PHYSICS

BOOKS - SARAS PUBLICATION

Electrostatics

Example

1. Three points charges +q,-2q and +q are placed at points (x=0,y=a,z=0),(x=0,y=0,z=0)and (x=a,y=0,z=0) respectively.The magnitude and

direction of the electric dipole moment vector of this charge assembly are .

A. $\sqrt{2}$qa along + x direction

B. $\sqrt{2}$qa along + y direction

C. $\sqrt{2}$qa along the line joining points (x=0,y=0,z=0)and()x=a,y=a,z=0)

D. qa along the line joining points(x=0,y=0,z=0)and (x=a,y=a,z=0)

Answer:

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2. The electric potential at a point in free space due to a charge Q coulomb is $Q \times 10^{11}$ volts. The electric field at the point is:

A. $4\pi\varepsilon_0 Q \times 10^{22}$volt/m

B. $12\pi\varepsilon_0 Q \times 10^{20}$ volt/m

C. $4\pi\varepsilon_0 Q \times 10^{20}$volt/m

D. $12\pi\varepsilon_0 Q \times 10^{22}$ volt/m

Answer:

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3. The energy required to charge a parallel plate condenser of plate separation d and plate area of cross-section A such that the uniform electric field between the plates is E, is:

A. $\frac{1}{2}\varepsilon_0 \frac{E^2}{Ad}$

B. $\varepsilon_0 \frac{E^2}{Ad}$

C. $\varepsilon_0 E^2 Ad$

D. $\frac{1}{2}\varepsilon_0 E^2 Ad$

Answer:

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4. In the phenomenon of electric discharge through gases at low pressure,the coloured glow in the tube appears as a result of :

A. excitation of electrons in the atoms

B. collision between the atoms of the gas

C. collisions between the charged particles emitted from the cathode and the atoms of the gas

D. collision between different elections of the atoms of the gas

Answer:

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5. A galvanometer of resistance 50Ω is connected to a battery of 3V along with a resistance of 2950 Ω in series. A full scale deflection of 30 divisions is obtained in the galvanometer. In order to reduce this deflection to 20 divisions, the resistance in series should be:

A. 5050 Ω

B. 5550Ω

C. 6050Ω

D. 4450Ω

Answer:

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6. The two ends of a rod of length L and a uniform cross-sectional area are kept at two temperatures T_1 and T_2 $(T_1 > T_2)$. The rate of heat transfer ,$d\frac{Q}{dt}$ through the rod in a steady state is given by:

A. $\frac{dQ}{dt} = k\frac{T_1 - T_2}{LA}$

B. $d\frac{Q}{dt} = KLA(T_1 - T_2)$

C. $\left(d\frac{Q}{dt}\right) = \frac{KA(T_1 - T_2)}{L}$

D. $\frac{dQ}{dt} = \frac{k(T_1 - T_2)}{A}$

Answer:

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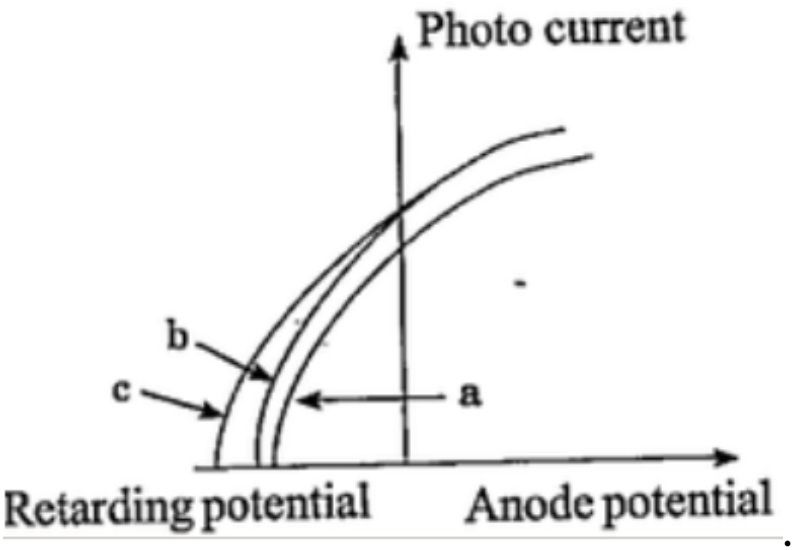
7. The Figure shows a plot of photo current versus anode potential for a photo sensitive surface for three different radiations. Which one

of the following is a correct statement ?



A. curves (a) and (b) represent incident radiations of same frequency but of different intensities.

B. curves (b) and (c) represent incident radiations of different frequencies and

different intensities.

C. curves (b) and (c) represent incident radiations of same frequency having same intensity.

D. curves (a) and (b) represent incident radiations of different frequencies and different intensities.

Answer:

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8. Three capacitors each of capacitance C and of breakdown voltage V are joined in series. The capacitance and of breakdown voltage of the combination will be :

A. 3C, $\frac{V}{3}$

B. $\frac{C}{3}$, V

C. 3C, 3V

D. $\frac{C}{3}$, $3V$

Answer:

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9. The electric potential at a point (x,y,z) is given by $V = -x^2y - xz^3 + 4$.The electric field $\vec{E}$ at the point is:

A. $\vec{E} = \hat{i}2xy + \hat{j}\left(x^2 + y^2\right) + \hat{k}\left(3xz - y^2\right)$

B. $\vec{E} = \hat{i}z^3 + \hat{j}xyz + kz^2$

C. $\vec{E} = \hat{i}\left(2xy - z^3\right) + \hat{j}xu^2 + \hat{k}3z^2x$

D. $\vec{E} = \hat{i}\left(2xy + z^3\right) + \hat{j}x^2 + \hat{k}3xz^2$

Answer:

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10. The electric field part of an electromagnetic wave in a medium is represtented by E_x=0., E_y =2.5$\frac{N}{C}$ cos $\left[\left(2\pi \times 10^{6} ra \frac{d}{s}\right)t - \left(\pi \times 10^{-2} ra \frac{d}{m}\right)x\right], E_z = 0$. The wave is,

A. moving along x direction with frequency 10^{6} Hz and wave length 100 m.

B. moving along x direction with frequency 10^{6} Hz and wave length 200 m.

C. moving along -x direction with frequency 10^{6} Hz and wave length 200 m.

D. moving along y direction with frequency $2\pi \times 10^6$ Hz and wave length 200 m.

Answer:

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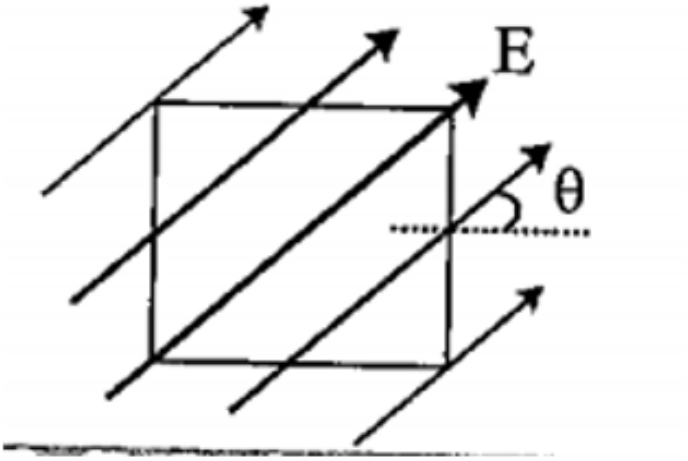
11. A square surface of side L metre in the plane of the paper is placed in a uniform electric field $E(vo < /m)$ acting along the same plane at an angle$\theta$with the horizontal side of the square as shown in figure.The electric flux linked to the

surface in units of volt meter is:



A. EL^2

B. $EL^2 \cos\theta$

C. $EL^2 \sin\theta$

D. Zero

Answer:

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12. A square current carrying loop is suspended in a uniform magnetic field acting in the plane of the loop. If the force on one arm of the loop is $\vec{F}$, the net force on the remaining three arms of the loop is :

A. $\vec{F}$ 3

B. -$\vec{F}$

C. -3$\vec{F}$

D. $\vec{F}$

Answer:

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13. A charge Q is enclosed by a Gaussian spherical surface of doubled,then the outward electric flux will

A. Be doubled

B. Increase four times

C. Be reduced to half

D. Remain the same

Answer:

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14. In the Davisson and Germer experiment, the velocity of electrons emitted from the electron gun can be increased by:

A. Decreasing the potential difference between the anode and filament.

B. Increasing the potential difference between the anode and filament.

C. Increasing the filament current.

D. Decreasing the filament current.

Answer:

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15. Four point charges -Q,-q,2q and 2Q are placed , one at each corner of the square. The relation between Q and q for which the potential at the centre of the square is zero is :

A. $Q=-\frac{1}{q}$

B. Q = -q

C. $Q=\frac{1}{q}$

D. -q

Answer:

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16. Monochromatic radiation emitted when electron on hydrogen atom jumps from first exicted to the ground state irradiates a photosensitive material. The stopping potential

is measured to be 3.57V. The threshold frequency of the material is:

A. 5×10^{15} Hz

B. 1.6×10^{15} Hz

C. 2.5×10^{15} Hz

D. 4×10^{15}Hz

Answer:

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17. The electric field associated with an e.m wave in vaccum is given by $\overrightarrow{E}$ = $\hat{i}40$ cos $\left(kz - 6 \times 10^{8}t\right)$, where E , z and t are in $vo < /m$, meter and seconds respectively. The value of wave vector k is

A. $0.5m^{-1}$

B. $6m^{-1}$

C. $3m^{-1}$

D. $2m^{-1}$

Answer:

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18. What is the flux through a cube of inside a if a point charge of q is at one of its corner:

A. $\frac{q}{8\varepsilon_0}$

B. $\frac{q}{\varepsilon_0}$

C. $\frac{q}{2\varepsilon_0} 6a^2$

D. $\frac{2q}{\varepsilon_0}$

Answer:

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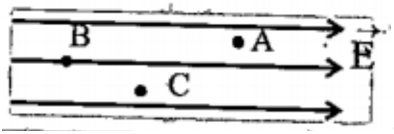
19. A, B and C are three points in a uniform electric field.The electric potential is



A. Maximum at A

B. Maximum at B

C. Maximum at C

D. Same at all thr three points A,B and C

Answer:

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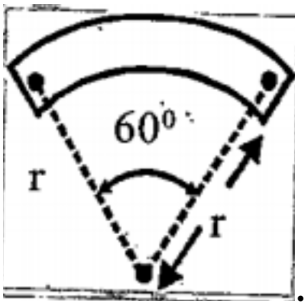
20. Arbar magnet of length and magnetic dipole moment M is bent in the form of an arc as shown in figure.The new magnetic dipole moment will be



A. M

B. $\frac{3}{\pi}M$

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

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

Answer:

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21. A wire loop is rotated in a magnetic field. The frequency of change of direction of the induced e.m.f. is

A. Once per revolution

B. Twice per revolution

C. Four times per revolution

D. Six times per revolution

Answer:

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22. An electric dipole of dipole moment p is aligned parallel to a uniform elec tric field E.The energy required to rotate the dipole by 90° is

A. pE^2

B. p^2E

C. pE

D. Infinity

Answer:

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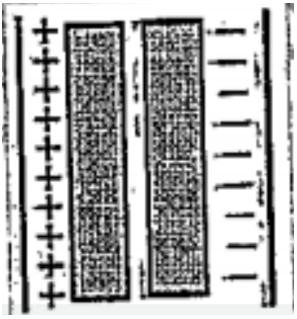
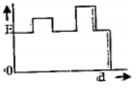
23. Two thin dielectric slabs of dielectric constants K_1 and K_2 $(K_1 < K_2)$ are inserted between plates of a parallel plate capacitor, as shown in the figure. The variation of electric field E between the plates with distance d as

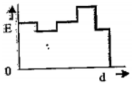
measured from plate P is correctly shown by



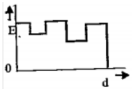
A.



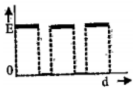
B.



C.



D.



Answer:

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24. A parallel plate air capacitor of capacitance Cis connected to a cell of emf V and then disconnected from it. A dielectric slab of dielectric constant K, which can just fill the air gap of the capacitor, is now inserted in it. Which of the following is incorrect?

A. The energy stored in the capacitor decreases K times.

B. The change in energy stored is $\frac{1}{2}CV^2\frac{1}{K}-1$

C. The charge on the capacitor is not conserved.

D. The potential difference between the plates decreases K times.

Answer:

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25. The electric field in certain region is acting radially outward and is given by E=Ar. A charge contained in a sphere of radius 'a' centred at the orgin of the field, will be given by:

A. $A\varepsilon_0 a^2$

B. $4\pi\varepsilon_0 A a^3$

C. $\varepsilon_0 A a^3$

D. $4\pi\varepsilon_0 A a^2$

Answer:

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26. If potential(in volts) in a region is expressed as V(x,y,z)=6xy-y+2yz, the electric field (in N/C) at pointb (1,1,0) is:

A. $-\left(\widehat{6i}+\widehat{9j}+\hat{k}\right)$

B. $-\left(\widehat{3i}+\widehat{5j}+3\hat{k}\right)$

C. $-\left(\widehat{6i}+\widehat{5j}+2\hat{k}\right)$

D. $-\left(\widehat{2i}+\widehat{3j}+\hat{k}\right)$

Answer:

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27. Two idential charged spheres suspended from a common point by two massless strings of lengths l, are intially at a distance d(d<<1) a part because of their mutual repulsion. The charges begin to leak from both the spheresapproach each other with a velocity v.Then v varies as a function of the distance x between the spheres as:

A. $\nu \alpha x^{-1}$

B. $\nu \alpha x^{1/2}$

C. $\nu \alpha$ x

D. $\nu \alpha x^{-(1/2)}$

Answer:

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28. The magnetic susceptibility negative for

A. a) paramagnetic and ferromagnetic materials

B. b) diamagnetic material only

C. c) paramagnetic material only

D. d) ferromagnetic material only

Answer:

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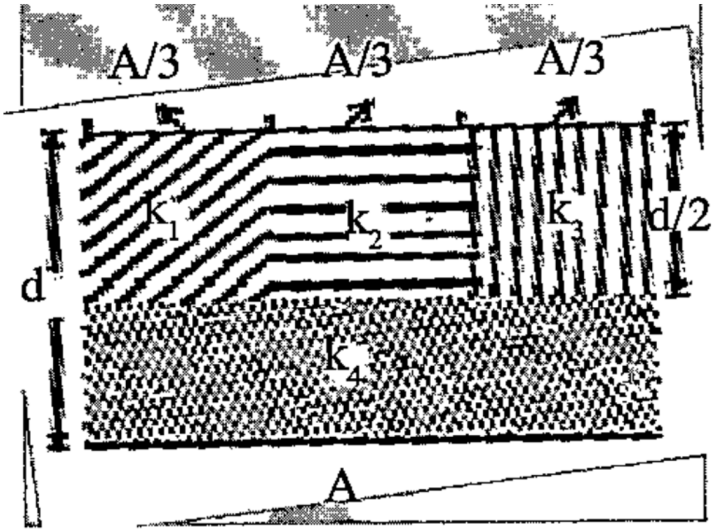
29. A parallel-plate capacitor of area A,plate separation d and capacitance C is filled with foue dielectric matertials having dielectric constants k1,k2,k3 and k4 as shown in the figure below.If a single dielectric material is to be used to have the same capacitance C in this capacitor,then its

dielectric constant k is given by



A. $\frac{2}{k} = \frac{3}{k_1 + k_2 + k_3} + \frac{1}{k_4}$

B. $\frac{1}{k} = \frac{1}{k_1} + \frac{1}{k_2} + \frac{1}{k_3} + \frac{3}{2k_4}$

C. $k = k_1 + k_2 + k_3 + 3k_4$

D. $k = \frac{2}{3}(k_1 + k_2 + k_3) + 2k_4$

Answer:

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30. An electric dipole is placed at an angle of 30 with an electric field intensity2×10^5 N/C. It experiences a torque equal to 4Nm. The charge on the dipole, if the dipole length is 2cm, is

A. 5 mC

B. 7μC

C. 8mC

D. 2mC

Answer:

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31. A capacitor is charged by a battery. The battery is removed and another identical uncharged capacitor is connected in parallel.The total electrostatic energy of resulting system

A. decreases by a factor of 2

B. remains the same

C. increases by a factor of 2

D. increases by a factor of 4

Answer:

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