# Sri Chaitanya IIT Academy.,India.

A.P T.S KARNATAKA TAMILNADU MAHARASTRA DELHI RANCHI

A right Choice for the Real Aspirant

ICON Central Office - Madhapur - Hyderabad

**SEC:** Sr.Super60_STERLING BT **JEE-MAIN** **Date: 13-09-2025**

**Time: 09:00AM to 12:00PM** **RPTM-06** **Max. Marks: 300**

# KEY SHEET

## MATHEMATICS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1) | **2** | 2 | **3** | 3) | **3** | 4) | **1** | 5) | **4** |
| 6) | **1** | 7) | **2** | 8) | **1** | 9) | **4** | 10) | **2** |
| 11) | **2** | 12) | **1** | 13) | **1** | 14) | **3** | 15) | **4** |
| 16) | **2** | 17) | **2** | 18) | **2** | 19) | **1** | 20) | **2** |
| 21) | **12** | 22) | **27** | 23) | **5** | 24) | **128** | 25) | **0** |

## PHYSICS

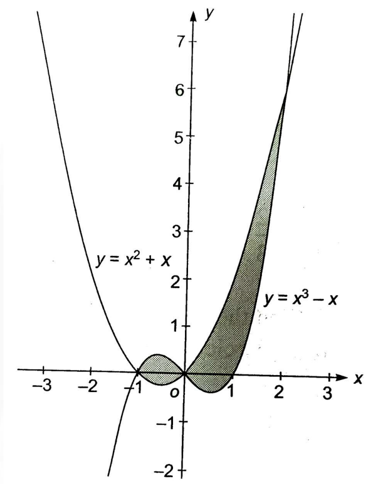
| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 26 | **1** | 27 | **4** | 28 | **1** | 29 | **2** | 30 | **3** |
| 31 | **3** | 32 | **2** | 33 | **2** | 34 | **1** | 35 | **4** |
| 36 | **2** | 37 | **1** | 38 | **4** | 39 | **4** | 40 | **2** |
| 41 | **3** | 42 | **2** | 43 | **3** | 44 | **4** | 45 | **4** |
| 46 | **6** | 47 | **2** | 48 | **2** | 49 | **12** | 50 | **8** |

## CHEMISTRY

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 51 | **2** | 52 | **3** | 53 | **1** | 54 | **3** | 55 | **4** |
| 56 | **1** | 57 | **1** | 58 | **3** | 59 | **4** | 60 | **1** |
| 61 | **1** | 62 | **3** | 63 | **3** | 64 | **1** | 65 | **3** |
| 66 | **4** | 67 | **4** | 68 | **2** | 69 | **2** | 70 | **3** |
| 71 | **6** | 72 | **7** | 73 | **4** | 74 | **6** | 75 | **5** |

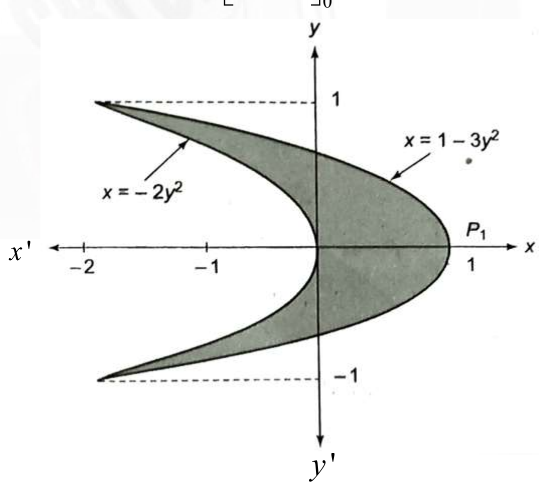
# SOLUTIONS
# MATHEMATICS

1. $y = x^3 - x = x(x-1)(x+1)$ is a cubic polynomial function interesting the x-axis at $(-1,0),(0,0),(1,0)$.
$y = x^2 + x = x(x+1)$ is a quadratic function which is concave upward and intersect x-axis at $(-1,0)(0,0)$.
The graph of curves are as shown in fig.

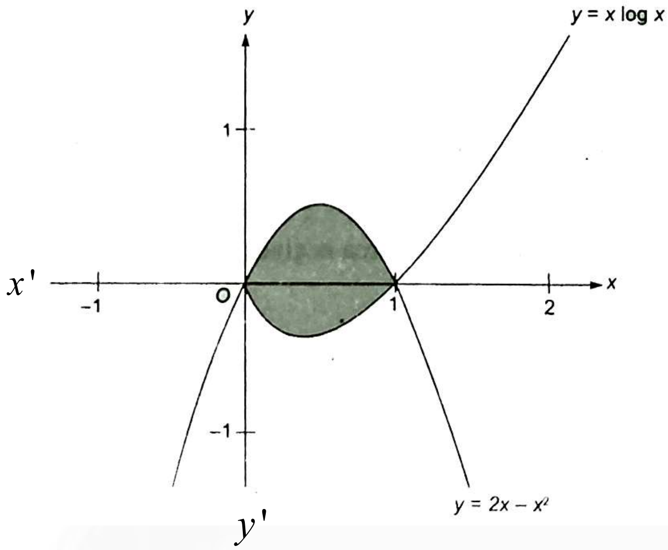



R.A $= \int_{-1}^{0} \left(\left(x^3 - x\right) - \left(x^2 + x\right)\right) dx + \int_{0}^{2} \left(\left(x^2 + x\right) - \left(x^3 - x\right)\right) dx$

2. The required area given by
$A = 2\int_0^1 (x_1 - x_2)\, dy = 2\int \left[\left(1 - 3y^2\right) - \left(-2y^2\right)\right] dy$
$= 2\int_0^1 \left(1 - y^2\right) dy = 2\left[y - \dfrac{y^3}{3}\right]_0^1 = \dfrac{4}{3}$




3. Required area
$= \int_0^1 \left(2x - 2x^2\right) dx - \int_0^1 x \log x\, dx$
$= \dfrac{1}{3} + \dfrac{1}{4} = \dfrac{7}{12}$




4. $y=\frac{1}{(x-1)^2+1}$

When $x=1, y_{\max}=1$

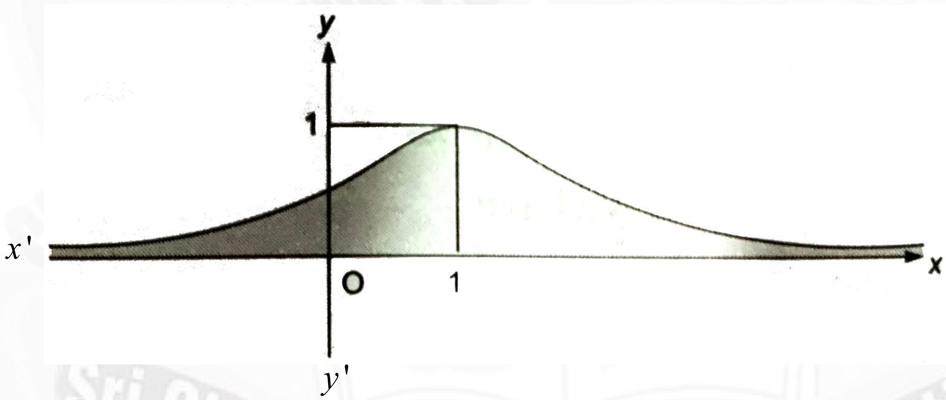
When $x\to\pm\infty, y\to 0$

Therefore, x-axis is the asymptote.

Also $f(1+x)=f(1-x)$

Hence, the graph is symmetrical about line x=1

From these information the graph of function is as shown in the fig.




R.A= $2\int_0^{\infty}\frac{1}{(x-1)^2+1}dx=\pi$

5. $\frac{dy}{dx}=-\frac{(2x+3y-2)}{(4x+6y-7)}$ put $2x+3y-2=t\Rightarrow\frac{dt}{dx}=\frac{t-6}{2t-3}\Rightarrow 4x+6y-4+9\log_e(2x+3y-8)=x+14$

6. Differential equation cab be rewritten as

$xy\frac{dy}{dx}=(1+y^2)\left(1+\frac{x}{1+x^2}\right)$

$\frac{y}{1+y^2}\frac{dy}{dx}=\frac{1}{x}+\frac{1}{1+x^2}$

Integrating, we get

$\frac{1}{2}\ln(1+y^2)=\ln x+\tan^{-1}x+\ln c$

Or $\sqrt{1+y^2} = cxe^{\tan^{-1}x}$

7. $\left(\sin\frac{y}{x}\right)dy = \left(\frac{y}{x}.\sin\frac{y}{x} - 1\right)dx$

Put $y = vx$

$\Rightarrow \sin v\left(v + x\frac{dv}{dx}\right) = (v\sin v - 1)$

$\sin v\frac{xdv}{dx} = -1$

$\int \sin v dv = -\int \frac{dx}{x}$

$\Rightarrow \cos v = \log_e x + c$

$\Rightarrow \cos\frac{y}{x} = \log_e x + c$

8. The equation can be re-written in the form

$\frac{dx}{dy} = \frac{1}{y}x + 2y^2$

$\frac{dx}{dy} - \frac{1}{y}x = 2y^2$

$I.F = e^{-\int \frac{1}{y}dy} = e^{-\log y} = \frac{1}{y}$

Therefore, solution is $x\frac{1}{y} = \int \frac{1}{y}2y^2 dy + C$

$\frac{x}{y} = y^2 + C$

$x = y^3 + Cy$

9. The D.E. can be written as

$\frac{1}{2}d\left(x^2+y^2\right) = d\left\{\tan^{-1}(y/x)\right\}$

Integrating, we get

$\frac{1}{2}\left(x^2+y^2\right) = \tan^{-1}(y/x) + c$

10. $\frac{dy}{dx} + 3\left(\sec^2 x\right)y = \sec^2 x, \quad IF = e^{3\tan x}$

Solution is $y.e^{3\tan x} = \frac{e^{3\tan x}}{3} + e^3$

$\therefore y\left(\frac{\pi}{4}\right) = \frac{4}{3}$

11. $RA = \int_0^{\pi/4} \cos x dx + \int_{\pi/4}^{\pi} \sin x dx$

12. $f'(x) = 7 - \frac{3f(x)}{4x}(LDE) \;\; IF = e^{\int \frac{3}{4x}dx} = x^{3/4}$

Solution is $y.x^{3/4} = \int 7.x^{3/4}dx \Rightarrow yx^{3/4} = 4x^{7/4} + c$

$\therefore \underset{x\to 0+}{Lt}\, xf\left(\frac{1}{x}\right) = 4$

13. Integrating the given differential equation, we have

$$\frac{dy}{dx}=\frac{-\cos 3x}{3}+e^x+\frac{x^3}{3}+C_1$$

but $y_1(0)=1$ so $1=(-1/3)+1+C_1 \Rightarrow C_1=1/3$.

Again integrating, we get

$$y=\frac{-\sin 3x}{9}+e^x+\frac{x^4}{12}+\frac{1}{3}x+C_2$$

But $y(0)=0$ so $0=0+1+C_2 \Rightarrow C_2=-1$. Thus

$$y=\frac{-\sin 3x}{9}+e^x+\frac{x^4}{12}+\frac{1}{3}x-1$$

14. $\frac{dy}{dx}=\frac{\sqrt{1-y^2}}{y} \Rightarrow \frac{y}{\sqrt{1-y^2}}dy=dx$

Integrating we have $-\sqrt{1-y^2}=x+C$

$\Rightarrow (x+C)^2+y^2=1$. This represents a family of circles with variable centre $(-C,0)$ (which lies on x-axis) and radius 1.

15. $\frac{dy}{dx}=\frac{5x^2\sqrt{1+x^2}-xy}{1+x^2} \Rightarrow \frac{dy}{dx}+\frac{xy}{1+x^2}=\frac{5x^2}{\sqrt{1+x^2}}\ (LDE)$

$\Rightarrow y=\frac{5x^3}{3\sqrt{1+x^2}} \Rightarrow y\left(\sqrt{3}\right)=\frac{5\sqrt{3}}{2}$

16. Putting $u=x-y$, we get $du/dx=1-dy/dx$.

The given equation can be written as $1-du/dx=\cos u$

$\Rightarrow (1-\cos u)=du/dx$

$\Rightarrow \int\frac{du}{1-\cos u}=dx \Rightarrow \frac{1}{2}\int \operatorname{cosec}^2(u/2)du=dx$

$\Rightarrow x+\cot(u/2)=const.$ or $x+\cot\frac{x-y}{2}=C$

17. According to the given condition

$y\frac{dy}{dx}=a \Rightarrow y\,dy=adx$

$\Rightarrow \frac{y^2}{2}=ax+b \Rightarrow y^2=2ax+2b$

18. Equation of the required parabola is of the form $y^2=4a(x-h)$. Differentiating we have

$2y\frac{dy}{dx}=4a \Rightarrow y\frac{dy}{dx}=2a \Rightarrow \left(\frac{dy}{dx}\right)^2+y\frac{d^2y}{dx^2}=0$

The degree of this differential equation is 1 and the order is 2.

19. **S-I :** Let centre $c=(0,\alpha)$, radius =k

Eq. of circle is $x^2+(y-\alpha)^2=k^2 \Rightarrow \alpha=x\frac{dx}{y}+y$ ....... (2)

Putting value of $\alpha$ in (1) $\Rightarrow \left(x^2-k^2\right)\left(\frac{dy}{dx}\right)^2+x^2=0$

Hence S-I is true

**S-II :** Circle passing through origin and its centre lies on x-axis is

$(x-\alpha)^2+y^2=\alpha^2$ ....(1) ($\alpha$ is radius)

$\Rightarrow\ x^2+y^2-2\alpha x=0$ on differentiating we get

$x + yy^1 = \alpha$ …..(2) putting value of $\alpha$ in (1)

$\Rightarrow \; x^2 - y^2 + 2xy\dfrac{dy}{dx} = 0$

Hence S-II is also true.

20. Linear differential equations.

21. $y = 2x + K \Rightarrow \dfrac{dy}{dx} = 2$

22. $\dfrac{\Delta^{3/2}}{6a^2}$

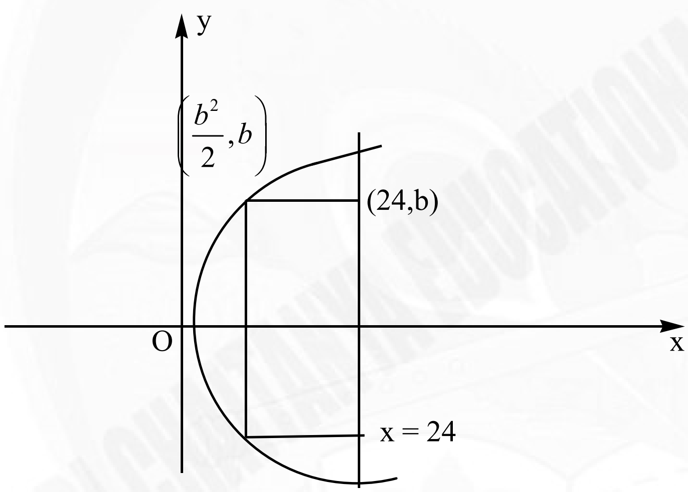
23. 23. $\int_0^x \sqrt{1-\left(y'(t)\right)^2}\,dt = \int_0^x y(t)\,dt$ dwrt ''x''

$\sqrt{1-\left(y'(x)\right)^2} = y(x)$

$1-\left(y'\right)^2 = y^2 \Rightarrow y^2 + \left(y'\right)^2 = 1$

$\Rightarrow 2yy' + 2y'y'' = 0 \Rightarrow y + y'' = 0$

24.




$A = 2\left(24 - \dfrac{b^2}{2}\right)b$

$\dfrac{dA}{db} = 0 \Rightarrow b = 4$

$\therefore A = 128$

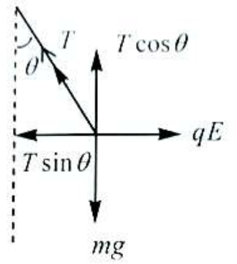
25. $(1+t)\dfrac{dy}{dt} - ty = 1 \Rightarrow \dfrac{dy}{dt} - \left(\dfrac{t}{1+t}\right)y = \dfrac{1}{+t}$ which is LDE

# PHYSICS

26. $T\sin\theta = qE = \dfrac{q\sigma}{2\varepsilon_0}$

$T\cos\theta = mg$

$\tan\theta = \dfrac{q\sigma}{2\varepsilon_0 mg}$




27. Let $\phi_A, \phi_B$ and $\phi_C$ are the electric flux linked with A,B and C according to Gauss theorem,

$\phi_A + \phi_B + \phi_C = \dfrac{q}{\varepsilon_0}$

Since, $\phi_A = \phi_C$

$\therefore\ 2\phi_A + \phi_B = \dfrac{q}{\varepsilon_0}$ or $2\phi_A = \dfrac{q}{\varepsilon_0} - \phi_B$

Or $2\phi_A = \dfrac{q}{\varepsilon_0} - \phi$

$\therefore\ \phi_A = \dfrac{1}{2}\left(\dfrac{q}{\varepsilon_0} - \phi\right)$

28. $E = \dfrac{v}{d} = 20\times10^6$

Energy density $u = \dfrac{1}{2}\epsilon_0 E^2$

$= \dfrac{1}{2}\times 8.85\times10^{-12}\times\left(20\times10^6\right)^2$

$= 1.8\times10^3 J/m^3$

29. Initially

$Q_1 = CV = 2V$

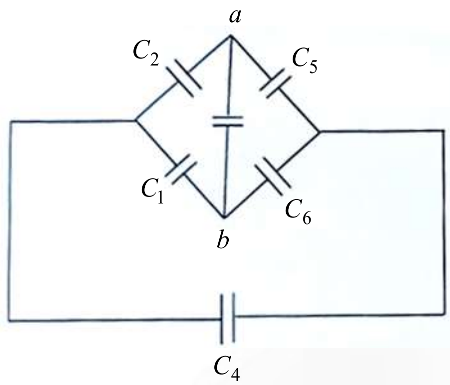
$E_1 = \dfrac{1}{2}\dfrac{Q_1^2}{C} = \dfrac{1}{2}\dfrac{(2V)^2}{2} = V^2$

Finally charge will be divided equally

$\therefore\ Q_2 = \dfrac{Q_1}{2} = \dfrac{2V}{2} = V$

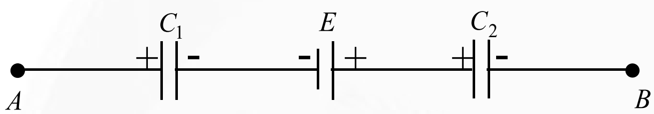
$E_2 = 2\left(\dfrac{1}{2}\dfrac{Q_2^2}{C}\right) = \dfrac{V^2}{2} \qquad \therefore\ \dfrac{E_2}{E_1} = \dfrac{1}{2}$

30. The given network of capacitors can be redrawn as follows :




$C_4$ is in parallel to a balanced Wheatstone bridge made from the rest five capacitors as shown in the figure. Therefore, equivalent capacitance $=C+C=2C$

31.



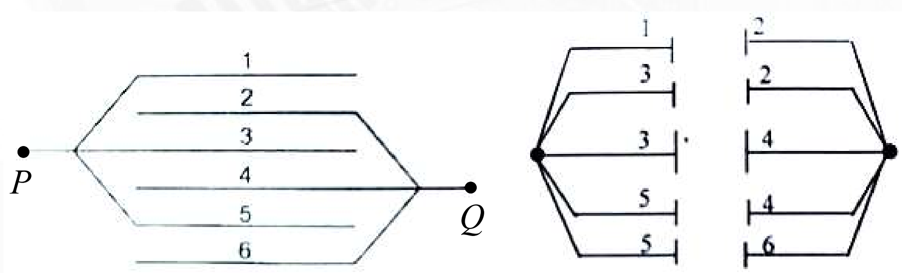

K.V.L $V_A-\frac{q}{c_1}-\frac{q}{c_2}+E=V_B$

$\frac{q}{c_1}+\frac{q}{c_2}=V_A-V_B+E$

$q\left[\frac{c_1+c_2}{c_1c_2}\right]=V+E$

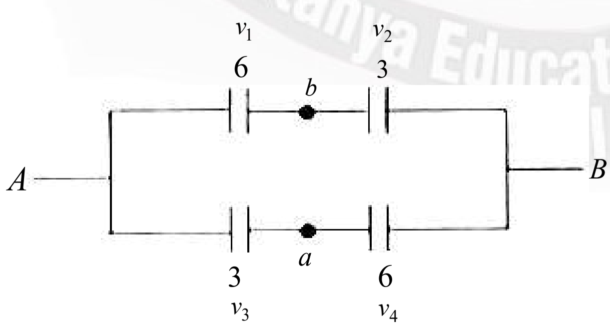
Potential Difference across $C_1$ , $\frac{q}{C_1}=\frac{(V+E)C_2}{C_1+C_2}$

32.




Capacitors in parallel. $C_{eff}=5.C=\frac{5\in_0 A}{d}$

33.




$v_1:v_2=\frac{1}{6}:\frac{1}{3}=1:2$

$v_1 = \frac{200}{3}$

$v_3 : v_4 = \frac{1}{3} : \frac{1}{6} = 2:1$

$v_3 = \frac{2}{3} \times 200$

P.D. $= \frac{2}{3} \times 200 - \frac{1}{3} \times 200$

$= \frac{200}{3} v$

34. For parallel combination

$q_1 = 10(C_1 + C_2)$

$q_1 = 500 \mu C$

$500 = 10(C_1 + C_2)$

$C_1 + C_2 = 50 \mu F$ ......(i)

For series combination

$q_2 = 10 \frac{C_1 C_2}{(C_1 + C_2)}$

$80 = 10 \frac{C_1 C_2}{50}$ [from equation (i)]

$C_1 C_2 = 400$ .........(ii)

From equation (i) and (ii)

$C_1 = 10 \mu F$ $C_2 = 40 \mu F$

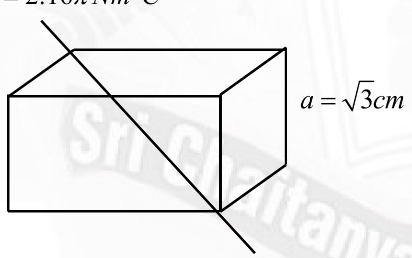
35. Linear charge density

$\lambda = \frac{q}{l}$

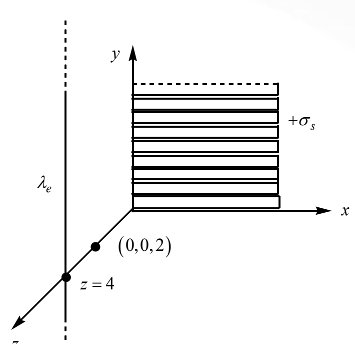
Net flux, $\phi = \frac{q_{enc}}{\varepsilon_0} = \frac{\lambda . \sqrt{3} a}{\varepsilon_0}$

$= 2 \times 10^{-9} \times \sqrt{3} \times \sqrt{3} \times 10^{-2} \times 36\pi \times 10^9 \, Nm^2C^{-1}$

$= 2.16\pi Nm^2C^{-1}$




36.



Here, $E_s = \frac{\sigma_s}{2\varepsilon_0}$ and $E_\ell = \frac{\lambda e}{2\pi r\varepsilon_0}$

$\therefore\ \frac{E_s}{E_\ell} = \frac{\sigma}{2\varepsilon_0} \times \frac{2\pi\varepsilon_0 r}{\lambda}$

$= \frac{\pi \times \sigma r}{\lambda} = \frac{\pi \times 2\lambda \times 2}{\lambda} = \frac{4\pi}{1}$

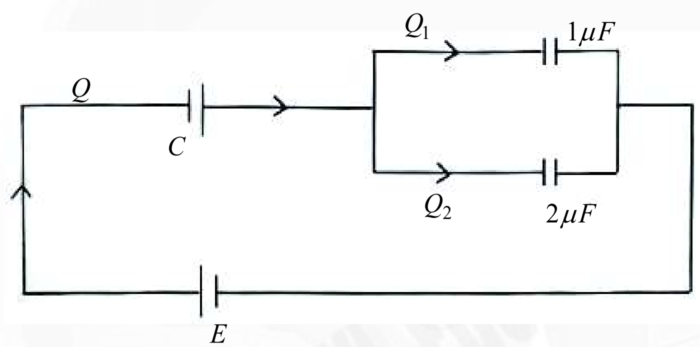
$\therefore\ 4\pi : 1 = \pi\sqrt{n} : 1 \qquad \therefore\ n = 16$

37. $Q_1 = Q_{plate}\left(1 - \frac{1}{K}\right)$

$= KCV\left(1 - \frac{1}{K}\right) = CV(K-1)$

$= 90\,pF \times 20 \times \left(\frac{5}{3} - 1\right) = 1.2nC$

38.

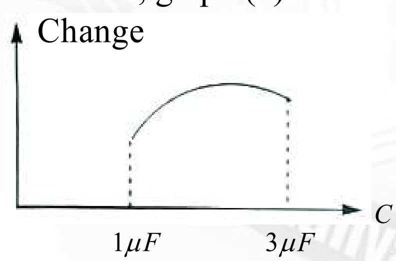



From figure, $Q_2 = \frac{2}{2+1}Q = \frac{2}{3}Q$

$Q = E\left(\frac{C \times 3}{C + 3}\right)$

$\therefore\ Q_2 = \frac{2}{3}\left(\frac{3CE}{C+3}\right) = \frac{2CE}{C+3}$

Therefore, graph (d) correctly depicts.




39. When capacitors are connected in parallel, the voltage across each capacitor is the same.

$V_1 = V_2 = V$

The charge stored in a capacitors, $q = CV$

$q_1 = C_1\ V,\ q_2 = C_2 V$

The energy stored in a capacitor is given by

$U = \frac{1}{2}CV^2$

As $q_1 < q_2 \qquad \therefore\ C_1 < C_2\ \&\ U_1 < U_2$

40. Flux depends on charge inside. But Electric filed intensity on both charge inside and outside.

41. If a dielectric slab of dielectric constant K is filled in between the plates of condenser while charging becomes K times, therefore $V'=V, C'=KC$.

42. The electric flux through the cube,

$\phi = q/\varepsilon_0$

A cube has six faces of equal area, therefore, electric flux through each

Face $=\frac{1}{6}.\phi=\frac{1}{6}(q/\varepsilon_0)=\frac{1}{6}\times$ total flux.

43. Energy conservation does not fail during sharing of charges between two bodies. Some energy is lost in the form of heat or light or sparking.

44. Capacitance of sphere is given by

$C=1F$ then radius of sphere from $c=4\pi\epsilon_0 r$

$$r=\frac{C}{4\pi\epsilon_0}=\frac{1}{4\pi\times 8.85\times 10^{-12}}\Rightarrow r=\frac{10^{12}}{4\pi\times 8.85}=9\times 10^9 m$$

$9\times 10^9 m$ is very large, it is not possible to obtain such a large sphere. In fact earth has radius $6.4\times 10^6 m$ only and capacitance of earth is $711\mu F$.

45. For spherical shell,

$$E_{inside}=0, E_{outside}=\frac{\sigma}{\epsilon_0}\left(\frac{R}{r}\right)^2$$

For infinite plane sheet,

$$E=\frac{\sigma}{2\epsilon_0}$$

For two oppositely charge infinite plane sheets $E=\frac{\sigma}{\epsilon_0}$

46. On connecting the two given capacitors, let the final voltage be V. If capacity of capacitor without the dielectric is C, then the charge on this capacitor is $q_1=CV$. The other capacitor with dielectric has capacity $\in C$.

Therefore, charge on it is $q_2=\in CV$

As $\in=\alpha V$, hence $q_2=\alpha CV^2$

The initial charge on the capacitor, (without dielectric) that was charged, is :

$q_0=CV_0$

From the conservation of charge,

$q_0=q_1+q_2$

$CV_0=CV+\alpha CV^2$

Or $\alpha V^2+V-V_0=0$

Or $V=\frac{-1\pm\sqrt{1+4\alpha V_0}}{2\alpha}$

Using $\alpha=2V^{-1}$ and $V_0=78V$, we get:

$$V=\frac{-1\pm\sqrt{1+4\times 2\times 78}}{2\times 2}=\frac{-1\pm\sqrt{625}}{4}$$

As V is +ve, so $V=\frac{\sqrt{625}-1}{4}=\frac{24}{4}=6V$

47. Electric field at point P is,

$\vec{E}=\left(\frac{\sigma}{2\varepsilon_0}+\frac{2\sigma}{2\varepsilon_0}+\frac{\sigma}{2\varepsilon_0}\right)(-\hat{i})=\frac{2\sigma}{\varepsilon_0}\hat{i}$

$\therefore\ x=2$

48. Electric field due to infinitely long wire, $E=\frac{\lambda}{2\pi\varepsilon_0 r}$

$F=qE$

$=\frac{\lambda q}{2\pi\varepsilon_0 r}=m\omega^2 r \qquad \left(\because k=\frac{1}{4\pi\varepsilon_0}\right)$

$\frac{2k\lambda q}{r}=m\omega^2 r\Rightarrow\omega^2=\frac{2k\lambda q}{mr^2}$

$\left(\frac{2\pi}{T}\right)^2=\frac{2k\lambda q}{mr^2}\Rightarrow T=2\pi r\sqrt{\frac{m}{2k\lambda q}}$

49. Given, electric field

$\vec{E}=2x^2\hat{i}-4y\hat{j}+6\hat{k}$

Electric flux for face, $x=1,\phi=2\times(1)^2\times2\times3=12$

Electric flux for face, $y=2,\phi=-4\times2\times3\times1=-24$

Electric flux for face, $z=3,\phi=6\times1\times2=12$

Electric flux for faces $x=0,y=0$, is zero

Electric flux for $z=0,\phi=-12$

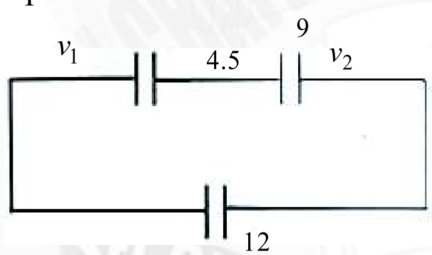
$\phi_{net}=-24+12=-12$

From the Gauss's theorem

$-12=\frac{q}{\epsilon_0}$

$|q|=12\epsilon_0$

50. 3 parallel 6 $\quad =3+6=9$

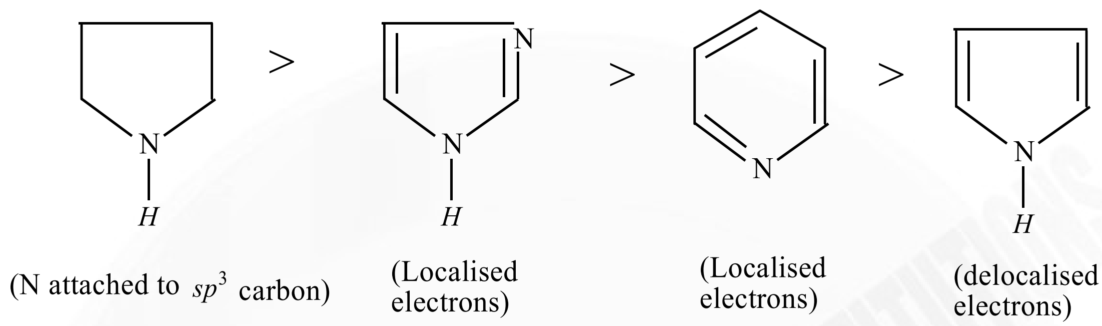



$v_1:v_2=\frac{1}{4.5}:\frac{1}{9}=2:1$

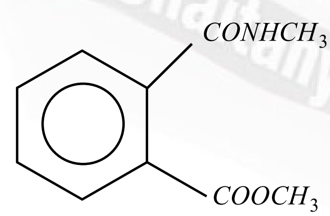
$v_1=\frac{2}{3}\times12=8v$

# CHEMISTRY

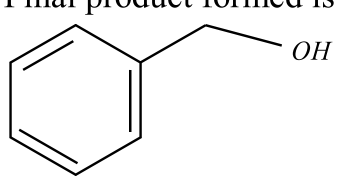
51. Rate of hydrolysis & leaving ability of group.
52. Based on Pka values.
EWG increases acidity of compounds.
53.




54. Diazonium salt undergo coupling reaction with phenol to form p-hydroxy Azo benzene.
55. Secondary amines having higher boiling point than $3^0$ amines due to hydrogen bonding
56. $\ddot{N}H_2$ is more electron donating than $\ddot{O}C_2H_5$
57. Diazonium salts are unstable above 300K.
58. Carboxylic acids having higher boiling point due to intermolecular H-bonding.
59. Aromatic amines cannot be prepared by Gabriel-Phthalimide reaction.
60. Carbylamine reaction is used as test for primary amines.
61. $NaBH_4$ Does not reduce esters
62. $LiAlH_4$ is strong R.A, reduces both Esters and Ketones.
63. X gives positive test with $NaHCO_3$ and product is Achiral.
64. Isocyanides on reduction forms $2^0$ amines
65. $NH_2$ group attached to $2^0$ carbon gives $2^0$ alcohol with $HNO_2$
66. Basicity order : Aliphatic amines > Aromatic amines > Amides
67. In I,III,IV reactions methylcyanide is formed.
68.

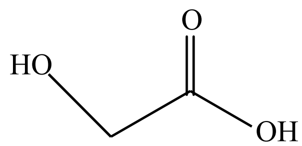
Z=



69. X gives both $NaHCO_3$ test & Lucas test
70. Final product formed is



71. C,D,E,F,G,H

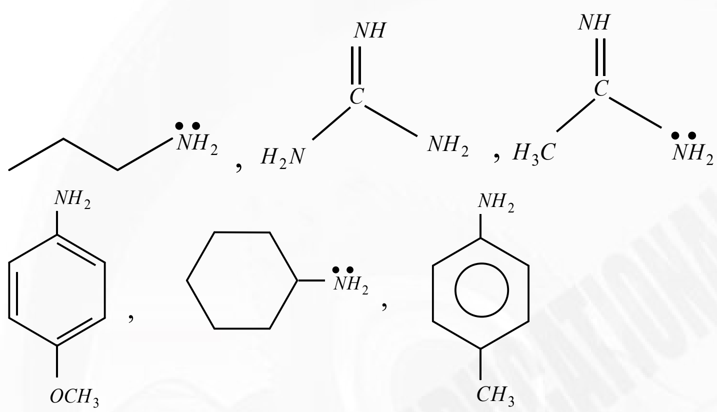
Glycolic acid



72. $\beta-$keto acids, $\beta\gamma$ unsaturated carboxylic acid & gem dicarboxylic acids on heating undergoes decarboxylation.

73. Hofmann's mustard oil reaction is given by only primary amines

74.



75. I,III,IV,V, VI