ST. LAWRENCE HIGH SCHOOL

27, BALLYGUNGE CIRCULAR ROAD

Class : 12 **Subject : PHYSICS** **Term : FIRST TERM** **Max Marks : 60**

Q 1 : Three charges 2q , -q and -q are located at the vertices of an equilateral triangle. If at the centre of the triangle E be the electric field and V be the potential , then - **Marks :** 1

1 . The E=0 but V≠0

2 . The E≠0 but V=0 (This Answer is Correct)

3 . E=0 and V=0

4 . E≠0 and V≠0

Q 2 : In a meter bridge when the known resistance at the left gap is changed from 10 ohm to 35 ohm, it is seen that for a fixed unknown resistance at right gap, the null reading shifts from L to 2L. Then L = **Marks :** 1

1 . 30 m (This Answer is Correct)

2 . 35 m

3 . 40 m

4 . Nome of these

Q 3 : A magnetic needle is kept in a non uniform magnetic field. It experiences - **Marks :** 1

1 . A force and a torque (This Answer is Correct)

2 . a force but not a torque

3 . a torque but not a force

4 . neither a force nor a torque

Q 4 : Two parallel straight current carrying wires are placed close to each other. **Marks :** 1

1 . They will attract each other when current flows along same direction. (This Answer is Correct)

2 . They will attract each other when current flows in opposite direction.

3 . They repel each other when current flows along same direction.

4 . None of these.

Q 5 : At resonance condition, a series LCR circuit becomes **Marks :** 1

1 . Purely Inductive

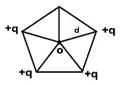
2 . Purely Capacitive

3 . Purely Resistive (This Answer is Correct)

4 . None of these

Q 6 : Four charges each of value +q are placed at the vertices of a regular pentagon as shown in the figure. What will be the net electric field at point 'O'?

1. Zero 2. $\frac{1}{\pi\epsilon_0}\frac{q}{d^2}$ 3. $\frac{1}{4\pi\epsilon_0}\frac{q}{d^2}$ 4. None of these



Marks : 1

1 . 1

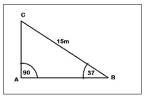
2 . 2

3 . 3 (This Answer is Correct)

4 . 4

Q 7 : A negative point charge of $-10^{10}C$ is placed at the point A (angles are in degree). The work done by one external agency to displace one electron from point C to B will be –

1. −0.4 J 2. 0.4 J 3. 4J 4. 40J



Marks : 1

1 . 1 (This Answer is Correct)

2 . 2

3 . 3

4 . 4

Q 8 : Infinite number of point charges (each of charge $10^{-9}C$) are placed along the +ve x-axis at 3m, 9m, 27m, 81m .....and so on. The potential at the origin will be –

1) Infinite 2) 13.5 volt 3) 4.5 volt 4) 3 volt

Marks : 1

1 . 1

2 . 2

3 . 3 (This Answer is Correct)

4 . 4

Q 9 : A very long straight uniformly charged cylindrical wire of radius 'r' penetrates a non conducting hollow spherical shell of radius 'R' (R>>r) such that the wire passes through the centre of the sphere . If σ be the volume charge density of the wire, then the total outward flux through the spherical shell will be –

1) $\frac{2\pi\sigma r R^2}{\epsilon_0}$ 2) $\frac{2\pi\sigma rR}{\epsilon_0}$ 3) $\frac{\sigma r^2 R}{2\pi\epsilon_0}$ 4) $\frac{2\pi\sigma r^2 R}{\epsilon_0}$

Marks : 1

1 . 1

2 . 2

3 . 3

4 . 4 (This Answer is Correct)

Q 10 : An arc of radius 'r' has uniform charge distribution of linear charge density λ. If the arc subtends angle $\frac{\pi}{3}$ at the centre then the potential at the centre is –

1) $\frac{\lambda}{4\epsilon_0}$ 2) $\frac{\lambda}{8\epsilon_0}$ 3) $\frac{\lambda}{12\epsilon_0}$ 4) $\frac{\lambda}{16\epsilon_0}$

Marks : 1

1 . 1

2 . 2

3 . 3 (This Answer is Correct)

4 . 4

Q 11 : At equilibrium, the net charges on the thin concentric spherical shells (of radii a, b and c) are +z, +y and +x respectively. The potential at the surface of the shell of radius b is ($k = \frac{1}{4\pi\epsilon_0}$) –

1) $k\left[\frac{x}{c}+\frac{y}{b}+\frac{z}{a}\right]$ 2) $k\left[\frac{x}{c}+\frac{y+z}{b}\right]$ 3) $k\left[\frac{x}{c}+\frac{y+z}{a}\right]$ 4) $k\left[\frac{x}{c-b}+\frac{y+z}{b}\right]$

Marks : 1

1 . 1

2 . 2 (This Answer is Correct)

3 . 3

4 . 4

Q 12 : A point charge of charge q and mass m is thrown towards a static charge Q with initial velocity v. After a certain time q charge returns back along the same path due to coulomb repulsion. The shortest distance between two charges will be – $\left(k = \frac{1}{4\pi\epsilon_0}\right)$

1) $\frac{kQq}{mv^2}$ 2) $\frac{kQq}{2mv^2}$ 3) $\frac{2kq}{qmv^2}$ 4) $\frac{2kQq}{mv^2}$

Marks : 1

1 . 1

2 . 2

3 . 3

4 . 4 (This Answer is Correct)

Q 13 : The bob of a pendulum of weight 'w' has charge 'q' (which is numerically equal to $2\sqrt{3}\epsilon_0$). If the pendulum is brought near an infinite charged thin sheet of surface charge density numerically equal to the weight of the bob, then the angle the sting of the pendulum makes with vertical downward direction is

1) 30^0 2) 45^0 3) 53^0 4) 60^0

Marks : 1

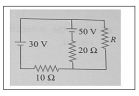
1 . 1

2 . 2

3 . 3

4 . 4 (This Answer is Correct)

Q 14 : In the circuit as shown in the figure, the value of R that will result no net current through 10Ω resistor is



1) 10 Ω 2) 25 Ω 3) 30 Ω 4) 40 Ω

Marks : 1

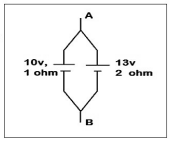
1 . 1

2 . 2

3 . 3 (This Answer is Correct)

4 . 4

Q 15 : Two cells are connected as shown in the figure. The potential difference between the points A and B is –



1) $\frac{23}{3}$ volt 2) $\frac{23}{2}$ volt 3) 3 volt 4) 11 volt

Marks : 1

1 . 1

2 . 2

3 . 3

4 . 4 (This Answer is Correct)

Q 16 : When a battery of potential V is applied across an wire (of conductivity σ and number density of electron as 'n'), E be the uniform electric field across it. The drift velocity of the electrons inside the conductor will be –

1) $\frac{ne}{\sigma E}$ 2) $\frac{\sigma E}{ne}$ 3) $\frac{\sigma E}{e}$ 4) σE

Marks : 1

1 . 1

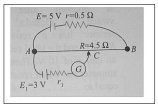
2 . 2 (This Answer is Correct)

3 . 3

4 . 4

Q 17 : In the given potentiometer, length of the wire AB is 3m and resistance is 4.5 Ω. The length AC for no deflection in the galvanometer is

1) 2 m 2) 1.8 m 3) Depends on r_1 4) None of these



Marks : 1

1 . 1 (This Answer is Correct)

2 . 2

3 . 3

4 . 4

Q 18 : A current i is flowing in a straight conductor of length L. The magnetic field at a perpendicular distance L/4 from the center of the straight wire is

1) $\frac{4\mu_0 i}{\sqrt{5}\pi L}$ 2) $\frac{\mu_0 i}{2\pi L}$ 3) $\frac{\mu_0 i}{\sqrt{2}L}$ 4) zero

Marks : 1

1 . 1 (This Answer is Correct)

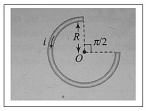
2 . 2

3 . 3

4 . 4

Q 19 : The magnetic field at the center of the loop as shown in the figure will be

1) $\frac{\mu_0 i}{R}$ 2) $\frac{\mu_0 i}{2R}$ 3) $\frac{2\mu_0 i}{R}$ 4) $\frac{3\mu_0 i}{8R}$



Marks : 1

1 . 1

2 . 2

3 . 3

4 . 4 (This Answer is Correct)

Q 20 : A very long solid cylindrical straight current carrying wire of radius R is conducting current in upward direction. If J be the volume current density then magnetic field at a distance 2R from the axis of the wire will be –

1) $\frac{\mu_0 J}{2\pi R}$ 2) $\frac{\mu_0 RJ}{2\pi}$ 3) $\frac{\mu_0 RJ}{4}$ 4) None of these

Marks : 1

1 . 1

2 . 2

3 . 3 (This Answer is Correct)

4 . 4

Q 21 : The torque on a current carrying rectangular loop when placed symmetrically in an uniform magnetic field is

1. Maximum when area vector of loop makes 0^0 angle with magnetic field.
2. Maximum when area vector of loop makes 90^0 angles with magnetic field.
3. Minimum when area vector of loop makes 90^0 angles with magnetic field.
4. Same for any orientation of the loop.

Marks : 1

1 . 1

2 . 2 (This Answer is Correct)

3 . 3

4 . 4

Q 22 : An infinite current carrying wire is carrying a current of 5A. The magnetic field at a point near the middle of the wire at a perpendicular distance 10cm from the wire will be

1) $10^{-7}T$ 2) $10^{-5}T$ 3) $10^{7}T$ 4) $10^{5}T$

Marks : 1

1 . 1

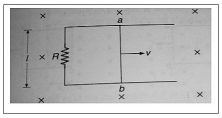
2 . 2 (This Answer is Correct)

3 . 3

4 . 4

Q 23 : As indicated in the figure, the power used by the external agency to displace the moveable rod with constant velocity v in the magnetic field B is

1) Blv 2) $B\frac{lv}{R}$ 3) $\frac{B^2l^2v^2}{R}$ 4) $\frac{B^2l^2v^2}{R^2}$



Marks : 1

1 . 1

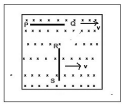
2 . 2

3 . 3 (This Answer is Correct)

4 . 4

Q 24 : Two thin conducting rods (of equal lengths l) PQ and RS are pulled towards right with uniform velocity v in a uniform magnetic field B directed perpendicularly inward as shown in the figure. Then –

1) Induced emf in both is Blv 2) Induced emf in PQ is Blv but that in RS is zero
3) Induced emf in PQ is zero but that in RS is Blv 4) Induced emf in both is zero



Marks : 1

1 . 1

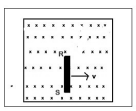
2 . 2

3 . 3 (This Answer is Correct)

4 . 4

Q 25 : A thick iron rod of length l and breadth b is pulled with a constant velocity v in a region of constant magnetic field B as shown in the figure. The electric field developed across the length of the rod at equilibrium is –

1) Blv 2) $Blbv$ 3) $\frac{Blv}{b}$ 4) Bv



Marks : 1

1 . 1

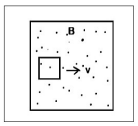
2 . 2

3 . 3

4 . 4 (This Answer is Correct)

Q 26 : A conducting square loop is pulled with constant velocity v in a region of uniform magnetic field B directed perpendicularly outward as shown in the figure. Due to this motion if E and I be the induced emf and emf and induced current respectively, then –

1) $E = 0$ *and* $I = 0$ 2) $E = 0$ *but* $I \neq 0$
3) $E \neq 0$ *but* $I = 0$ 4) $E \neq 0$ *and* $I \neq 0$



Marks : 1

1 . 1

2 . 2

3 . 3 (This Answer is Correct)

4 . 4

Q 27 : In an L-R circuit, the potential drop across the inductor and the resistor are 15 volt and 5 volt respectively. The power factor of the circuit is

1) $\frac{1}{10}$ 2) 10 3) $\sqrt{10}$ 4) $\frac{1}{\sqrt{10}}$

Marks : 1

1 . 1

2 . 2

3 . 3

4 . 4 (This Answer is Correct)

Q 28 : The bob of a pendulam of mass 'm' and charge 'q' was at mean position initially. When a uniform electric field of intensity 'E' is switched on, the string of the pendulam makes 'θ' angle w.r.t mean position. The tension of the string at this condition will be

Marks : 1

1 . mg/sinθ

2 . mg

3 . qE/sinθ (This Answer is Correct)

4 . qE/cosθ

Q 29 : A solid sphere of radius R has '+q' charge uniformly distributed all over it volume. The distance of the point from its centre where the electric field will be half of the electric field on its surface is -

Marks : 1

1 . 2R

2 . √2 R

3 . Elecric field will be same everywhere inside

4 . R/2 (This Answer is Correct)

Q 30 : The electric field at the centre of a uniformly chrged ring of radius 'R' and total charge 'Q' will be ($k=1/4\pi\epsilon_{\circ}$) -

Marks : 1

(This Answer is Correct)

1 . zero

2 . $4kQ/\pi R^2$

3 . $Q/4\pi\epsilon_{\circ}R^2$

4 . None of these

Q 31 : An electron achieves a linear momentum 'P' when just released in a constant potential 'V'. If it is released in a potential of '8V' then the linear momentum will be - **Marks :** 1

1 . 8P

2 . 4P

3 . $2\sqrt{2}$ P (This Answer is Correct)

4 . 2P

Q 32 : An alpha particle, an electron and a proton are released in region of constant potential V. The ratio of their kinetic energy will be - **Marks :** 1

1 . 1.1.1 (This Answer is Correct)

2 . 2.1.1

3 . 2.1.2

4 . None of these

Q 33 : The electrostatic potential at the centre of an uniformly charged ring of radius R and total charge '+Q' will be ($k=1/4\pi\epsilon_{\circ}$) - **Marks :** 1

1 . Zero

2 . $2\pi kQ$

3 . kq/R (This Answer is Correct)

4 . None of these

Q 34 : When a dipole is placed in an external electric field of intensity E, then - **Marks :** 1

1 . It experiences force and torque if E is uniform

2 . It experiences only force if E is uniform

3 . It does not experience any force and torque if E is uniform

4 . It experiences force and torque if E is non uniform (This Answer is Correct)

Q 35 : A cylindrical wire of length 'l' and area of cross section A has resistance 'R'. It is stretched such that the length becomes n times. It is then cut into n pieces and then joined in parallel. The resistance of this parallel combination will be **Marks :** 1

1 . R (This Answer is Correct)

2 . nR

3 . n/R

4 . R/n

Q 36 : A proton of mass 'm' and charge '+e' is moving in a circular orbit in a magnetic field with energy 1MeV. What should be the energy of α particle of mass '4m' and charge '+2e' so that it can revolve in a path of same radius? **Marks :** 1

1 . 1 MeV (This Answer is Correct)

2 . 4 MeV

3 . 2MeV

4 . 0.5MeV

Q 37 : An electron is moving along +ve x-axis. To get it moving on an anticlockwise circular path in x-y plane, a magnetic field should be applied along **Marks :** 1

1 . positive y axis

2 . positive z axis (This Answer is Correct)

3 . negative y axis

4 . negative z axis

Q 38 : A thin circular wire carrying a current I has a magnetic moment M. The shape of the wire is changed to a square and it carries same current . It will have a magnetic moment **Marks :** 1

1 . M

2 . $4M/\pi$

3 . $4M/\pi^2$

4 . $\pi M/4$ (This Answer is Correct)

Q 39 : The magnetic susceptibility is slightly negative for **Marks :** 1

1 . Paramagnetic substance

2 . Diamagnetic substance (This Answer is Correct)

3 . Both for para and diamagnetic substance

4 . ferromagnetic substance

Q 40 : If a = the magnetic susceptibility and b= relative permiability of a magnetic material, then identify the correct relation **Marks :** 1

1 . a=1+b

2 . a+b=1

3 . b=1+a (This Answer is Correct)

4 . None of these

Q 41 : The dimension of magnetic susceptibility is **Marks :** 1

1 . equal to that of magetic field

2 . equal to that of current

3 . equal to that of magnetic moment

4 . it is dimensionless (This Answer is Correct)

Q 42 : When a bar magnet of sufficiently strong pole strength is shaken in vacuume, then **Marks :** 1

1 . An electric field will be developed (This Answer is Correct)

2 . No electric field will be developed

3 . Induced emf will be developed

4 . Induced current will be developed

Q 43 : The induced electric field (produced by time varrying magnetic field) is **Marks :** 1

1 . Conservative in nature

2 . Non Conservative in nature (This Answer is Correct)

3 . Can be both

4 . None of these

Q 44 : In an ac circuit the impedance is $\sqrt{3}$ times the reactance. The phase angle between the voltage and current in the circuit in degree is **Marks :** 1

1 . 60

2 . 30

3 . 0

4 . None of these (This Answer is Correct)

Q 45 : In an series LCR circuit, the current will be maximum when phase angle between voltage and current in degree is **Marks :** 1

1 . 90

2 . 60

3 . 45

4 . 0 (This Answer is Correct)

Q 46 : Two charges '4Q' and 'Q' are placed at a distance 'l' apart. A third charge 'q' is now placed in between them and all three charges are made free. If now they are in equilibrium, then the value of 'q' will be –

1) $-\frac{4}{9}Q$ 2) $-\frac{9}{4}Q$ 3) $-\frac{2}{3}Q$ 4) $-\frac{3}{2}Q$ **Marks :** 1

1 . 1 (This Answer is Correct)

2 . 2

3 . 3

4 . 4

Q 47 : A particle of mass 'm' and charge 'q' is released at rest in a uniform electric field E. Then the kinetic energy of the particle after time 't' will be –

1) $\frac{2E^2t^2}{mq}$ 2) $\frac{E^2t^2q^2}{2m}$ 3) $\frac{Eq^2m}{2t^2}$ 4) $\frac{Eqm}{2t}$

Marks : 1

1 . 1

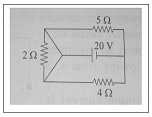
2 . 2 (This Answer is Correct)

3 . 3

4 . 4

Q 48 : In the circuit as shown in the figure –

1) The current through 4 Ω is 5A
2) The current leaving the +ve plate of the cell is 20/9 A
3) Current through 5 Ω is 5A
4) Current through 2 Ω is 10 A



Marks : 1

1 . 1 (This Answer is Correct)

2 . 2

3 . 3

4 . 4

Q 49 : A wire of length L carrying a current I is bent in the form of a circle. Its magnitude of magnetic moment will be

1) $\frac{IL}{4\pi}$ 2) $\frac{IL^2}{4\pi}$ 3) $\frac{I^2L^2}{4\pi}$ 4) $\frac{I^2L}{4\pi}$

Marks : 1

1 . 1

2 . 2 (This Answer is Correct)

3 . 3

4 . 4

Q 50 : A triangular loop of side l carries a current i. It is placed in a magnetic field B such that the area vector of the loop makes 90^0 angle with the magnetic field B. The torque on the loop is

1) Zero 2) iBl 3) $\frac{\sqrt{3}}{2}il^2B^2$ 4) $\frac{\sqrt{3}}{4}il^2B$

Marks : 1

1 . 1

2 . 2

3 . 3

4 . 4 (This Answer is Correct)

Q 51 : 1

A very long solenoid is made by close turns of a very long wire of radius r carrying current i. The magnetic field inside the solenoid will be

1) $\mu_0 ri$ 2) $2\mu_0 ri$ 3) $\frac{\mu_0 ri}{2}$ 4) None of these

Marks :

1 . 1

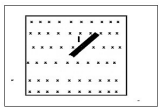
2 . 2 (This Answer is Correct)

3 . 3

4 . 4

Q 52 : A rod of length l is rotated n times in 1 sec in a magnetic field as shown in the figure. The potential difference at its two ends will be

1) 0 2) $\frac{1}{2}Bnl^2$ 3) πnBl^2 4) nBl^2



Marks : 1

1 . 1

2 . 2

3 . 3 (This Answer is Correct)

4 . 4

Q 53 : The frequency at which the power delivered to a series L-C-R circuit $\left(L = \frac{1}{10\pi}\ H,\ C = \frac{1}{20\pi}\ F \text{ and } R = 15\pi\ \Omega\right)$ by an ac source will be maximum, is

1) $5\sqrt{2}\ Hz$ 2) $10\sqrt{2}\ Hz$ 3) $5\sqrt{2}\ rad/sec$ 4) $10\sqrt{2}\ rad/sec$

Marks : 1

1 . 1 (This Answer is Correct)

2 . 2

3 . 3

4 . 4

Q 54 : The current and voltage functions in an ac circuit are given as $i = 100\sin 100t\ mA, V = 100\sin\left(100t + \frac{\pi}{3}\right)\ volt$. The power dissipated in the circuit is

1) 10 watt 2) 2.5 watt 3) 5 watt 4) 5 K-watt

Marks : 1

1 . 1

2 . 2 (This Answer is Correct)

3 . 3

4 . 4

Q 55 : A charge 'q' of mass 'm' enters a region of uniform electric field 'E' (directed along +ve x-axis) at t = 0 with initial velocity 'v' directed along +ve y-axis. The angle (in degree) made by the velocity vector of the charge at the instant t= (vm)/(qE) will be -

Marks : 1

1 . 0

2 . 30

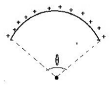
3 . 45 (This Answer is Correct)

4 . 90

Q 56 : 1

The electric field at the centre of this uniformly charged arc element of length 'l' and total charge '+q' is – ($k = \frac{1}{4\pi\epsilon_0}$ and the angle 'θ' is in radian unit)

1) Zero 2) $\frac{q}{2\pi^2\epsilon_0 r^2}$ 3) $\frac{2kq}{l^2}\sin\left(\frac{\theta}{2}\right)$ 4) $\frac{2k\theta q}{l^2}\sin\left(\frac{\theta}{2}\right)$



Marks :

1 . 1

2 . 2

3 . 3

4 . 4 (This Answer is Correct)

Q 57 : The electric field in a region is given as $\vec{E} = xy^2\hat{i} + x^2y\hat{j}$. The potential of this field at any point (x, y) will be (c is a constant) –

1) $\frac{x^2y^2}{2} + c$ 2) $x^2y^2 + c$ 3) $zero$ 4) $None\ of\ these$

Marks : 1

1 . 1 (This Answer is Correct)

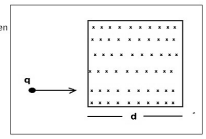
2 . 2

3 . 3

4 . 4

Q 58 : A particle with charge q, moving with momentum p enters a region of uniform magnetic field B as shown ($d < \frac{p}{Bq}$) . If the particle is deflected by an angle θ then $\sin\theta$ =

1) $\frac{Bqd}{p}$ 2) $\frac{p}{Bqd}$ 3) $\frac{Bp}{qd}$ 4) $\frac{pd}{qB}$



Marks : 1

1 . 1 (This Answer is Correct)

2 . 2

3 . 3

4 . 4

Q 59 : A uniformly charged non conducting circular disc of radius R and mass M is rotated about the axis passing through its centre and perpendicular to its plane. If it is containing a total charge Q, then the ratio of its magnetic moment to its angular momentum is

1) $\frac{2Q}{MR}$ 2) $\frac{Q}{2MR}$ 3) $\frac{QR}{M}$ 4) $\frac{Q}{2M}$

Marks : 1

1 . 1

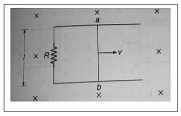
2 . 2

3 . 3

4 . 4 (This Answer is Correct)

Q 60 : As indicated in the figure, the force required to displace the moveable rod towards right with a constant velocity v in the magnetic field B is

1) Blv 2) $2\,Blv$ 3) $B\frac{lv}{R}$ 4) $\frac{B^2l^2v}{R}$



Marks : 1

1 . 1

2 . 2

3 . 3

4 . 4 (This Answer is Correct)
