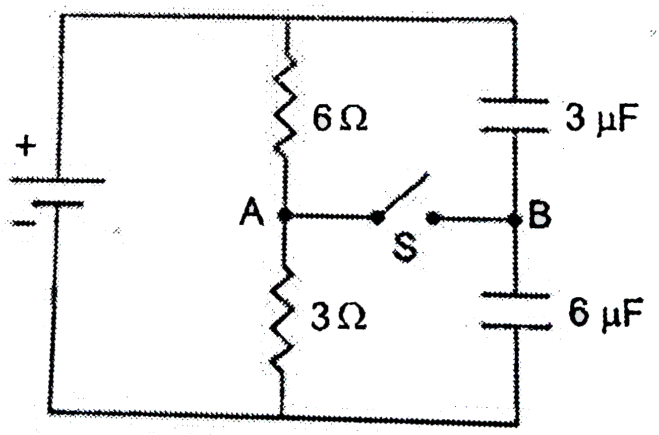
PHYSICS

BOOKS - D MUKHERJEE PHYSICS (HINGLISH)

MISCELLANEOUS QUESTION 1

Miscellaneous Questions 1 Straight Objective Type

1. 

In the circuit shown above, when then switch S is closed,

A. no charge flows through S

B. charge flows from A to B

C. charge flows from B to A

D. charge flows initially from A to B and later from B to A

Answer: A

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2. The horizontal range of a projectile is R and the maximum height at tained by it is H. A strong windnow begins to blow in the direction of the motion of the projectile, giving it a constant horizontal acceleration = g/2. Under

the same conditions of projection, the horizontal range of the projectile will now be:

A. $R + \frac{H}{2}$

B. $R + H$

C. $R + \frac{3H}{2}$

D. $R + 2H$

Answer: D

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3. A small object O is placed in front of a convex mirror, formin a virtual image, I A narrow beam of light is now made incident on the mirror, aimed at I. After reflection at the mirror, the bea, will reach O

A. In all cases

B. only if the beam of light moves very close to the axis OI

C. only if the distance of O from the mirror is small compared to the radius of

curvature of the mirror

D. only if both (b) and (c) are satisfied

Answer: A

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4. A particle of mass m and charfe Q is placed in an electric filed W which varies with time t as E = $E_0 \sin \omega t$. It will undergo simple harmonic motion of amplitude.

A. $\frac{QE_0^2}{m\omega^2}$

B. $\frac{QE_0}{m\omega^2}$

C. $\sqrt{\frac{QE_0}{m\omega^2}}$

D. $\frac{QE_0}{m\omega}$

Answer: B

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5. In a Young's double-slit experiment using identical slits, when one slit is used, the total energy reaching the screen is E_0 and the intensity of light at any point on the screen is

I_0. When both slits are usedm and fringes are formed on the screen, the total energy reaching the screen is E and the maximum intensity on the screen is I. Then,

A. $E = 2E_0, I = 2I_0$

B. $E = 4E_0, I = 4I_0$

C. $E = 2E_0, I = 4I_0$

D. $E = 4E_0, I = 2I_0$

Answer: C

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6. In a Young's double-slit experiment using slits of unequal widths, the intensities on the screen due to the slits are in the ratio $4:9$ when the slits are used separately. When they are used together, the ratio of the intensity at a dark fringe to the intensty at a bright fringe on the screen will be

A. $4:9$

B. $1:9$

C. $9:16$

D. $1:25$

Answer: D

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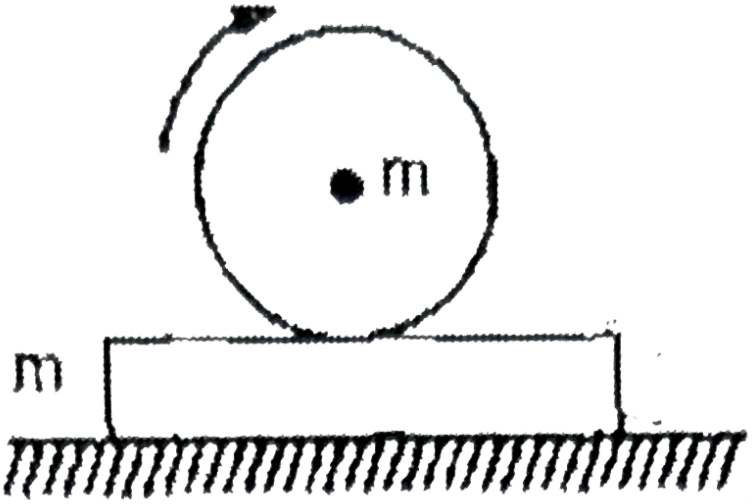
7. A sphere of mass m is given some angular velocity about a horizontal axis through the center, and gently placed on a plank of mass m. The coefficient of friction between the two is μ. The plank rests on a smooth horizontal surface. The intial acceleration of the sphere relative to

the plank will be:



A. zero

B. μg

C. $\frac{7}{5}\mu g$

D. $2\mu g$

Answer: D

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8. when beats are formed between sound waves of slightly different frequencies, the intensity of the sound heard changes form maximum to minimum in $0.2s$. The difference in frequencies of the two sound waves is

A. $5Hz$

B. $4hz$

C. $2.5Hz$

D. $2Hz$

Answer: C

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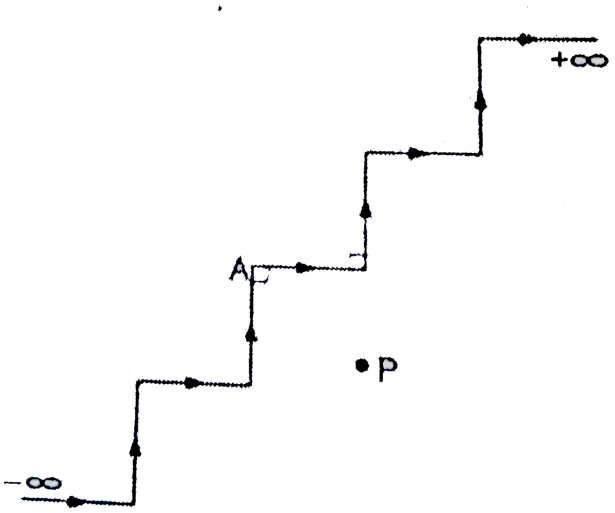
9.



an infinitely long thin conductor, shaped as shown, carries current. Each section is of the same length. The magnetic field at the point P

due to the secion from $-\infty$ to A is B. The field at P due to the entire conductor is

A. zero

B. B

C. $\sqrt{2}B$

D. $2B$

Answer: D

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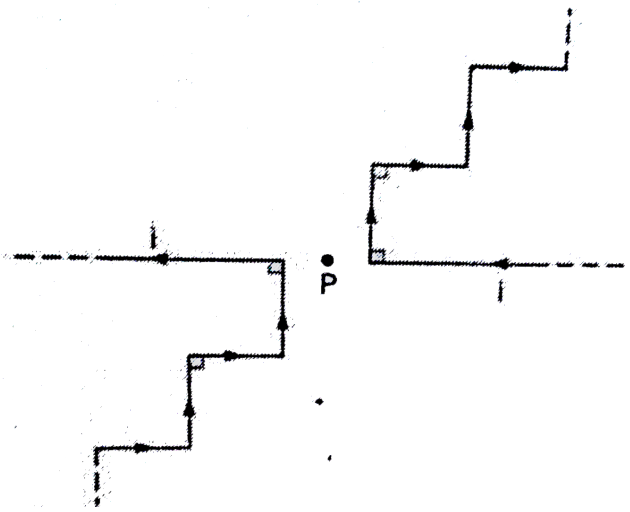

10.

Two infinitely long conductors carrying equal currents are shaped as shown. The short sectins are all of equal lengths. The point P is located symmetrically with respect to the two conductors. The magnetic filed at due to any one conductor is B. The total field at P is

A. zero

B. B

C. $\sqrt{2}B$

D. $2B$

Answer: A

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11. A satellite can be in a geostationary orbit around earth in an orbit of radius r. If the angular velocity of earth about its axis doubles,

a satellite can now be in a geostationary orbit

aroun earth radius

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

B. $\frac{r}{2\sqrt{2}}$

C. $\frac{r}{4^{1/3}}$

D. $\frac{r}{2r^{1/3}}$

Answer: C

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12. A bullet moving with a velcity u passes through a plank which is free to move. The two are of equal mass. After pssing through the plank, the velocity of the bullet becomes fu. Its velocity relative to the plank now is

A. fu

B. $(1-f)u$

C. $(2f-1)u$

D. $(2-f)u$

Answer: C

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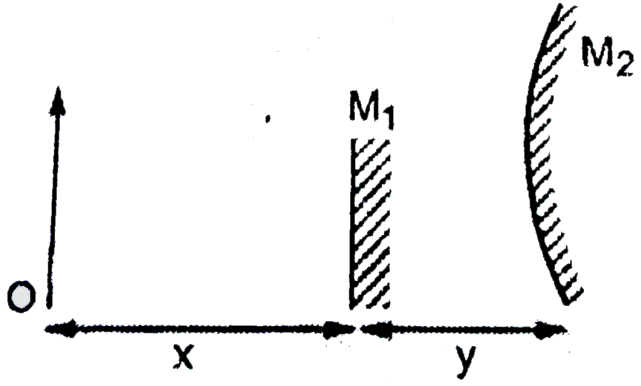
13.



An object O is placed in front of a small plane mirror M_1 and a large convex mirror M_2 of focal length f. The distance between O and M_1 is x, and the distance between M_1 and M_2 is y. The images of O forned by M_1 and M_2 coincide. The magnitude of f is

A. $\frac{x^2 - y^2}{2y}$

B. $\frac{x^2 + y^2}{2y}$

C. $x - y$

D. $\frac{x^2 + y^2}{x - y}$

Answer: A

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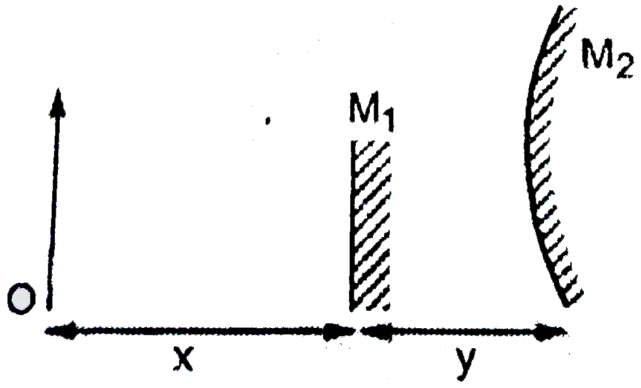
14.



An object O is placed in front of a small plane mirror M_1 and a large convex mirror M_2 of focal length f. The distance between O and M_1 is x, and the distance between M_1 and M_2 is y. The images of O forned by M_1 and M_2 coincide. The magnitude of f is

A. $\frac{y^2 - x^2}{2y}$

B. $\frac{y^2 + x^2}{2y}$

C. $y - x$

D. $\frac{y^2 + x^2}{y - x}$

Answer: A

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15. In a uniform magnetic field of 10^{-5} T in free space, the energy density is u. The electric field which will produce the same energy density in free space is

A. $10^5 V/m$

B. $3 \times 10^3 V/m$

C. $10 V/m$

D. $9 \times 10^{-3} V/m$

Answer: B

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16. A block of mass m is placed on a horizontal surface. The coefficient of frication between them is μ. The block has to be moved by

applying a single external force on it. The force may be applied in my direciton. The minimum value of this force must be

A. mg, applied vertically upward, if $\mu > 1$

B. μmg, applied horizontally, if $\mu < 1$

C. $\frac{\mu mg}{\sqrt{\mu^2 + 1}}$ for all values of μ

D. $\frac{\mu^2 mg}{\mu^2 + 1}$ for all values of μ

Answer: C

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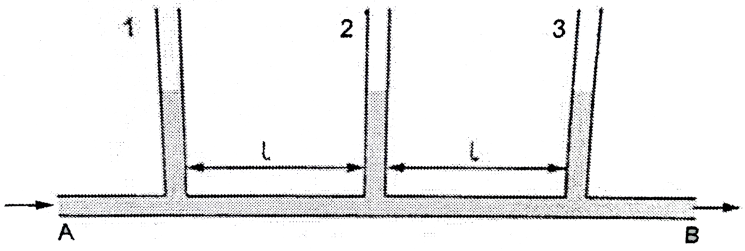
17. 

An ideal liqquid flows through the horizontal pipe AB, which is of uniform cross-section. The vertical pipes $1, 2$ and 3 equispaced. The liqudi levels in these pipes are at heightes $h_1, h_2 h_3$ respectively above AB. Liquid flows from A to B in AB.

A. $h_1 = h_2 = h_3$

B. $h_2 = \frac{1}{2}(h_1 + h_3)$

C. $h_2 > \frac{1}{2}(h_1 + h_3)$

D. $h_2 < \frac{1}{2}(h_1 + h_3)$

Answer: A

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18. A number of spherical conductors of different radii are given charge such a that the charge density of each condutor is inversely proportional to its radius. The conductors will have

A. the same potential

B. the same potential energy

C. the same charge

D. potentials inversely proportional to their radii

Answer: A

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19. A block of mass m slides down an inclined plane which makes an angle θ with the horizontal. The coefficient of friction between

the block and the plane is μ. The force exerted by the block on the plane is

A. $mg\cos\theta$

B. $\sqrt{\mu^2+1}mg\cos\theta$

C. $\frac{\mu mg\cos\theta}{\sqrt{\mu^2+1}}$

D. $\mu mg\theta$

Answer: B

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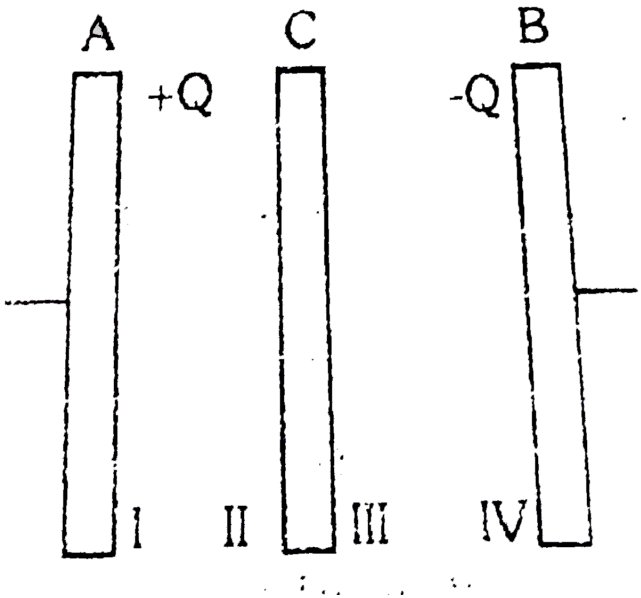
20. Plates A and B constitute an isolated, charge parallel plate capacitor. The inner surface (I and IV) of A and B have charge +Q and -Q respectively. A third plate C with charge +Q is now introduced midways between A and B. Which of the following statement is not

correct?



A. The surface I and II will have equal and opposite charges.

B. The surfaces III and IV will have equal and oppsite charges.

C. The charge of surface III will be greater than Q.

D. The potential difference beween A and C will be equal to the potential difference between C and B.

Answer: B

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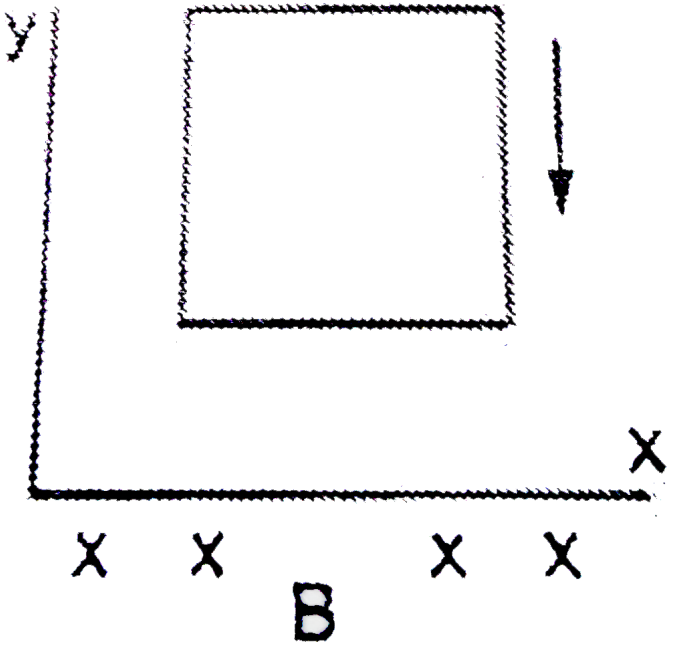
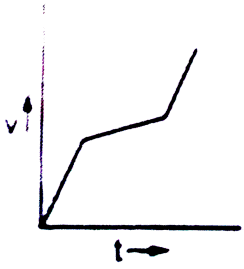


21.

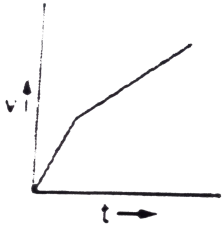
A square, conducting loop falls from rest in the xy-plane. There is a uniform magnetic field in the z-direction below the x-axis. The velocity v of the loop is plotted against time t. Which of

the following best represents the resulting curve

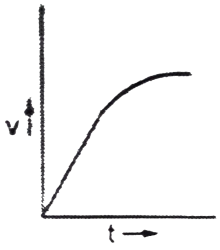
A.



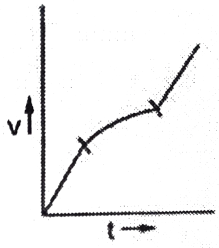
B.



C.



D.



Answer: D

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22. A wheel of radius R rolls without slipping on the horizontal surface with speed v_0. When the contact point is P on the road, a small patch of mud separates from the wheel at its

highest point strikes the road at point Q. Find distance PQ.

A. $2v\sqrt{\frac{r}{g}}$

B. $2\sqrt{2}v\sqrt{\frac{r}{g}}$

C. $4\sqrt{\frac{r}{g}}$

D. $v\sqrt{\frac{r}{g}}$

Answer: C

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23. An isolated parallel-plate capacitor of capacitor C has paltes X and Y. If plate X is given charge Q, the potential difference between X and Y Is

A. zero

B. $\frac{2Q}{C}$

C. $\frac{Q}{C}$

D. $\frac{Q}{2C}$

Answer: D

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24. In the previous question , if Y is earthed, what amount of charge wll flow Y into the earth?

A. zero

B. Q

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

D. $-\frac{Q}{2}$

Answer: B

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25. Three stars A, B, C have surface temperatures T_A, T_B and T_C. A appaears bluish, B appears reddish and C appears yellowish. We can conclude that

A. $T_A > T_C > T_B$

B. $T_A > T_B > T_C$

C. $T_B > T_C T_A$

D. $T_C > T_B > T_A$

Answer: A

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26. A horizontal rod rotates about a vertical axis through one end. A ring, which can slide along the rod witgour friction, is initially close to the axis and then slides to the other end of the rod. In this process, which of the following quantities will be conserved?

{L = angular momentum, E_T = total kinetic energy, E_R = rotational kientic energy.]

A. L only

B. L and E_T only

C. L and E_R only

D. E_T only

Answer: B

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27. Two electric lamps A and B radiate the same power. Their filaments have the same diemensions, and have emissivities. e_A and e_B.

Their surface tempratures are T_A an T_B. The ratio T_A / T_B will be equal to

A. $\left(\frac{e_B}{e_A}\right)^{1/4}$

B. $\left(\frac{e_B}{e_A}\right)^{1/2}$

C. $\left(\frac{e_A}{e_B}\right)^{1/2}$

D. $\left(\frac{e_A}{e_B}\right)^{1/4}$

Answer: A

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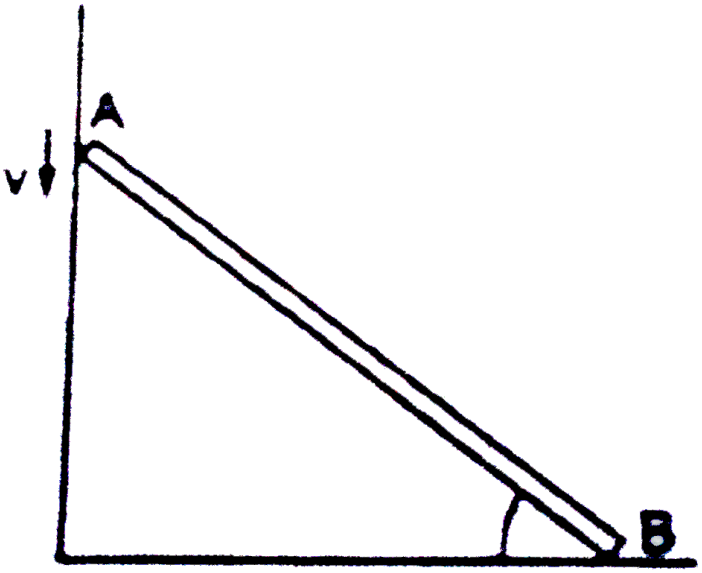
28. Then end A of a rod slides down a smooth wall and its end B slides on a smooth floor. When AB makes angle α with the horizontal, A has speed v. The speed of B must be



A. $\frac{v}{\tan\alpha}$

B. $v \tan \alpha$

C. $\frac{v}{\cos \alpha}$

D. $v \sin \alpha$

Answer: D

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29. An electric dipole has moment $\vec{p} = p\vec{i}$. Two point which are at equal distances from the dipole, and far away from it, have electric

intensities $E_1 \vec{i}$ and $-E_2 \vec{i}$. The ratio E_1 / E_2 must be

A. 1

B. $\sqrt{2}$

C. 2

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

Answer: A

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30. When a reciever of sound (e.g., microphone diaphragm or human eardrum) is receiving sound, the nature of its vibration is most likely to be

A. free

B. forced

C. resonance

D. similar to that of stationary waves

Answer: B

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31. A lens of power $16D$ is used as a simple microscope. In order to obtain maximum magnification, at what distance from the lens

A. $5cm$

B. $10cm$

C. $16cm$

D. $25cm$

Answer: A

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32. In the previous question, what is the range of the magnification that can be obtained

A. 4 to inifinity

B. 5 to infinity

C. 4 to 5

D. 5 to 6.25

Answer: C

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33. A flat, rectangular coil is placed in a uniform magnetic field and rotated about an axis passing through its centre, parallel to its shorter edges and perpendicular to the filed. The maximum emf induced is E. If the axis is shifted to coincide with one of the shorter edges, the maximum induced emf will be

A. zero

B. $E/2$

C. E

D. $2E$

Answer: C

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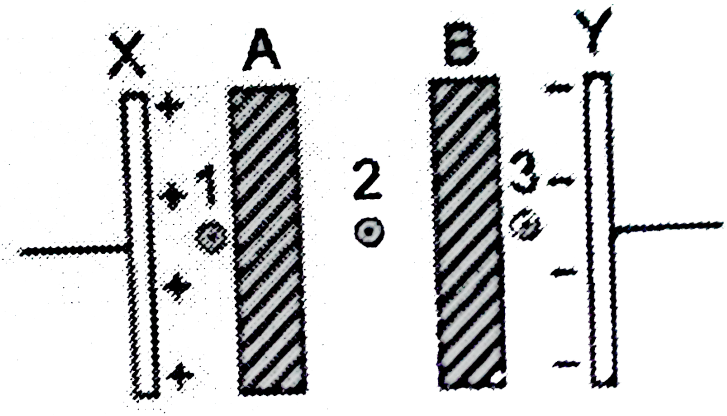

34.

Two identical dielectric slabs, A and B, are placed symmetrically between the plates X and Y of charged parallel-plate capacitor. The

electric intensity has magnitudes E_1 / E_2 and E_3 at the points $1, 2$ and 3

A. $E_1 > E_2 > E_3$

B. $E_1 = E_3 < E_2$

C. $E_1 = E_3 > E_2$

D. $E_1 = E_2 = E_3$

Answer: D

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35. A coil with resistance R is placed in a magnetic field. The flux linked with the coil is ϕ. If the magnetic filed suddently reverses in direction, how much charge will circulate in the coil?

A. $\frac{\phi}{2R}$

B. $\frac{\phi}{R}$

C. $\frac{2\phi}{R}$

D. zero

Answer: C

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36. One mole gas is first colled from $300K$ to $150K$ at constant volume and then heated from $150K$ to $300K$ at constant pressure. The net heat absorbeed by the gas is

A. zero

B. $150R$

C. $300R$

D. $450R$

Answer: B

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37. In the X-rays produced by a Coolidge tube let λ_C be the cut-off wavelength , λ_α be the wavelength of the K_α line and λ_β be the wavelength of the K_β the.

A. $\lambda_\beta > \lambda_\alpha > \lambda_C$

B. $\lambda_\alpha > \lambda_\beta > \lambda_C$

C. $\lambda_\alpha > \lambda_C > \lambda_\beta$

D. $\lambda_\beta > \lambda_C > \lambda_\alpha$

Answer: B

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38. A capacitor of capacitance C is given charge Q and then connected in parallel to a coil of inductance L. There is no resitance in the circuit. When the charge on the capacitor becomes zero, the current in the coil will be

A. $Q\sqrt{\frac{L}{C}}$

B. $\frac{Q}{\sqrt{LC}}$

C. $Q\sqrt{\frac{C}{L}}$

D. zero

Answer: B

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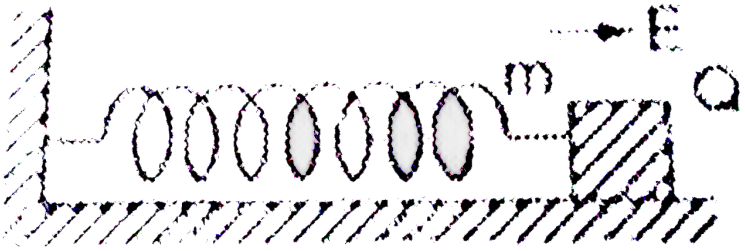
39.



In the spring-block system shown, the block

oscillates on a smooth horizontal surface with time period T. It is now given some charge Q and an electric filed E is swiched on, as shown. The block will not oscilalte with time period `T', where

A. $T' > T$

B. $T' = T$

C. $T' < T$

D. T' may be $>$ or $< T$ depending on the magnitude of m, Q and E

Answer: B

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40. An organ pipe filled with oxygen gas at $47^\circ C$ resoantes in its fundamental mode at a frequencey $300Hz$. If its is now filled with nitrogen gas, at what temperature will it resonate at the same frequency, in the fundamental mode?

A. $7^\circ C$

B. $27^\circ C$

C. $87^\circ C$

D. $107^\circ C$

Answer: A

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41. Two conducting spheres of unequal radii are given cahrge such that they have the same charge density. If they are now brought in contact,

A. no charge will be exchanged between tem

B. charge will flow the larger to the smaller sphere

C. charge will flow from the smaller to the larger sphere

D. some heat will be produced

Answer: B::D

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42. Two particles are projected simultaneously from the same point, with the same speed, in

the same vertical plane, and at different angles with the horizontal in a uniform gravitational field acting vertically downwards. A frame of reference is fixed to one particle. The position vector of the other particle , as observed from this frame, is $\overrightarrow{r}$. Which of the following statement is correct?

A. $\overrightarrow{r}$ is a cosntant vector.

B. $\overrightarrow{r}$ changes in magnitudes and direction with time.

C. The magnitude of $\overrightarrow{r}$ increases linearly with time, its direciton does not change.

D. The direaction of $\overrightarrow{r}$ changes with time, its magnitudes may or may not change, depending on the angles of projection.

Answer: C

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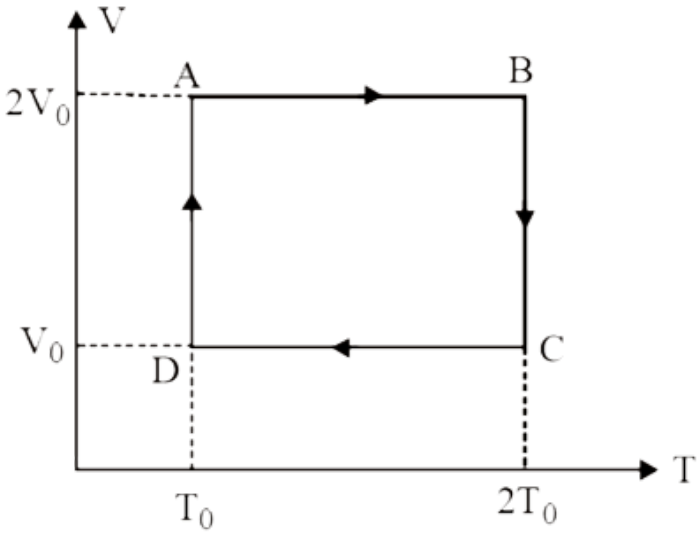
43. One mole of an ideal gas is taken through the cyclic through the cyclic process shown in

the V-T diagram, where V=volume and T-absolutute temperature of the gas. Which of the following statements are correct



A. Heat of given out by the gas.

B. Heat is absorbed by the gas.

C. The magnitude of the work done by the gas is RT_0 In 2.

D. The magnitude of the work done by the gas is V_0T_0.

Answer: A::C

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44. A parallel-plate capacitor is connected to a cell. Its positive plate A and its negative plate B have charges $+Q$ and $-Q$ respectively. A

third plate C, identical to A and B, with charge $+Q$, is now introduced midway between A and B, parallel to them. Which of the following are correct?

A. The charge on the inner face of B is now $-\frac{3Q}{2}$.

B. There is no charge in the pontential difference between A and B.

C. The potential difference between A and C is one-third of

D. The charge on the inner face of A is not Q/2.

Answer: A::B::C::D

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45. A ring of radius R has uniformly distributed charge. It spins about its axis with an angular velocity ω. P is a point on its axis at a distance x from its centre. The velocity of light in vecuum

is c. The ratio of the magnetic field to the electric field at P is proportional to

A. ω

B. R^2

C. $\frac{1}{x}$

D. $\frac{1}{c^2}$

Answer: A::B::C::D

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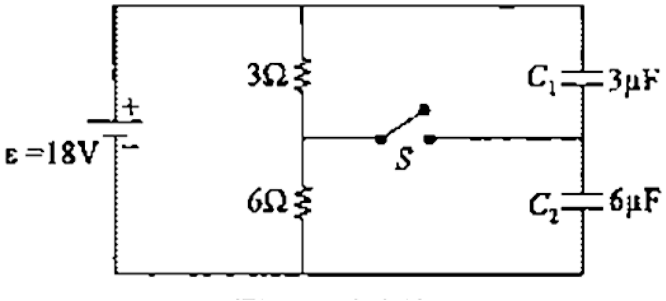
46. In the circuit shown, which of the following statement(s) is/are correct ?



A. When S is open, charge on C_1 is $36\mu C$.

B. When S is open, charge on C_2 is $36\mu C$.

C. When S is closed, the charges on C_1 and C_2 do not change.

D. When S is closed, charges on both C_1 and C_2 change.

Answer: A::B::D

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47. Two sounds of equal amplitude and frequencies, n_1 and n_2, reach a point together. The resultant wave can have which of the following forms (symbols have their usual meanings) ?

A.

$$y = A\sin\left[\left(\frac{n_1 - n_2}{2}\right)t\right]\sin\left[\left(\frac{n_1 + n_2}{2}\right)t\right]$$

B.

$$y = A\cos\left[\left(\frac{n_1 - n_2}{2}\right)t\right]\cos\left[\left(\frac{n_1 + n_2}{2}\right)t\right]$$

C. $y = A\sin[(n_1 - n_2)t]\cos[(n_1 + n_2)t]$

D. $y = A\sin[(n_1 - n_2)t]\sin\left[\left(\frac{n_1 + n_2}{2}\right)t\right]$

Answer: A::B

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48. A particle moving with kinetic energy $3J$ makes an elastic head-on collision with a stationary particle which has twice its mass. During the impact :-

A. the minimum kinetic energy of the system is $1J$

B. the maximum and total energy are conserved at every instant

C. momentum and total energy are conserved at every instant

D. the ratio of kinetic energy to potential energy of the system first decreases and then increases

Answer: A::B::C::D

49. A hollow closed conductor of irregular shape is given some charge . Which of the following statements are correct ?

A. The entire charge will appear on its outer surface.

B. All points on the conductor will have the same potential.

C. All points on its surface will have the same charge density.

D. All points near its surface and outsiede it will have the same electric intensity.

Answer: A::B

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50. A particle moves in the xy plane with a constant acceleration 'g' in the negative- direction. Its equation of motion is $y = ax - bx^2$, where a and b are constants. Which of the following are correct?

A. The x-component of its velocity is constant.

B. At the origin, the y-component of its velocity is $a\sqrt{\frac{g}{2b}}$.

C. At the origin, its velocity makes an angle $\tan^{-1} a$ with the x-axis.

D. The particles moves exactly like a projectile

Answer: A::B::C::D

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51. A converging lens of focal length f is placed in front of a fixed oject, at a distance f from it. The lens is then moved away from the object

with a constant velocity. The velocity of the image will

A. be constant

B. always be directed towards the object

C. pass through a maximum

D. be zero when the distance of the lens from the object is $2f$.

Answer: D

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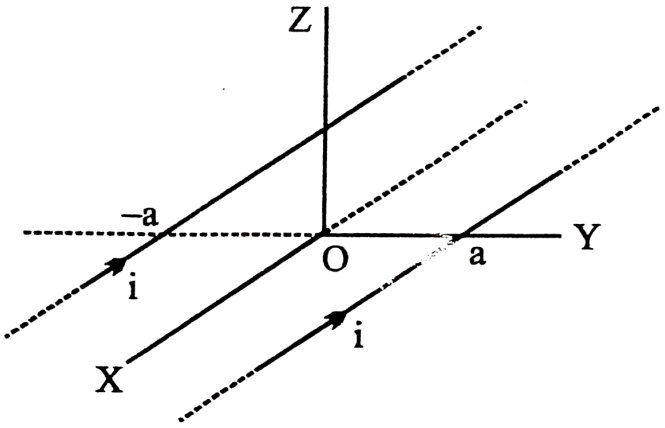
52. Two long thin, parallel conductors carrying equal current in the same direction are fixed parallel to the x-axis one passing through magnetic field due to the two conductors at any point is B Which of the following are correct ?(A) B=0 for all points on the x-axis (B) At all points on the y-axis, excluding the origin, B has only a zcomponent. (C) At all points on the z-axis, excluding the origin, B has only an x-

component.



A. $B = 0$ for all points on the x-axis

B. At all points on the y-axis. Excluding the origin, B has only a z- component.

C. At all points on the z-axis. Excluding the origin, B has only a y- component.

D. B cannot have an x-component.

Answer: A::B::C::D

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53. A thin walled spherical conducting shells S of radius R is given charge Q,the same amount of charge is also placed at its centre C.Which of the following statements are correct.

A. On the outer surface of S. The charge density is $\frac{Q}{2\pi R^2}$.

B. The electric field is zero at all points inside S.

C. At a point just outside S, the electric field is double the field is double the field at point just inside S.

D. At any point inside S, the electric field is inversley proportional to the square of its dentance from C.

Answer: A::C::D

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54. A man can swim with velocity v relative to water. He has to cross a river of width d flowing with a velocity $u(u > v)$. The distance through which he is carried down stream by the river is x. Which of the following statements is correct?

A. If he crosses the river in minimum time, $x = \frac{du}{v}$.

B. x cannot be less than $\frac{du}{v}$.

C. For x to be minimum, he has to swim in a direction making an angle of

$\frac{\pi}{2} + \sin^{-1}(v/u)$ with the direction of the flow of water.

D. x will be maximum if he swims in a direction making an angle of $\frac{\pi}{2} 0 \sin^{-1}(v/u)$ with the direction of the flow of water.

Answer: A::C

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