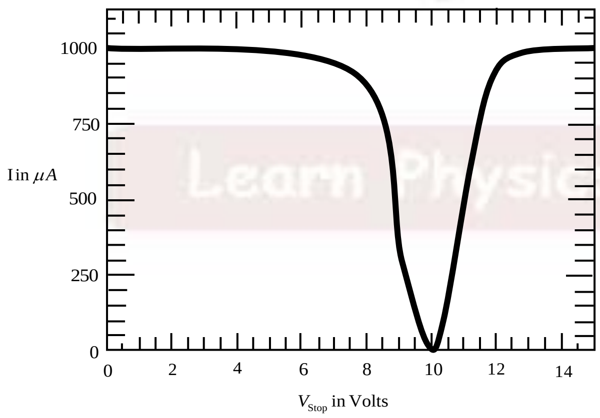
Ans.:(d)

Q9. A well-collimated constant-current electron beam of Gaussian energy distribution centred at 10 eV with FWHM of 2 eV is detected using a metal cup connected to an ammeter, as shown in the figure below. The entire apparatus is kept in vacuum.

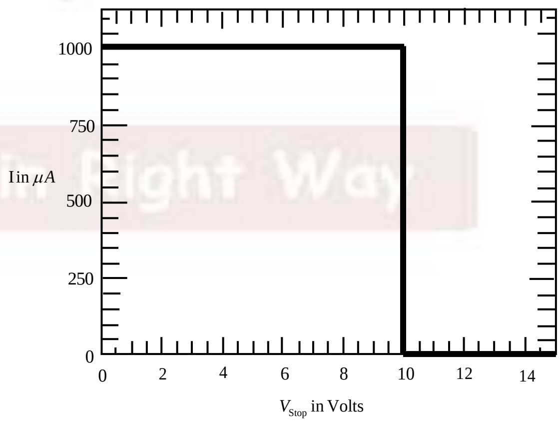


To measure the energy width of the electron beam, a grid is introduced with a voltage source V_{stop} connected to it, as shown in the figure. The current measured in the cup is plotted as a function of the value of V_{stop}. The graph of the current I vs V_{stop} would be

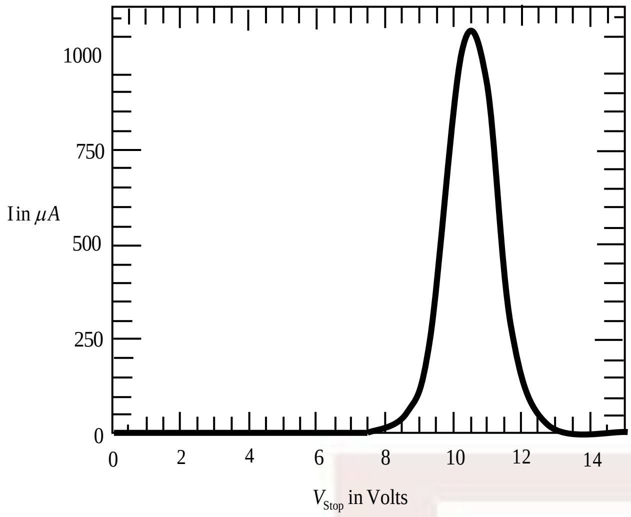
(a)



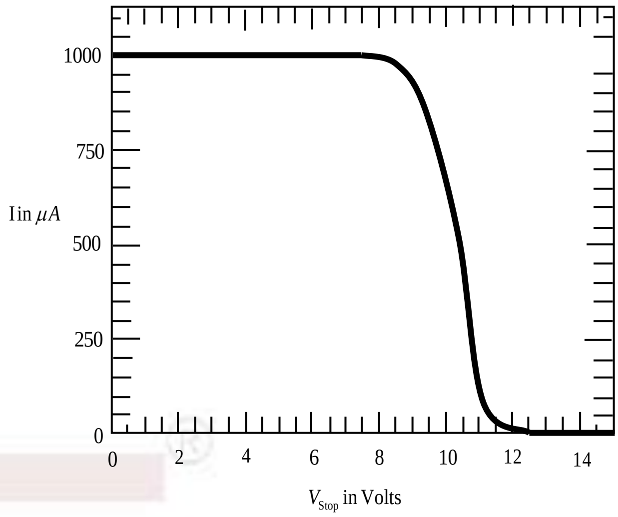
(b)



(c)



(d)



Ans.:(d)

Q10. Consider a diatomic molecule with two atoms of masses $m_1 = 1$ a.m.u. and $m_2 = 8$ a.m.u. which are separated by a distance r and bound by an effective interaction potential of the form

$$V(r) = \in \left(\frac{a^4}{4r^4} - \frac{b^2}{2r^2} \right)$$

where $\in = 4\times10^{-18}$ J, $a = b = 1Å$ and 1 a.m.u. $\approx 1.6\times10^{-27}$ kg.

Making a small oscillations approximation, the transition frequency corresponding to the vibrational spectra of the molecule is approximately

(a) 1.2×10^{14} Hz
(b) 0.4×10^{14} Hz
(c) 3.6×10^{14} Hz
(d) 7.5×10^{14} Hz

Ans.:(a)

Q11. The equilibrium temperature (T_0) on the surface of a planet results from the balance between the energy received from their host star and the energy they emit back into space. In the case of the Earth, $T_0 = 300\,K$ and the orbit is almost circular. We may safely assume that planets absorb and emit radiation like perfect blackbodies

Now consider an exoplanet of the same size as the Earth, which orbits a fainter star having a power output only 25% of that of the Sun, in an almost-circular orbit of radius 25% that of the Earth-Sun distance.

The equilibrium temperature $T_0^{'}$ on the surface of this exoplanet will be about

(a) 300 K
(b) 212 K
(c) 424 K
(d) 600 K

Ans.:(c)

Q12. A random positive variable x follows an exponential distribution

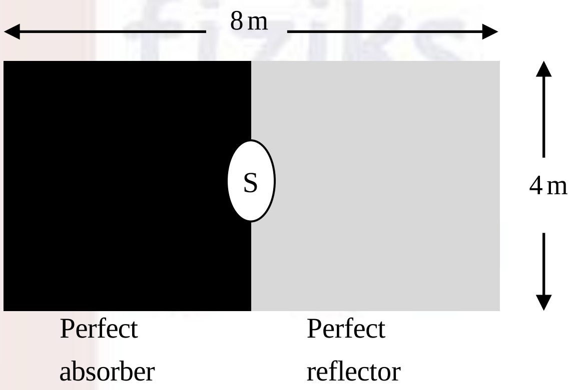
$$p(x) \propto e^{-\lambda x}$$

with $\lambda > 0$. The probability of observing an event $x > 3\langle x \rangle$, where $\langle x \rangle$ represents the average value of x, is

(a) $1/e^3$ (b) $1/e$ (c) $1/e^4$ (d) $1/e^2$

Ans.:(a)

Q13. A small statellite S has a rectangular solar sail of dimensions 8 m × 4m, which propels the satellite upon receiving sunlight. One half of the sail is a perfect reflector, while the other half is a perfect absorber, as shown in the figure.



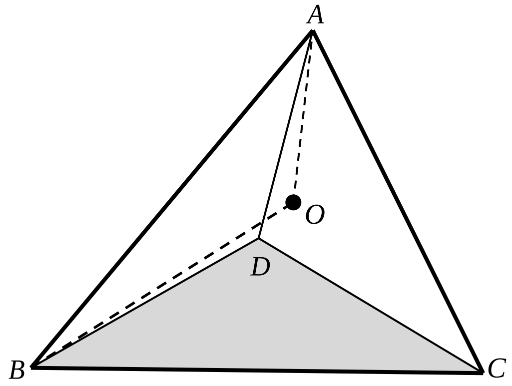
Assuming uniform sunlight incident normally on the sail with an intensity 1370 Wm^{-2} and ignoring the satellite's shadowing effects, the instantaneous torque experienced by the satellite is

(a) 2.92×10^{-4} N-m (b) 1.46×10^{-4} N-m

(c) 2.19×10^{-4} N-m (d) 0.73×10^{-4} N-m

Ans.:(b)

Q14. Consider a regular tetrahedron ABCD, as shown in the figure below. Let the point O be its centre

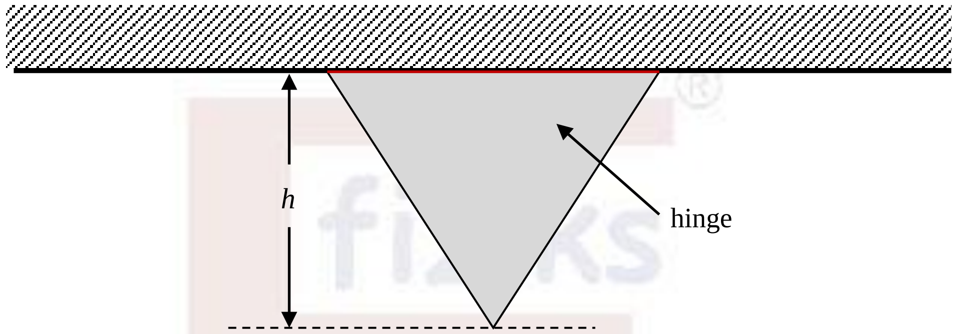


The value of the angle AOB must be

(a) $2\pi/3$ (b) $\cos^{-1}(-4/5)$ (c) $\cos^{-1}(-1/3)$ (d) $\cos^{-1}\left(-\sqrt{4/5}\right)$

Ans.:(c)

Q15. A thin equilateral triangular plate of uniform mass density is attached to a fixed horizontal support along one of its sides through a frictionless hinge, as shown in the figure below. The vertical distance between the rod and the lower tip of the plate is *h*.



If the pointed tip of the plate is displaced (out of the plane of the paper) so that its plane forms a small angle with the vertical plane passing through the rod, the angular frequency ω of the resultant motion is ω =

(a) $\sqrt{\frac{2\sqrt{3}g}{h}}$ (b) $\sqrt{\frac{2g}{\sqrt{3}h}}$ (c) $\sqrt{\frac{\sqrt{3}g}{2h}}$ (d) $\sqrt{\frac{2g}{h}}$

Ans.:(d)

fiziks

Physics by fiziks

Learn Physics in Right Way

Physics by fiziks

Pioneering Excellence Since Year 2008

Learn Physics in Right Way

Courses for NET-JRF, IIT-JAM, GATE, JEST, TIFR & Other M.Sc. Entrances

Offline Classes

Online Live Classes

Online Pre-recorded Classes

Study Material

Online Test Series

Interview Guidance

Our Teaching Methodologies

- Well Planned Course Structure
- Develop Conceptual Clarity
- Learn Problem Solving Techniques
- Build Speed and Accuracy
- Individual Mentoring
- One on One Discussion
- Instant Doubts Clearing
- Steps to Achieve Competence [QIP]
- Better Time Management
- Performance Analysis
- Student Learning Outcome

Be Part of Disciplined Learning

011-26865455, +9871145498

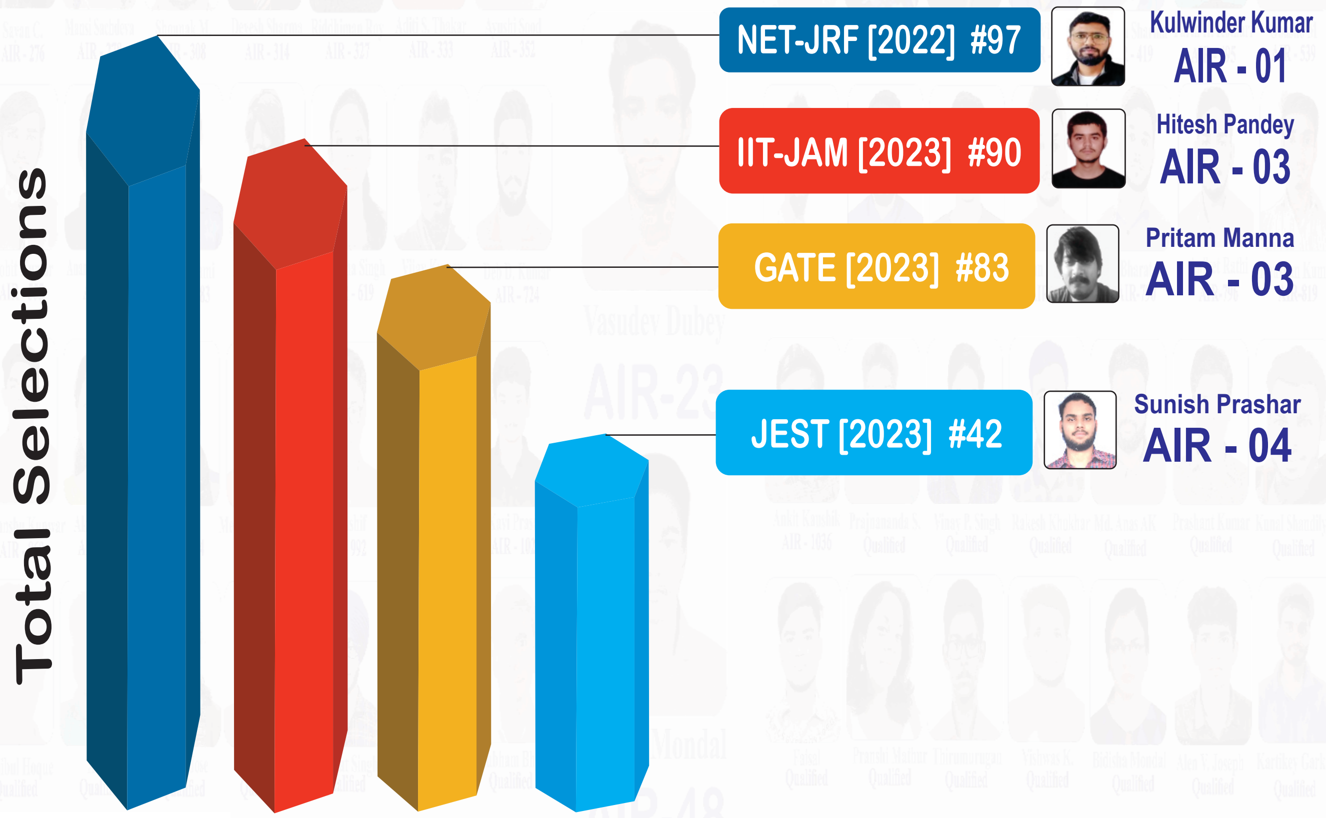
Head Office: House No. 40-D, Ground Floor, Jia Sarai Near IIT-Delhi, Hauz Khas, New Delhi-110016 fiziks

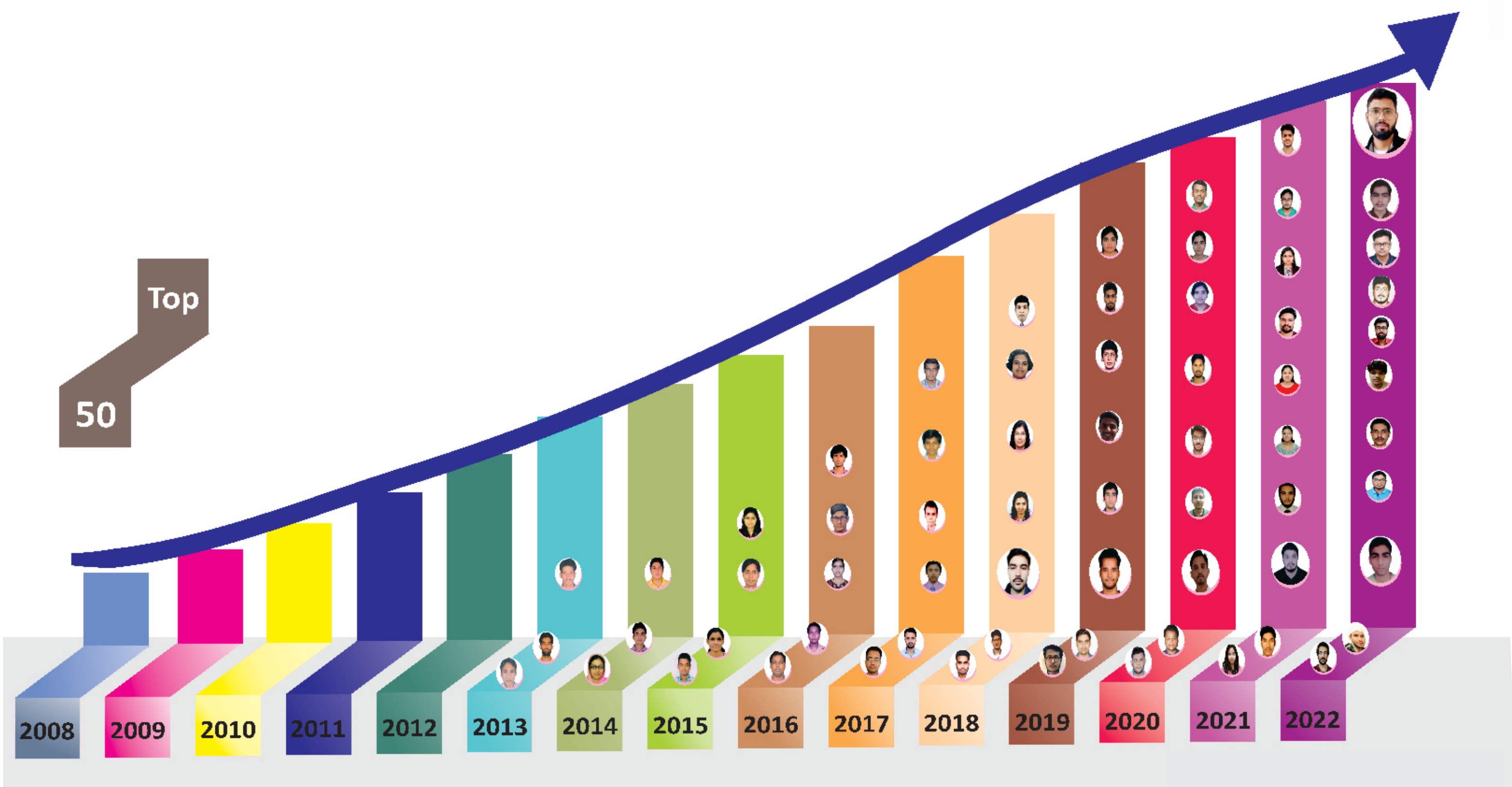
Physics by fiziks

Learn Physics in Right Way

Pioneering Excellence Since Year 2008

Achivements : Year [2022-23]





011-26865455, +9871145498

Head Office: House No. 40-D, Ground Floor, Jia Sarai
Near IIT-Delhi, Hauz Khas, New Delhi-110016