Sri Chaitanya IIT Academy, India

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A right Choice for the Real Aspirant

ICON CENTRAL OFFICE, MADHAPUR-HYD

Sec: Sr. IPLCO **Date: 31-10-15**

Time: 9:00 AM to 12:00 Noon **RPTM-10** **Max.Marks: 360**

KEY SHEET

MATHS			PHYSICS			CHEMISTRY	
Q.NO	ANSWER		Q.NO	ANSWER		Q.NO	ANSWER
1	3		31	1		61	1
2	3		32	3		62	1
3	4		33	4		63	3
4	1		34	3		64	2
5	4		35	1		65	2
6	4		36	3		66	3
7	4		37	4		67	2
8	1		38	3		68	3
9	1		39	1		69	3
10	4		40	2		70	3
11	4		41	2		71	2
12	1		42	3		72	3
13	2		43	2		73	2
14	2		44	2		74	3
15	2		45	1		75	3
16	3		46	2		76	3
17	4		47	4		77	2
18	1		48	2		78	2
19	4		49	1		79	2
20	1		50	4		80	4
21	3		51	3		81	1
22	2		52	3		82	2
23	2		53	1		83	4
24	3		54	1		84	4
25	1		55	2		85	3
26	3		56	3		86	1
27	3		57	2		87	4
28	4		58	2		88	2
29	4		59	2		89	2
30	3		60	2		90	3

PHYSICS

31. Key: (1)

Hint: $\mu mg = \frac{kq^2}{d^2}$

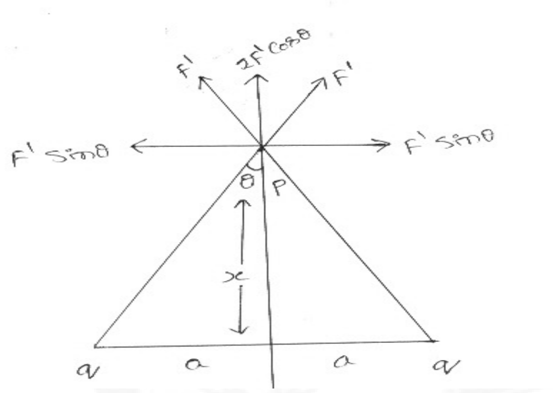
32. Key: (3)

Hint: $\bar{E} = \frac{-dV}{dr}\hat{r}$

33. Key: (4) $\phi_1 = 100\times(100)^2\ Vm; \phi_2 = -60\times(100)^2\ Vm$, $\phi_1 - \phi_2 = (100)^2\times 40 = \frac{1}{\epsilon_0}q$

$q = 4\times10^5\times\epsilon_0 = 3.54\times10^{-6}C$

34. Key: (3)



Resultant force on a test charge Q at P $F = 2F'cos\theta$

$$= \frac{2Qq}{4\pi\in_0(a^2+x^2)}\left(\frac{x}{\sqrt{a^2+x^2}}\right)$$

For maximum value of force, $\frac{dF}{dx} = 0 \Rightarrow x = \frac{a}{\sqrt{2}}$

35. Key: (1)

Hint: $E = \frac{1}{4\pi\varepsilon_0}\frac{Q}{2\pi R}\frac{1}{R^2} \Rightarrow E\ \alpha\ \frac{1}{R^3}$

36. Key: (3)

Hint: $E_x = \frac{\lambda}{4\pi\varepsilon_0 r}\left(\sin 90^0\right)$ and $E_y = \frac{\lambda}{4\pi\varepsilon_0 r}\left(\cos 0^0\right)$

Net field $E = \sqrt{2}\frac{\lambda}{4\pi\varepsilon_0 r}$

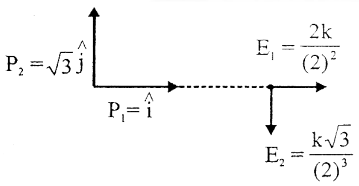
37. Key: (4)

Hint : Resolving the given dipole into two component dipoles with dipole moments $\overline{p}_1 = \frac{p}{\sqrt{2}}\hat{i}$ and $\overline{p}_2 = -\frac{p}{\sqrt{2}}\hat{j}$. The point P is on the equatorial line of p_1 and axial line of p_2.

Therefore the net field at 'p will be $\overline{E} = \overline{E}_1 + \overline{E}_2$.

38. Key: (3)

Hint:



$$E = \sqrt{E_1^2 + E_2^2}$$

$$= \frac{k}{8}\sqrt{(3+4)}$$

$$= \sqrt{7}\frac{k}{8}$$

39. Key: (1)

Hint: Centripetal force = Electrostatic force of attraction.

$$m r \omega^2 = \frac{\lambda q}{2\pi\varepsilon_0 r}$$

$$m r \omega^2 = \frac{2K\lambda q}{r}, \; k = \frac{1}{4\pi\varepsilon_0}$$

40. Key: (2)

Hint: $dF = \frac{\lambda_1 dq}{2\pi\varepsilon_0 R}$ and $dq = \lambda_2 dl$

$$\frac{dF}{dl} = \frac{2\lambda_1\lambda_2}{R}$$

41. Key:(2)

Hint: From law of con. Of angular momentum: $mv(0.5) = mv'(1)$

From law of con. Of energy: $\frac{1}{2}mv^2 = qV_{surface} + \frac{1}{2}m(v')^2$

42. Key :(3) $= \frac{1}{4\pi \in_0}.\frac{2q}{a}\left[1-\frac{1}{\sqrt{1+\frac{b^2}{a^2}}}\right] = \frac{1}{4\pi \in_0}.\frac{2q}{a}\left[1-\left(1+\frac{b^2}{a^2}\right)^{-\frac{1}{2}}\right] = \frac{1}{4\pi \in_0}.\frac{2q}{a}\left[1-1+\frac{1}{2}.\frac{b^2}{a^2}\right]$

$V = \frac{1}{4\pi \in_0}.\frac{qb^2}{a^3}$

43. Key: (2)

Hint: Perpendicular distance b/w origin and given equi-potential plane is $d = \frac{1}{\sqrt{3}}$

As the electric field is uniform $E = \frac{\Delta V}{\Delta r} = \text{constant}$

$\Rightarrow \frac{10-8}{\left(1/\sqrt{3}\right)} = \frac{10-V_p}{\sqrt{3}}$

$\therefore V_p = 4V$

44. Key: (2)

Hint: $E = -\frac{dV}{dr} = \frac{1V}{1/\sqrt{2}} = \sqrt{2}$

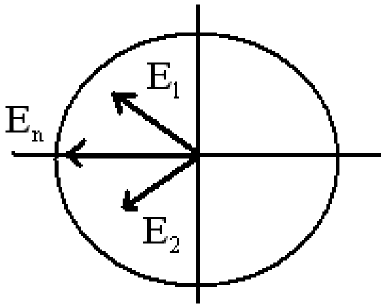
$\bar{E} = \left(+\hat{i}-\hat{j}\right)V/m$

$\bar{E}$ is $\perp^r$ to equipotential surface and is in the direction of decreasing potential

45.
KEY: (1)

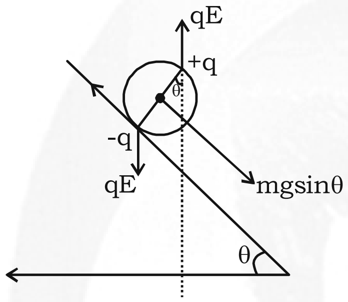
Hint: $E_1 = \frac{\sqrt{2}\lambda}{4\pi\varepsilon_0 R}$ and $E_2 = \frac{\sqrt{2}\lambda}{4\pi\varepsilon_0 R}$

Net field , $E_{net} = (E_1+E_2)\cos 45^0 = \frac{\lambda}{2\pi\varepsilon_0 R}$



46. Key: (2)

Hint:



Balancing torque about –q is

$$qE\ 2\ R\sin\theta = mg\sin\theta\ R \Rightarrow E = \frac{mg}{2q}$$

47. Key: (4)

Hint: $W = q\int_{\vec{r}_A}^{\vec{r}_B} \vec{E}.d\vec{r} = 1\times\int_{(2,2)}^{(4,1)}\left(E_x dx + E_y dy\right)$

$$= 1\times\int_{(2,2)}^{(4,1)}\left(ydx + xdy\right) = \int_{(2,2)}^{(4,1)} d\left(xy\right) = \left[xy\right]_{(2,2)}^{(4,1)} = 4\times1 - 2\times2 = 0$$

48. Key: (2)

Hint: Conceptual

49. Key: (1)

Hint: $\Delta V = E\Delta r$

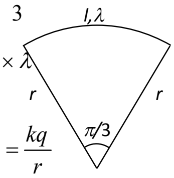
50. Key: (4)

Hint. $\frac{1}{2}mV_0{}^2 = \frac{q\sigma z}{2\varepsilon_0} \Rightarrow V_0\sqrt{\frac{q\sigma z}{m\varepsilon_0}}$

51. Key:(3)

Hint: Length of the arc $= r\theta = \frac{r\pi}{3}$

Charge on the arc $= \frac{r\pi}{3} \times \lambda$



$\therefore$ Potential at center $= \frac{kq}{r}$

$$= \frac{1}{4\pi\varepsilon_0} \times \frac{r\pi}{3}\frac{\lambda}{r} = \frac{\lambda}{12\varepsilon_0}$$

52. Key: (3)

Hint: The direction of uniform electric field E in xy-plane is as shown in figure 1.

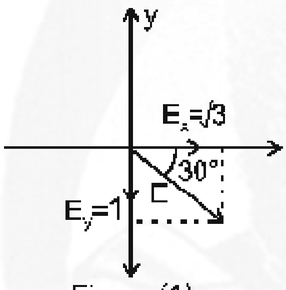


Figure (1)

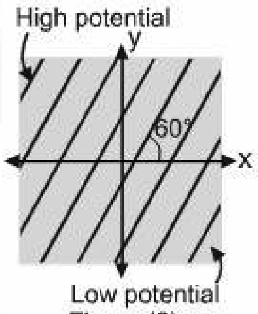


Figure (2)

The equipotential lines will be perpendicular to electric field. Also electric field points from high potential region towards low potential region. Therefore nature of equipotential lines in x-y plane is given by figure 2.

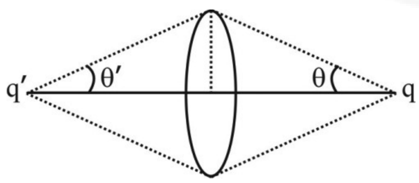
53. Key: (1)

Hint: Applying Gauss law we have $\phi_E = \frac{q_{enclosed}}{\varepsilon_0}$

$\phi_E = \text{Closed surface integral of } \overline{E}.d\overline{s}$

54. Key: (1)

Hint:



$$\frac{q'}{q} = \frac{1-\cos\theta'}{1-\cos\theta}$$

55. Key: (2)

Hint: $\vec{E} = -\frac{\partial V}{\partial x}\hat{i} - \frac{\partial V}{\partial y}\hat{j} - \frac{\partial V}{\partial z}\hat{k} = -(6x+4)\hat{i}$

56. From conservation of linear momentum we have $mv = 2mv_c$

From conservation of energy we have $\frac{1}{2}mv^2 = \frac{1}{2}2mv_c^2 + \frac{1}{4\pi\varepsilon_0}\frac{Q^2}{d}$

57. Key: (2)

Sol. $V = \frac{K\,\vec{p}.\vec{r}}{r^3}$, V = – 2 ×10^9 volts

58. Key: (2)

Hint $U = qV$

$$U = \frac{4kq^2}{\sqrt{x^2+y^2+z^2}}$$

59. Key: (2)

Hint: $\frac{V}{E} = \frac{\frac{k(n-1)q}{r}}{\frac{kq}{r^2}} = (n-1)r$

60. Key:.(2)

Hint: Form conservation of mechanical energy $\frac{1}{2}Kr^2 = \frac{1}{4\pi\varepsilon_0}\left[\frac{q^2}{r} - \frac{q^2}{r+r}\right]$

or $\frac{1}{2}Kr^2 = \frac{q^2}{8\pi\varepsilon_0 r}$ $\therefore K = \frac{q}{2r}\sqrt{\frac{1}{\pi\varepsilon_0 r}}$