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 NUCLEUS-BT	**JEE-MAIN**	**Date: 28-06-2025**
Time: 09.00Am to 12.00Pm	**WTM-34**	**Max. Marks: 300**

IMPORTANT INSTRUCTION:

1. Immediately fill in the Admission number on this page of the Test Booklet with **Blue/Black** Ball Point **Pen** only.
2. The candidates should not write their Admission Number anywhere (except in the specified space) on the Test Booklet/ Answer Sheet.
3. The test is of **3 hours** duration.
4. The Test Booklet consists of 90 questions. The maximum marks are **300.**
5. There are **three** parts in the question paper 1,2,3 consisting of **Physics, Chemistry** and **Mathematics** having **30 questions** in each subject and subject having **two sections.**

   (I) Section –I contains 20 **multiple choice** questions with only one correct option.

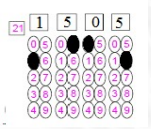
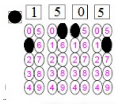
   Marking scheme: +4 for correct answer, 0 if not attempt and -1 in all other cases.

   (II) Section-II contains 10 **Numerical Value Type** questions. Attempt any 5 questions only, if more than 5 questions attempted, First 5 attempted questions will be considered.

   ■ The Answer should be within **0 to 9999.** If the Answer is in **Decimal** then round off to the **nearest Integer** value (Example i,e. If answer is above **10** and less than **10.5** round off is **10** and If answer is from **10.5** and less than **11** round off is **11).**

   To cancel any attempted question bubble on the question number box.

   For example: To cancel attempted question 21. Bubble on 21 as shown below

   Question Answered for Marking **Question Cancelled for Marking**

   Marking scheme: +4 for correct answer, 0 if **not attempt** and **-1** in all other cases.
6. Use **Blue / Black Point Pen only** for writing particulars / marking responses on the Answer Sheet. **Use of pencil is strictly prohibited.**
7. No candidate is allowed to carry any textual material, printed or written, bits of papers, mobile phone any electron device etc, except the Identity Card inside the examination hall.
8. Rough work is to be done on the space provided for this purpose in the Test Booklet only.
9. On completion of the test, the candidate must hand over the Answer Sheet to the invigilator on duty in the Hall. **However, the candidate are allowed to take away this Test Booklet with them.**
10. **Do not fold of make any stray marks on the Answer Sheet**

Name of the Candidate (in Capital): _____

Admission Number: | | | | | | | | | |

Candidate's Signature:_____ **Invigilator's Signature:** _____

28-06-2025_Sr.Super60_NUCLEUS-BT_Jee-Main-WTM-34_Test Syllabus

MATHEMATICS : Conditional probability, Multiplication theorem, Independent events

PHYSICS : NUCLEI: Nuclear notation, Composition of nucleus, Mass of nucleus, Mass-energy equivalence relation, Size of nucleus, Density of nucleus, Charge of nucleus, Nuclear shapes, Isotopes, Isobars and Isotones, Nuclear binding energy and mass defect, Binding energy curve, Nuclear force and its comparison with gravitational and electrostatic forces, Nature of nuclear force, Variation of nuclear force with distance, NUCLEI: Packing fraction (Optional), Nuclear Stability, Radioactivity, Three types of radiations, Radioactivity decay law, Half-life period: Half life, T1/2, Average life: Mean life, Decay rate: Activity, Alpha decay, Theory and energy distribution, Velocity of alpha-particle emitted during radioactivity decay (Optional), Beta decay: Theory and energy distribution, Positron emission, Electron capture, Gamma decay: Theory and energy distribution (Deleted pertaining to JEE MAINS but still in JEE ADV Syllabus), Radioactivity decay series, Radioactivity dating (Deleted pertaining to JEE MAINS but still in JEE ADV Syllabus), Nuclear reactions, Discovery of neutron, Mass of neutron, Pair production and Pair annihilation, Artificial radioactivity, Nuclear energy, Nuclear fission, Nuclear fusion processes, Nuclear power reactor

CHEMISTRY : Tests for Amines and nitro compounds, Principles of separation of organic compounds by solvent extraction method, BIOMOLECULES: Carbohydrates: Classification; Mono- and di saccharides (glucose and sucrose); Oxidation; Reduction;, Glycoside formation and hydrolysis of disaccharides (sucrose, maltose, lactose); Anomers. Tests for carbohydrates, Reactions of glucose with HIO4, PhNHNH2,

MATHEMATICS **Max Marks: 100**

SECTION-I
(SINGLE CORRECT ANSWER TYPE)

This section contains **20 Multiple Choice Questions.** Each question has 4 options (1), (2), (3) and (4) for its answer, out of which ONLY ONE option can be correct.

Marking scheme: +4 for correct answer, 0 if not attempted and –1 in all other cases.

1. A fifteen digit number is formed at random by using all the digits 1, 1, 1, 1, 2, 2, 3, 3, 3, 4, 4, 4, 4, 4, 4. If the number so formed is a palindrome, then the probability that it contains no two 4's adjacent is:

1) $\frac{5}{21}$ **2)** $\frac{3}{14}$ **3)** $\frac{4}{35}$ **4)** $\frac{2}{7}$

2. A wooden cube whose faces are painted same colour red and with volume 64 cubic units is divided into 64 unit cubes by cutting the cube along planes parallel to its faces. Out of 64 units cubes obtained one is chosen at random and one of its faces is found painted red then the probability that none of the remaining faces of it, is painted is ……..

1) $\frac{2}{7}$ **2)** $\frac{1}{4}$ **3)** $\frac{3}{7}$ **4)** $\frac{4}{7}$

3. Four standard, six faced dice are rolled. If the product of their values turns out to be an even number then the probability that their sum is odd, is :

1) $\frac{1}{2}$ **2)** $\frac{3}{4}$ **3)** $\frac{8}{15}$ **4)** $\frac{4}{15}$

4. If E_1, E_2 are two events such that $P(E_1)=\frac{1}{4}$, $P(E_2/E_1)=\frac{1}{2}$ and $P\left(\frac{E_1}{E_2}\right)=\frac{1}{4}$ then which of the following is not true?

1) E_1 and E_2 are independent

2) $E_1$and E_2 are exhaustive

3) E_2 is twice as likely to occur as E_1

4) Probabilities of the events $E_1 \cap E_2, E_1, E_2$ are in G.P

5. Two cubes have each of their faces painted either red or blue. The first cube has five red faces and one blue face. When the two cubes are rolled simultaneously, the probability that the two top faces show the same colour is (1/2). Number of red faces on the second cube, is

1) 1 **2)** 2 **3)** 3 **4)** 4

6. For any two elements E and F in a sample space and if P(A) denote probability of event A, then

1) $P\left(\frac{E}{F}\right)+P\left(\frac{\bar{E}}{F}\right)=\frac{1}{2}$ **2)** $P\left(\frac{E}{F}\right)+P\left(\frac{E}{\bar{F}}\right)=1$

3) $P\left(\frac{\bar{E}}{F}\right)+P\left(\frac{E}{\bar{F}}\right)=1$ **4)** $P\left(\frac{E}{\bar{F}}\right)+P\left(\frac{\bar{E}}{\bar{F}}\right)=1$

7. One ticket is selected at random from 50 tickets numbered 00, 01, 02 ,……,49. Then the probability that the sum of the digits on the selected ticket is 4, given that product of digits is zero, equals

1) $\frac{1}{50}$ **2)** $\frac{1}{7}$ **3)** $\frac{1}{4}$ **4)** $\frac{5}{14}$

8. A 4-digit number is chosen at random. If it is known that its digits (from 1000's place to unit place) are in strictly decreasing order then the probability that the number is divisible by 4 is

1) $\frac{3}{7}$ **2)** $\frac{2}{7}$ **3)** $\frac{5}{7}$ **4)** $\frac{1}{2}$

9. A bag contains 4 black, 5 white and 6 red balls. If 4 balls are drawn one by one with replacement the probability that none is red is

1) $\frac{81}{625}$ **2)** $\frac{27}{125}$ **3)** $\frac{81}{125}$ **4)** $\frac{27}{625}$

10. From the set of all positive integral divisors of $\left(2^3.3^4.5^2.7^1\right)$ one number 'x' is selected at random. If 'x' is even, then the probability that it is a multiple of 10 is

1) $\frac{1}{3}$ **2)** $\frac{1}{2}$ **3)** $\frac{2}{3}$ **4)** $\frac{1}{4}$

11. Two persons A, B and 8 others are arranged in a row at random. In the arrangement if A is not at the starting place or the ending place, then the probability that A, B are adjacent to each other is …..

1) $\frac{2}{9}$ **2)** $\frac{1}{5}$ **3)** $\frac{4}{5}$ **4)** $\frac{1}{9}$

12. Two balls are selected at random one by one without replacement from a bag containing 4 white and 6 black balls. If the probability that the first selected ball is black, given that the second selected ball is also black, is $\frac{m}{n}$, where gcd (m,n) = 1, then m + n is equal to :

1) 14 **2)** 4 **3)** 11 **4)** 13

13. Let the sum of two positive integers be 24. If the probability, that their product is not less than $\frac{3}{4}$ times their greatest possible product, is $\frac{m}{n}$, where gcd(m, n) = 1, then n – m equals

1) 10 **2)** 9 **3)** 11 **4)** 8

14. Let A and B be two events. Suppose $P(A)=0.4$, $P(B)=p$ and $P(A\cup B)=0.7$. The value of 'p' for which A and B are independent is

1) 1/3 **2)**1/4 **3)**1/2 **4)**1/5

15. A, B are two events such that $P(A)=\lim\limits_{x\to 0}\frac{1-\cos^2 x}{9x^2}$, $P(B)=\lim\limits_{x\to 0}\frac{\sin^2 2x}{3x\tan 4x}$,

$P(A\cap B)=\lim\limits_{x\to\infty}\left(\frac{x-1}{2x+1}\right)^x$ then A, B are

1) Independent **2)** mutually exclusive
3) equally likely **4)** none

16. A card from a pack of 52 cards is lost. From the remaining 51 cards, n cards are drawn and are found to be spades. If the probability of the lost card to be a spade is $\frac{11}{50}$, then 'n' is equal to

1) 5 **2)** 7 **3)** 3 **4)** 2

17. If A and B are two events such that P(A) = 0.7, P(B) = 0.4 and $P(A\cap\bar{B})=0.5$, where $\bar{B}$ denotes the complement of B, then $P(B|(A\cup\bar{B}))$ is equal to : ….

1) $\frac{1}{4}$ **2)** $\frac{1}{2}$ **3)** $\frac{1}{6}$ **4)** $\frac{1}{3}$

18. A speaks truth in 75% of the cases and B in 80% of the cases. The percentage of cases they are likely to contradict each other in making the same statement is

1) 25% **2)** 35% **3)** 50% **4)** 65%

19. Statement – I : If A and B are two events such that $P(A)=\frac{1}{3}, P(B)=\frac{1}{5}$ and $P(A\cup B)=\frac{1}{2}$ then $P(A/B^C)+P(B/A^C)$ is equal to $\frac{5}{8}$

Statement – II : If A and B are two events such that $P(A\cap B)=0.1$ and P(A/B) and P(B/A) are the roots of the equation $12x^2-7x+1=0$, then the value of $\frac{P(\bar{A}\cup\bar{B})}{P(\bar{A}\cap\bar{B})}$ is $\frac{9}{4}$

1) Both Statement – I and Statement – II are true
2) Both Statement – I and Statement – II are false
3) Statement – I is false and Statement – II is true
4) Statement – I is true and Statement – II is false

20. If E_1 and E_2 are two events of a random experiment such that

$P(E_1)=\frac{1}{8}, P(E_1/E_2)=\frac{1}{3}, P(E_2/E_1)=\frac{1}{4}$ then match the items of List – I with the items of List – II :

List – I	**List – II**
A) $P(E_2)$	I) $\frac{3}{16}$
B) $P(E_1\cup E_2)$	II) $\frac{3}{29}$
C) $P(\bar{E}_1/\bar{E}_2)$	III) $\frac{3}{32}$
D) $P(E_1/\bar{E}_2)$	IV) $\frac{26}{29}$
	V) $\frac{13}{32}$

The correct match is:

1) A – I; B – III; C – IV; D – II **2)** A – II; B – I; C – IV; D – V
3) A – III; B – I; C – IV; D – II **4)** A – I; B – II; C – V; D – IV

SECTION-II
(NUMERICAL VALUE TYPE)

This section contains **5 Numerical Value Type Questions.** The Answer should be within **0 to 9999.** If the Answer is in **Decimal** then round off to the **Nearest Integer** value (Example i,e. If answer is above **10** and less than **10.5** round off is **10** and If answer is from **10.5** and less than **11** round off is **11**).

Marking scheme: +4 for correct answer, 0 if not attempt and -1 in all other cases.

21. From a box containing 3 red ball, 4 white ball and 5 blue balls, 3 balls are drawn together at random. Out of the 3 balls drawn, it is found that one is blue. Then the probability that all the 3 balls drawn are of different colours is equal to 'p' then $18\left(\frac{1}{p}-1\right)=$

22. A = {1, 2, 3, 4, 5, 6}. Two subsets P, Q are chosen from the power set of A, one by one with replacement. Then the value of the conditional probability $P\left(\frac{n(P\cap Q)=1}{n(P\cup Q)=4}\right)$ is $\left(\frac{\alpha}{\beta}\right)$ where $\alpha, \beta \in N$ are coprime. Then the sum of all positive integral divisors of $(\beta-\alpha)$ is

23. $A_1, A_2, ...,A_{10}$ are independent events where $P(A_i)=\left(\frac{1}{1+i}\right)\forall 1\le i\le 10, i\in N$. If the probability that none of $A_1, A_2, ...,A_{10}$ occurs, except A_5 is equal to $\left(\frac{1}{p}\right)$, then p = …

24. Three distinct numbers are selected randomly from the set {1, 2, 3,……,40}. If the probability, that the selected numbers are in an increasing G.P. is $\frac{m}{n}$, gcd(m, n) = 1, then m + n is equal to …….

25. All five letter words are made using all the letters A, B, C, D, E and arranged as in an English dictionary with serial numbers. Let the word at serial number 'n' be denoted by W_n. Let the probability $P(W_n)$ of choosing the word W_n satisfy $P(W_n)=2P(W_{n-1}), n>1$. If $P(CDBEA)=\frac{2^\alpha}{2^\beta-1}, \alpha, \beta\in N,$ then $\alpha+\beta$ is equal to : …

PHYSICS **Max Marks: 100**

SECTION-I
(SINGLE CORRECT ANSWER TYPE)

This section contains **20 Multiple Choice Questions.** Each question has 4 options (1), (2), (3) and (4) for its answer, out of which ONLY ONE option can be correct.

Marking scheme: +4 for correct answer, 0 if not attempted and –1 in all other cases.

26. A radionuclide A_1 with decay constant λ_1 transform into a radionuclide A_2 with decay constant λ_2. Assuming that at the initial moment the preparation contained only the radionuclide A_1, then the time interval after which the activity of the radionuclide A_2 reaches its maximum value is

1) $\frac{\ln(\lambda_2/\lambda_1)}{\lambda_2-\lambda_1}$ **2)** $\frac{\ln(\lambda_1/\lambda_2)}{\lambda_2-\lambda_1}$ **3)** $\ln(\lambda_2-\lambda_1)$ **4)** $\frac{\ln(\lambda_2/\lambda_1)}{2\lambda_2-\lambda_1}$

27. If the binding energy per nucleon in ${}_3^7Li$ *and* ${}_2^4He$ nuclei are 5.60 MeV and 7.06 MeV respectively, then in the reaction $p+{}_3^7Li \rightarrow 2\,{}_2^4He$ energy of proton must be

1) 28.24 MeV **2)** 17.28 MeV **3)** 1.46 MeV **4)** 39.2 MeV

28. If radius of the ${}_{13}^{27}Al$ nucleus is estimated to be 3.6 fm, then the radius of ${}_{52}^{125}Te$ nucleus be nearly

1) 6 fm **2)** 8 fm **3)** 4 fm **4)** 5 fm

29. A nucleus initially of rest disintegrates into two nuclear parts which have their velocities in the ratio 2 : 1. The ratio of their nuclear sizes will be

1) $2^{1/3}:1$ **2)** $1:3^{1/2}$ **3)** $3^{1/2}:1$ **4)** $1:2^{1/3}$

30. In the nuclear fusion reaction, ${}_1^2H+{}_1^3H \rightarrow {}_2^4He+n$ given that the repulsive potential energy between the two nuclei is $20.7\times10^{-14}\ J$, the temperature at which the gases must be heated to initiate the reaction is nearly [Boltzmann's constant, $k=1.38\times10^{-23}\ J/K$]

1) 10^9 K **2)** 10^5 K **3)** 10^3 K **4)** 10^{10} K

31. A star initially has 10^{40} deuterons. It produces energy via the process ${}_1^2H + {}_1^2H \rightarrow {}_1^3H + p$ *and* ${}_1^2H + {}_1^3H \rightarrow {}_2^4He + n$ Where the masses of the nuclei are $m\left({}^2H\right) = 2.014\ amu, m(p) = 1.007\ amu, m(n) = 1.008\ amu$ *and* $m\left({}^4He\right) = 4.001\ amu$.

If the average power radiated by the star is $10^{16}W$, the deuteron supply of the star is exhausted in a time of the order of

1) $10^6 s$ **2)** $10^8 s$ **3)** $10^{12} s$ **4)** $10^{16} s$

32. What is the probability of a radioactive nucleus to survive one mean life?

1) $\frac{1}{e}$ **2)** $\frac{1}{e+1}$ **3)** $1-\frac{1}{e}$ **4)** $\frac{1}{e}-1$

33. The binding energy per nucleon for deuteron $\left({}_1^2H\right)$ *and helium* $\left({}_2^4He\right)$ are 1.1 MeV and 7.0 MeV respectively. The energy released when two deuterons fuse to form a helium nucleus is

1) 47.12 MeV **2)** 23.6 MeV **3)** 11.8 MeV **4)** 34.4 MeV

34. A radioactive sample of mass number A is undergoing alpha decay. Its initial activity is A_0 and decay constant for this decay is λ. Which of the following statement is incorrect?

1) The ratio of kinetic energies of the alpha particle and the daughter product is $\frac{(A-4)}{4}$

2) Initially present number of radioactive nuclei is $\frac{A_0}{\lambda}$

3) At time t, the activity is reduced to 1/n times the initial activity then $t = \frac{\ln(n)}{\lambda}$

4) Momentum of the alpha particle will vary from zero to a certain maximum value

35. The positron is the anti-matter counterpart of the electron. It has same mass of the electron, but has non-zero energy and momentum. Away from all other matter an electron and positron moving towards each other with equal and opposite velocities,

1) Can annihilate into one photon, conserving both energy and momentum

2) Can annihilate into one photon, because energy and momentum are not conserved in quantum mechanics

3) Cannot annihilate into one photon because energy cannot be conserved

4) Cannot annihilate into one photon because momentum is to be conserved

36. In a certain experiment it is found that the ratio of the decay current in an L – R circuit to the activity of a radio active sample remains constant with respect to time. If the time constant of the L – R circuit is 0.4 s, then the average life of the radio-active sample is

1) 0.2 s **2)** 0.4 s **3)** 0.6 s **4)** 0.8 s

37. Half lives of two isotopes X and Y of a material are known to be 2×10^9 *years* and 4×10^9 *years* respectively. If a planet was formed with equal number of these isotopes, estimate the current age of the planet, given that currently the material has 20% of X and 80% of Y by number.

1) 2×10^9 *years* **2)** 4×10^9 *years* **3)** 6×10^9 *years* **4)** 8×10^9 *years*

38.

$$A \xrightarrow{\lambda_1} B \xrightarrow{\lambda_2} C$$

$t=0$	N_0	0	0
t	N_1	N_2	N_3

In the above radioactive decay C is stable nucleus. Then

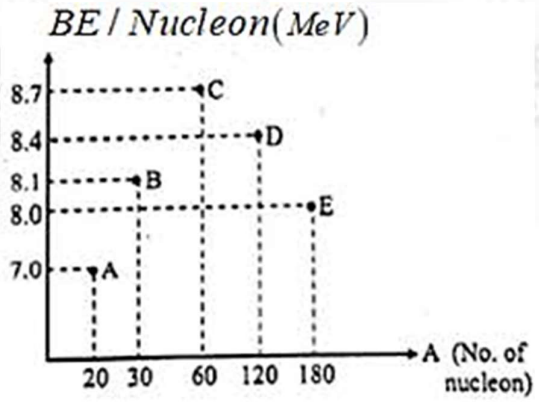
1) number of nuclei of B will first increases and then decreases

2) rate of decay of A will first increases and then decreases

3) if $\lambda_2 > \lambda_1$, then activity of B will always be higher than activity of A.

4) if $\lambda_1 >> \lambda_2$, then number of nucleus of C will always be less than number of nucleus of B

39. Consider the positions of different nuclei on the binding energy per nucleon graph as shown

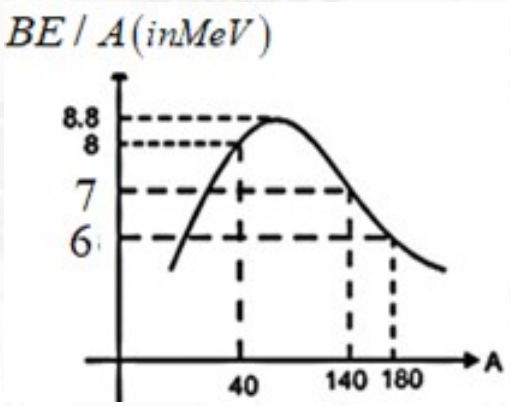


Column – I (Reaction)	Column – II (Q-Values (Mev))
A) $2B \rightarrow C$	P) 0
B) $2B + C \rightarrow D$	Q) 102
C) $E \rightarrow C + D$	R) non-zero
D) $3A \rightarrow C$	S) 36
	T) 90

1) A – RS; B – P; C – RT; D – QR **2)** A – R; B – PS; C – RT; D – QR

3) A – RT; B – PS; C – R; D – QR **4)** A – R; B – PQ; C – R; D – SR

40. A heavy nucleus x(A = 180) breaks into two nuclei y(A = 140) and z (A= 40). Energy released during fission reaction is:



1) 110MeV **2)** 220MeV **3)** 200MeV **4)** Energy is not released

41. In a certain hypothetical radioactive decay process, species A decays into species B and species B decays into species C according to the reactions

$A \rightarrow 2B + particles + energy$: $B \rightarrow 3C + particles + energy$

The decay constant for the species A is $\lambda_1 = 1\sec^{-1}$ and that for the species B is $\lambda_2 = 100\sec^{-1}$, initially 10^4 moles of the species of A were present while there was none of B and C. It was found that species B reaches its maximum number at a time $t = 2\ln(10)$ sec. Then value of the maximum number of moles of B is

1) 2 **2)** 3 **3)** 4 **4)** 6

42. The energy released in the fission reaction ${}_{92}U^{236} \rightarrow {}_{46}X^{117} + {}_{46}Y^{117} + 2\ {}_{0}n^{1}$, given that the binding energy per nucleon of X and Y is 8.5 MeV and that of ${}_{92}U^{236}$ is 7.6 MeV, is nearly

1) 220 MeV **2)** 180 MeV **3)** 195 MeV **4)** 190 MeV

43. Nuclei of radioactive element A are produced at rate t^2 at an time 't' the element A has decay constant λ. Let N be the number of nuclei of element A at any time 't' at time $t = t_0, \frac{dN}{dt}$ is minimum. Then the number of nuclei of element A at time $t = t_0$ is

1) $\frac{-2t_0 + \lambda t_0^2}{\lambda^2}$ **2)** $\frac{t_0 - \lambda t_0^2}{\lambda^2}$ **3)** $\frac{2t_0 - \lambda t_0^2}{\lambda}$ **4)** $\frac{t_0 - \lambda t_0^2}{\lambda}$

44. Statement – I: Nuclear forces are strongest in nature and is always attractive
Statement – II: The nuclear force between two neutrons can be repulsive

1) Statement – I and Statement – II are true

2) Statement – I and Statement – II are false

3) Statement – I is true and Statement – II is false

4) Statement – I is false and Statement – II is true

45. Assertion (A): The binding energy per nucleon is practically constant in the range $30 < A < 170$ (where A is the mass number)
Reason (R): Nuclear forces are short range forces

1) A and R are true and R is correct explanation of A

2) A and R are true and R is not correct explanation of A

3) A is true and R is false

4) A is false and R is true

SECTION-II
(NUMERICAL VALUE TYPE)

This section contains **5 Numerical Value Type Questions.** The Answer should be within **0 to 9999.** If the Answer is in **Decimal** then round off to the **Nearest Integer** value (Example i,e. If answer is above **10** and less than **10.5** round off is **10** and If answer is from **10.5** and less than **11** round off is **11).**

Marking scheme: +4 for correct answer, 0 if not attempt and -1 in all other cases.

46. ^{131}I is an isotope of Iodine that β decays to an isotope of Xenon with a half-life of 8 days. A small amount of a serum labelled with ^{131}I is injected into the blood of a person. Activity of the amount of ^{131}I injected was 2.4×10^5 Becquerel (Bq). It is known that the injected serum will get distributed uniformly in the blood stream in less than half an hour. After 11.5 h, 2.5 ml of blood is drawn from the person 's body, and gives an activity of 115 Bq. The total volume of blood in the person's body, in litres is approximately (you may use $e^2 \approx 1+x$ *for* $|x|<<1$ *and* $\ln 2 \approx 0.7$).

47. For a radioactive material, its activity A and rate of change of its activity R are defined as $A=-\frac{dN}{dt}$ *and* $R=-\frac{dA}{dt}$, where N (t) is the number of nuclei at time 't'. Two radioactive source P(mean life τ) and Q (mean life 2τ) have the same activity at t = 0. Their rate of change of activities at t = 2τ are R_P *and* R_Q, respectively. If $\frac{R_P}{R_Q}=\frac{n}{e}$, then the value of 'n' is

48. A sample contains two radio active materials A and B with half life of 51 hours and 2 hours respectively. The nucleus A decays into B and B decays into stable nucleus C. At t = 0 activities of both samples were equal. The ratio of activity of A to that of B when the activity of B is maximum is

49. In the fusion reaction $^2_1H+{}^2_1H\rightarrow{}^3_2He+{}^1_0n$, the masses of deuteron helium and neutron expressed in amu are 2.015, 3.017 and 1.009 respectively. If 1 kg of deuterium undergoes complete fusion, the amount of total energy released (1 amu = 931.5 MeV/c^2) is $p\times10^{13}J$. Find P. (Round off to nearest integer)

50. If mass U^{235} = 235.12142 a.m.u., mass of U^{236} = 236.123050 a.m.u. and mass of neutron = 1.008665 a.m.u., then the energy required to remove one neutron from the nucleus of U^{236} is x MeV. Nearly. Find 10x. (1 a.m.u=931MeV)

CHEMISTRY **Max Marks: 100**

SECTION-I
(SINGLE CORRECT ANSWER TYPE)

This section contains **20 Multiple Choice Questions.** Each question has 4 options (1), (2), (3) and (4) for its answer, out of which ONLY ONE option can be correct.

Marking scheme: +4 for correct answer, 0 if not attempted and –1 in all other cases.

51. On oxidation with nitric acid, glucose as well as gluconic acid both yield a product contains ….

1) Dicarboxylic acid **2)** Monocarboxylic acid

3) Tricarboxylic acid **4)** Only alcohol group

52. Which of the following is not a monosaccharide?

1) Glucose **2)** Maltose **3)** Ribose **4)** Fructose

53. Glucose does not

1) React with HNO_3 **2)** React with acetic anhydride

3) Give Schiff's test **4)** Reduce Tollen's reagent

54. Which of the following gives positive Libermann nitroso test?

1) 2-butanamine **2)** N-ethyl-2-pentanamine

3) N-methylpiperdine **4)** N,N-dimethyl cyclohexylamine

55. Which of the following option is correct regarding Lactose.

1) Glucose has acetal and galactose has hemiacetal linkage in Lactose.

2) Glucose is forming glycosidic bond from C_1 carbon in Lactose.

3) β – glycosidic bond is formed by C_1 of galactose and C_4 of glucose in Lactose.

4) α – glycosidic bond is formed by C_1 of galactose and C_4 of glucose in Lactose.

56. **Assertion:** The carbohydrates are stored in animal body as glycogen. It is also known as animal starch

Reason: Its structure is similar to amylopectin and is rather more highly branched

1) If both assertion and reason are true and the reason is the correct explanation of the assertion

2) If both assertion and reason are true but reason is not the correct explanation of the assertion

3) If assertion is true but reason is false.

4) If the assertion is false reason is true

57. Assertion (A) : D – (+) – sucrose on hydrolysis gives a levorotatory solution

Reason (R) : D – (+) – sucrose on hydrolysis produces one mole of each D – (+) – glucose and D – (–) – fructose and magnitude of specific rotation is greater for D – (–) – fructose

1) A and R are true and R is correct explanation of A

2) A and R are true and R is not correct explanation of A

3) A is true and R is false

4) A is false and R is true

58. D-glucose in dilute alkaline or acidic solution contains

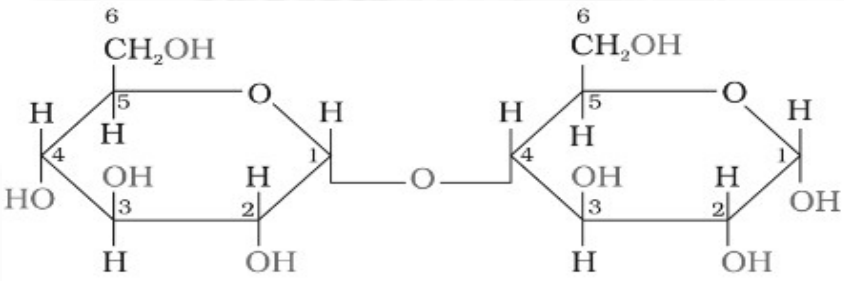
1) 50% each of α-D-glucose and β-D-glucose

2) 64% of α-D-glucose and 36% of β-D-glucose

3) 36% of α-D-glucose & 64% of β-D-glucose

4) 33% each of α-D-glucose, β-D-glucose & open structure

59. The incorrect statement regarding following compound (Y) is



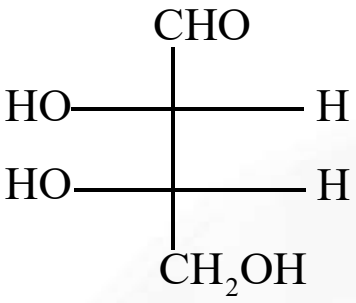
(Y)

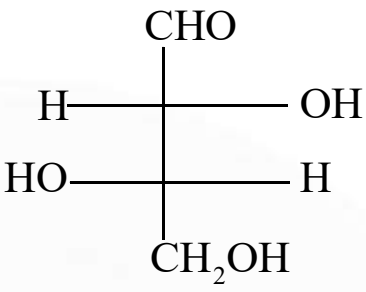
1) It is a reducing sugar **2)** Can show mutarotation

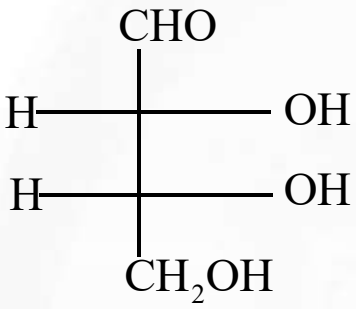
3) Consumes 5 moles of HIO_4 **4)** It is known as maltose

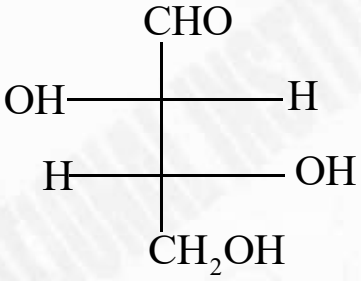
60. L-isomer of a compound $A(C_4H_8O_4)$ gives a positive test with $\left[Ag(NHL_3)_2\right]^+$.

Treatment of 'A' with acetic anhydride yield triacetate derivative. Compound 'A' produces an optically active compound (B) and an optically inactive compound (C) on treatment with bromine water and HNO_3 respectively, compound (A) is :

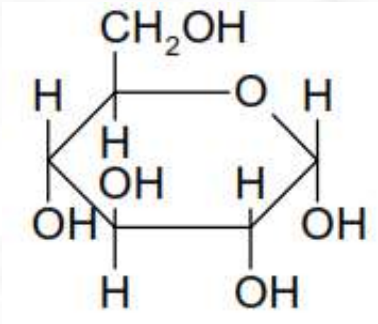
1) 

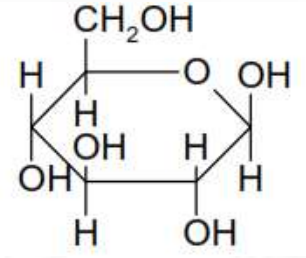
2) 

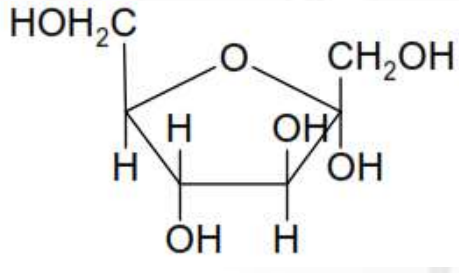
3) 

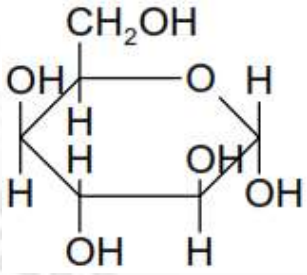
4) 

61. Which of the following is correct Haworth projection for α – D glucopyranose?

1) 

2) 

3) 

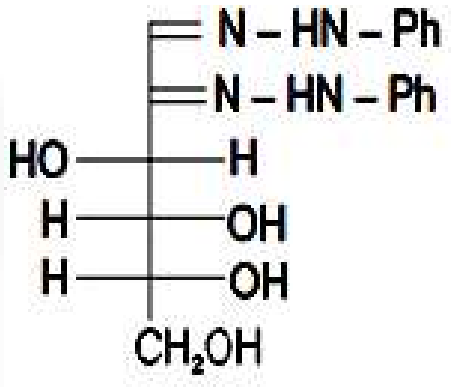
4) 

62. A positive carbyl amine test is given by

1) N, N-dimethylaniline **2)** N-methyl benzylamine

3) N-methylaniline **4)** p-methyl benzylamine

63. The given osazone could be obtained from



1) Glucose & galactose **2)** Glucose & mannose

3) Galactose & fructose **4)** Sucrose & Galactose

64. Identify the correct statement

a) Lactose is reducing sugar

b) In Amylopectin there are 1,4 & 1,6 glycosidic linakages

c) Sucrose is reducing sugar

d) Starch gives Maltose on partial hydrolysis

1) a, b, c **2)** a, b, d **3)** b, c, d **4)** a, c, d

65. Match the following Column – I with Column – II :

Column – I	**Column – II**
A) Glucose/ $NaHSO_3$ / Δ	I) Gluconic acid
B) Glucose/ HNO_3	II) No reaction
C) Glucose/ HI / Δ	III) n-hexane
D) Glucose/Bromine water	IV) Saccharic acid

Choose the incorrect answer from the options given below :

1) A – II; B – IV; C – III; D – I **2)** A – III; B – II; C – I; D – IV

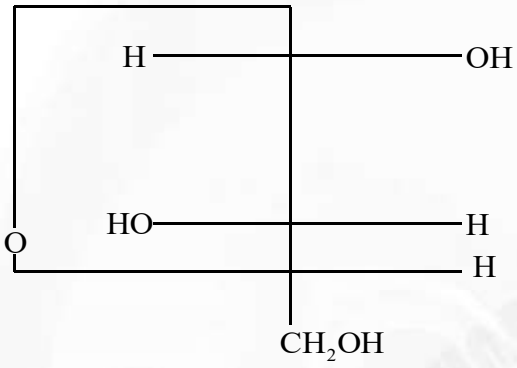
3) A – IV; B – I; C – III; D – II **4)** A – I; B – IV; C – III; D – II

66. L-isomer of tetrose $X(C_4H_8O_4)$ gives positive Schiff's test and has two chiral carbons. On acetylation X yields triacetate. X also undergoes following reactions

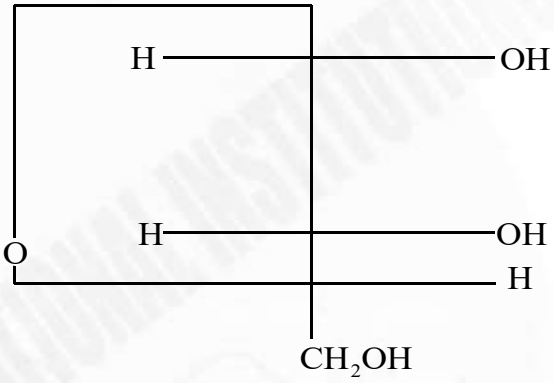
$$A \xleftarrow{HNO_3} X \xrightarrow{NaBH_4} B$$

Chiral compound 'X' is

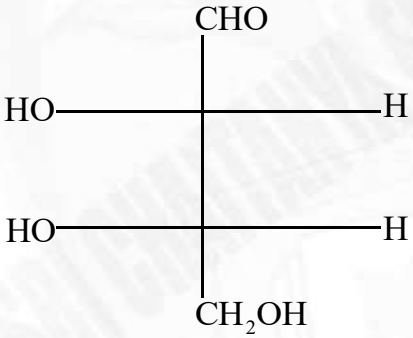
1)



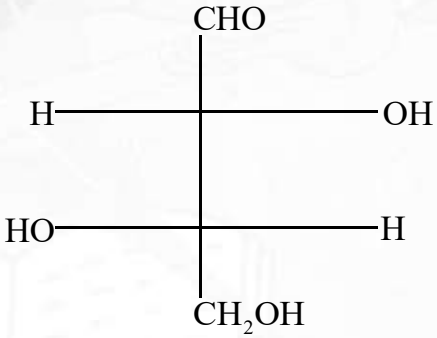
2)



3)



4)



67. An organic compound upon hydrolysis produces two compounds one product gave silver mirror test, other product reacts with Hinsberg reagent to produce an alkali insoluble product. The organic compound is

1) $CH_3 - CH_2 - \overset{\overset{O}{\|}}{C} - NHCH_3$

2) $(CH_3)_2NCHO$

3) $CH_3 - CH_2CONH_2$

4) $CH_3 - CH_2NH - CHO$

68. Isomeric amines with molecular formula $C_8H_{11}N$ give the following tests

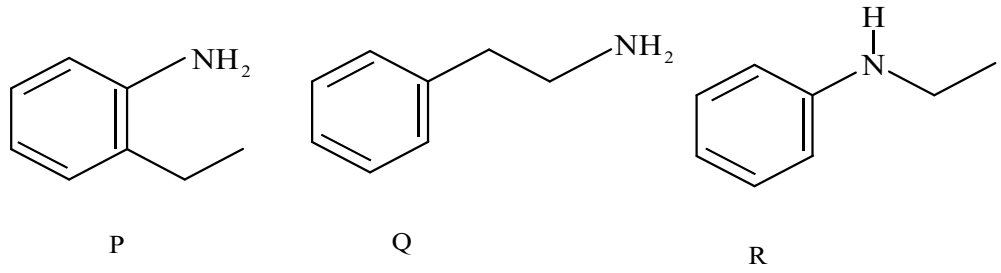
Isomer (P) $\Rightarrow$ can be prepared by Gabriel phthalimide synthesis

Isomer (Q) $\Rightarrow$ reacts with Hinsberg's reagent to give solid insoluble in NaOH

Isomer (R) $\Rightarrow$ reacts with HONO followed by β-naphthol in NaOH to given red dye

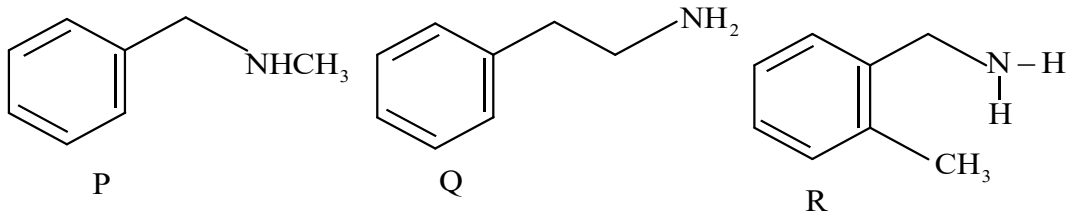
Isomers (P), (Q) and (R) respectively are :

1)



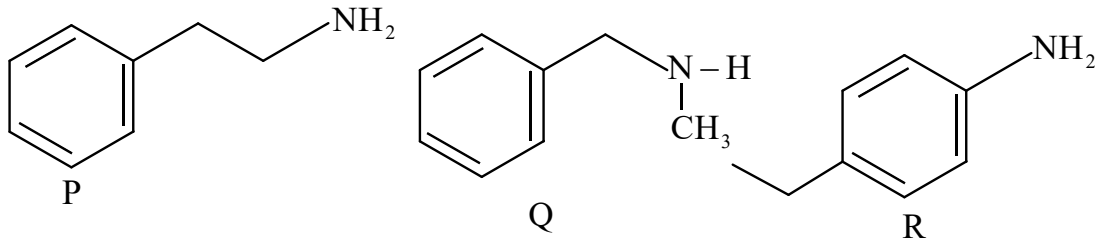
P Q R

2)



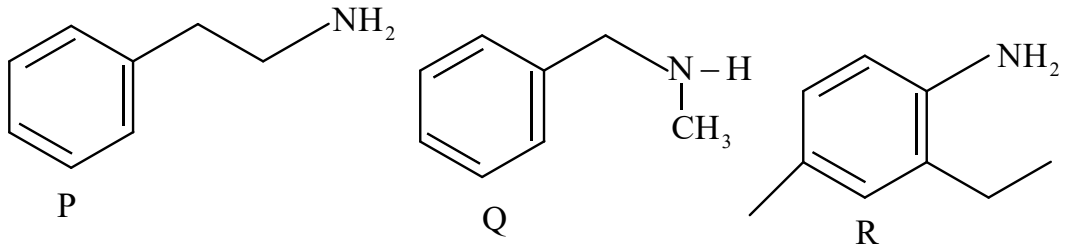
P Q R

3)



P Q R

4)



P Q R

69. Statement 1 : Bromine water changes glucose to gluconic acid.

Statement 2 : Bromine water acts as oxidising agent.

1) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

2) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

3) Statement-1 is true, statement-2 is false.

4) Statement-1 is false, statement-2 is true.

70. Statement 1 : All monosaccharide ketoses are reducing sugars.

Statement 2 : Monosaccharide ketose give positive Tollen's and Fehling's test.

1) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

2) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

3) Statement-1 is true, statement-2 is false.

4) Statement-1 is false, statement-2 is true.

SECTION-II
(NUMERICAL VALUE TYPE)

This section contains **5 Numerical Value Type Questions.** The Answer should be within **0 to 9999.** If the Answer is in **Decimal** then round off to the **Nearest Integer** value (Example i,e. If answer is above **10** and less than **10.5** round off is **10** and If answer is from **10.5** and less than **11** round off is **11).**

Marking scheme: +4 for correct answer, 0 if not attempt and -1 in all other cases.

71. Count the number of true statement/s among the following

1) Despite having the aldehyde group, glucose does not give Schiff's test.

2) Pentacetate of glucose is not reducing in nature.

3) Glucose does not form the bisulphite addition product with $NaHSO_3$.

4) α – glucose has a melting point of 419 k whereas that of β – form of glucose is 423 k.

5) D-Fructose is a leavorotatory sugar.

6) Glucose has a specific rotation $+52.5^0$

72. Number of chiral carbons in $\beta-\mathrm{D}-(+)-$ glucopyranose is

73. A carbohydrate X having molecular weight 180g mol^{-1} has one primary alcoholic group and four secondary alcoholic groups. It reacts with acetic anhydride to form pentaacetate. The molecular weight of pentaacetate formed is

74. Aniline and N-methylaniline can be distinguished by using, how many of the following tests?

I) Tollen's reagent
II) Hinsberg reagent
III) Carbylamine test
IV) Mulliken Test
V) Azo dye test
VI) Bayer's test
VII) Lucas test
VIII) Hofmann mustard oil test

75. The incorrect statement among the following is :

1) $\alpha-\mathrm{D}-$ glucose and $\beta-\mathrm{D}-$glucose are anomers

2) $\alpha-\mathrm{D}-$ glucose and $\beta-\mathrm{D}-$glucose are enantiomers

3) Cellulose is a straight chain polysaccharide made up of only $\beta-\mathrm{D}-$ glucose units

4) The penta acetate of glucose does not react with hydroxyl amine

5) Amylopectin is a branched polymer of $\alpha-$ glucose

6) Cellulose is a linear polymer of $\beta-$ glucose

7) Glycogen is the food reserve of plants

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