INSTRUCTIONS TO THE CANDIDATES
(Read the Instructions carefully before Answering)

1. Separate Optical Mark Reader (OMR) Answer Sheet is supplied to you along with Question Paper Booklet. Please read and follow the instructions on the OMR Sheet for marking the responses and also the required data.

2. Candidates should write the Hall Ticket Number only in the space provided on this page and OMR Sheet. Do not Write the Hall ticket number anywhere else.

3. Immediately on opening the Question Paper Booklet by tearing off the paper seal please check for (i) The same booklet code (A/B/C/D) on each page, (ii) Serial number of the questions (1—160), (iii) The number of pages and (iv) Correct Printing. In case of any defect, please report to the invigilator and ask for replacement with same booklet code within five minutes from the commencement of the test.

4. Electronic gadgets like Cell Phone, Pager, Calculator, Electronic watches and Mathematical/Log Tables are not permitted into the examination hall.

5. Darken the appropriate circles of 1, 2, 3 or 4 in the OMR sheet corresponding to correct or the most appropriate answer to the concerned question number in the sheet. Darkening of more than one circle against any question automatically gets invalidated.

6. Rough work should be done only in the space provided for this purpose in the Question Paper Booklet.

7. Once the candidate enters the Examination Hall, he/she shall not be permitted to leave the Hall till the end of the Examination.

8. Ensure that the Invigilator puts his/her signature in the space provided on Question Paper Booklet and OMR Answer Sheet. Candidate should sign in the space provided on the OMR Answer Sheet and filled in application form.

9. The candidate should write the Question Paper Booklet number, OMR Answer Sheet number, sign in the space provided in the Nominal Rolls and affix the left hand thumb impression in the nominal rolls and filled in application form.

10. Return the OMR Answer Sheet to the Invigilator before leaving the examination hall. Failure to return the OMR is liable for criminal action. The Question Paper Booklet shall be taken away by the candidate and should be preserved till the declaration of results.


This booklet consists of 61 Pages for 160 questions + 2 Pages of Rough Work + 1 Title Page i.e. Total 64 Pages.
Instructions:
(i) Each question carries one mark.
(ii) Choose the correct or most appropriate answer from the given options to the following questions and darken, with blue/black ball point pen the corresponding digit 1, 2, 3 or 4 in the circle pertaining to the question number concerned in the OMR Answer Sheet, separately supplied to you.

MATHEMATICS

1. If \( f(x) = (p - x^n)^{1/n}, \) \( p > 0 \) and \( n \) is a positive integer, then \( f(f(x)) = \)
\[ f(x) = (p - x^n)^{1/n}, \]
\[ p > 0 \text{ and } n \text{ is a positive integer}, \]
\[ \therefore f(f(x)) = \]
\[
\begin{align*}
(1) \ & x \\
(2) \ & x^n \\
(3) \ & p^{1/n} \\
(4) \ & p - x^n
\end{align*}
\]

2. \[
\left\{ x \in \mathbb{R} \mid \log \left( (1.6)^{1-x^2} - (0.625)^{6(1+x)} \right) \in \mathbb{R} \right\} =
\]
\[
(1) \ & (-\infty, -1) \cup (7, \infty) \\
(2) \ & (-1, 5) \\
(3) \ & (1, 7) \\
(4) \ & (-1, 7)
\]

3. If \( I \) is the identity matrix of order 2 and \( A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix} \), then for \( n \geq 1 \), mathematical induction gives
\[
A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}
\]
\[
\times 2^n \text{ के } \therefore \text{ चूँकि, } A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}
\]
\[
\text{समी, } \text{ तब } n \geq 1 \text{ के } \therefore \text{ स्थापन करा} \]
\[
(1) \ & A^n = nA - (n - 1) I \\
(2) \ & A^n = nA + (n - 1) I \\
(3) \ & A^n = 2^nA - (n + 1) I \\
(4) \ & A^n = 2^{n-1}A - (n - 1) I
\]
4. \(^nC_{r-1} = 330, \ ^nC_r = 462, \ ^nC_{r+1} = 462 \Rightarrow r = \)

(1) 3  (2) 4  (3) 5  (4) 6

5. 10 men and 6 women are to be seated in a row so that no two women sit together. The number of ways they can be seated is:

(1) 11! 10!  (2) \(\frac{11!}{6! 5!}\)
(3) \(\frac{10! 9!}{5!}\)  (4) \(\frac{11! 10!}{5!}\)

6. If \(t_n\) denotes the number of triangles formed with \(n\) points in a plane no three of which are collinear and if \(t_{n+1} - t_n = 36\), then \(n =\)

(1) 7  (2) 8  (3) 9  (4) 10

7. The term independent of \(x\) \((x > 0, x \neq 1)\) in the expansion of

\[
\left[ \frac{(x+1)}{(x^{2/3} - x^{1/3} + 1)} - \frac{(x-1)}{(x-x^{1/2})} \right]^{10}
\]

\[
\left[ \frac{(x+1)}{(x^{2/3} - x^{1/3} + 1)} - \frac{(x-1)}{(x-x^{1/2})} \right]^{10}
\]

(1) 105  (2) 210  (3) 315  (4) 420

Rough Work
8. If \( x \) is small so that \( x^2 \) and higher powers can be neglected, then the approximate value for 
\[
\frac{(1-2x)^{-1}(1-3x)^{-2}}{(1-4x)^{-3}}
\]
is 
\( x^2 \).  అయితే పొడవుల  మధ్య సంఖ్యలకు,  
\[
\frac{(1-2x)^{-1}(1-3x)^{-2}}{(1-4x)^{-3}}
\]
విశేషాధికారం ఉంటుంది.  
(1) 1 - 2x  
(2) 1 - 3x  
(3) 1 - 4x  
(4) 1 - 5x

9. If 
\[
\frac{1}{x^4 + x^2 + 1} = \frac{Ax + B}{x^2 + x + 1} + \frac{Cx + D}{x^2 - x + 1}
\]
then \( C + D = \) 
\[\frac{1}{x^4 + x^2 + 1} = \frac{Ax + B}{x^2 + x + 1} + \frac{Cx + D}{x^2 - x + 1} \]
(1) -1  
(2) 1  
(3) 2  
(4) 0

10. 
\[
\frac{1}{2.3} + \frac{1}{4.5} + \frac{1}{6.7} + \frac{1}{8.9} + \ldots
\]
(1) \( \log \left(\frac{2}{e}\right) \)  
(2) \( \log \left(\frac{e}{2}\right) \)  
(3) \( \log (2e) \)  
(4) \( e - 1 \)

11. If the harmonic mean between the roots of \( (5 + \sqrt{2})x^2 - bx + (8 + 2\sqrt{5}) = 0 \) is 4, then the value of \( b \) 
\( (5 + \sqrt{2})x^2 - bx + (8 + 2\sqrt{5}) = 0 \) నిష్పత్తి విభాగానికి, ప్రతిభ విభాగానికి 4 అంటే \( b \) విభాగం ఉంటుంది.  
(1) 2  
(2) 3  
(3) 4 - \( \sqrt{5} \)  
(4) 4 + \( \sqrt{5} \)

Rough Work
12. The set of solutions satisfying both \( x^2 + 5x + 6 \geq 0 \) and \( x^2 + 3x - 4 < 0 \) is

\[
\begin{align*}
(1) \quad &(-4, 1) \\
(2) \quad &(-4, -3) \cup [-2, 1) \\
(3) \quad &(-4, -3) \cup (-2, 1) \\
(4) \quad &[-4, -3) \cup [-2, 1]
\end{align*}
\]

13. If the roots of \( x^3 - 42x^2 + 336x - 512 = 0 \), are in increasing geometric progression, then its common ratio is

\[
\begin{align*}
(1) \quad &2 \\
(2) \quad &3 \\
(3) \quad &4 \\
(4) \quad &6
\end{align*}
\]

14. If \( \alpha \) and \( \beta \) are the roots of the equation \( x^2 - 2x + 4 = 0 \), then \( \alpha^9 + \beta^9 = \)

\[
\begin{align*}
(1) \quad &-2^8 \\
(2) \quad &2^9 \\
(3) \quad &-2^{10} \\
(4) \quad &2^{10}
\end{align*}
\]

15. If \( A = \begin{bmatrix} -8 & 5 \\ 2 & 4 \end{bmatrix} \) satisfies the equation \( x^2 + 4x - p = 0 \), then \( p = \)

\[
\begin{align*}
A = \begin{bmatrix} -8 & 5 \\ 2 & 4 \end{bmatrix} \quad \text{then} \quad x^2 + 4x - p = 0 \quad \text{and} \quad p = \\
(1) \quad &64 \\
(2) \quad &42 \\
(3) \quad &36 \\
(4) \quad &24
\end{align*}
\]

Rough Work
16. \[
\begin{vmatrix}
  x+2 & x+3 & x+5 \\
  x+4 & x+6 & x+9 \\
  x+8 & x+11 & x+15
\end{vmatrix}
= \\
(1) \ 3x^2 + 4x + 5 \\
(2) \ x^3 + 8x + 2 \\
(3) \ 0 \\
(4) \ -2
\]

17. The system of equations \(3x + 2y + z = 6, 3x + 4y + 3z = 14, 6x + 10y + 8z = a\), has infinite number of solutions, if \(a =\)

(1) 8 \hspace{1cm} (2) 12 \hspace{1cm} (3) 24 \hspace{1cm} (4) 36

18. The number of real values of \(t\) such that the system of homogeneous equations
\[
\begin{align*}
  tx + (t + 1)y + (t - 1)z &= 0 \\
  (t + 1)x + ty + (t + 2)z &= 0 \\
  (t - 1)x + (t + 2)y + tz &= 0
\end{align*}
\]
has non-trivial solutions, is

(1) 3 \hspace{1cm} (2) 2 \hspace{1cm} (3) 1 \hspace{1cm} (4) 4

Rough Work
19. \( \left( \frac{1+i}{1-i} \right)^4 + \left( \frac{1-i}{1+i} \right)^4 = \)

(1) 0  (2) 1  (3) 2  (4) 4

20. If a complex number \( z \) satisfies \( |z^2 - 1| = |z|^2 + 1 \), then \( z \) lies on:

(1) the real axis  (2) the imaginary axis
(3) \( y = x \)  (4) a circle

\( z = \frac{1+i}{1-i} \)  \( z = \frac{1-i}{1+i} \)

(1) \( \frac{1+i}{1-i} \)  (2) \( \frac{1-i}{1+i} \)
(3) \( y = \frac{1+i}{1-i} \)  (4) \( y = \frac{1-i}{1+i} \)

21. \( \frac{(1+i)x-i}{2+i} + \frac{(1+2i)y+i}{2-i} = 1 \Rightarrow (x, y) = \)

(1) \( \left( \frac{7}{3}, -\frac{7}{15} \right) \)  (2) \( \left( \frac{7}{3}, \frac{7}{15} \right) \)
(3) \( \left( \frac{7}{5}, -\frac{7}{15} \right) \)  (4) \( \left( \frac{7}{5}, \frac{7}{15} \right) \)

22. The period of \( f(x) = \cos \left( \frac{x}{3} \right) + \sin \left( \frac{x}{2} \right) \) is

\( f(x) = \cos \left( \frac{x}{3} \right) + \sin \left( \frac{x}{2} \right) \)  \( \text{మధ్య సంఖ్య} \)

(1) 2 \( \pi \)  (2) 4 \( \pi \)
(3) 8 \( \pi \)  (4) 12 \( \pi \)

Rough Work
23. \( \sin \theta + \cos \theta = p, \sin^3 \theta + \cos^3 \theta = q \Rightarrow p(p^2 - 3) = \)

\[
\begin{align*}
(1) & \quad q \\
(2) & \quad 2q \\
(3) & \quad -q \\
(4) & \quad -2q
\end{align*}
\]

24. If \( \tan (\pi \cos \theta) = \cot (\pi \sin \theta) \) then a value of \( \cos \left( \theta - \frac{\pi}{4} \right) \) among the following is

\[
\begin{align*}
\tan (\pi \cos \theta) = \cot (\pi \sin \theta) \quad &\Rightarrow \quad \cos \left( \theta - \frac{\pi}{4} \right) \quad \text{is one of these} \\
(1) & \quad \frac{1}{2\sqrt{2}} \\
(2) & \quad \frac{1}{\sqrt{2}} \\
(3) & \quad \frac{1}{2} \\
(4) & \quad \frac{1}{4}
\end{align*}
\]

25. The set of solutions of the system of equations:

\[
x + y = \frac{2\pi}{3} \quad \text{and} \quad \cos x + \cos y = \frac{3}{2},
\]

where \( x, y \) are real, is

\[
x, y \in \mathbb{R} \quad \text{such that} \quad x + y = \frac{2\pi}{3} \quad \text{and} \quad \cos x + \cos y = \frac{3}{2}
\]

\[
(1) \quad \left\{ (x, y) : \cos \left( \frac{x-y}{2} \right) = \frac{1}{2} \right\} \\
(2) \quad \left\{ (x, y) : \sin \left( \frac{x-y}{2} \right) = \frac{1}{2} \right\} \\
(3) \quad \left\{ (x, y) : \cos (x-y) = \frac{1}{2} \right\} \\
(4) \quad \text{empty set}
\]
26. \(\cos^{-1}\left(\frac{5}{13}\right) + \cos^{-1}\left(\frac{3}{5}\right) = \cos^{-1} x \Rightarrow x =\)

(1) \(\frac{3}{65}\)  (2) \(-\frac{36}{65}\)  (3) \(-\frac{33}{65}\)  (4) \(-1\)

27. \(\tanh^{-1}\left(\frac{1}{2}\right) + \coth^{-1}\left(2\right) =\)

(1) \(\frac{1}{2}\log 3\)  (2) \(\frac{1}{2}\log 6\)  (3) \(\frac{1}{2}\log 12\)  (4) \(\log 3\)

28. In any triangle ABC,

\[r_1r_2 + r_2r_3 + r_3r_1 =\]

\(\Rightarrow\) the \(\frac{r_1r_2 + r_2r_3 + r_3r_1}{r_1r_2 + r_2r_3 + r_3r_1} =\)

(1) \(\frac{\Delta^2}{r^2}\)  (2) \(\frac{\Delta}{r}\)  (3) \(\frac{2\Delta}{r}\)  (4) \(\Delta^2\)

29. If, in \(\Delta ABC\), \(\frac{1}{a+c} + \frac{1}{b+c} = \frac{3}{a+b+c}\) then the angle \(C =\)

\(\Rightarrow\) the \(\frac{1}{a+c} + \frac{1}{b+c} = \frac{3}{a+b+c}\) then \(C =\)

(1) \(30^\circ\)  (2) \(45^\circ\)  (3) \(60^\circ\)  (4) \(90^\circ\)
30. A person observes the top of a tower from a point A on the ground. The elevation of the tower from this point is 60°. He moves 60 m in the direction perpendicular to the line joining A and base of the tower. The angle of elevation of the tower from this point is 45°. Then the height of the tower (in meters) is

\[
\begin{align*}
1 & \quad 60 \sqrt{\frac{3}{2}} \\
2 & \quad 60 \sqrt{2} \\
3 & \quad 60 \sqrt{3} \\
4 & \quad 60 \sqrt{\frac{2}{3}}
\end{align*}
\]

31. The points whose position vectors are \(2\mathbf{i} + 3\mathbf{j} + 4\mathbf{k}, \ 3\mathbf{i} + 4\mathbf{j} + 2\mathbf{k}\) and \(4\mathbf{i} + 2\mathbf{j} + 3\mathbf{k}\) are the vertices of

- (1) an isosceles triangle
- (2) right angled triangle
- (3) equilateral triangle
- (4) right angled isosceles triangle

32. P, Q, R and S are four points with the position vectors \(3\mathbf{i} - 4\mathbf{j} + 5\mathbf{k}, \ 4\mathbf{k}, \ -4\mathbf{i} + 5\mathbf{j} + \mathbf{k}\) and \(-3\mathbf{i} + 4\mathbf{j} + 3\mathbf{k}\) respectively. Then the line PQ meets the line RS at the point

- (1) \(3\mathbf{i} + 4\mathbf{j} + 3\mathbf{k}\)
- (2) \(-3\mathbf{i} + 4\mathbf{j} + 3\mathbf{k}\)
- (3) \(-\mathbf{i} + 4\mathbf{j} + \mathbf{k}\)
- (4) \(\mathbf{i} + \mathbf{j} + \mathbf{k}\)
33. \( \vec{a} \neq 0, \vec{b} \neq 0, \vec{c} \neq 0, \vec{a} \times \vec{b} = 0, \vec{b} \times \vec{c} = 0 \Rightarrow \vec{a} \times \vec{c} = \)

(1) \( \vec{b} \)  
(2) \( \vec{a} \)  
(3) \( 0 \)  
(4) \( \vec{i} + \vec{j} + \vec{k} \)

34. The shortest distance between the lines \( \vec{r} = 3\vec{i} + 5\vec{j} + 7\vec{k} + \lambda (\vec{i} + 2\vec{j} + \vec{k}) \) and 

\[ \vec{r} = -\vec{i} - \vec{j} - \vec{k} + \mu (7\vec{i} - 6\vec{j} + \vec{k}) \]

is

\[ \vec{r} = 3\vec{i} + 5\vec{j} + 7\vec{k} + \lambda (\vec{i} + 2\vec{j} + \vec{k}) \]

\[ \vec{r} = -\vec{i} - \vec{j} - \vec{k} + \mu (7\vec{i} - 6\vec{j} + \vec{k}) \]

(1) \( \frac{16}{5\sqrt{5}} \)  
(2) \( \frac{26}{5\sqrt{5}} \)  
(3) \( \frac{36}{5\sqrt{5}} \)  
(4) \( \frac{46}{5\sqrt{5}} \)

35. A unit vector coplanar with \( \vec{i} + \vec{j} + 3\vec{k} \) and \( \vec{i} + 3\vec{j} + \vec{k} \) and perpendicular to \( \vec{i} + \vec{j} + \vec{k} \) is

\( \vec{i} + \vec{j} + 3\vec{k}, \vec{i} + 3\vec{j} + \vec{k} \) అవిని ప్రాంగణ లోని విద్యుత్తులు తిరుగుతూ \( \vec{i} + \vec{j} + \vec{k} \) రోతుస్తున్న విద్యుత్తు విద్యుత్తు

(1) \( \frac{1}{\sqrt{2}} (\vec{j} + \vec{k}) \)  
(2) \( \frac{1}{\sqrt{3}} (\vec{i} - \vec{j} + \vec{k}) \)  
(3) \( \frac{1}{\sqrt{2}} (\vec{j} - \vec{k}) \)  
(4) \( \frac{1}{\sqrt{3}} (\vec{i} + \vec{j} - \vec{k}) \)

Rough Work
36. If \( \bar{a} \) and \( \bar{b} \) are two non-zero perpendicular vectors, then a vector \( \bar{y} \) satisfying equations \( \bar{a} \cdot \bar{y} = c \) (c scalar) and \( \bar{a} \times \bar{y} = \bar{b} \) is

\[
\begin{align*}
\bar{a} \cdot \bar{b} &= c \\
\bar{a} \times \bar{y} &= \bar{b} \\
(1) \quad |\bar{a}|^2 (c\bar{a} - (\bar{a} \times \bar{b})) & \\
(2) \quad \frac{1}{|\bar{a}|^2} (c\bar{a} + (\bar{a} \times \bar{b})) & \\
(3) \quad \frac{1}{|\bar{a}|^2} (c\bar{a} + (\bar{a} \times \bar{b})) & \\
(4) \quad \frac{1}{|\bar{a}|^2} (c\bar{a} + (\bar{a} \times \bar{b})) &
\end{align*}
\]

37. Two numbers are chosen at random from \{1, 2, 3, 4, 5, 6, 7, 8\} at a time. The probability that smaller of the two numbers is less than 4 is

\[
\begin{align*}
(1) \quad \frac{7}{14} & \\
(2) \quad \frac{8}{14} & \\
(3) \quad \frac{9}{14} & \\
(4) \quad \frac{10}{14} &
\end{align*}
\]

38. Two fair dice are rolled. The probability of the sum of digits on their faces to be greater than or equal to 10 is

\[
\begin{align*}
(1) \quad \frac{1}{5} & \\
(2) \quad \frac{1}{4} & \\
(3) \quad \frac{1}{8} & \\
(4) \quad \frac{1}{6} &
\end{align*}
\]

Rough Work
39. A bag contains $2n + 1$ coins. It is known that $n$ of these coins have a head on both sides, whereas the remaining $n + 1$ coins are fair. A coin is picked up at random from the bag and tossed. If the probability that the toss results in a head is $\frac{31}{42}$, then $n =$

\begin{align*}
\text{(1)} & \quad 10 \\
\text{(2)} & \quad 11 \\
\text{(3)} & \quad 12 \\
\text{(4)} & \quad 13 \\
\end{align*}

40. The random variable takes the values 1, 2, 3, ......., $m$. If $P(X = n) = \frac{1}{m}$ to each $n$, then the variance of $X$ is

\begin{align*}
\text{(1)} & \quad \frac{(m+1)(2m+1)}{6} \\
\text{(2)} & \quad \frac{m^2 - 1}{12} \\
\text{(3)} & \quad \frac{m+1}{2} \\
\text{(4)} & \quad \frac{m^2 + 1}{12} \\
\end{align*}

41. If $X$ is a Poisson variate and $P(X = 1) = 2P(X = 2)$ then $P(X = 3) =$

\begin{align*}
\text{(1)} & \quad \frac{e^{-1}}{6} \\
\text{(2)} & \quad \frac{e^{-2}}{2} \\
\text{(3)} & \quad \frac{e^{-1}}{2} \\
\text{(4)} & \quad \frac{e^{-1}}{3} \\
\end{align*}
42. The origin is translated to (1, 2). The point (7, 5) in the old system undergoes the following transformations successively.

(i) Moves to the new point under the given translation of origin.

(ii) Translated through 2 units along the negative direction of the new X-axis.

(iii) Rotated through an angle \( \frac{\pi}{4} \) about the origin of new system in the clockwise direction.

The final position of the point (7, 5) is

\[ (1, 2), \ \frac{7}{\sqrt{2}}, \ \frac{1}{\sqrt{2}}, \ \frac{7}{\sqrt{2}}, \ \frac{-1}{\sqrt{2}} \]

\[ (1) \left( \frac{9}{\sqrt{2}}, -\frac{1}{\sqrt{2}} \right), \ \ (2) \left( \frac{7}{\sqrt{2}}, \frac{1}{\sqrt{2}} \right), \ \ (3) \left( \frac{7}{\sqrt{2}}, -\frac{1}{\sqrt{2}} \right), \ \ (4) \left( \frac{5}{\sqrt{2}}, -\frac{1}{\sqrt{2}} \right) \]

43. If \( p \) and \( q \) are the perpendicular distances from the origin to the straight lines

\[ x \sec \theta - y \cosec \theta = a \] and \[ x \cos \theta + y \sin \theta = a \cos 2\theta, \]

then

\[ (1) \quad 4p^2 + q^2 = a^2 \]

\[ (2) \quad p^2 + q^2 = a^2 \]

\[ (3) \quad p^2 + 2q^2 = a^2 \]

\[ (4) \quad 4p^2 + q^2 = 2a^2 \]
44. If \(2x + 3y = 5\) is the perpendicular bisector of the line segment joining the points \(A(1, \frac{1}{3})\) and \(B\), then \(B =\)

\(A\left(1, \frac{1}{3}\right)\) విశేషం B సహయదిరు సంతరించడానికి ఆరోగ్యత్వం ప్రత్యేకం ప్రత్యేకం ప్రత్యేకం ప్రత్యేకం ప్రత్యేకం ప్రత్యేకం ప్రత్యేకం ప్రత్యేకం

\(2x + 3y = 5\) అంటే \(B =\)

\[
\begin{align*}
(1) & \left(\frac{21}{13}, \frac{49}{39}\right) \\
(2) & \left(\frac{17}{13}, \frac{31}{39}\right) \\
(3) & \left(\frac{7}{13}, \frac{49}{39}\right) \\
(4) & \left(\frac{21}{13}, \frac{31}{39}\right)
\end{align*}
\]

45. If the points \((1, 2)\) and \((3, 4)\) lie on the same side of the straight line \(3x - 5y + a = 0\) then \(a\) lies in the set

మరిగా సంఖ్యలు \((1, 2), (3, 4)\) అంటే \(3x - 5y + a = 0\) అంటే జీంతు జీంతు జీంతు జీంతు జీంతు జీంతు జీంతు జీంతు జీంతు

\[
\begin{align*}
(1) & \ [7, 11] \\
(2) & \ \mathbb{R} - [7, 11] \\
(3) & \ [7, \infty) \\
(4) & \ (-\infty, 11]
\end{align*}
\]

46. The equation of the pair of lines passing through the origin whose sum and product of slopes are respectively the arithmetic mean and geometric mean of 4 and 9 is

మరిగా సంఖ్యలు కొనసాగి గా అంటే \(4\) మరింత సంఖ్యలు కొనసాగి గా అంటే \(9\) మరింత సంఖ్యలు కొనసాగి గా అంటే \(4\) మరింత సంఖ్యలు కొనసాగి గా అంటే \(9\) మరింత సంఖ్యలు కొనసాగి గా అంటే \(4\) మరింత సంఖ్యలు కొనసాగి గా అంటే \(9\) మరింత సంఖ్యలు కొనసాగి గా అంటే \(4\) మరింత సంఖ్యలు కొనసాగి గా అంటే \(9\) మరింత సంఖ్యలు కొనసాగి గా అంటే

\[
\begin{align*}
(1) & \ 12x^2 - 13xy + 2y^2 = 0 \\
(2) & \ 12x^2 + 13xy + 2y^2 = 0 \\
(3) & \ 12x^2 - 15xy + 2y^2 = 0 \\
(4) & \ 12x^2 + 15xy - 2y^2 = 0
\end{align*}
\]

**Rough Work**
47. The equation \( x^2 - 5xy + py^2 + 3x - 8y + 2 = 0 \) represents a pair of straight lines. If \( \theta \) is the angle between them, then \( \sin \theta = \) 
\[ x^2 - 5xy + py^2 + 3x - 8y + 2 = 0 \] 
\( \sin \theta = \) 
\[ \frac{1}{\sqrt{50}} \] 
\( \frac{1}{7} \) 
\[ \frac{1}{5} \] 
\[ \frac{1}{\sqrt{10}} \]

48. If the equation \( ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0 \) represents a pair of straight lines, then the square of the distance of their point of intersection from the origin is 
\[ ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0 \] 
\( \text{Distance} = \) 
\[ \frac{c(a + b) - af^2 - bg^2}{ab - h^2} \] 
\( \frac{c(a + b) + f^2 + g^2}{ab - h^2} \] 
\[ \frac{c(a + b) - f^2 - g^2}{ab - h^2} \] 
\[ \frac{c(a + b) - f^2 - g^2}{(ab - h^2)^2} \]

49. The circle \( 4x^2 + 4y^2 - 12x - 12y + 9 = 0 \)
(1) touches both the axes 
(2) touches the x-axis only 
(3) touches the y-axis only 
(4) does not touch the axes 
\[ 4x^2 + 4y^2 - 12x - 12y + 9 = 0 \] 
\[ \text{Circle} \]
\( \frac{c(a + b) - af^2 - bg^2}{ab - h^2} \] 
\[ \frac{c(a + b) + f^2 + g^2}{ab - h^2} \] 
\[ \frac{c(a + b) - f^2 - g^2}{ab - h^2} \] 
\[ \frac{c(a + b) - f^2 - g^2}{(ab - h^2)^2} \]

Rough Work
50. For the circle C with the equation \( x^2 + y^2 - 16x - 12y + 64 = 0 \) match the list-I with the list-II given below:

**List-I**

(i) The equation of the polar of 
(\(-5, 1\)) with respect to C

(ii) The equation of the tangent at 
\((8, 0)\) to C

(iii) The equation of the normal at 
\((2, 6)\) to C

(iv) The equation of the diameter of 
C through \((8, 12)\)

**List-II**

(a) \( y = 0 \)

(b) \( y = 6 \)

(c) \( x + y = 7 \)

(d) \( 13x + 5y = 98 \)

(e) \( x = 8 \)

The correct match is:

(i) (ii) (iii) (iv)

(1) (d) (b) (a) (e)

(2) (d) (a) (b) (e)

(3) (c) (d) (a) (b)

(4) (c) (e) (b) (a)

Rough Work
51. If the length of the tangent from \((h, k)\) to the circle \(x^2 + y^2 = 16\) is twice the length of the tangent from the same point to the circle \(x^2 + y^2 + 2x + 2y = 0\), then

\[(h, k)\]  ఈ వ్యాసం స్థిరంగా వస్తుంది కానా, సూక్ష్మంగా వస్తుంది యిది సూక్ష్మమైన సూక్ష్మమైన పరిస్థితీల కారణం అంటే సూక్ష్మమైన (1) \(h^2 + k^2 + 4h + 4k + 16 = 0\)  (2) \(h^2 + k^2 + 3h + 3k = 0\) (3) \(3h^2 + 3k^2 + 8h + 8k + 16 = 0\) (4) \(3h^2 + 3k^2 + 4h + 4k + 16 = 0\)

52. \((a, 0)\) and \((b, 0)\) are centres of two circles belonging to a co-axial system of which \(y\)-axis is the radical axis. If radius of one of the circles is ‘\(r\)’, then the radius of the other circle is

\(y\)-ఎక్కడ మధ్యభింభంగా కనిపించే నాలుగవుతున్న సోష్ణ సూక్ష్మం వాటి సూక్ష్మమైన పరిస్థితిలో అంటే (a, 0) మాత్రం కానం (b, 0). అదే సూక్ష్మం ఎక్కడి రెండో సూక్ష్మమైన పరిస్థితిలో

(1) \((r^2 + b^2 + a^2)^{1/2}\) (2) \((r^2 + b^2 - a^2)^{1/2}\) (3) \((r^2 + b^2 - a^2)^{1/3}\) (4) \((r^2 + b^2 + a^2)^{1/3}\)

53. If the circle \(x^2 + y^2 + 4x - 6y + c = 0\) bisects the circumference of the circle \(x^2 + y^2 - 6x + 4y - 12 = 0\), then \(c = \)

\(y\)-ఎక్కడ \(x^2 + y^2 - 6x + 4y - 12 = 0\) విభజించే పరిస్థితిలో అంటే \(x^2 + y^2 + 4x - 6y + c = 0\) పరిస్థితిలో \(c = \)

(1) 16 (2) -24 (3) -42 (4) -62

54. A circle of radius 4, drawn on a chord of the parabola \(y^2 = 8x\) as diameter, touches the axis of the parabola. Then, the slope of the chord is

\(y^2 = 8x\) ఎక్కడ కానం అంటే చివరి అనేటానికి, 4 విభజించే పరిస్థితిలో అంటే చివరి చివరి లో ఎక్కడ ఆశ్చర్యమైంది. అంటే ఎక్కడ ఎక్కడ ఎక్కడ

(1) \(\frac{1}{2}\) (2) \(\frac{3}{4}\) (3) 1 (4) 2

Rough Work
55. The midpoint of a chord of the ellipse \( x^2 + 4y^2 - 2x + 20y = 0 \) is \((2, -4)\). The equation of the chord is

\[
\begin{align*}
(1) \; x - 6y &= 26 \\
(2) \; x + 6y &= 26 \\
(3) \; 6x - y &= 26 \\
(4) \; 6x + y &= 26
\end{align*}
\]

56. If the foci of the ellipse \( \frac{x^2}{25} + \frac{y^2}{16} = 1 \) and the hyperbola \( \frac{x^2}{4} - \frac{y^2}{b^2} = 1 \) coincide, then \( b^2 = \)

\[
\begin{align*}
(1) \; 4 \\
(2) \; 5 \\
(3) \; 8 \\
(4) \; 9
\end{align*}
\]

57. If \( x = 9 \) is a chord of contact of the hyperbola \( x^2 - y^2 = 9 \), then the equation of the tangent at one of the points of contact is

\[
\begin{align*}
(1) \; x + \sqrt{3}y + 2 &= 0 \\
(2) \; 3x - 2\sqrt{2}y - 3 &= 0 \\
(3) \; 3x - \sqrt{2}y + 6 &= 0 \\
(4) \; x - \sqrt{3}y + 2 &= 0
\end{align*}
\]

58. The perpendicular distance from the point \((1, \pi)\) to the line joining \((1, 0^0)\) and \((1, \frac{\pi}{2})\), (in polar coordinates) is

\[
\begin{align*}
(1) \; 2 \\
(2) \; \sqrt{3} \\
(3) \; 1 \\
(4) \; \sqrt{2}
\end{align*}
\]

Rough Work
59. \(D(2, 1, 0), E(2, 0, 0), F(0, 1, 0)\) are mid-points of the sides \(BC, CA, AB\) of \(\Delta ABC\) respectively. Then, the centroid of \(\Delta ABC\) is

\[
\begin{align*}
(1) & \quad \left(\frac{1}{3}, \frac{1}{3}, \frac{1}{3}\right) \\
(2) & \quad \left(\frac{4}{3}, \frac{2}{3}, 0\right) \\
(3) & \quad \left(\frac{1}{3}, \frac{1}{3}, \frac{1}{3}\right) \\
(4) & \quad \left(\frac{2}{3}, \frac{1}{3}, \frac{1}{3}\right)
\end{align*}
\]

60. The direction ratios of two lines \(AB, AC\) are 1, -1, -1 and 2, -1, 1. The direction ratios of the normal to the plane \(ABC\) are

\[
\begin{align*}
(1) & \quad 2, 3, -1 \\
(2) & \quad 2, 2, 1 \\
(3) & \quad 3, 2, -1 \\
(4) & \quad -1, 2, 3
\end{align*}
\]

61. A plane passing through \((-1, 2, 3)\) and whose normal makes equal angles with the coordinate axes is

\[
\begin{align*}
(-1, 2, 3) & \quad \text{is the point and three \(ABC\) coordinates of normal are} \\
(1) & \quad x + y + z + 4 = 0 \\
(2) & \quad x - y + z + 4 = 0 \\
(3) & \quad x + y + z - 4 = 0 \\
(4) & \quad x + y + z = 0
\end{align*}
\]

Rough Work
62. A variable plane passes through a fixed point \((1, 2, 3)\). Then the foot of the perpendicular from the origin to the plane lies on
(1) a circle  (2) a sphere  (3) an ellipse  (4) a parabola

63. Let \(f\) be a non-zero real valued continuous function satisfying \(f(x + y) = f(x)f(y)\) for all \(x, y \in \mathbb{R}\). If \(f(2) = 9\), then \(f(6) =\)

(1) \(2^2\)  (2) \(3^6\)  (3) \(3^4\)  (4) \(3^3\)

64. \(\lim_{x \to 0} \frac{\tan^3 x - \sin^3 x}{x^5} =\)

(1) \(\frac{5}{2}\)  (2) \(\frac{3}{2}\)  (3) \(\frac{3}{5}\)  (4) \(\frac{2}{5}\)

65. \(f(x) = \frac{1}{1 + \frac{1}{x}}\); \(g(x) = \frac{1}{1 + \frac{1}{f(x)}}\) \(\Rightarrow g'(2) =\)

(1) \(\frac{1}{5}\)  (2) \(\frac{1}{25}\)  (3) \(5\)  (4) \(\frac{1}{16}\)

Rough Work
66. \( \sqrt{\frac{y}{x}} + \sqrt{\frac{x}{y}} = 2 \Rightarrow \frac{dy}{dx} = \)

(1) \( \frac{x^2 + y^2}{x + y} \)  (2) \( \frac{x^2 - y^2}{x + y} \)  (3) 1  (4) 2

67. \( \frac{d}{dx} [(x + 1)(x^2 + 1)(x^4 + 1)(x^8 + 1)] = (15x^p - 16x^q + 1)(x - 1)^{-2} \Rightarrow (p, q) = \)

(1) (12, 11)  (2) (15, 14)  (3) (16, 14)  (4) (16, 15)

68. \( \cos^{-1}\left(\frac{y}{b}\right) = 2 \log\left(\frac{x}{2}\right), x > 0 \Rightarrow x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} = \)

(1) 4y  (2) -4y  (3) 0  (4) -8y

69. The relation between pressure \( p \) and volume \( v \) is given by \( pv^4 = \text{Constant} \). If the percentage decrease in volume is \( \frac{1}{2} \), then the percentage increase in pressure is \( \left(\frac{1}{2}\right)^{-\frac{1}{4}} \), which is \( \frac{1}{8} \) times the original volume. If the percentage decrease in volume is \( \frac{1}{2} \), the percentage increase in pressure is \( \frac{1}{8} \).

(1) \(-\frac{1}{8}\)  (2) \(\frac{1}{16}\)  (3) \(\frac{1}{8}\)  (4) \(\frac{1}{2}\)

Rough Work
70. If the curves \( x^2 + py^2 = 1 \) and \( qx^2 + y^2 = 1 \) are orthogonal to each other, then

\[
\begin{align*}
    x^2 + py^2 &= 1 \\
    qx^2 + y^2 &= 1 \\
    \frac{1}{p} - \frac{1}{q} &= 2 \\
    \frac{1}{p} + \frac{1}{q} &= -2 \\
    \frac{1}{p} + \frac{1}{q} &= 2
\end{align*}
\]

Thus, the correct answer is (4) \( \frac{1}{p} + \frac{1}{q} = 2 \).

71. The focal length of a mirror is given by \( \frac{2}{f} = \frac{1}{u} - \frac{1}{v} \). In finding the values of \( u \) and \( v \), the errors are equal and equal to ‘p’. Then, the relative error in \( f \) is

\[
\frac{\Delta f}{f} = \frac{\Delta u}{u} - \frac{\Delta v}{v}
\]

Thus, the correct answer is (4) \( \frac{1}{u} - \frac{1}{v} \).

72. \( u = \log (x^3 + y^3 + z^3 - 3xyz) \Rightarrow (x + y + z)(u_x + u_y + u_z) = \)

\[
\begin{align*}
    (1) \quad 0 \\
    (2) \quad x - y + z \\
    (3) \quad 2 \\
    (4) \quad 3
\end{align*}
\]

73. \( \int e^x \left( \frac{2 + \sin 2x}{1 + \cos 2x} \right) dx = \)

\[
\begin{align*}
    (1) \ e^x \cot x + c \\
    (2) \ 2e^x \sec^2 x + c \\
    (3) \ e^x \cos 2x + c \\
    (4) \ e^x \tan x + c
\end{align*}
\]

Rough Work
74. \[ \int \frac{x - \sin x}{1 + \cos x} \, dx = x \tan \left( \frac{x}{2} \right) + p \log \left| \sec \left( \frac{x}{2} \right) \right| + c \implies p = \]

(1) \(-4\)  (2) \(4\)  (3) \(2\)  (4) \(-2\)

75. \[ \int \frac{dx}{x(\log x - 2)(\log x - 3)} = 1 + c \implies 1 = \]

(1) \(\frac{1}{x} \log \left| \frac{\log x - 3}{\log x - 2} \right|\)  (2) \(\log \left| \frac{\log x - 3}{\log x - 2} \right|\)

(3) \(\log \left| \frac{\log x - 2}{\log x - 3} \right|\)  (4) \(\log \left| (\log x - 3)(\log x - 2) \right|\)

76. If \(\int_{0}^{b} \frac{dx}{1 + x^2} = \int_{b}^{\infty} \frac{dx}{1 + x^2}\), then \(b = \)

\[ \int_{0}^{b} \frac{dx}{1 + x^2} = \int_{b}^{\infty} \frac{dx}{1 + x^2} \implies b = \]

(1) \(\tan^{-1} \left( \frac{1}{3} \right)\)  (2) \(\frac{\sqrt{3}}{2}\)  (3) \(\sqrt{2}\)  (4) \(1\)

77. The area (in square units) bounded by the curves \(x = -2y^2\) and \(x = 1 - 3y^2\) is

\[ x = -2y^2 \quad \text{and} \quad x = 1 - 3y^2 \quad \text{are} \quad \text{hyperbolic} \quad \text{parabolas} \quad (x > y > 0) \]

(1) \(\frac{2}{3}\)  (2) \(1\)  (3) \(\frac{4}{3}\)  (4) \(\frac{5}{3}\)

Rough Work
78. The approximate value of \( \int_{1}^{3} \frac{dx}{2+3x} \) using Simpson's Rule and dividing the interval \([1, 3]\) into two equal parts is

\[
\int_{1}^{3} \frac{dx}{2+3x} = \frac{1}{3} \log \left( \frac{11}{5} \right)
\]

\[
\int_{1}^{3} \frac{dx}{2+3x} = \frac{107}{110}
\]

\[(3) \ \frac{29}{110} \ 
(4) \ \frac{119}{440}
\]

79. An integrating factor of the equation \((1 + y + x^2y) \ dx + (x + x^3) \ dy = 0\) is

\[(1 + y + x^2y) \ dx + (x + x^3) \ dy = 0
\]

\[(1) \ e^x \ 
(2) \ x^2 \ 
(3) \ \frac{1}{x} \ 
(4) \ x
\]

80. The solution of the differential equation \( \frac{dy}{dx} - 2y \tan 2x = e^x \sec 2x \) is:

\[
\frac{dy}{dx} - 2y \tan 2x = e^x \sec 2x
\]

\[(1) \ y \sin 2x = e^x + c
\]

\[(2) \ y \cos 2x = e^x + c
\]

\[(3) \ y = e^x \cos 2x + c
\]

\[(4) \ y \cos 2x + e^x = c
\]

Rough Work
PHYSICS

81. If E, M, J and G respectively denote energy, mass, angular momentum and universal gravitational constant, the quantity, which has the same dimensions as the dimensions of \( \frac{EJ^2}{M^5G^2} \)

(1) Time  (2) Angle  (3) Mass  (4) Length

E, M, J మాచల గ్యాయం సూచించాయం కంటి, లేదా గ్యాయం, ప్రతిక్షా ప్రకారం సూచించాయం వంటి

మాచల గ్యాయం సూచించాయం కంటి వంటి ప్రకారం \( \frac{EJ^2}{M^5G^2} \) మాచల గ్యాయం లేదా జనాథం వంటి

(1) ఎన్నిక  (2) రెండు  (3) మనుగేల  (4) మిగిల

82. The work done in moving an object from origin to a point whose position vector is \( \vec{r} = 3\hat{i} + 2\hat{j} - 5\hat{k} \) by a force \( \vec{F} = 2\hat{i} - \hat{j} - \hat{k} \) is

(1) 1 unit  (2) 9 units  (3) 13 units  (4) 60 units

వచ్చే రాశి \( \vec{F} = 2\hat{i} - \hat{j} - \hat{k} \) కంటి వచ్చే ఉత్తమ ప్రత్యేకం లేదా వచ్చే మాధ్యమం వచ్చే ఉత్తమ రాశి వచ్చే వచ్చే రాశి \( \vec{r} = 3\hat{i} + 2\hat{j} - 5\hat{k} \)

సూచించాయం వచ్చే ఉత్తమ ప్రత్యేకం లేదా వచ్చే రాశి వచ్చే రాశి

(1) 1 ఎన్నిక  (2) 9 ఎన్నిక  (3) 13 ఎన్నిక  (4) 60 ఎన్నిక

Rough Work
83. A particle is projected from the ground with an initial speed of \( v \) at an angle of projection \( \theta \). The average velocity of the particle between its time of projection and time it reaches highest point of trajectory is

\[
\begin{align*}
(1) & \quad \frac{v}{2} \sqrt{1+2\cos^2 \theta} \\
(2) & \quad \frac{v}{2} \sqrt{1+2\sin^2 \theta} \\
(3) & \quad \frac{v}{2} \sqrt{1+3\cos^2 \theta} \\
(4) & \quad v \cos \theta
\end{align*}
\]

84. Two wooden blocks of masses \( M \) and \( m \) are placed on a smooth horizontal surface as shown in figure. If a force \( P \) is applied to the system as shown in figure such that the mass \( m \) remains stationary with respect to block of mass \( M \), then the magnitude of the force \( P \) is

\[
\begin{align*}
(1) & \quad (M + m) g \tan \beta \\
(2) & \quad g \tan \beta \\
(3) & \quad mg \cos \beta \\
(4) & \quad (M + m) g \csc \beta
\end{align*}
\]
85. A ball at rest is dropped from a height of 12 m. It loses 25% of its kinetic energy on striking the ground and bounces back to a height ‘h’. Then value of ‘h’ is

(1) 3 m  
(2) 6 m  
(3) 9 m  
(4) 12 m

86. Two bodies of mass 4 kg and 5 kg are moving along east and north directions with velocities 5 m/s and 3 m/s respectively. Magnitude of the velocity of centre of mass of the system is

\[ \frac{9}{25} m/s \]  
(2) \[ \frac{9}{25} m/s \]  
(3) \[ \frac{41}{9} m/s \]  
(4) \[ \frac{16}{9} m/s \]

87. A mass of 2.9 kg is suspended from a string of length 50 cm and is at rest. Another body of mass 100 g, which is moving horizontally with a velocity of 150 m/s strikes and sticks to it. Subsequently when the string makes an angle of 60° with the vertical, the tension in the string is \( g = 10 \, m/s^2 \)

50 cm వంటి యొక్క ద్రవయం 2.9 kgవల చేసే చేసి తాండితీరించి, మరియు ఒకే విశాలం యొక్క సాధనం. యోగ్యమంతో '150 m/s వీధితం సాధనం 100 g (వంటించి) కానే నియంత్రితం నిర్ణయించడానికి, అనుకుంటే యోగ్యమంతో 60° కోణమైన విశాలం లో ద్రవయం చేసి (g = 10 m/s²)

(1) 140 N  
(2) 135 N  
(3) 125 N  
(4) 90 N

Rough Work
88. The upper half of an inclined plane with an angle of inclination $\phi$, is smooth while the lower half is rough. A body starting from rest at the top of the inclined plane comes to rest at the bottom of the inclined plane. Then the coefficient of friction for the lower half is

\[ \tan \phi \]

(1) $2 \tan \phi$

(2) $\tan \phi$

(3) $2 \sin \phi$

(4) $2 \cos \phi$

89. Moment of inertia of a body about an axis is 4 kgm². The body is initially at rest and a torque of 8 Nm starts acting on it along the same axis. Work done by the torque in 20 sec. in Joules, is

\[ 8 \text{ Nm} \times 20 \text{ sec} = 160 \text{ J} \]

(1) 40

(2) 640

(3) 2560

(4) 3200

Rough Work
90. A uniform circular disc of radius R, lying on a frictionless horizontal plane is rotating with an angular velocity \( \omega \) about its own axis. Another identical circular disc is gently placed on the top of the first disc coaxially. The loss in rotational kinetic energy due to friction between the two discs, as they acquire common angular velocity is (I is Moment of Inertia of the disc)

\[
\frac{1}{8} I \omega^2
\]

(1) \( \frac{1}{8} I \omega^2 \)

(2) \( \frac{1}{4} I \omega^2 \)

(3) \( \frac{1}{2} I \omega^2 \)

(4) \( I \omega^2 \)

Rough Work
91. The gravitational force acting on a particle, due to a solid sphere of uniform density and radius R, at a distance of 3R from the centre of the sphere is F_1. A spherical hole of radius (R/2) is now made in the sphere as shown in the figure. The sphere with hole now exerts a force F_2 on the same particle. Ratio of F_1 to F_2 is

\[ \frac{\text{F}_1}{\text{F}_2} \]

(1) \( \frac{50}{41} \)  (2) \( \frac{41}{50} \)  (3) \( \frac{41}{25} \)  (4) \( \frac{25}{41} \)

92. Two particles A and B of masses ‘m’ and ‘2m’ are suspended from two massless springs of force constants K_1 and K_2. During their oscillation, if their maximum velocities are equal, then ratio of amplitudes of A and B is

\[ \sqrt{\frac{K_1}{K_2}} \]

(1) \( \sqrt{\frac{K_1}{K_2}} \)  (2) \( \sqrt{\frac{K_2}{2K_1}} \)  (3) \( \sqrt{\frac{K_2}{K_1}} \)  (4) \( \sqrt{\frac{2K_1}{K_2}} \)

Rough Work
93. A tension of 20 N is applied to a copper wire of cross sectional area 0.01 cm², Young’s Modulus of copper is $1.1 \times 10^{11}$ N/m² and Poisson’s ratio is 0.32. The decrease in cross sectional area of the wire is

\[0.01 \text{ cm}^2 \text{ कर्षक में मारी 20 N सहित (मुद्दत रूप से) सहली लगाने पर } 1.1 \times 10^{11} \text{ N/m}^2 \text{ में 32% घटने के बाद कर्षक का समानता है 0.32)}.

(1) $1.16 \times 10^{-6}$ cm²  
(2) $1.16 \times 10^{-5}$ m²  
(3) $1.16 \times 10^{-4}$ m²  
(4) $1.16 \times 10^{-3}$ cm²

94. A capillary tube of radius ‘r’ is immersed in water and water rises to a height of ‘h’. Mass of water in the capillary tube is $5 \times 10^{-3}$ kg. The same capillary tube is now immersed in a liquid whose surface tension is $\sqrt{2}$ times the surface tension of water. The angle of contact between the capillary tube and this liquid is 45°. The mass of liquid which rises into the capillary tube now is, (in kg)

\[r \text{ कर्षक में सेतु किया गया है जिसमें पानी की ऊंचाई ‘h’ है। पानी की द्रव्यता } 5 \times 10^{-3} \text{ kg. इस कर्षक को पत्ती हर तरह से } \sqrt{2} \text{ गुनी द्रव्यता है। ज्या की ऊंचाई } 45° \text{ है। पत्ती की द्रव्यता जिसकी (क्ग)}

(1) $5 \times 10^{-3}$  
(2) $2.5 \times 10^{-3}$  
(3) $5\sqrt{2} \times 10^{-3}$  
(4) $3.5 \times 10^{-3}$

95. The terminal velocity of a liquid drop of radius ‘r’ falling through air is v. If two such drops are combined to form a bigger drop, the terminal velocity with which the bigger drop falls through air is (Ignore any buoyant force due to air)

\[r \text{ वाले द्रव्य की द्रव्यता के लकड़ी के अनुसार है। जब दो ऐसे ड्राप किए जाते हैं, तो उसका वेग } v \text{ है। जब दो गोलाकार गोले के अनुसार, तो उसका वेग } \frac{\sqrt{2}}{\sqrt{3}} \text{ है। वेग जिसकी (क्व) द्राप हैं।}

(1) $\sqrt{2} v$  
(2) $2 v$  
(3) $\sqrt{4} v$  
(4) $\sqrt{2} v$

Rough Work
96. A glass flask of volume one litre is filled completely with mercury at 0°C. The flask is now heated to 100°C. Coefficient of volume expansion of mercury is $1.82 \times 10^{-4}/\text{°C}$ and coefficient of linear expansion of glass is $0.1 \times 10^{-4}/\text{°C}$. During this process, amount of mercury which overflows is

0°C లో, 1 లిట్ర హెర్మునియా ను పూషం కావలసి 0°C విద్యుత్ ను పూషం కావలసి. 100°C లో కొంత పంపుపం కొంతంది. $1.82 \times 10^{-4}/\text{°C}$ వరకు గుండా ప్రచేత శిరా కావలసి 0.1 $\times 10^{-4}/\text{°C}$. అంటే శిరాను

(1) 21.2 cc  
(2) 15.2 cc
(3) 2.12 cc  
(4) 18.2 cc

97. On a temperature scale Y, water freezes at $-160°$ Y and boils at $-50°$ Y. On this Y scale, a temperature of 340 K is

Y స్కేల్ లో, వ్యాసాలు $-160°$ Y లో ప్రాచుర్యత్తు కంటే సంఖ్య లో పరిస్థితి $-50°$ Y లో ప్రాచుర్యత్తు సంస్థానం. అంటే Y స్కేల్ లో 340 K ఎంత ఎంత;

(1) $-106.3°$ Y  
(2) $-96.3°$ Y 
(3) $-86.3°$ Y  
(4) $-76.3°$ Y

Rough Work
98. Three moles of an ideal monoatomic gas undergoes a cyclic process as shown in the figure. The temperature of the gas in different states marked as 1, 2, 3 and 4 are 400 K, 700 K, 2500 K and 1100 K respectively. The work done by the gas during the process 1–2–3–4–1 is (Universal gas constant R)

\[ W = \int p \, dv \]

\[ = \int_{V_1}^{V_2} p \, dv + \int_{V_2}^{V_3} p \, dv + \int_{V_3}^{V_4} p \, dv + \int_{V_4}^{V_1} p \, dv \]

Using the ideal gas law \[ pV = nRT \]

(1) 1650 R  
(2) 550 R  
(3) 1100 R  
(4) 2200 R

99. Efficiency of a heat engine whose sink is at a temperature of 300 K is 40%. To increase the efficiency to 60%, keeping the sink temperature constant, the source temperature must be increased by

\[ \eta = \frac{T_s - T_f}{T_s} \]

\[ \text{where } T_s \text{ is the source temperature} \]

(1) 750 K  
(2) 500 K  
(3) 250 K  
(4) 1000 K

Rough Work
100. Two bodies A and B of equal surface area have thermal emissivities of 0.01 and 0.81 respectively. The two bodies are radiating energy at the same rate. Maximum energy is radiated from the two bodies A and B at wavelengths $\lambda_A$ and $\lambda_B$ respectively. Difference in these two wavelengths is 1 $\mu$m. If the temperature of the body A is 5802 K, then value of $\lambda_B$ is

\[ \text{Option: (1) } \frac{1}{2} \mu m \quad \text{(2) } 1 \mu m \quad \text{(3) } 2 \mu m \quad \text{(4) } \frac{3}{2} \mu m \]

101. An air column in a tube 32 cm long, closed at one end, is in resonance with a tuning fork. The air column in another tube, open at both ends, of length 66 cm is in resonance with another tuning fork. When these two tuning forks are sounded together, they produce 8 beats per second. Then the frequencies of the two tuning forks are, (Consider fundamental frequencies only)

\[ \text{32 cm: } \text{Option: (1) } 250 \text{ Hz, } 258 \text{ Hz} \quad \text{(2) } 240 \text{ Hz, } 248 \text{ Hz} \quad \text{(3) } 264 \text{ Hz, } 256 \text{ Hz} \quad \text{(4) } 280 \text{ Hz, } 272 \text{ Hz} \]

Rough Work
102. A source of sound of frequency 640 Hz is moving at a velocity of \( \frac{100}{3} \text{ m/s} \) along a road, and is at an instant 30 m away from a point A on the road (as shown in figure). A person standing at O, 40 m away from the road hears sound of apparent frequency \( v^1 \). The value of \( v^1 \) is (velocity of sound = 340 m/s)

\[
\text{640 Hz} \rightarrow \text{30 m} \rightarrow \text{A} \rightarrow \text{O} \rightarrow \text{40 m} \rightarrow \text{\( v^1 \)} \rightarrow \text{\( v^1 \)} \rightarrow \text{\( v^1 \)} \rightarrow \text{\( v^1 \)}
\]

\[
\begin{align*}
\text{(1)} & \quad 620 \text{ Hz} \\
\text{(2)} & \quad 680 \text{ Hz} \\
\text{(3)} & \quad 720 \text{ Hz} \\
\text{(4)} & \quad 840 \text{ Hz}
\end{align*}
\]
103. The two surfaces of a concave lens, made of glass of refractive index 1.5 have the same radii of curvature R. It is now immersed in a medium of refractive index 1.75, then the lens

(1) becomes a convergent lens of focal length 3.5 R
(2) becomes a convergent lens of focal length 3.0 R
(3) changes as a divergent lens of focal length 3.5 R
(4) changes as a divergent lens of focal length 3.0 R

104. A microscope consists of an objective of focal length 1.9 cm and eye piece of focal length 5 cm. The two lenses are kept at a distance of 10.5 cm. If the image is to be formed at the least distance of distinct vision, the distance at which the object is to be placed before the objective is (Least distance of distinct vision is 25 cm)

(1) 6.2 cm (2) 2.7 cm (3) 21.0 cm (4) 4.17 cm

Rough Work
105. Fresnel diffraction is produced due to light rays falling on a small obstacle. The intensity of light at a point on a screen beyond an obstacle depends on

(1) the focal length of lens used for observation
(2) the number of half-period zones that superpose at the point
(3) the square of the sum of the number of half period zones
(4) the thickness of the obstacle

106. A short bar magnet having magnetic moment $4\,\text{Am}^2$, placed in a vibrating magnetometer, vibrates with a time period of 8 seconds. Another short bar magnet having a magnetic moment $8\,\text{Am}^2$ vibrates with a time period of 6 seconds. If the moment of inertia of the second magnet is $9 \times 10^{-2} \,\text{kg m}^2$, the moment of inertia of the first magnet is

(Assume that both magnets are kept in the same uniform magnetic induction field.)

$4\,\text{Am}^2$ మరియు $8\,\text{Am}^2$ మరియు వివిధ వ్యాప్తి సిద్ధమైనాయి. అడుగుపెట్టిన వర్ధితాలు $8\,\text{Am}^2$ మరియు $8\,\text{Am}^2$ మరియు వివిధ వ్యాప్తి సిద్ధమైనాయి. అడుగుపెట్టిన వర్ధితాలు $6\,\text{Am}^2$ మరియు $8\,\text{Am}^2$ మరియు వివిధ వ్యాప్తి సిద్ధమైనాయి. అడుగుపెట్టిన వర్ధితాలు $9 \times 10^{-2} \,\text{kg m}^2$ మరియు వివిధ వ్యాప్తి $9 \times 10^{-2} \,\text{kg m}^2$

(1) $9 \times 10^{-2} \,\text{kg m}^2$  (2) $8 \times 10^{-2} \,\text{kg m}^2$
(3) $5.33 \times 10^{-2} \,\text{kg m}^2$  (4) $12.2 \times 10^{-2} \,\text{kg m}^2$
107. Two short bar magnets have their magnetic moments 1.2 Am\(^2\) and 1.0 Am\(^2\). They are placed on a horizontal table parallel to each other at a distance of 20 cm between their centres, such that their north poles pointing towards geographic south. They have common magnetic equatorial line. Horizontal component of earth's field is \(3.6 \times 10^{-5}\) T. Then, the resultant horizontal magnetic induction at mid point of the line joining their centers is \(\frac{\mu_0}{4\pi} 10^{-7}\) H/m.

\[
\begin{align*}
\text{(1)} & \quad 3.6 \times 10^{-5} \text{ T} \\
\text{(2)} & \quad 1.84 \times 10^{-4} \text{ T} \\
\text{(3)} & \quad 2.56 \times 10^{-4} \text{ T} \\
\text{(4)} & \quad 5.8 \times 10^{-5} \text{ T}
\end{align*}
\]

108. A deflection magnetometer is adjusted and a magnet of magnetic moment \(M\) is placed on it in the usual manner and the observed deflection is \(\theta\). The period of oscillation of the needle before settling to the deflection is \(T\). When the magnet is removed, the period of oscillation of the needle is \(T_0\) before settling to \(0^\circ\). If the earth’s induced magnetic field is \(B_H\), the relation between \(T\) and \(T_0\) is

\[
\begin{align*}
\text{(1)} & \quad T^2 = T_0^2 \cos \theta \\
\text{(2)} & \quad T^2 = \frac{T_0^2}{\cos \theta} \\
\text{(3)} & \quad T = T_0 \cos \theta \\
\text{(4)} & \quad T = \frac{T_0}{\cos \theta}
\end{align*}
\]

**Rough Work**
109. Two metal plates each of area 'A' form a parallel plate capacitor with air in between the plates. The distance between the plates is 'd'. A metal plate of thickness \( \frac{d}{2} \) and of same area A is inserted between the plates to form two capacitors of capacitances \( C_1 \) and \( C_2 \) as shown in the figure. If the effective capacitance of the two capacitors is \( C' \) and the capacitance of the capacitor initially is \( C \), then \( \frac{C'}{C} \) is

\[
\text{Given:}
\begin{align*}
A & = \text{Area of each plate} \\
C_1 & = \text{Capacitance of initial capacitor} \\
C_2 & = \text{Capacitance of capacitor with metal plate inserted} \\
C' & = \text{Effective capacitance of the two capacitors} \\
C & = \text{Capacitance of capacitor initially}
\end{align*}
\]

\[
\frac{C'}{C} = \frac{C_1 + C_2}{C} \]

\[
\frac{C'}{C} = \frac{C_1}{C} + \frac{C_2}{C}
\]

\[
\frac{C'}{C} = \frac{1}{\frac{d}{2}} + \frac{1}{\frac{d}{2}} = \frac{4}{d}
\]

\[
\frac{C'}{C} = \frac{4}{d}
\]

(1) 4  (2) 2  (3) 6  (4) 1

110. In the circuit shown in the figure, the current 'I' is

\[
\text{Given:}
\begin{align*}
24 \text{ V} & = \text{Voltage source} \\
10 \text{ V} & = \text{Voltage source} \\
2 \Omega & = \text{Resistor} \\
3 \Omega & = \text{Resistor} \\
1 \Omega & = \text{Resistor} \\
9 \text{ V} & = \text{Voltage source}
\end{align*}
\]

\[
\text{Ohm's Law:}
\begin{align*}
I & = \frac{V}{R} \\
I & = \frac{24}{3} + \frac{10}{2} + \frac{9}{1} = 8 + 5 + 9 = 22 \text{ Amps}
\end{align*}
\]

(1) 6 Amp  (2) 2 Amp  (3) 4 Amp  (4) 7 Amp

Rough Work
111. In the meter bridge experiment, the length AB of the wire is 1 m. The resistors X and Y have values 5 Ω and 2 Ω respectively. When a shunt resistance S is connected to X, the balancing point is found to be 0.625 m from A. Then, the resistance of the shunt is

\[ S = \frac{R_X \times R_Y}{R_X + R_Y} \]

where \( R_X = 5 \) Ω and \( R_Y = 2 \) Ω.

(1) 5 Ω  (2) 10 Ω  (3) 7.5 Ω  (4) 12.5 Ω

112. The ends of an element of zinc wire are kept at a small temperature difference \( \Delta T \) and a small current (I) is passed through the wire. Then, the heat developed per unit time is

(1) proportional to \( \Delta T \) and I
(2) proportional to \( I^3 \) and \( \Delta T \)
(3) proportional to Thomson coefficient of the metal
(4) proportional to \( \Delta T \) only

\[ Q = \rho A L \frac{I^2}{R} \Delta T \]

(1) \( \Delta T \) = \[ \frac{Q}{A L \rho \frac{I^2}{R}} \]
(2) \( I^3 \) \[ \frac{Q}{A L \rho} \]
(3) \[ \frac{Q}{A L \rho} \]
(4) \[ \frac{Q}{A L \rho} \]

Rough Work
113. A series LCR circuit is connected across a source of alternating emf of changing frequency
and resonates at frequency $f_0$. Keeping capacitance constant, if the inductance ($L$) is increased
by $\sqrt{3}$ times and resistance is increased ($R$) by 1.4 times, the resonant frequency now is

\[ f_0 \]  

Therefore, the new resonant frequency is given by

\[ f_{new} = f_0 \times \left( \frac{L}{\sqrt{3}L} \right) \times \left( \frac{R}{1.4R} \right) = f_0 \times \left( \frac{1}{\sqrt{3}} \right) \times \left( \frac{1}{1.4} \right) \]

(3) $f_0$  

(4) $f_0$  

(3) $(\sqrt{3}-1)^{1/4} f_0$  

114. The sensitivity of a galvanometer that measures current is decreased by $\frac{1}{40}$ times by using
shunt resistance of 10 $\Omega$. Then, the value of the resistance of the galvanometer is

\[ \text{Sensitivity} = \frac{1}{40} \times \text{Original Sensitivity} \]

(1) 400 $\Omega$  

(2) 410 $\Omega$  

(3) 30 $\Omega$  

(4) 390 $\Omega$
115. Initially a photon of wavelength $\lambda_1$ falls on photocathode and emits an electron of maximum energy $E_1$. If the wavelength of the incident photon is changed to $\lambda_2$, the maximum energy of the electron emitted becomes $E_2$. Then value of $hc$ ($h = \text{Planck’s constant}, c = \text{Velocity of light}$) is

$$\frac{h}{c} = \frac{E_1 + E_2}{\lambda_2 - \lambda_1}$$

$$\frac{h}{c} = \frac{E_1 - E_2}{\lambda_2 - \lambda_1}$$

$$\frac{h}{c} = \frac{(E_1 - E_2)(\lambda_2 - \lambda_1)}{\lambda_1 \lambda_2}$$

$$\frac{h}{c} = \frac{\lambda_2 - \lambda_1}{\lambda_1 \lambda_2} \cdot E_1$$

116. The work function of a metal is 2 eV. If a radiation of wavelength 3000 Å is incident on it, the maximum kinetic energy of the emitted photoelectrons is

(Planck’s constant $h = 6.6 \times 10^{-34}$ JS; Velocity of light $c = 3 \times 10^8$ m/s; 1 eV = 1.6 $\times 10^{-19}$ J)

(1) $4.4 \times 10^{-19}$ J  (2) $5.6 \times 10^{-19}$ J  (3) $3.4 \times 10^{-19}$ J  (4) $2.5 \times 10^{-19}$ J

117. The radius of $^{72}\text{Te}^{125}$ nucleus is 6 fermi. The radius of $^{13}\text{Al}^{27}$ nucleus in meters is

$^{72}\text{Te}^{125}$ కిలోశాంశ 6 ఫెర్మి. $^{13}\text{Al}^{27}$ కిలోశాంశ ఎంతం ఫెర్మి?

(1) $3.6 \times 10^{-12}$ m  (2) $3.6 \times 10^{-15}$ m

(3) $7.2 \times 10^{-8}$ m  (4) $7.2 \times 10^{-15}$ m

Rough Work
118. A U^{235} nuclear reactor generates energy at a rate of $3.70 \times 10^7$ J/s. Each fission liberates 185 MeV useful energy. If the reactor has to operate for $144 \times 10^4$ seconds, then, the mass of the fuel needed is

(Assume Avogadro's number = $6 \times 10^{23}$ mol^{-1}, 1 eV = $1.6 \times 10^{-19}$ J)

(1) 70.5 kg (2) 0.705 kg (3) 13.1 kg (4) 1.31 kg

119. The base current in a transistor circuit changes from 45 $\mu$A to 140 $\mu$A. Accordingly, the collector current changes from 0.2 mA to 4.00 mA. The gain in current is

(1) 9.5 (2) 1 (3) 40 (4) 20

120. Of the following, NAND gate is

(1) [Diagram]

(2) [Diagram]

(3) [Diagram]

(4) [Diagram]

Rough Work
CHEMISTRY

121. The number of radial nodes of 3s and 2p orbitals respectively are:
(1) 0, 2  (2) 2, 0  (3) 1, 2  (4) 2, 1

122. The basis of quantum mechanical model of an atom is:
(1) angular momentum of electron  (2) quantum numbers
(3) dual nature of electron       (4) black body radiation

123. The number of elements present in fourth period is:
(1) 32  (2) 8  (3) 18  (4) 2

124. Identify the correct set:

<table>
<thead>
<tr>
<th>molecule</th>
<th>hybridisation of central atom</th>
<th>shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCl₅</td>
<td>dsp³</td>
<td>square pyramidal</td>
</tr>
<tr>
<td>[Ni(CN)₄]²⁻</td>
<td>sp³</td>
<td>tetrahedral</td>
</tr>
<tr>
<td>SF₆</td>
<td>sp³d²</td>
<td>octahedral</td>
</tr>
<tr>
<td>IF₃</td>
<td>dsp³</td>
<td>pyramidal</td>
</tr>
</tbody>
</table>

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<td>dsp³</td>
</tr>
</tbody>
</table>

Rough Work
125. Which one of the following statements is correct?

1. Hybrid orbitals do not form σ bonds
2. Lateral overlap of p-orbitals or p- and d-orbitals produces π-bonds
3. The strength of bonds follows the order:
   \[ \sigma_{p-p} < \sigma_{s-s} < \pi_{p-p} \]
4. s-orbitals do not form σ bonds

126. Which one of the following is an example of disproportionation reaction?

1. \(3\text{Cl}_2 (g) + 6\text{OH}^- (aq) \rightarrow \text{ClO}_3^- (aq) + 5\text{Cl}^- (aq) + 3\text{H}_2\text{O (l)}\)
2. \(\text{Ag}^{2+} (aq) + \text{Ag} (s) \rightarrow 2\text{Ag}^+ (aq)\)
3. \(\text{Zn} (s) + \text{CuSO}_4 (aq) \rightarrow \text{Cu} (s) + \text{ZnSO}_4 (aq)\)
4. \(2\text{KClO}_3 (s) \rightarrow 2\text{KCl} (s) + 3\text{O}_2 (g)\)
127. At T(k), the ratio of kinetic energies of 4 g of H\textsubscript{2}(g) and 8 g of O\textsubscript{2}(g) is:

\[ T(k) \text{ such that } 4 \text{ mol } \text{H}_2 \text{ and } 8 \text{ mol } \text{O}_2 \text{ have the same energy.} \]

\[ \begin{array}{llll}
(1) & 1 : 4 & (2) & 4 : 1 \\
(3) & 2 : 1 & (4) & 8 : 1 \\
\end{array} \]

128. Which one of the following is an isotonic pair of solutions?

\[ (1) \quad 0.15 \text{ M NaCl and } 0.1 \text{ M Na}_2\text{SO}_4 \]

\[ (2) \quad 0.2 \text{ M Urea and } 0.1 \text{ M Sugar} \]

\[ (3) \quad 0.1 \text{ M BaCl}_2 \text{ and } 0.2 \text{ M Urea} \]

\[ (4) \quad 0.2 \text{ M MgSO}_4 \text{ and } 0.1 \text{ M NH}_4\text{Cl} \]

129. The vapour pressure in mm of Hg, of an aqueous solution obtained by adding 18 g of glucose (C\textsubscript{6}H\textsubscript{12}O\textsubscript{6}) to 180 g of water at 100°C is:

\[ 100^\circ \text{C } 18 \text{ g glucose (C}_6\text{H}_{12}\text{O}_6) \text{ in } 180 \text{ g water } \text{ results in a solution of} \]

\[ \begin{array}{llll}
(1) & 7.60 & (2) & 76.0 \\
(3) & 759 & (4) & 752.4 \\
\end{array} \]
130. During the electrolysis of copper sulphate aqueous solution using copper electrode, the reaction taking place at the cathode is:

\[(1) \quad \text{Cu} \rightarrow \text{Cu}^{2+}_{(aq)} + 2e^- \quad (2) \quad \text{Cu}^{2+}_{(aq)} + 2e^- \rightarrow \text{Cu}_{(s)}\]

\[(3) \quad \text{H}^{+}_{(aq)} + e^- \rightarrow \frac{1}{2} \text{H}_2(g) \quad (4) \quad \text{SO}_4^{2-}_{(aq)} \rightarrow \text{SO}_3(g) + \frac{1}{2} \text{O}_2(g) + 2e^-\]

131. The extent of charge of lead accumulator is determined by:

(1) amount of \(\text{PbSO}_4\) in the battery

(2) amount of \(\text{PbO}_2\) in the battery

(3) specific gravity of \(\text{H}_2\text{SO}_4\) of the battery

(4) amount of \(\text{Pb}\) in the battery

раг్రి ప్రతిభాశాలీని ప్రమాణికం చేయడానికి

(1) ప్రతిభాశాలీని \(\text{PbSO}_4\) ని చేస్తుంది

(2) ప్రతిభాశాలీని \(\text{PbO}_2\) ని ఉపయోగిస్తుంది

(3) ప్రతిభాశాలీని \(\text{H}_2\text{SO}_4\) ఎంచుకుంటుంది

(4) ప్రతిభాశాలీని \(\text{Pb}\) ఎంచుకుంటుంది
132. The number of octahedral and tetrahedral holes respectively present in a hexagonal close packed (hcp) crystal of ‘X’ atoms are :

‘X’ తొమగుతున్న కంటే మిలిసే తెట్రాహోదాయ స్థానాలు (hcp) రెండు భాగాలు ఉంటాయి (హెప్) రెండు భాగాలు ఉంటాయి (హెప్) ఎలాంటి సమానం ఉంటుందా?

(1) X, 2X  (2) X, X  (3) 2X, X  (4) 2X, 2X

133. Which one of the following plots is correct for a first order reaction?

ఎందుకంటే ప్లోట్ సర్వం సరేపాడు ఎందుకంటే ప్లోట్ సర్వం సరేపాడు?

(1)  (2) 

\[ \log(a-x) \quad \text{Time in s} \]

(3)  (4)

\[ \log(a-x) \quad \text{Time in s} \]

\[ \text{log(a-x)} \quad \text{Time in s} \]

\[ \text{log(a-x)} \quad \text{Time in s} \]

Rough Work
134. The degree of ionization of 0.10 M lactic acid is 4.0%

\[
\begin{align*}
\text{H} & \quad \text{H} \\
\text{H}_3\text{C} - \text{C} - \text{COOH} & \quad \text{H}_3\text{C} - \text{C} - \text{COO}^- \\
\text{OH} \ (\text{aq}) & \quad \text{OH} \ (\text{aq})
\end{align*}
\]

0.10 M lactic acid 4.0%

\[
\begin{align*}
\text{H} & \quad \text{H} \\
\text{H}_3\text{C} - \text{C} - \text{COOH} & \quad \text{H}_3\text{C} - \text{C} - \text{COO}^- \\
\text{OH} \ (\text{aq}) & \quad \text{OH} \ (\text{aq})
\end{align*}
\]

The value of $K_c$ is

$K_c$ .choice(1) $1.66 \times 10^{-5}$  (2) $1.66 \times 10^{-4}$  (3) $1.66 \times 10^{-3}$  (4) $1.66 \times 10^{-2}$

135. The pH of a buffer solution made by mixing 25 ml of 0.02 M NH$_4$OH and 25 ml of 0.2 M NH$_4$Cl at 25°C is: (pK$_b$ of NH$_4$OH = 4.8)

25°C 25 ml 0.02 M NH$_4$OH 25 ml 0.2 M NH$_4$Cl pH: (pK$_b$ NH$_4$OH = 4.8)

(1) 5.8  (2) 8.2  (3) 4.8  (4) 3.8
136. For which one of the following reactions, the entropy change is positive?

(1) \( H_2 + \frac{1}{2} O_2 \rightarrow H_2O \)  
(g) (g) (ℓ)

(2) \( Na^+ + Cl^- \rightarrow NaCl \)
(g) (g) (s)

(3) \( NaCl \rightarrow NaCl \)
(ℓ) (s)

(4) \( H_2O \rightarrow H_2O \)
(ℓ) (g)

137. Match the following:

**List-I**

(A) Solid dispersed in liquid  
(B) Liquid dispersed in liquid  
(C) Gas dispersed in liquid  
(D) Liquid dispersed in solid

**List-II**

(I) Emulsion  
(II) Foam  
(III) Gel  
(IV) Sol  
(V) Aerosol

The correct match is:

(A) (B) (C) (D)

(1) (IV) (I) (II) (III)

(2) (III) (I) (V) (II)

(3) (III) (I) (II) (IV)

(4) (IV) (I) (V) (III)

Rough Work
138. Observe the following statements:
1. Heavy water is harmful for the growth of animals
2. Heavy water reacts with Al₄C₃ and forms deuterated acetylene
3. BaCl₂·2D₂O is an example of interstitial deuterate

The correct statements are:

(1) 1 & 3  (2) 1 & 2
(3) 1, 2 & 3  (4) 2 & 3

139. Solution "X" contains Na₂CO₃ and NaHCO₃. 20 ml of X when titrated using methyl orange indicator consumed 60 ml of 0.1 M HCl solution. In another experiment, 20 ml of X solution when titrated using phenolphthalein consumed 20 ml of 0.1 M HCl solution. The concentrations (in mol lit⁻¹) of Na₂CO₃ and NaHCO₃ in X are respectively

"X" లో Na₂CO₃ మరియు NaHCO₃ ఉన్నట్లు. 20 మిల్యం X లను పాచడానికి 60 మిల్యం 0.1 M HCl లను పచ్చాడు వాటికి వేయారని. ఇది లో 20 మిల్యం X లను పాచడానికి 20 మిల్యం 0.1 M HCl లను పచ్చాడు. X లో Na₂CO₃ మరియు NaHCO₃ మందికి (క్లిమైత్తుడు) నిర్ధిష్టం

(1) 0.01, 0.02  (2) 0.1, 0.1
(3) 0.01, 0.01  (4) 0.1, 0.01
140. Diborane reacts with HCl in the presence of AlCl₃ and liberates:

(1) H₂  (2) Cl₂  (3) BCl₃  (4) Cl₂ & BCl₃

141. How many corners of SiO₄ unit are shared in the formation of three dimensional silicates?

SiO₄ సంఖ్య పొడవు మిదరు చివరు సాధారణ రూపంలో రూపాలు (అనగా పాల్సు రూపాలు)
సాగుడు చివరు విధానం.

(1) 3  (2) 2  (3) 4  (4) 1

142. Which one of the following is not correct?

(1) Pyrophosphoric acid is a tetrabasic acid
(2) Pyrophosphoric acid contains P–O–P linkage
(3) Pyrophosphoric acid contains two P–H bonds
(4) Orthophosphoric acid can be prepared by dissolving P₄O₁₀ in water

(ఎంటి సంఖ్య విధానం నేకు లేదు?

(1) ప్యూరోఫ్ఫోస్ఫాసిక్ ఎస్సే తెరిబస్యక ఎస్సే
(2) ప్యూరోఫోస్ఫాసిక్ ఎసే పి–ఒ–ప్పు లింకేజ్ కల్చుకురించినది
(3) ప్యూరోఫోస్ఫాసిక్ ఎసే పి–ఐ బంధాలు కల్చుకురించినది
(4) ఓర్థోఫోస్ఫాసిక్ ఎసే పి4O₁₀ లో ఉంటూ పి ఒ లింకేజ్ కల్చుకురించినది

Rough Work
143. \( \text{Na}_2\text{S}_2\text{O}_3 \) reacts with moist \( \text{Cl}_2 \) to form \( \text{Na}_2\text{SO}_4 \), \( \text{HCl} \) and \( X \). Which one of the following is \( X \)?

\( \text{Na}_2\text{S}_2\text{O}_3 + \text{Cl}_2 \rightarrow \text{Na}_2\text{SO}_4 + \text{HCl} \)

(1) \( \text{H}_2\text{S} \)  
(2) \( \text{SO}_2 \)  
(3) \( \text{SO}_3 \)  
(4) \( \text{S} \)

144. The role of copper diaphragm in Whytlaw-Gray's method is:

(1) preventing the corrosion of electrolytic cell
(2) preventing the mixing of \( \text{H}_2 \) and \( \text{F}_2 \)
(3) as anode
(4) as cathode

145. Liquid \( X \) is used in Bubble chamber to detect neutral mesons and gamma photons. Then, \( X = \)

(1) \( \text{He} \)  
(2) \( \text{Ne} \)  
(3) \( \text{Kr} \)  
(4) \( \text{Xe} \)

Rough Work
146. A compound absorbs light in the wavelength region 490–500 nm. Its complementary colour is:

(1) Red  
(2) Blue  
(3) Orange  
(4) Blue-green

147. Which of the following is not added during the extraction of silver by cyanide process?

(1) NaCN  
(2) Air (రాయ)  
(3) Zn  
(4) Na₂S₂O₃

148. Cataract and skin cancer are caused by _______.

(1) Depletion of Nitric oxide  
(2) Depletion of Ozone layer  
(3) Increase in Methane  
(4) Depletion of Nitrous oxide

Rough Work
149. Which one of the following gives Prussian blue colour?

(1) \( \text{Fe}_2[\text{Fe(CN)}_6] \)  
(2) \( \text{Na}_4[\text{Fe(CN)}_6] \)
(3) \( \text{Fe}_3[\text{Fe(CN)}_6]_3 \)  
(4) \( \text{Fe}_4[\text{Fe(CN)}_6]_3 \)

150. \( \text{C}_2\text{H}_6 \xrightarrow{450^\circ C} \text{C}_2\text{H}_4 + \text{H}_2 \)

Above reaction is called as ______.

(1) Combustion  
(2) Rearrangement  
(3) Pyrolysis  
(4) Cleavage

\( \text{C}_2\text{H}_6 \xrightarrow{450^\circ C} \text{C}_2\text{H}_4 + \text{H}_2 \)

ే చేతు కంటే _____ తీసుకుంటుంది.

(1) యిస్తేనురి  
(2) యిస్తేప్పుకుంటే  
(3) జూతులు ఉంటే మంత్రిగా  
(4) జూతును మంత్రి

Rough Work
151. **Assertion (A):** –NH₂ group of aniline is ortho, para directing in electrophilic substitutions.

**Reason (R):** –NH₂ group stabilises the arenium ion formed by the ortho, para attack of the electrophile.

The correct answer is

1. Both (A) and (R) are correct, (R) is the correct explanation of (A)
2. Both (A) and (R) are correct, (R) is not the correct explanation of (A)
3. (A) is correct, but (R) is not correct
4. (A) is not correct, but (R) is correct

**急需 (A):** అనిలీను యొక్క –NH₂ గ్రుట్టు ప్రయోగానికి ఉపయోగపడుతుంది.

**పరిమితం (R):** అనిలీను యొక్క –NH₂ గ్రుట్టు, అనేక ఉద్యంతే ప్రయోగించబడుతుంది.

**ప్రాంణం (R):** –NH₂ గ్రుట్టు మూలమే ప్రమాణం, అనేక ఉద్యంతే ప్రయోగించబడుతుంది.

1. కరుణు (R) ఎన్ని విషయాలు, (A) ఎన్ని విషయాలు విశేషాలు
2. (A) ఎన్ని విషయాలు, (R) ఎన్ని విశేషాలు నిర్ణయం
3. (A) ఎన్ని విషయాలు, రాయ (R) ఎన్ని విశేషాలు నిర్ణయం
4. (A) ఎన్ని విషయాలు రాయ, రాయ (R) ఎన్ని విశేషాలు

**Rough Work**
152. In which of the following properties, the two enantiomers of lactic acid differ from each other?

(1) Sign of specific rotation
(2) Density
(3) Melting point
(4) Refractive index

153. Heating chloroform with aqueous sodium hydroxide solution forms:

(1) Sodium acetate
(2) Sodium oxalate
(3) Sodium formate
(4) Chloral

Rough Work
154. The products formed in the reaction of phenol with \( \text{Br}_2 \) dissolved in \( \text{CS}_2 \) at 0°C are:

(1) o-bromo, m-bromo and p-bromophenols
(2) o-bromo and p-bromophenols
(3) 2, 4, 6-tribromo and 2, 3, 6-tribromophenols
(4) 2, 4-dibromo and 2, 6-dibromophenols

155. The structure of PCC is:

PCC శిక్షక విశేషాలు:

(1) \( \text{C}_6\text{H}_5\text{NHCrO}_2\text{Cl} \)
(2) \( \text{C}_6\text{H}_5\text{NHCrO}_3\text{Cl} \)
(3) \( \text{C}_5\text{H}_5\text{NHCrO}_2\text{Cl} \)
(4) \( \text{C}_5\text{H}_5\text{NHCrO}_3\text{Cl} \)
156. The pK_a values of four carboxylic acids are given below. Identify the weakest carboxylic acid.

(1) 4.89       (2) 1.28
(3) 4.76       (4) 2.56

157. Identify X and Y in the following reactions:

\[ X \xrightarrow{\text{Zn/NH}_3\text{Cl}} \] \[ \text{NO}_2 \text{Zn} + \text{KOH/CH}_3\text{OH} \rightarrow Y \]

(1) \[ \text{NO} \]
(2) \[ \text{NH}_2 \]
(3) \[ \text{NHOH} \]
(4) \[ \text{NH} \]

Y

Rough Work
158. Example of a biodegradable polymer pair is:

(1) Nylon-6,6 and Terylene
(2) PHBV and Dextron
(3) Bakelite and PVC
(4) PET and Polyethylene

159. The number of hydrogen bonds between Guanine & Cytosine; and between Adenine & Thymine in DNA is:

DNA యంత్ర పడవు మరియు లెంగ్స్ వీటి పదార్థాలు మరియు డైనోర్ వీటి సాధనాలు నుండి సంబంధం వచ్చు వంటిది:

(1) 1, 2
(2) 3, 2
(3) 3, 1
(4) 2, 1

Rough Work
160. Identify Phenacetin from the following:

(1) \( \text{NHCOCH}_3 \)

(2) \( \text{NHCOCH}_3 \)

(3) \( \text{OCH}_3 \)

(4) \( \text{OCH}_3 \)

Rough Work