Sri Chaitanya IIT Academy.,India.

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A right Choice for the Real Aspirant

ICON Central Office - Madhapur - Hyderabad

SEC: Sr.Super60_STERLING BT **JEE-MAIN** **Date: 26-07-2025**
Time: 09:00AM to 12:00PM **WTM-39** **Max. Marks: 300**

KEY SHEET

MATHEMATICS

1	**1**	2	**3**	3	**1**	4	**3**	5	**1**
6	**3**	7	**2**	8	**1**	9	**4**	10	**3**
11	**4**	12	**1**	13	**2**	14	**1**	15	**1**
16	**3**	17	**1**	18	**3**	19	**2**	20	**1**
21	**9**	22	**12**	23	**52**	24	**6**	25	**8288**

PHYSICS

26	**3**	27	**3**	28	**1**	29	**1**	30	**2**
31	**1**	32	**3**	33	**1**	34	**3**	35	**1**
36	**1**	37	**1**	38	**1**	39	**2**	40	**2**
41	**1**	42	**2**	43	**1**	44	**3**	45	**3**
49	**5**	47	**7**	48	**4**	49	**8**	50	**14**

CHEMISTRY

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

SOLUTIONS
MATHEMATICS

1.Sol: $p(A \wedge \bar{B}) + p(\bar{A} \wedge B)$

$P(A)P(\bar{B}) + P(\bar{A})P(B)$

$= \frac{3}{10}.\frac{3}{5} + \frac{7}{10}.\frac{2}{5}$

$= \frac{23}{50}$

2. Sol: The man has to win at least 4 times. Required problem

$= \left(7_{C_4} + 7_{C_5} + 7_{C_6} + 7_{C_7}\right)\frac{1}{2^7} = \frac{1}{2}$

3. Sol: The probability of getting at least one head $= 1 -$probability of getting no heads

$= 1 - n_{C_0}\left(\frac{1}{2}\right)^n = 1 - \frac{1}{2^n}$

The probability of getting at least two tails $=1 -$probability of getting no tails $-$ probability of getting 1 tail

$= 1 - \frac{1}{2^n} - n.\frac{1}{2^n}$

$\left(1 - \frac{1}{2^n}\right) - \left(1 - \frac{1+n}{2^n}\right) = \frac{5}{32}$

$\Rightarrow \frac{n+1}{2^n} - \frac{1}{2^n} = \frac{5}{3^n} \Rightarrow \frac{n}{2^n} = \frac{5}{32}$

$\Rightarrow n = 5$

4. Sol: By using Bayes' theorem

5. Sol: By using conditional probability $= \frac{40}{60} = \frac{2}{3}$

6. Sol: Expected $= 15 \times \frac{6}{36} + 12 \times \frac{4}{36} - 6 \times \frac{26}{36}$

$= -\frac{1}{2}$ (by using R.V)

7. Sol: $P(6) = \frac{7}{36}$, $P(6) = \frac{5}{36}$

Req probability $P(6) + P(\bar{6})P(\bar{7})P(6) + -----$

$= \frac{5}{36} + \frac{31}{36}.\frac{30}{36}.\frac{5}{36} + ----$

$= \frac{30}{61}$

8. Sol: By using Baye's Theorem

9. Sol: $P(E)P(F) = \frac{1}{12}, P(\bar{E})P(\bar{F}) = \frac{1}{2}$

And solve above

10. Sol: $P\left(\bar{s}\, missing\, /\, both\, found\, spade\right)$

$$=\frac{p\left(\bar{s} \wedge Both\, spades\right)}{p\left(Both\, found\, spade\right)}$$

$$=\frac{\left(1-\frac{13}{52}\right)\left(\frac{13}{51}\right)\left(\frac{12}{50}\right)}{\left(1-\frac{3}{52}\right)\left(\frac{13}{51}\times\frac{12}{50}\right)+\frac{13}{52}.\frac{12}{51}\times\frac{11}{50}}$$

$$=\frac{39}{50}$$

11. Sol: $p\left(X\geq 5 / X>2\right)=\frac{p\left(X\geq 5 \wedge x>2\right)}{p\left(x>2\right)}$

$$\frac{\left(\frac{5}{6}\right)^4\frac{1}{6}+\left(\frac{5}{6}\right)^5\frac{1}{6}+.........}{\left(\frac{5}{6}\right)^2\frac{1}{6}+\left(\frac{5}{6}\right)^3\left(\frac{1}{6}\right)+........}$$

$$=\frac{25}{36}$$

12. Sol: **Given,** $P\left(\frac{B}{A}\right)=\frac{2}{5}, P\left(\frac{A}{B}\right)=\frac{1}{7}$ **and**

$$P\left(A\cap B\right)=\frac{1}{9}; P\left(\frac{B}{A}\right)=\frac{P\left(B\cap A\right)}{P\left(A\right)}$$

$$\Rightarrow P\left(A\right)=\frac{P\left(B\cap A\right)}{P\left(\frac{B}{A}\right)}=\frac{1/9}{2/5}=\frac{5}{18}$$

Similarly, $P\left(B\right)=\frac{P\left(B\cap A\right)}{P\left(\frac{A}{B}\right)}=\frac{1/9}{1/7}=\frac{7}{9}$

Statement I $P\left(\bar{A}\cup B\right)=1-P\left(A-B\right)$

$$=1-P\left(A\right)+P\left(A\cap B\right)$$

$$=1-\frac{5}{18}+\frac{1}{9}=\frac{15}{18}=\frac{5}{6}$$

Statement II $P\left(\bar{A}\cap\bar{B}\right)=P\overline{\left(A\cup B\right)}$

$$=1-P\left(A\cup B\right)=1-P\left(A\right)-P\left(B\right)+P\left(A\cap B\right)$$

$$=1-\frac{5}{18}-\frac{7}{9}+\frac{1}{9}=\frac{1}{8}$$

Hence both statements I and II are true .

13. Sol: let the integers be x & y

Then $x+y=24, x, y \in N$

$xy \geq \frac{3}{4}$

When $x=y=\frac{24}{2}=12$

$xy \geq \frac{3}{4}(12 \times 12)$

$xy \geq 108$

Possible cases = 13

$P(\bar{E})=\frac{13}{23}$

14. Sol: req probability $\frac{p(x=2)}{p(x=0)+p(x=1)+p(x=2)}=\frac{4}{7}$

15. Sol: a $\rightarrow$ r; b $\rightarrow$ p; c $\rightarrow$ q; d $\rightarrow$ s.

a. The required event will occur if last digit in all the chosen numbers is 1,3,7 or 9. Therefore, the required probability is $(4 \backslash 10)^n$

b. The required probability is equal to the probability that the last digit is 2,4,6,8 and is given by P (last digit is 1,2,3,4,6,7,8,9) –P (last digit is 1,3,7,9) $=\frac{8^n-4^n}{10^n}$

c. P(1,3,5,7,9) –P(1,3,7,9) $=\frac{5^n-4^n}{10^n}$

d. The required probability is

$$P(0,5)-P(5)=\frac{\left(10^n-8^n\right)-\left(5^n-4^n\right)}{10^n}$$

$$=\frac{10^n-8^n-5^n+4^n}{10^n}$$

16. Sol: prob. To get intercepted $=\frac{1}{3}$

Prob. To not get intercepted = $\frac{2}{3}$

Prob. Of missile to hit the target given that it is not intercepted $=\frac{3}{4}$

Req prob = $\frac{2}{3} \times \frac{3}{4} \times \frac{2}{3} \times \frac{3}{4} \times \frac{2}{3} \times \frac{3}{4}=\frac{1}{8}$

17.Sol:

x	0	1	2	3
P(x)	$\frac{1}{6}$	$\frac{1}{2}$	$\frac{2}{10}$	$\frac{1}{10}$

$10\left(\mu^2+\sigma^2\right)=20$

18. Sol: by using conditional probability and definition of independent events

19.Sol:

x	0	1
P(x)	$\frac{1}{2}$	$\frac{1}{2}$

$64\left(\mu+\sigma^2\right)=48$

20. Sol: probability $=\frac{5}{9}$ by using conditional probability and dependent events

21. Sol: $p(s)=\frac{25}{100}=\frac{1}{4}$

$p(\bar{s})=\frac{3}{4}$

$p\left(\frac{L}{S}\right)=$ probability of smoker to get lung cancer

probability of non smoker to get a lung cancer $=P\left(\frac{L}{N}\right)$

$P\left(\frac{L}{S}\right)=27p\left(\frac{L}{N}\right)$ and $P\left(\frac{S}{L}\right)=\frac{k}{10}$

$P\left(\frac{S}{L}\right)=\frac{p(s)p\left(\frac{L}{s}\right)}{p(L)}=\frac{k}{10}$

$p(L)=p(N)p\left(\frac{L}{N}\right)+p(s)p\left(\frac{L}{S}\right)$

$=3p\left(\frac{L}{N}\right)+\frac{1}{4}27p\left(\frac{L}{N}\right)$

$\Rightarrow p\left(\frac{s}{L}\right)=\frac{9}{10}\Rightarrow k=9$

22. Sol: $a=p(x=3)=\frac{5}{6}\times\frac{5}{6}\times\frac{1}{6}=\frac{25}{216}$

$b=p(x\geq 3)=\frac{5}{6}\times\frac{5}{6}\times\frac{1}{6}+\left(\frac{5}{6}\right)^3\times\frac{1}{6}+\ldots\ldots\ldots$

$=\frac{25}{36}$

$p(x\geq 6)=\left(\frac{5}{6}\right)^3\times\frac{1}{6}+\left(\frac{5}{6}\right)^4\times\frac{1}{6}+\ldots\ldots.$

$=\left(\frac{5}{6}\right)^5$

$c=\frac{25}{36}$

$\frac{b+c}{9}=12$

23. Sol: a = mean, b = variance

$a+b=5, ab=6$

$a=3, b=2$

$np=3, nqp=2 \Rightarrow q=\frac{2}{3}$

$p=\frac{1}{3}, n=9$, $6(n+p-q)=6\left(9+\frac{1}{3}-\frac{2}{3}\right)=52$

24. Sol: $p(E_1)=x, p(E_2)=y, p(E_3)=z$

$p=(1-x)(1-y)(1-z)$

$\alpha=x(1-y)(1-z)$

$\beta=(1-x)y(1-z)$

$\gamma=(1-x)(1-y)z$

By solving $\frac{p(E_1)}{p(E_3)}=6$

25. Sol: $p(w)=\frac{1}{3}, p(L)=\frac{2}{3}$

X = no. of matches team wins

Y = no. of matches team losses

$|x-y|=0,1,2 \qquad x, y \in N$

Case (i) $|x-y|=0 \Rightarrow x=y=5$

$p(x-y)=10_{C_5}\left(\frac{1}{3}\right)^5\left(\frac{2}{3}\right)^5$

Case (ii) $|x-y|=1 \Rightarrow x-y=\pm 1$

Not possible

Case (iii) $|x-y|=2 \Rightarrow x-y=\pm 2$

$p(|x-y|=2)=10_{C_6}\left(\frac{1}{3}\right)^6\left(\frac{2}{3}\right)^4+10_{C_4}\left(\frac{1}{3}\right)^4\left(\frac{2}{3}\right)^6$

Req prob. $=\frac{10_{C_5}2^5}{3^{10}}+\frac{10_{C_6}2^4}{3^{10}}+\frac{10_{C_4}2^6}{3^{10}}$

$3^p9=8288$

PHYSICS

26. Binding energy per nucleon is a measure of the stability of a nucleus. Iron-56 has the maximum binding energy per nucleon(~ 8.8 MeV), making it the most stable nucleus.

27. $12.5\% = \frac{1}{8}$ This means $\left(\frac{1}{2}\right)^3$, so 3 half-lives.

$Time = 3 \times 10 = 30$ days

28. Using Einstein's equation

$E = mc^1 = 1amu = 931MeV$

29. $T_{1/2} = \frac{0.693}{\lambda} = \frac{0.693}{0.693} = 1day$

30. Nuclear force is the strongest known but acts only over $\sim 1-2$ fm; it rapidly diminishes beyond this

31. Mass defect arises as mass converts to binding energy when nucleons bind, so nuclear mass < sum of individual nucleon masses.

32. Density $\sim M / V \alpha A / \left(A.R_0^3\right) =$

Independent of $A \rightarrow$ same density.

33. $n_A = n_0\left(\frac{1}{2}\right)^{\frac{60}{10}} = n_0.\left(\frac{1}{2}\right)^6 = \frac{n_0}{64} \Rightarrow Decayed = n_0 - \frac{n_0}{64} = \frac{63n_0}{64}$

$n_B = n_0\left(\frac{1}{2}\right)^{\frac{60}{20}} = n_0.\left(\frac{1}{2}\right)^3 = \frac{n_0}{8} \Rightarrow Decayed = n_0 - \frac{n_0}{8} = \frac{7n_0}{8}$

Ratio $= \frac{63n_0/64}{7n_0/8} = \frac{63}{64}.\frac{8}{7} = \frac{504}{448} = \frac{9}{8}$

34. Reason is incorrect because decay constant and half-life are intrinsic properties and do not depend on physical conditions like temperature or pressure.)

35. The total mass of the products is less than the total mass of the reactants.

36. Fe-56 is more stable than U-238
37. Because of mass defect

38. • $(A)\frac{1}{1}H$ *and* $\frac{2}{1}H$:

Same atomic number (X=1)
Different mass numbers (1 and 2) $\rightarrow$
Isotopes $\rightarrow$ P

•$(B)\frac{14}{6}C$ *and* $\frac{14}{7}N$:

Same mass number (A=14),
Different atomic numbers $\rightarrow$Isobars $\rightarrow$Q

•$(C)\frac{40}{20}Ca$ *and* $\frac{38}{18}Ar$:

Neutrons:

- Ca: 40 $-$20=20
- Ar : 38 $-$18=20 $\rightarrow$Same neutron count $\rightarrow$Isotones $\rightarrow$R

•$(D)\frac{12}{6}C$ *and* $\frac{14}{6}C$:

Same atomic number (Z=6),
Different mass number $\rightarrow$ Isotopes $\rightarrow$P

39. . Binding energy of 2 deuterium nuclei:
Each deuterium has 2 nucleons (1proton+ 1 neutron)
So, total binding energy $= 2\times 2\times 1.1 = 4.4MeV$
.Binding energy of 1 helium-4 nucleus :
$4\times 7.0 = 28.0MeV$
.Energy released =Final BE-Initial BE= $28.0 - 4.4 = 23.6MeV$

40. Alpha particle $= \frac{4}{2}He \rightarrow$
New mass =238$-$4=234,
New atomic number =92$-$2=90$\rightarrow$
Thorium$-$234

41. $N_1 = N_0 \times \left(\frac{1}{2}\right) = \frac{N_0}{2}$

$$N_2 = N_0 e^{-\lambda_2 t} = N_0 e^{-3\lambda_1 \cdot \frac{In2}{\lambda_1}} = N_0\left(e^{-In2}\right)^3 = N_0\left(\frac{1}{2}\right)^3 = \frac{N_0}{8}.$$

$$\frac{N_2}{N_1} = \frac{\frac{N_0}{8}}{\frac{N_0}{2}} = \frac{1}{4}.$$

42. We use the decay law in terms of half-life:

$$N = N_0\left(\frac{1}{2}\right)^{\frac{t}{t_{1/2}}}$$

Let initial nuclei: $N_{A0} = N_{B0} = N_0$

Time elapsed : $t = 4, h$

$$N_A = N_0\left(\frac{1}{2}\right)^{\frac{4}{2}} = N_0\left(\frac{1}{2}\right)^2 = \frac{N_0}{4}$$

$$N_B = N_0\left(\frac{1}{2}\right)^{\frac{4}{4}} = N_0\left(\frac{1}{2}\right)^1 = \frac{N_0}{2}$$

$$\frac{N_A}{N_B} = \frac{N_0/4}{N_0/2} = \frac{1}{2}$$

43. $N_X = N_0 e^{-\lambda_X t}, N_Y = N_0 e^{-\lambda_Y t}$

$$N_Y = \frac{1}{2}N_X \Rightarrow N_0 e^{-\lambda_Y t} = \frac{1}{2}N_0 e^{-\lambda_X t}$$

Dividing both sides by N_0:

$$e^{-\lambda_Y t} = \frac{1}{2}e^{-\lambda_X t} \Rightarrow e^{-(\lambda_Y - \lambda_X)t} = \frac{1}{2}$$

Taking natural logarithm:

$$-(\lambda_Y - \lambda_X)t = ln\left(\frac{1}{2}\right) = -ln2 \Rightarrow t = \frac{ln2}{\lambda_Y - \lambda_X} = \frac{0.693}{0.2 - 0.1} = \frac{0.693}{0.1} = 6.93\,\text{min}$$

44. Initial mass=
$U - 235 +$ neutron=
$235.0439 + .0087 = 236.0526,u$
Final mass=
$Ba - 141 + Kr - 92 + 3$ neutrons=
$140.9144 + 91.9262 + 3 \times 1.0087 = 140.9144 + 91.9262 + 3.0261 = 235.8667u$
Mass defect=
$236.0526 - 235.8667 = 0.1859u$
Energy released=
$0.1859 \times 931 = 173.1MeV$

45. We use the decay law: $N = N_0 e^{-\lambda t}$

Given: $\bullet \dfrac{N}{N_0} = \dfrac{2.5}{10} = 0.25$

$\bullet$ Half-life $T_{1/2} = 5730$ years

$\bullet \lambda = \dfrac{ln2}{T_{1/2}} = \dfrac{0.693}{5730}$

Now solve :

$0.25 = e^{-\lambda t}$

$\Rightarrow ln(0.25) = -\lambda t$

$\Rightarrow -ln(4) = -\lambda t$

$\Rightarrow \lambda t = ln(4) = 2ln(2)$

$\Rightarrow t = \frac{2ln2}{\lambda} = \frac{2ln2}{\frac{ln2}{5730}} = 2 \times 5730 = 11460\, years$

46. If $\frac{1}{8}$ remains, $\Rightarrow \left(\frac{1}{2}\right)^3$

$\Rightarrow$ 3 half-lives=15 min $\Rightarrow$ half-life $= \frac{15}{3} = 5\min$

47. • Number of protons =2
• Number of neutrons =2
• Mass of nucleons =
$2 \times 1.0080 + 2 \times 1.0087 = 4.0334, u$
• Mass defect
$\Delta m = 4.0334 - 4.0026 = 0.0308, u$
• Binding energy =
$0.0308 \times 931 \approx 28.69, MeV$
BE per nucleon =28.69/4=7.17 MeV

48. $\lambda = \frac{A}{N} = \frac{8000}{2 \times 10^{20}} = 4 \times 10^{-17} s^{-1} = 4$

49. • Moles $= \frac{1}{235}$, number of atoms =
$\frac{6 \times 10^{23}}{235} \approx 2.55 \times 10^{21}$
• Total energy =
$2.55 \times 10^{21} \times 200 \times 1.6 \times 10^{-13} \approx 8.16 \times 10^{10}, J$ =8

50. Mean life $= \frac{T_{1/2}}{In2} = \frac{10}{0.693} \approx 14.43 \approx 14$

CHEMISTRY

51. Serine and cysteine are not essential amino acids

52. Ammonolysis $\rightarrow$ Reaction with $R-X+NH_3$

Gabriel phthalimide $\rightarrow$ Reaction with phthalimide $+KOH+RX$

Hoffmann Bromamide $\rightarrow$ Amines with 1'c' less

Carbylamine Reaction $\rightarrow$ Detection for 1^0 Amines

53. Glycine is achiral and optically inactive

54. Enzymes are highly specific for their substrates

55. Cellulose is a polymer of β-glucose OH-left at anomeric "C"

Mutarotation $\rightarrow$OH group of anomeric "C" is Reducing in nature [Open chain]

56. 1^0 structure of amino acid is linked together by peptide bonds .

57. Hemiacetal carbon (C_1 or C_2) is called the anomeric carbon

58. Formula for permutations of a set of n distinct elements is given by n!

n!= $n\times(n-1)\times(n-2)\times---\times 1$

n=4 (Given)

$n!=4\times3\times2\times1=24$

$\therefore$ 24 different tetra peptide sequences are possible

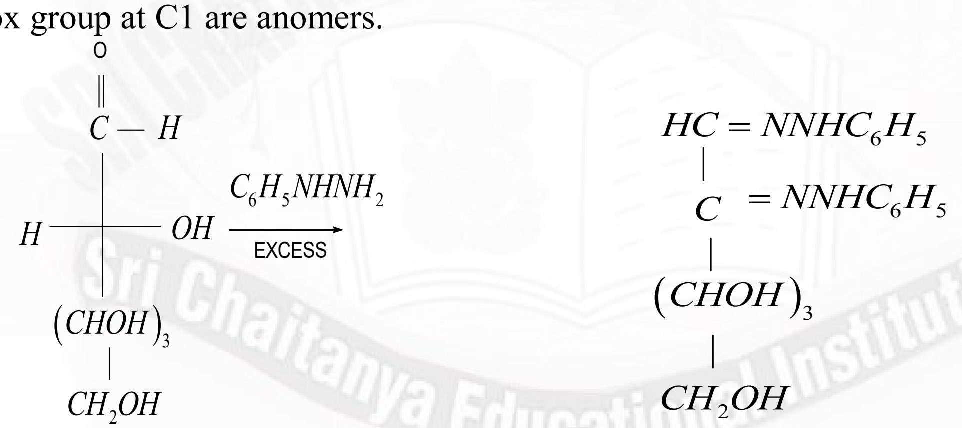
59. Protein Acidic hydrolysis produce alpha-amino acids.

60. Amylose is soluble in H_2O.

61. Glycogen is also called as animal starch.

62. Maltose $\xrightarrow{maltose}$ 2(Glucose units)

63. Cyclic Hemiacetal forms of monosaccharide which differ only in the configuration of hydrox group at C1 are anomers.



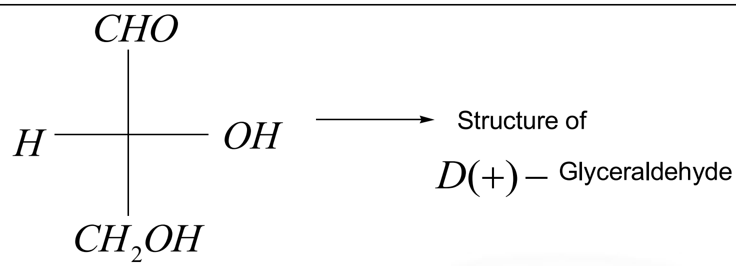
64. Glucose Osazone

65. In Fibrous proteins polypeptide chains are held by disulphide and Hydrogen bonds.

66. Glucose is present in pyranose from

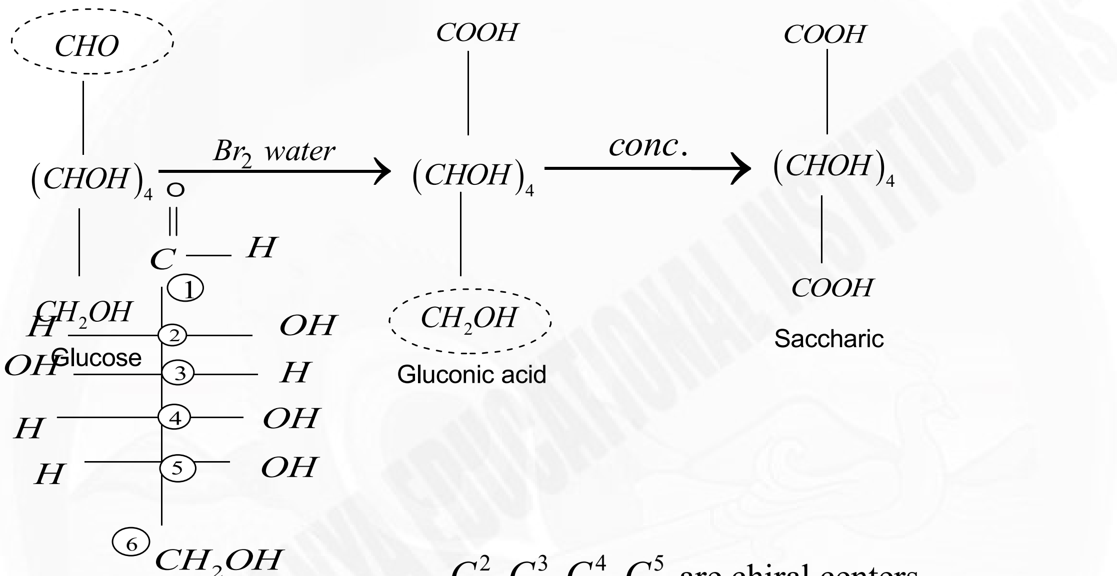
67. The 'R' group in cysteine is $HS-CH_2-$

68.



69. vitamins are organic compounds required in diet in small amounts for optimum growth of organism.

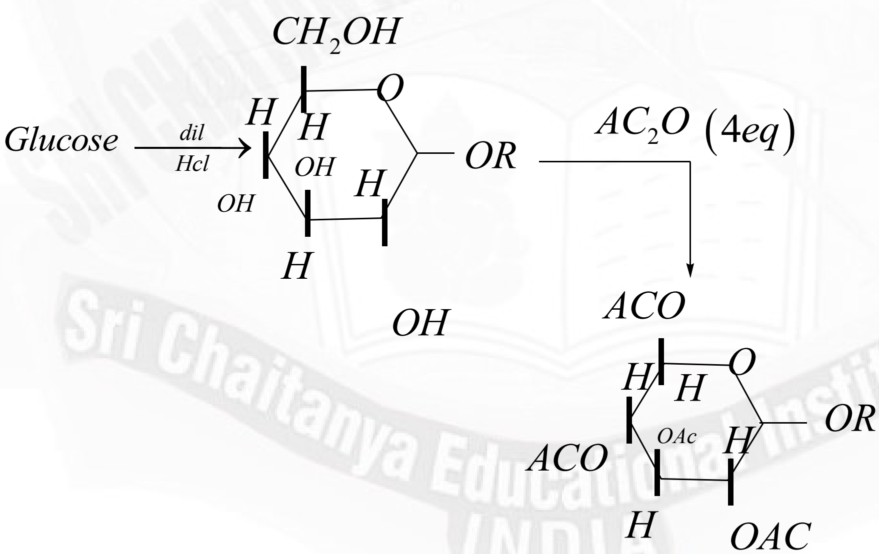
70.



71.

C^2, C^3, C^4, C^5 are chiral centers

72.



73. C_1 and C_4 $1 \times 4 = 4$

74. Sucrose gives –ve Test

$\because$ No free aldehyde (or) ketone group

75. $\dfrac{2.3+9.6}{2} = \dfrac{11.9}{2}$

PI= $\dfrac{Pka_1 + Pka_2}{2}$