PHYSICS

BOOKS - D MUKHERJEE PHYSICS (HINGLISH)

IIT QUESTIONS 1

Straight Objective Type

1. Electrons with energy $80keV$ are incident on the tungsten target of an X - rays tube , k- shell electrons of tungsten have $72.5keV$ energy X- rays emitted by the tube contain only

A. a continuous X-ray spectrum (bremssrahlung)with a minimum wavelength of ~0.0155 nm

B. a continuous X-ray spectrum (bremsstrahlung) with all wavelengths

C. the charcterstic X-ray spectrum of tungsten

D. a continuous X-ray spectrum (bremsstrahlung) with a minimumwavelength of ~0.0155 nm and the characterstic X-ray spectrum of tungsten

Answer: d

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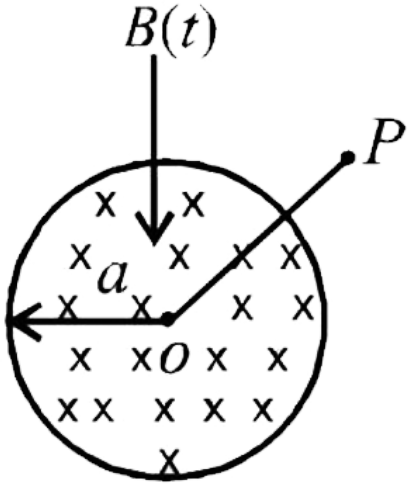
2. A uniform but time-varying magnetic field B(t) exists in a circular region of radius a and is directed into the plane of the paper, as shown. The magnitude of the induced electric field at point P at a distance r from the

centre of the circular region



A. is zero

B. decreases as $\frac{1}{r}$

C. increases as r

D. decreases as $\frac{1}{r^2}$

Answer: b

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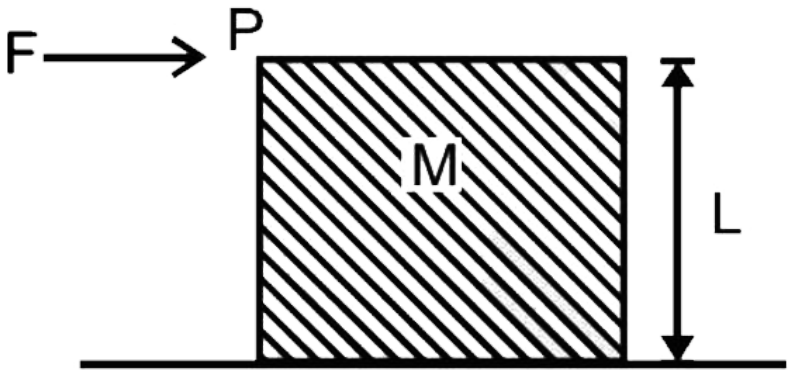
3. A cubical block of side L rests on a rough horizonta surface with coefficient of friction μ. A horizontal force F is applied on the block as shown. If the coefficient of friction is sufficiently high so that the block does not slide before toppling, the minimum force required to topple the block is



A. infinitesimal

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

C. $\frac{mg}{2}$

D. $mg(1-\mu)$

Answer: c

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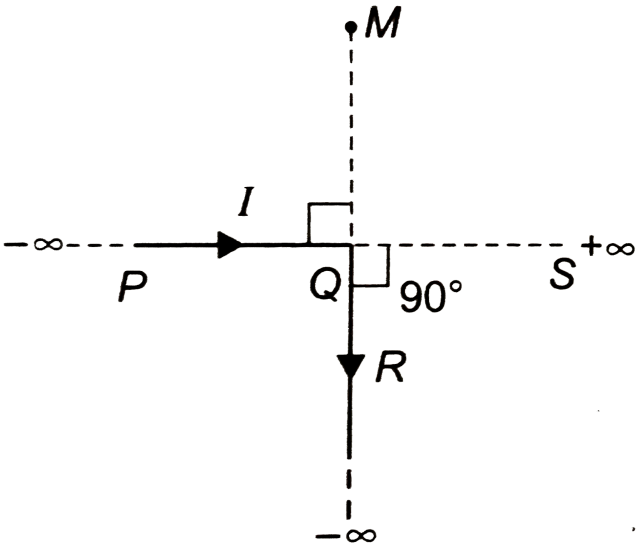
4. An infinetely long conductor PQR is bent to from a right angle as shown. A current I flows through PQR. The magnetic field due to this current at the point M is H_1.Now, another infinitely long straight conductor QS is connected at Q so that the current is $I/2$ in QR as well as in QS, the current in PQ remaining unchanged. The magnetic field at M is now H_z, the ratio H_1/H_2 is given by



A. $\frac{1}{2}$

B. 1

C. $\frac{2}{3}$

D. 2

Answer: c

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5. A train moves towards a stationary observer with speed $34m/s$. The train sounds a whistle and its frequency registered by the observer is f_1. If the train's speed is reduced to $17m/s$, the frequency registered is f_2. If the speed of sound of $340m/s$, then the ratio $f_1/f_2$is

A. $\frac{18}{19}$

B. $\frac{1}{2}$

C. 2

D. $\frac{19}{18}$

Answer: d

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6. A particle of the charged q and $massm$ moves in a circular orbit of radius r with angular speed ω . The ratio of the magnitude of its magnetic moment to that of its angular momentum depends on

A. ω and q

B. ωq and m

C. q and m

D. ω and m

Answer: c

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7. In a double slit experiment, instead of taking slits of equal widths, one slit is made twice as wide as the other. Then, in the interference pattern

A. the intensities of both the maxima and minima inceease

B. the intensity of the maxima increases but that of the minima has the zero intersity

C. the intersity of the maxima decreases but that of the minma increases

D. the intensity of the maxima decreases and the minima has the zero intersity

Answer: a

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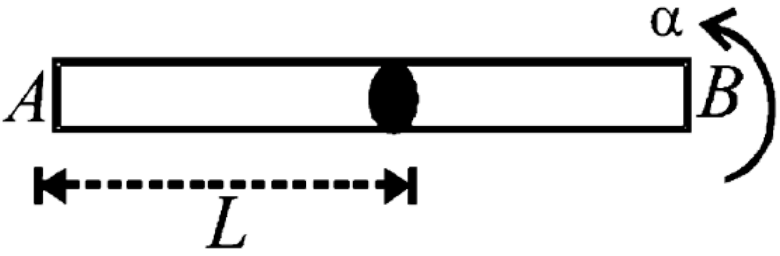
8. A long horizontal rod has a bead which can slide along its length and initially placed at a



distance L from one end A of the rod. The rod is set in angular motion about A with constant angular acceleration α. if the coefficient of friction between the rod and the bead is μ, and gravity is neglected, then the time after which the bead starts slipping is

A. $\sqrt{\frac{\mu}{\alpha}}$

B. $\frac{\mu}{\sqrt{\alpha}}$

C. $\frac{1}{\sqrt{\mu\alpha}}$

D. infinitesimal

Answer: a

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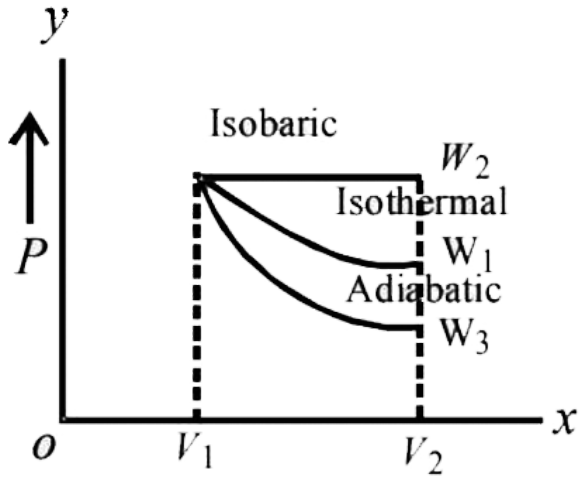
9. Starting with the same initial conditions, an ideal gas expands from volume $V_1 \rightarrow V_2$ in three different ways. The work done by the gas is W_1 if the process is purely isothermal, W_2if purely isobaric and W_3 if purely adiabatic. Then



A. $W_2 > W_1 > W_3$

B. $W_2 > W_3 > W_1$

C. $W_1 > W_2 > W_3$

D. $W_1 > W_3 > W_2$

Answer: a

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10. An ionized gas contains both positive and negative ions . If it is subjected simultaneously to an electric field along the $+x$ - direction and a magnetic field along the $+y$ - direction and the negative ions towardws $-y$ - direction

A. the positive ions deflect towards the =y-direction and nagative ions towards the -y-direction

B. all the ions deflect towards the -y-direction

C. all the ions deflect towards the -y-direction

D. the positive ions deflect towards the -y-direction and nagative ions towads the +y- direction

Answer: c

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11. The electron in a hydrogen atom makes a transition from an excited state to the ground state. Which of the following statements is true?

A. Its kinetic energy increases , and the potential and total energies decrease .

B. Its kinetic energy decreaawss but the potential energy increases , and thus the total ebergy ramains the same.

C. Its kinetic and toatal energies decrease , and the potential energy increases .

D. Its Kinetic , potential and total energyies decrease.

Answer: a

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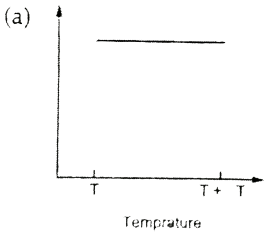
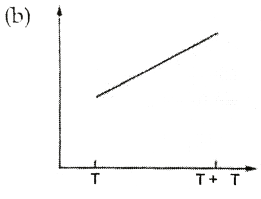
12. An ideal gas is initially at temperature T and volume V. Its volume is increased by ΔV due to an increase in temperature ΔT, pressure remaining constant. The quantity $\delta = \frac{\Delta V}{V\Delta T}$ varies with temperature as

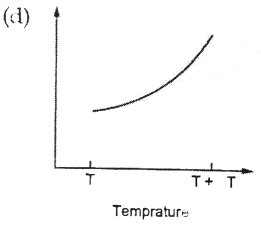
A.



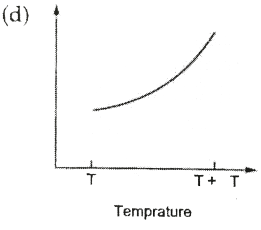
B.



C.



D.



Answer: c

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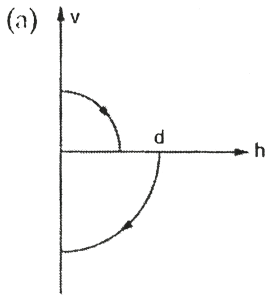
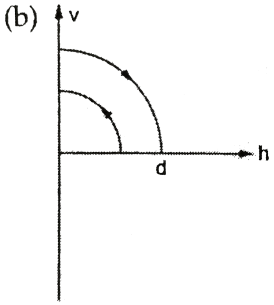
13. A ball is dropped vertically from a height d above the ground . It hits the ground and bounces up vertically to a height $(d)/(2)$. $Neg \leq ct \in g \subset sequentmotion$ and $airresis\tan ce, itsvelocity$ v$varieswiththeheighth$` above the ground as

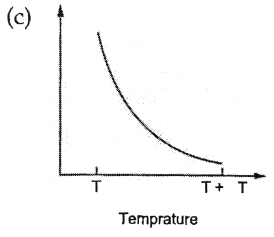
A.



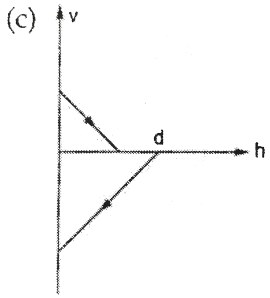
B.



C.



D.



Answer: a

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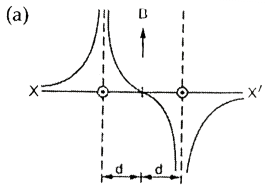
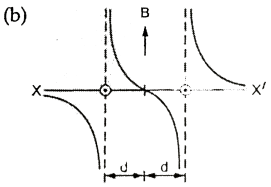
14. Two long parallel wires are at a distance $2d$ apart. They carry steady equal currents flowing out of the plane of the paper , as shown. The variation of the magnetic field B along the line XX is given by

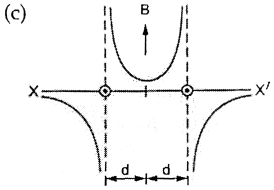
A.



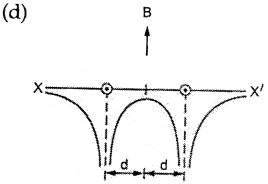
B.



C.



D.



Answer: b

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15. Two vibrating strings of the same material but lengths L and $2L$ have radii $2r$ and r respectively. They are stretched under the same tension. Both the string vibrate in their fundamental nodes, the one of length L with freuqency v_1 and the other with frequency v_2. the ratio v_1/v_2 is given by

A. 2

B. 4

C. 8

D. 1

Answer: d

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Assertion Reason Type

1. STATEMENT-I : In an elastic collision between two bodies, the relative speed of the bodies after collision is equal to the relative speed before the collision.

STATEMENT-2 : In an elastic collision, the linear momentum of the system is conserved.

A. Statement -1 is true ,Statement-2 is true , Statement -2 is a correct explantion for Statement -2

B. Statement -1 is true ,stATEMENT -2 IS TRUE , Statement -2 is not a correct explation for astatement -1.

C. Statement-1 True ,Statement-2 is false.

D. Statement-1 true ,statement-2 is true.

Answer: b

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2. Asseration : A block of mass m starts moving on a rough horizontal surface with a velocity v. It stops due to friction between the block and the surface after moving through a ceratin distance. The surface is now tilted to an angle of 30° with the horizontal and same block is made to go up on the surface with the same initial velocity v. The decrease in the mechanical energy in the second situation is small than the first situation.

Reason : The coefficient of friction between the block and the surface decreases with the increase in the angle of inclination.

A. Statement -1 is true ,Statement -2 is true , Statement -2 is a correcct explantion for Statement-1

B. Statement -1 is true ,stATEMENT -2 IS TRUE , Statement -2 is not a correct explation for astatement -1.

C. Statement-1 True ,Statement-2 is false.

D. Statement-1 true ,statement-2 is true.

Answer: c

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Linked Comprehension Type

1. Two discs A and B are mounted coaxially ona vertical axle. The discs have moments of inertia l and $2l$ respectively about the common axis. Disc A is imparted an initial angular velocity 2ω using the centre potential energy of a spring compressed by a distance x_1. Disc B is imparted

angular velocity ω by a spring having the same spring constant and compressed by a distance x_2. Both the disc rotate in the clockwise direction.

The rotation $x_1 / (x_2$ is.

A. 2

B. $\frac{1}{2}$

C. $\sqrt{2}$

D. $\frac{1}{\sqrt{2}}$

Answer: c

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2. Two discs A and B are mounted coaxially ona vertical axle. The discs have moments of inertia l and $2l$ respectively about the common axis. Disc A is imparted an initial angular velocity 2ω using the centre potential energy of a spring compressed by a distance x_1. Disc B is imparted angular velocity ω by a spring having the same spring constant and

compressed by a distance x_2. Both the disc rotate in the clockwise direction.

When disc B is brought in contact with disc A, they acquirea common angularvelocity in time t. The average frictional torque on one disc by the other during this period is -

A. $\frac{2l\omega}{3t}$

B. $\frac{9l\omega}{2t}$

C. $\frac{9l\omega}{4t}$

D. $\frac{3l\omega}{2t}$

Answer: a

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3. Two discs A and B are mounted coaxially ona vertical axle. The discs have moments of inertia l and $2l$ respectively about the common axis. Disc A is imparted an initial angular velocity 2ω using the centre potential energy of a spring compressed by a distance x_1. Disc B is imparted

angular velocity ω by a spring having the same spring constant and compressed by a distance x_2. Both the disc rotate in the clockwise direction.

The loss of kinetic energy the above process is -

A. $\frac{l\omega^2}{2}$

B. $\frac{l\omega^2}{3}$

C. $\frac{l\omega^2}{4}$

D. $\frac{l\omega^2}{2t}$

Answer: b

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Matrix Matching Type

1. Some physical quanties are given in Column I and some possible SI units in which these quantities may be expressed are given in Column II.

Match the physical quantities in Column I with the units in Column II.

	Column I		Column II
(A)	GM_eM_s G – universal gravitational constant M_e – mass of the earth, M_s – mass of the sun	(p)	(volt)(cou
(B)	$\frac{3RT}{M}$ R – universal gas constant, T – absolute temperature, M- molar mass	(q)	(kilogram)
(C)	$\frac{F^2}{q^2B^2}$ F – force, q – charge, B – magnetic field	(r)	$(\text{metre})^2$(s
(D)	$\frac{GM_e}{R_e}$ G – universal gravitational constant, M_e – mass of the earth, R_e – radius of the earth.	(s)	(farad)(vo

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