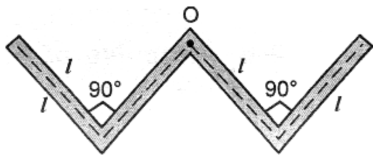
1. A thin rod of length 4l, mass 4m is bent at the points as shown in the fig. What is the moment of inertia of the rod about the axis passing point O & perpendicular to the plane of the paper.



(a) $\frac{ml^2}{3}$ (b) $\frac{10ml^2}{3}$

(c) $\frac{ml^2}{12}$ (d) $\frac{ml^2}{24}$

2. A solid sphere, a hollow sphere and a disc, all having same mass and radius, are placed at the top of an incline and released. The friction coefficients between the objects and the incline are same and not sufficient to allow pure rolling. Least time will be taken in reaching the bottom by

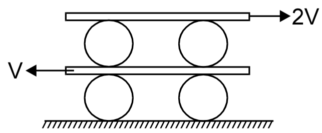
(a) the solid sphere (b) the hollow sphere

(c) the disc (d) all will take same time.

3. A uniform disc of radius R lies in the x-y plane, with its centre at origin. Its moment of inertia z-axis is equal to its moment of inertia about line y = x + c. The value of c will be

(a) –R/2 (b) $\pm\frac{R}{\sqrt{2}}$ (c) $\frac{+R}{4}$ (d) –R

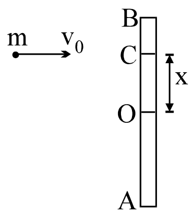
4. A system of uniform cylinders and plates is shown in figure. All the cylinders are identical and there is no slipping at any contact. Velocity of lower & upper plate is V and 2V respectively as shown in figure. Then the ratio of angular speed of the upper cylinders to lower cylinders is



(a) 3 (b) 1/3

(c) 1 (d) none of these

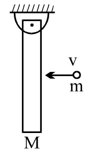
5. A uniform rod AB of length L and mass M is lying on a smooth table. A small particle of mass m strike the rod with a velocity v_0 at point C a distance x from the centre O. The particle comes to rest after collision. The value of x, so that point A of the rod remains stationary just after collision, is :



(a) L/3 (b) L/6

(c) L/4 (d) L/12

6. A uniform rod of mass M is hinged at its upper end. A particle of mass m moving horizontally strikes the rod at its mid point elastically. If the particle comes to rest after collision find the value of M/m =?



(a) 3/4 (b) 4/3

(c) 2/3 (d) none

7. A particle executing SHM on x–axis with amplitude A and time period T. The taken by the particle to travel a distance A/5 starting from rest is

(a) $\frac{T}{20}$ (b) $\frac{T}{2\pi}\cos^{-1}\left(\frac{4}{5}\right)$ (c) $\frac{T}{2\pi}\cos^{-1}\left(\frac{1}{5}\right)$ (d) $\frac{T}{2\pi}\sin^{-1}\left(\frac{1}{5}\right)$

8. A particle performs SHM of amplitude A along a straight line. When it is at a distance $\frac{\sqrt{3}}{2}A$ from mean position, its kinetic energy gets increased by an amount $\frac{1}{2}m\omega^2A^2$ due to an impulsive force. Then its new amplitude becomes

(a) $\frac{\sqrt{5}}{2}A$ (b) $\frac{\sqrt{3}}{2}A$ (c) $\sqrt{2}A$ (d) $\sqrt{5}A$

9. Time period of a particle executing SHM is 8 sec. At t = 0 it is at the mean position. The ratio of the distance covered by the particle in the 1st second to the 2nd second is:

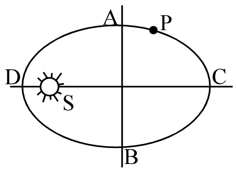
(a) $\frac{1}{\sqrt{2}+1}$ (b) $\sqrt{2}$ (c) $\frac{1}{\sqrt{2}}$ (d) $\sqrt{2}+1$

10. A space ship of mass m is in circular orbit of radius $2R_e$ about the earth of mass M and radius R_e. Energy required to transfer the space ship to circular orbit of radius $3R_e$ is

(a) $\frac{GMm}{8R_e}$ (b) $\frac{GMm}{4R_e}$ (c) $\frac{GMm}{24R_e}$ (d) $\frac{GMm}{12R_e}$

Question No. 11to 12

Figure shows the orbit of a planet P round the sun S. AB and CD are the minor and major axes of the ellipse.



11. If t_1 is the time taken by the planet to travel along ACB and t_2 the time along BDA, then

(a) $t_1 = t_2$ (b) $t_1 > t_2$ (c) $t_1 < t_2$ (d) nothing can be concluded

12. If U is the potential energy and K kinetic energy then |U| > |K| at

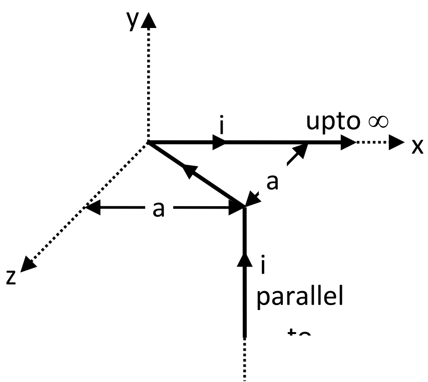
(a) Only D (b) Only C (c) both D & C (d) neither D nor C

13. A particle is moving with velocity $\vec{v} = \hat{i} + 3\hat{j}$ and it produces an electric field at a point given by $\vec{E} = 2\hat{k}$. It will produce magnetic field at that point equal to (all quantities are in S.I. units)

(a) $\frac{6\hat{i} - 2\hat{j}}{c^2}$ (b) $\frac{6\hat{i} + 2\hat{j}}{c^2}$ (c) zero

(d) cannot be determined from the given data

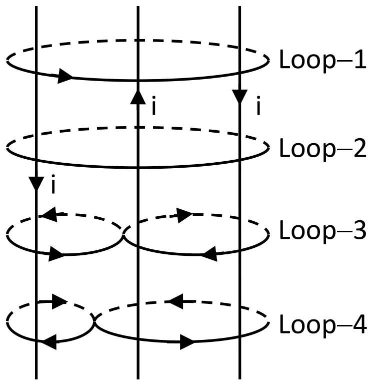
14. The magnetic field at the origin due to the current flowing in the wire is



(a) $-\frac{\mu_0 I}{8\pi a}(\mathbf{i} + \mathbf{k})$ (b) $\frac{\mu_0 I}{2\pi a}(\mathbf{i} + \mathbf{k})$

(c) $\frac{\mu_0 I}{8\pi a}(-\mathbf{i} + \mathbf{k})$ (d) $\frac{\mu_0 I}{4\pi a\sqrt{2}}(\mathbf{i} - \mathbf{k})$

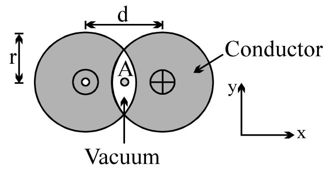
15. Three wires are carrying same constant current i in different directions. Four loops enclosing the wires in different manners are shown. The direction of $\mathbf{d\vec{l}}$ is shown in the figure.



COLUMN –I	COLUMN – II
(a) Along closed Loop –1	(P) $\oint \vec{\mathbf{B}}.\mathbf{d\vec{l}} = \mu_0 \mathbf{i}$
(b) Along closed Loop –2	(Q) $\oint \vec{\mathbf{B}}.\mathbf{d\vec{l}} = -\mu_0 \mathbf{i}$
(c) Along closed Loop –3	(R) $\oint \vec{\mathbf{B}}.\mathbf{d\vec{l}} = \mathbf{0}$
(d) Along closed Loop –4	(S) net work done by the magnetic force to move a unit charge along the loop is zero

(a) (a)→(R,S), (b)→(Q,S), (c)→(Q,P), (d)→(P,R)
(b) (a)→(Q,S), (b)→(P,S), (c)→(Q,S), (d)→(P,S)
(c) (a)→(P,S), (b)→(R,S), (c)→(Q,R), (d)→(P,Q)
(d) (a)→(Q,R), (b)→(P,R), (c)→(Q,S), (d)→(P,S)

16. Two long conductors are arranged as shown above to form overlapping cylinders, each of raidus r, whose centers are separated by a distance d. Current of density J flows into the plane of the page along the shaded part of one conductor and an equal current flows out of the plane of the page along the shaded portion of the other, as shown. What are the magnitude and direction of the magnetic field at point A?

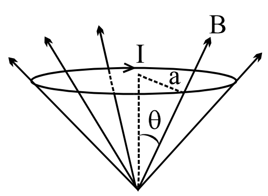


(a) $(\mu_o/2\pi)\pi dJ$, in the +y-direction
(b) $(\mu_o/2\pi)d^2/r$, in the +y-direction
(c) $(\mu_o/2\pi)4d^2J/r$, in the –y-direction
(d) $(\mu_o/2\pi)Jr^2/d$, in the –y-direction

17. A particle of charge q and mass m starts moving from the origin under the action of an electric field $\vec{E} = E_0\hat{i}$ and $\vec{B} = B_0\hat{i}$ with velocity $\vec{v} = v_0\hat{j}$. The speed of the particle will become $2v_o$ after a time

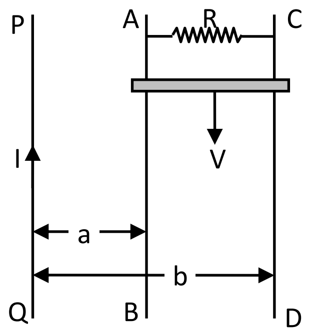
(a) $t = \frac{2mv_0}{qE}$
(b) $t = \frac{2Bq}{mv_0}$
(c) $t = \frac{\sqrt{3}\ Bq}{mv_0}$
(d) $t = \frac{\sqrt{3}\ mv_0}{qE}$

18. A circular current loop of radius a is placed in a radial field B as shown. The net force acting on the loop is



(a) zero
(b) $2\pi BaI\cos\theta$
(c) $2\pi aIB\sin\theta$
(d) None

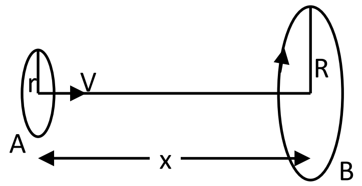
19. PQ is an infinite current carrying conductor. AB and CD are smooth conducting rods on which a conductor EF moves with constant velocity V as shown. The force needed to maintain constant speed of EF is.



(a) $\frac{1}{VR}\left[\frac{\mu_0 IV}{2\pi}\ln\left(\frac{b}{a}\right)\right]^2$ (b) $\left[\frac{\mu_0 IV}{2\pi}\ln\left(\frac{b}{a}\right)\right]^2\frac{1}{VR}$

(c) $\left[\frac{\mu_0 IV}{2\pi}\ln\left(\frac{b}{a}\right)\right]^2\frac{V}{R}$ (d) $\frac{V}{R}\left[\frac{\mu_0 IV}{2\pi}\ln\left(\frac{b}{a}\right)\right]^2$

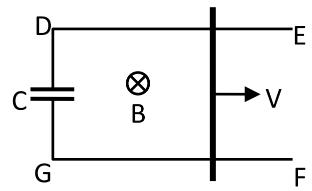
20. Loop A of radius (r<<R) moves towards loop B with a constant velocity V in such a way that their planes are always parallel. What is the distance between the two loops(x). When the induced emf in loop A is maximum



(a) R (b) $\frac{R}{\sqrt{2}}$

(c) $\frac{R}{2}$ (d) $R\left(1-\frac{1}{\sqrt{2}}\right)$

21. In the figure shown the section EDFG is fixed. A rod having resistance R is moved with constant velocity in a uniform magnetic field B as shown in figure. DE & FG are smooth and resistanceless. Initially capacitor is uncharged. The charge on the capacitor



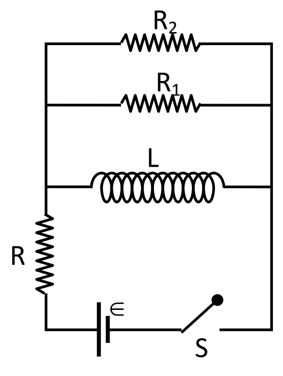
(a) remains constant

(b) increases exponentially with time

(c) increases linearly with time

(d) oscillate

22. Switch S is closed for a long time at t = 0. It is opened, then



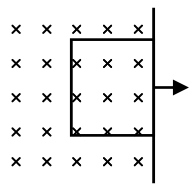
(a) total heat produced in resistor R after opening the switch is $\frac{1}{2}\frac{LV^2}{R^2}$

(b) total heat produced in resistor R_1 after opening the switch is $\frac{1}{2}\frac{LV^2}{R^2}\left(\frac{R_1}{R_1+R_2}\right)$

(c) heat produced in resistor R_1 after opening the switch is $\frac{1}{2}\frac{R_2LV^2}{(R_1+R_2)R^2}$

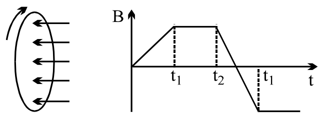
(d) no heat will be produced in R_1

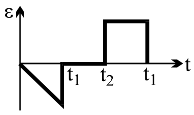
23. A square loop of area 2.5×10^{-3} m^2 and having 100 turns with a total resistance of 100 Ω is moved out of a uniform magnetic field of 0.40 T in 1 sec with a constant speed. Then work done, in pulling the loop is

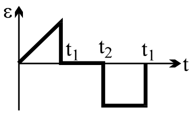


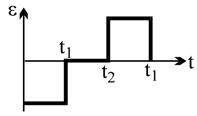
(a) zero (b) 1mJ (c) 1μJ (d) 0.1mJ

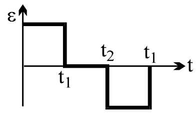
24. A wire loop is placed in a region of time varying magnetic field which is oriented orthogonally to the plane of the loop as shown in the figure. The graph shows the magnetic field variation as the function of time. Assume the positive emf is the one which drives a current in the clockwise direction and seen by the observer in the direction of B. Which of the following graphs best represents the induced emf as a function of time.



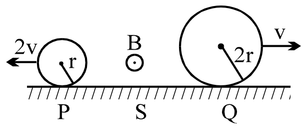
(a) 

(b) 

(c) 

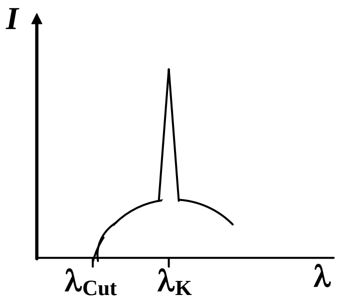
(d) 

25. Two conducting rings P and Q of radii r and 2r rotate uniformly in opposite directions with centre of mass velocities 2v and v respectively on a conducting surface S. There is a uniform magnetic field of magnitude B perpendicular to the plane of the rings. The potential difference between the highest points of the two rings is



(a) zero (b)4 Bvr (c) 8 Bvr (d) 16 Bvr

26. The intensity of X-rays from a Coolidge tube is plotted against wavelength λ as shown in the figure. The minimum wavelength found is λ_C and the wavelength of the K_α line is λ_K. As the accelerating voltage is increased



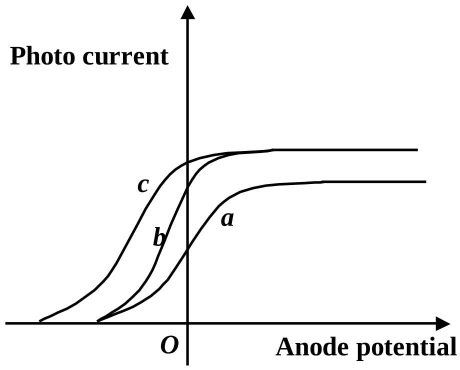
(a) $\lambda_K - \lambda_C$ increases

(b) $\lambda_K - \lambda_C$ decreases

(c) λ_K increases

(d) λ_K increases

27. The figure shows the variation of photocurrent with anode potential for a photo-sensitive surface for three different radiations. Let I_a, I_b and I_c be the intensities and ν_a, ν_b and ν_c be the frequencies for the curves *a*, *b* and *c* respectively then.



(a) $\nu_a = \nu_b$ and $I_a \neq I_b$

(b) $\nu_a = \nu_c$ and $I_a = I_c$

(c) $\nu_a = \nu_b$ and $I_a = I_b$

(d) $\nu_b = \nu_c$ and $I_b = I_c$

28. A photon collides with a stationary hydrogen atom in ground state inelastically. Energy of the colliding photon is 10.2 eV. After a time interval of the order of micro second another photon collides with same hydrogen atom inelastically with a energy of 15 eV. What will be observed by the detector?

(a) 2 photon of energy 10.2 eV

(b) 2 photon of energy of 1.4 eV

(c) One photon of energy 10.2 eV and an electron of energy 1.4 eV

(d) One photon of energy 10.2 eV and another photon of 1.4 eV

29. When the electron in a hydrogen atom jumps from the second orbit to the first orbit, the wavelength of the radiation emitted is λ. When the electron jumps from the third to the first orbit, the wavelength of the radiation emitted is

(a) $\frac{9}{4}\lambda$

(b) $\frac{4}{9}\lambda$

(c) $\frac{27}{32}\lambda$

(d) $\frac{32}{27}\lambda$

30. Let λ_α, λ_β and λ_α' denote the wavelengths of the X-rays of the K_α K_β and L_α lines in the characteristic X-rays for a metal

(a) $\lambda_\alpha' > \lambda_\alpha > \lambda_\beta$

(b) $\lambda_\alpha' > \lambda_\beta > \lambda_\alpha$

(c) $\frac{1}{\lambda_\beta} = \frac{1}{\lambda_\alpha} + \frac{1}{\lambda'_\alpha}$

(d) $\frac{1}{\lambda_\alpha} + \frac{1}{\lambda_\beta} = \frac{1}{\lambda'_\alpha}$

ANSWERS

1.	**b**	**2.**	**d**	**3.**	**b**	**4.**	**a**	**5.**	**b**	**6.**	**a**	**7.**	**a**
8.	**c**	**9.**	**d**	**10.**	**d**	**11.**	**b**	**12.**	**c**	**13.**	**a**	**14.**	**c**
15.	**b**	**16.**	**a**	**17.**	**d**	**18.**	**c**	**19.**	**a**	**20.**	**c**	**21.**	**b**
22.	**c**	**23.**	**d**	**24.**	**c**	**25.**	**c**	**26.**	**a**	**27.**	**a**	**28.**	**c**
29.	**c**	**30.**	**c**										