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-ADV-2023_P1 — Date: 21-09-2025

Time: 09.00Am to 12.00Pm — RPTA-07 — Max. Marks: 180

KEY SHEET

MATHEMATICS

1	**BCD**	2	**ABCD**	3	**BC**	4	**B**	5	**B**	6	**B**
7	**C**	8	**4**	9	**12**	10	**2**	11	**3**	12	**6**
13	**36**	14	**A**	15	**C**	16	**C**	17	**D**		

PHYSICS

18	**ABD**	19	**CD**	20	**AC**	21	**C**	22	**A**	23	**A**
24	**A**	25	**4**	26	**2**	27	**2**	28	**24**	29	**4**
30	**8**	31	**A**	32	**D**	33	**C**	34	**B**		

CHEMISTRY

35	**ABC**	36	**ABCD**	37	**ABC**	38	**D**	39	**A**	40	**D**
41	**C**	42	**2**	43	**42**	44	**10**	45	**3**	46	**3**
47	**19**	48	**A**	49	**B**	50	**A**	51	**D**		

SOLUTIONS
MATHEMATICS

01. $\left|\bar{b}+\bar{c}\right|^2=\left|\bar{a}\right|^2$

$\left|\bar{c}\right|=6$

$\left|\bar{a}\times\bar{b}+\bar{c}\times\bar{b}\right|-\left|\bar{c}\right|=\left|\left(\bar{a}+\bar{c}\right)\times\bar{b}\right|-\left|\bar{c}\right|=0-6$

$\left|\bar{a}+\bar{b}\right|^2=\left|\bar{c}\right|^2$

$\left|\bar{a}\right|^2+\left|\bar{b}\right|^2-2\left|\bar{a}\right|\left|\bar{b}\right|\cos\underline{|ACB}=\left|\bar{c}\right|^2$

$\cos\underline{|ACB}=\sqrt{\frac{2}{3}}$

02. $R(3\lambda+5,4\lambda+3,2\lambda+4)$ Lie on $x-y+z=4\Rightarrow\lambda=-2$

$\therefore R=(-1,-5,0)$

Line $\frac{x+1}{2}=\frac{y+5}{2}=\frac{z-0}{1}=\mu\Rightarrow T=(2\mu-1,2\mu-5,\mu)$ lie on plane $\mu=1$

03. $\bar{a}\times\bar{b}=15\bar{i}-20\bar{j}-25\bar{k}$

$\bar{c}.\left(\bar{a}\times\bar{b}\right)+25=0\Rightarrow 15x-20y-25z+25=0$ (1)

$\bar{c}.\left(\bar{i}+\bar{j}+\bar{k}\right)=4\Rightarrow x+y+z=4$ (2)

$\frac{\bar{c}.\bar{a}}{\left|\bar{a}\right|}=1\Rightarrow 4x+3y-5=0$ (3)

Solving (1,) ,(2) &(3) $\bar{c}=2\bar{i}-\bar{j}+3\bar{k}$

04. The eight pts are $(\pm1,\pm1,\pm1)$ these are four diagonals of a cube and their opposites. For 3 non coplanar vectors, first we select 3 groups of diagonals and its opposite in 4_{C_3} ways .The one vector from each group can be selected in $2\times2\times2$ ways

Total $=4_{C_3}\times2\times2=2^5$

05. Dr's of common line = (1,-3,-5)

$L:\frac{x}{1}=\frac{y}{-3}=\frac{z}{5}=t$

$M(\alpha,\beta,\gamma)$ is feet of perpendicular from $(t,-3t-5t)$ on P_1

$\frac{\alpha-t}{1}=\frac{\beta+3t}{2}=\frac{\gamma+5t}{-1}=\frac{-(t-6t+5t+1)}{6}\Rightarrow\alpha=t-\frac{1}{6},\beta=-3t-\frac{1}{3},\gamma=-5t+\frac{1}{6}$

06. Normal vector of $P_1 = \left(2\bar{j}+3\bar{k}\right)\times\left(4\bar{j}-3\bar{k}\right)=18\bar{i}$

$P_2 = \left(\bar{j}-\bar{k}\right)\times\left(3\bar{i}+3\bar{k}\right)=3\bar{i}-3\bar{j}-3\bar{k}$

$\bar{A}$ is parallel to $\pm\left(\hat{n}_1\times\hat{n}_2\right)=\pm\left(-54\hat{j}+54\hat{k}\right)$

Angle between $\bar{A}$ and $2\hat{i}+\hat{j}-2\hat{k}=\pm\frac{1}{\sqrt{2}}$

07. V_2 is obtained by rotating of V_1 then $\left|\bar{V}_1\right|=\left|\bar{V}_2\right|$

$3p^2+1=4+\left(p+1\right)^2$

$p=2, p=-1$ (Rejected)

$\cos\theta=\frac{\bar{V}_1.\bar{V}_2}{\left|\bar{V}_1\right|\left|\bar{V}_2\right|}=\frac{4\sqrt{3}+3}{13}$

$\tan\theta=\frac{6\sqrt{3}-2}{4\sqrt{3}+3}$

$\alpha=6$

08. Let angle between $\bar{a}$ & $\bar{b}$ be θ

$\left|\bar{a}+\bar{b}\right|=\sqrt{1+1+2\cos\theta}=2\left|\cos\frac{\theta}{2}\right|$

$\left|\bar{a}-\bar{b}\right|=2\left|\sin\frac{\theta}{2}\right|$

Max= $2\ \sqrt{3+1}=4$

09. Image of $A(1,2,3)$ about $x+y+z=12$ is D = (5,6,7)

Equation of CD is $\frac{x-5}{-2}=\frac{y-6}{-1}=\frac{z-7}{2}=\lambda$

$B\left(-2\lambda+5,-\lambda+6,2\lambda+7\right)$ lie on $x+y+z=12$

$\Rightarrow -2\lambda+5-\lambda+6+2\lambda+7=12$

$\lambda=6$

$B=\left(-7,0,19\right)$

10. $\begin{vmatrix}3 & -2 & 1\\ 4 & -3 & 4\\ 2 & -1 & m\end{vmatrix}=0\Rightarrow m=-2$

11. $\left|\frac{\left(\bar{a}_2-\bar{a}_1\right).\left(\bar{b}_1\times\bar{b}_2\right)}{\left|\bar{b}_1\times\bar{b}_2\right|}\right|=14\Rightarrow\lambda=3$

12. $G=\left(\frac{2\alpha}{3},\frac{2\alpha}{3},\frac{2\alpha}{3}\right)$

Equation of line , $\frac{x}{1}=\frac{y}{0}=\frac{z-3}{-1}=\lambda$

$D=(\lambda,0,3-\lambda)$

$GD^2=\left(\lambda-\frac{2\alpha}{3}\right)^2+\left(\frac{2\alpha}{3}\right)^2+\left(3-\lambda-\frac{2\alpha}{3}\right)^2=f(\lambda)$

$f^1(\lambda)=0\Rightarrow\lambda=\frac{3}{2}$

$(GD)_{\min}=\frac{57}{2}\Rightarrow\alpha=6$

13. $\bar{b}=\frac{5\hat{i}+5k\hat{j}}{K+1}$

$|\bar{b}|\le\sqrt{37}$

$\Rightarrow\frac{\sqrt{25(1+K^2)}}{1+K}\le\sqrt{37}$

$25(1+K^2)\le 37(K^2+1+2K)$

$6K^2+37K+6\ge 0$

$(6K+1)(K+6)\ge 0$

$K\in(-\infty,-6)\cup\left[-\frac{1}{6},\infty\right)$

14. Point on L_1 is $(2\lambda+1,-\lambda,\lambda-3)$

Point on L_2 is $(\mu+4,\mu-3,2\mu-3)$

For point of intersection, $2\lambda+1=\mu+4,-\lambda=\mu-3,$

$\lambda-3=2\mu-3$

$\Rightarrow\lambda=2,\mu=1$

$\therefore$ Intersection of L_1 and L_2 is (5,-2,-1)

Equation of plane passing through $(5,-2,-1)$ and perpendicular to P_1 and P_2 is

$\begin{vmatrix}x-5 & y+2 & z+1\\ 7 & 1 & 2\\ 3 & 5 & -6\end{vmatrix}=0\Rightarrow x-3y-2z=13.$

15. $\bar{L}_1\times\bar{L}_2=-\bar{i}-7\bar{j}+5\bar{k}$

S.D= $\left|\frac{(\bar{a}_2-\bar{a}_1).(\bar{b}_1\times\bar{b}_2)}{|\bar{b}_1\times\bar{b}_2|}\right|=\frac{17}{5\sqrt{3}}$

Equation of plane, $x+7y-5z+10=0$

Distance = $\dfrac{13}{\sqrt{75}}$

$$\begin{vmatrix} x+1 & y+2 & z+1 \\ 3 & 1 & 2 \\ 1 & 2 & 3 \end{vmatrix}=0$$

16. P) $\left[\bar{a}\,\bar{b}\,\bar{c}\right]^2=6(2)^2=24$

Q) $6\left[2\left[\bar{a}\,\bar{b}\,\bar{c}\right]\right]=6(10)=60$

R) $\dfrac{1}{2}\left|\left(2\bar{a}+3\bar{b}\right)\times\left(\bar{a}-\bar{b}\right)\right|=\dfrac{1}{2}(200)=100$

S) $\left|\left(\bar{a}+\bar{b}\right)\times\bar{a}\right|=\left|-\bar{b}\times\bar{a}\right|=\left|\bar{a}\times\bar{b}\right|=30$

17. $\Delta=\det$ of coefficient matrix = $-\dfrac{1}{2}(a+b+c)\left[(a-b)^2+(b-c)^2+\left(c-a^2\right)\right]$

p) $\Rightarrow(a-b)^2+(b-c)^2+(c-a)^2=0$

$\Rightarrow a=b=c\neq 0$

$\Rightarrow$ Identical planes

Q) $\Delta=0$ & a,b,c not equal

All equations are not identical but have infinity may solutions.

R) $\Delta\neq 0\Rightarrow$ Equations have only trivial solution

S) $a=b=c\,\&\,\Delta=0\Rightarrow a=b=c=0$

$\therefore$ The equations represent the whole of $3-D$ space.

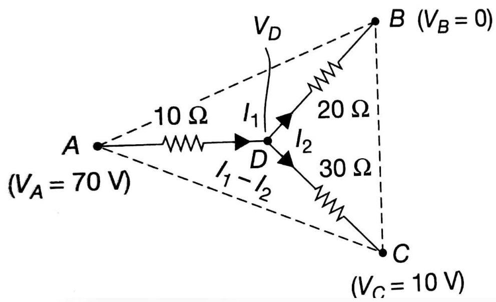
PHYSICS

18. Let V_D be the potential at the point D, then

$70 - V_D = I_1 \times 10\Omega$

$V_D - 0 = I_2 \times 20\Omega$

$V_D - 10 = (I_1 - I_2) \times 30\Omega$



Solve for I_1, I_2 and V_D, we get

$V_D = 40V$

$I_1 = 3A, I_2 = 2A\, and\, (I_1 - I_2) = 1A$

$\Rightarrow P_{total} = 90 + 80 + 30 = 200\ W$

$\Rightarrow I_1 : I_2 : (I_1 - I_2) :: 3:2:1\, and\, P_{total} = 200W$

Hence, (A) ,(B) and (D) are correct.

19. $V = V_0\left(1 - e^{-t/\tau}\right)$

$\tau = \frac{RC}{2}$

$V_0 = \frac{E}{2}$ (as both R and R are in series)

$\Rightarrow V = \frac{E}{2}\left(1 - e^{\frac{-2t}{RC}}\right)$

Hence,(C) and (D) are correct

20. $H = \frac{V^2}{R_1} t_1$

$\Rightarrow R_1 = \frac{V^2 t_1}{H}$ -----------------(1)

Similarly, $R_2 = \frac{V^2 t_2}{H}$ -----------------(2)

In series, $H = \left(\frac{V^2}{R_1 + R_2}\right) t$ ---------------(3)

(1),(2), in (3)

$t = t_1 + t_2$

In parallel, $H = \frac{V^2}{R_{net}} t = V^2 t\left(\frac{1}{R_1} + \frac{1}{R_2}\right)$

$$\boxed{=V^2t\left(\frac{H}{V^2t_1}+\frac{H}{V^2t_2}\right)}$$

Solving we get, $t=\frac{t_1t_2}{t_1+t_2}$

Hence,(A) and (C) are correct

21. Since net resistance is to be found between A and B. So let a current I enter at A then exit at B. By symmetry a current $\frac{1}{6}$ must flow in the branch AB from A to B.

For current I to exit from B, a current $\frac{1}{6}$ must flow in the branch AB from A to B.

Super- imposing the two, we conclude that a current $\left(\frac{I}{6}+\frac{I}{6}\right)$ must flow in the

According to Thevenin's Theorem we have

$$I_{total}R_{eq}=V_{AB}=\left(\frac{I}{6}+\frac{I}{6}\right)R_0=\frac{IR_0}{3}$$

$$\Rightarrow IR_{eq}=\frac{IR_0}{3}$$

$$\Rightarrow R_{eq}=\frac{R_0}{3}$$

22. Slope = $\frac{V}{I}=$Resistance

So, $R_1>R_2$

$\Rightarrow T_1>T_2$

23. Current decreases $\frac{20}{30}$ times or $\frac{2}{3}$ times. Therefore,

Net resistance should become $\frac{3}{2}$ times.

$$\Rightarrow R+50=\frac{3}{2}(2950+50)$$

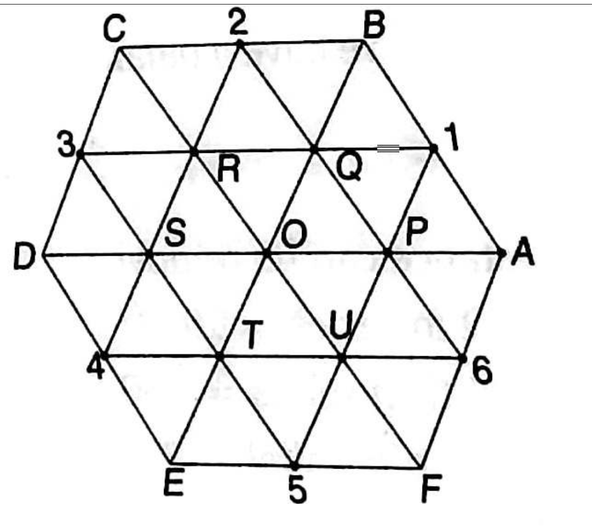
Solving we get, $R=4450\ \Omega$

24. $\frac{E}{2}=\varepsilon-ir\ or\ i=\frac{\varepsilon}{2r}$ ----(1)

$2\varepsilon=i(3+r)$ ------(2)

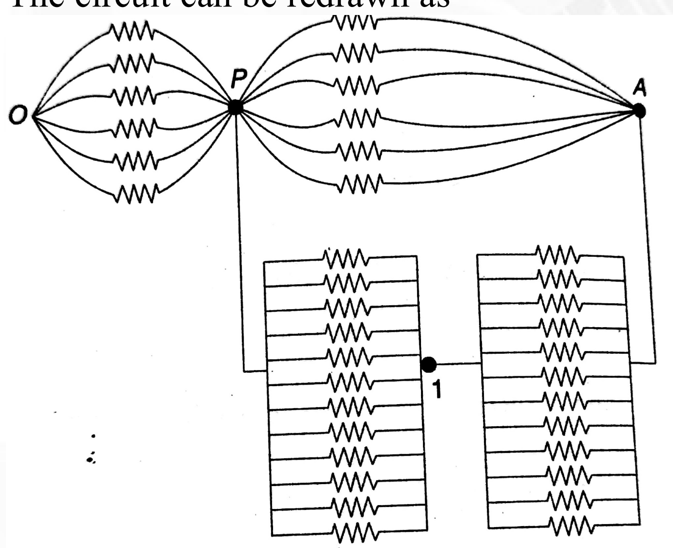
$r=1\Omega$

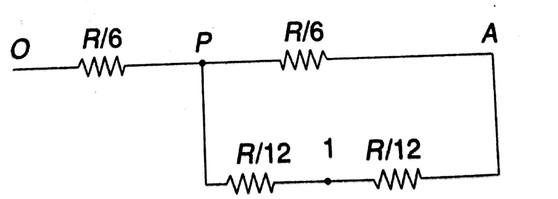
25. Points A,B,C,D,E and F are equipotentials.



From symmetry, points P,Q,R,S,T and U are equipotential and 1,2,3,4,5 and 6 are also equipotential.

The circuit can be redrawn as

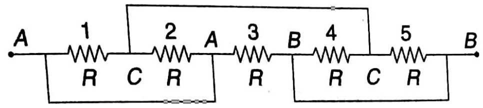


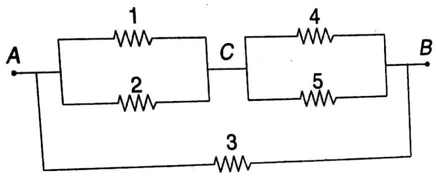


$\Rightarrow \therefore R_{eq} = \dfrac{R}{4}$

26. The circuit can be redrawn as shown in the figure.

1 and 2 are in parallel; 4 and 5 are in parallel. Equivalent of each pair is $\dfrac{R}{2}$. They add to become R which is in parallel to 3.





$\therefore \qquad R_{eq} = \frac{R}{2}$

27. Let the potential gradient along the potentiometer wire PQ be K
When galvanometer shows zero deflection the current in two loops are independent of each other. If current in loop having R and R_x is i, then

$iR = Kx$ ……(1)

And $i(R + R_x) = K(3x)$ ……(2)

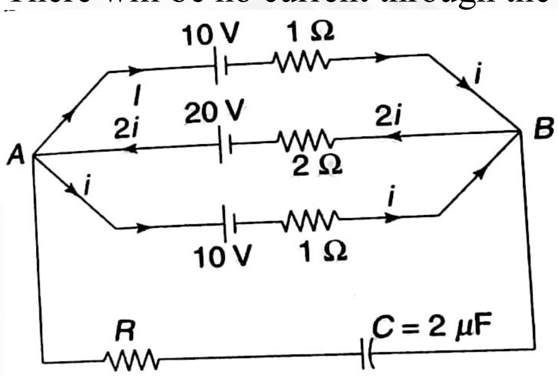
(2) –(1) $\quad iR_x = 2Kx$

(3) + (1) ……. (3)

$$\frac{R_X}{R} = 2$$

$\Rightarrow R_X = 2R$.

28. There will be no current through the branch having the capacitor



Using kinchhoff's voltage law in a loop containing 20 V cell and one 10 V cell, we get

$2i(2) + i(1) = 20 - 10$

$i = 2A$

$\therefore V_A - V_B = 12\,volt.$

(OR, you can find the equivalent emf of the three cells in parallel)

$\therefore \quad q = (V_A - V_B)C = 24\mu C.$

29. At $t = 0$, when capacitor is uncharged equivalent resistance of capacitor =0

In this case, 6Ω and 3Ω are parallel

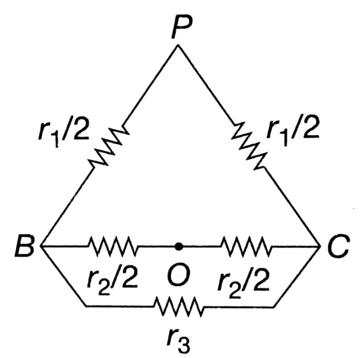
(equivalent = $2\ \Omega$

$\Rightarrow R_{net} = (1+2)\Omega = 3\Omega$

$\Rightarrow$ Current from battery = $\dfrac{12}{3} = 4A$

= Current through $1\ \Omega$ resistor is 4A

30. Points (A and C) and (D and B) are symmetrically located with respect to points O and P. Hence, the circuit can be drawn as shown in figure



This is a balanced whetstone bridge between P and O

Hence, r_3 can be removed. And,

$R_{PO} = \dfrac{r_1 + r_2}{4}$

Here $r_1 = R_{PB} = R_{PD} = \dfrac{(\pi a)\lambda}{2}$

And $r_2 = R_{OB} = (a)\lambda$

$\Rightarrow R_{PO} = \dfrac{(2+\pi)a\lambda}{8} = \left(\dfrac{2+\pi}{8}\right)a\left(\dfrac{64}{2+\pi}\right)\dfrac{1}{a} = 8\Omega$

31. For 2 V range : $I_g(R_G + R_1) = 2V$

Or $R_1 = \dfrac{2}{10^{-3}} - 40 = 1960\Omega = 1.96k\Omega$

For 10 V ranges: $I_G(R_G + R_1 + R_2) = 10V$

Or $R_2 = \dfrac{10}{1\times10^{-3}} - 40 - 1960 = 8000\Omega = 8k\Omega$

For 100 V range : $I_G(R_G + R_1 + R_2 + R_3) = 100V$

Or $R_3 = \dfrac{100}{10^{-3}} - 40 - 1960 - 8000 = 90000\Omega = 90k\Omega$

The overall resistances of the meter on 100 V range is

$R_G + R_1 + R_2 + R_3 = 100\,k\Omega$

The overall resistance of the meter on $2\,V$ range is

$R_G + R_1 = 2k\Omega$

32. Effective resistance of the circuit = 4Ω
Potential difference across $3\Omega = 20V - 8V = 12V$
Find currents in resistors using Ohm's law and series parallel and the use junction law to find current in ammeter.
Effective resistance of the circuit = 10 Ω

33.

Since $R = \frac{\rho l}{A}\, or\, R \propto \frac{l}{A}$

$\Rightarrow R_1 : R_2 : R_3 = \left(\frac{l}{A}\right)_1 : \left(\frac{l}{A}\right)_2 : \left(\frac{l}{A}\right)_3$

$\Rightarrow R_1 : R_2 : R_3 = \frac{1}{2} : \frac{1}{2} : \frac{3}{1} = 1:1:6$

Hence (A) $\rightarrow$(s)

As V is constant so

$1 \propto \frac{1}{R}\, and\, P \propto \frac{1}{R}, so\, P \propto I$

Hence , $I_1 : I_2 : I_3 = P_1 : P_2 : P_3 = \left(\frac{2}{1}\right) : \left(\frac{2}{1}\right) : \left(\frac{1}{3}\right)$

$\Rightarrow I_1 : I_2 : I_3 = 6:6:1$

So $(B) \rightarrow (q), (C) \rightarrow (p)$

Since wires are of same material, so

$\rho_1 : \rho_2 : \rho_3 = 1:1:1$

Hence (D) $\rightarrow (p)$

34.

$A \rightarrow (r)$

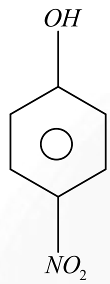
$B \rightarrow (s)$

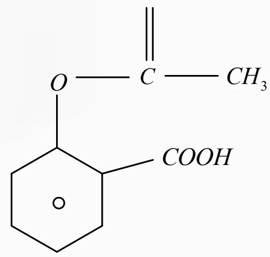
$C \rightarrow (q)$

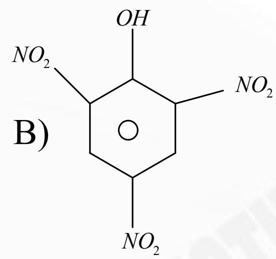
$D \rightarrow (p)$

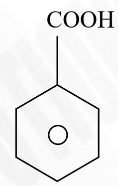
CHEMISTRY

35. $pH = 2$ Cationic
$pH = 6$ iso electric point (Zwitter ion)
$pH = 10$ Amion.
36. All are correct option NCERT
37.

D) 

A) 

B) 

C) 

38. No acidic group to react with $NaHCO_3$
39. Only formic acid gives + VE tollens test.
40. Mutarotation possible in Hemiacetals
41. They are diastereomers exist as alpha beta forms
42. $C_xH_y + \left(x + \frac{y}{4}\right)O_2 \rightarrow xCO_2 + \frac{Y}{2}H_2O$

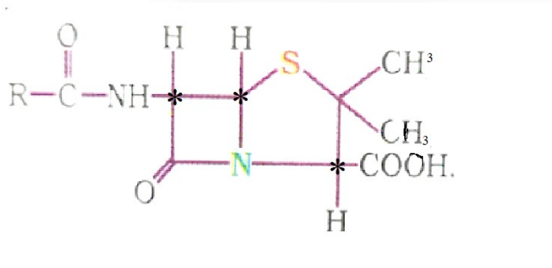
C_xH_y CO_2
1 mole x mole
$\frac{1}{22.4}$ $\frac{1.964}{44}$
X= 1
C_xH_y H_2O
1 mole $\frac{y}{2}mole$
$\frac{1}{22.4}$ $\frac{1.607}{18}$
Y=4
Hydrocarbon CH_4
C_xH_y O_2
$1mole$ $x + \frac{y}{4}mole$
$\frac{1mole}{1L}$ $1 + \frac{4}{y} = 2mole$
X= 2L
43. S $BaSO_4$
32 233
X 1.44
X= 0.2g

$S\% = \frac{0.2}{0.471} \times 100 = 42\%$

44. Sulphur cysteine, methionine $x = 2$
Basic Ariginine, lysine $z = 2$
Essential amino acids $z = 6$

45 $pI = \frac{4.3 + 2.2}{2}$
$= \frac{6.5}{2} = 3.25 \simeq 3.00$

46. Pencilllin has 3 chiral carbon



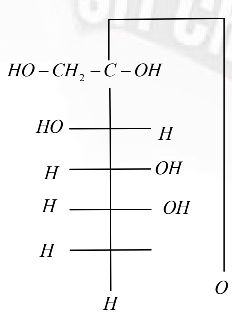
47.

$$\left[CH_3-(CH_2)_{15}-\overset{+}{N}(CH_3)_2-CH_3\right] Br^-$$

48. Soap- $C_{17}H_{35}COO\,Na$
Amionic detergent- sodium lauryl sulphate
Cationic detergent- Cetyltrimethyl ammonium bromide
Non ionic detergent- Stearic acid + poly ethyleneglycol

49. $C_6H_3COONa-$ Food preservative
SO_2 SO_3^2 Antioxidantes for wine and beet

50. $\alpha - D$ *fructopyranose*



51. ammonical $AgNO_3 - aldehyde\ or\ HC \equiv C$
$NaHCO_3$ – Strong acid
$NaOH / I_2$ - Iodoform test
Ozolylysis- Double bond detection