MATHS

BOOKS - SAI MATHS (TELUGU ENGLISH)

QUESTION PAPER

Math

1. The domain of function $f(x) = \frac{1}{\sqrt{x}^2 - [x] - 2}$ is (Here [x] denotes the greatest integral not exceeding the value of x)

A. $(-\infty, -2) \cup (1, \infty)$

B. $(-\infty, -2) \cup (0, \infty)$

C. $(-\infty, 2) \cup (2, \infty)$

D. $(-\infty, -1) \cup (3, \infty)$

Answer: D

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2. Let $f: R \to T$ and $g: R \to R$ be the function defined by $f(x) = \frac{x}{1+x^2}, x \in R, g(x) = \frac{x^2}{1+x^2}, x \in R$

Then, the correct statement (s) among the following is/are:

(A) both f, g are one-one

(B) Both f, g are onto

(C) both f, g are not one-one as well as not onto

(D) f and g onto but not one-one

A. A

B. A,B

C. D

D. C

Answer: D

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3. If

$\alpha \in R, n \in N$ and $n + 2(n-1) + 3(n-2) + \ldots\ldots + (n-1)2 + n.1 =$

A. $\frac{1}{2}$

B. $\frac{1}{3}$

C. $\frac{1}{5}$

D. $\frac{1}{6}$

Answer: D

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4. If the function $f\left\{[a.\, b] \to \left[-\frac{\sqrt{3}}{4}, \frac{1}{2}\right]\right.$ defined by.

$f(x) = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1+\sin x & 1 \\ 1+\cos x & 1 & 1 \end{bmatrix}$ is one-one onto, then

A. $a = \frac{-\pi}{4}, b = \frac{\pi}{6}$

B. $a = \frac{-\pi}{2}, b = \frac{\pi}{2}$

C. $a = \frac{-\pi}{6}, b = \frac{\pi}{4}$

D. $a = -\pi, b = \pi$

Answer: A

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5. The rank of the matrix $\begin{vmatrix} 3 & 5 & -1 & 4 \\ 2 & 1 & 3 & -2 \\ 8 & 11 & 1 & 6 \\ -7 & 14 & 6 & -14 \end{vmatrix}$ is

A. 1

B. 2

C. 3

D. 4

Answer: B

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6. A value of e for which the following system of equations has a non-trivial solution is

$(4\sin\theta)x - 3y + z = 0, \ -(6\cos 2\theta)y + z = 0, 3x - 12y + 4z = 0$

A. $\tan^{-1}\left(\frac{1}{2}\right)$

B. $\frac{\pi}{4}$

C. $\sin^{-1}\left(\frac{3}{16}\right)$

D. $\frac{\pi}{12}$

Answer: C

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7. If $z = \sqrt{2}\sqrt{1+\sqrt{3i}}$ represents a point P in the argand plane and P lies in the third quadrant, then the polar form of z is

A. $\left[\cos\left(\frac{-4\pi}{3}\right)+I\sin\left(\frac{-4\pi}{3}\right)\right]$

B. $2\left[\cos\left(\frac{-5\pi}{6}\right)+I\sin\left(\frac{-5\pi}{6}\right)\right]$

C. $2\left[\cos\left(\frac{-\pi}{6}\right)+I\sin\left(\frac{-\pi}{6}\right)\right]$

D. $2\left[\cos\left(\frac{-2\pi}{3}\right)+I\sin\left(\frac{-2\pi}{3}\right)\right]$

Answer: B

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8. If z = x + iy represents a point P in the argand plane, then the area of the region represented by the inequality 2 <|z-(1+i)|<3 is

A. 49π

B. 36π

C. 25π

D. 5π

Answer: D

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9. If p is complex number whose modulus is one, then the equation $\left(\frac{1+iz}{1-iz}\right)^4$ =p` has

A. real and equal roots

B. real and distinct roots

C. two real and two complex roots

D. all complex roots

Answer: B

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10. $\sum_{r=1}^{16}\left(\sin\left[\frac{2r\pi}{17}\right]+i\cos\left[\frac{2r\pi}{17}\right]\right)$ =

A. 1

B. -1

C. i

D. $-I$

Answer: D

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11. If the maximum value of $2x - 7 - ax^2$ cannot exceed 20, then the minimum value of a is

A. 27

B. $\frac{1}{13}$

C. 13

D. $\frac{1}{27}$

Answer: D

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12. A student while solbing a quadratic equation in x, he sopied its constant term incorrectly and got its roots as 5 and 9. Another student copied the constant term and coefficient of x^2 of the same equation correctly as 12 and 4 respectively. If s, p and Δ denote respectively the sum of the roots, the product of the roots and discriminant of the correct equation, then, $\frac{\Delta}{3p+s} =$

A. 48

B. 45

C. 8

D. 16

Answer: C

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13. The product of the real roots of the equation $(x+1)^4 + (x+3)^4 = 8$ is

A. 0

B. 74

C. $7 - 2\sqrt{3}$

D. $7 + 2\sqrt{3}$

Answer: C

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14. The sum of all the real numbers satisfying the equation $x^2 + |x-3| = 4$ is

A. 0

B. 1

C. 2

D. -1

Answer: B

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15. Consider the following statements:

(i) Number of one-one functions from set A to B, where $O(A) = m$ and $O(B) = n(m \leq n)$ is given by ${}^{n}P_{m}$,

(ii) Number of ways in which 'n' people can be arranged at a circular table is $\frac{(n-1)!}{2}$.

(iii) Number of ways of selecting atleast one thing out of the given n distinct things is $2^{n} - 1$.

(iv) Number of ways in which n distinguishable objects can be distributed into k distinguishable bins is ${}^{n}C_{k-1}$.

A. All the statements are true

B. All except (iii) are true

C. Only (i) and (iii)are true

D. Only (ii) is false

Answer: C

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16. The number of ways is which 3 identical balls can be distributed into 7 distinct bins is

A. 49

B. 84

C. 35

D. 42

Answer: B

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17. For $x = \frac{5}{7}$, If t_k is the first negative term in the expansion of $(1+x)^{7/5}$, then $t_1, +t_2, + \ldots . t_k =$

A. $\frac{13}{7}$

B. $\frac{107}{14}$

C. $\frac{104}{49}$

D. $\frac{921}{28}$

Answer: C

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18. The cofficient of x^6 in the tower series expansion of $\frac{x^4 - 12x^2 + 7}{(x^2+1)^3}$ is

A. 149

B. -253

C. -145

D. 253

Answer: C

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19. Show that $\left(1+\cos.\frac{\pi}{8}\right)\left(1+\cos.\frac{3\pi}{8}\right)\left(1+\cos.\frac{5\pi}{8}\right)\left(1+\cos.\frac{7\pi}{8}\right)=\frac{1}{8}$

A. $\frac{1+\sqrt{2}}{2\sqrt{2}}$

B. $\frac{\pi}{8}$

C. $\frac{1}{8}$

D. $\frac{1}{2}$

Answer: C

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20. If A and B are acute angles satisfying

$3\cos^2 A + 2\cos^2 B = 4$ and $\frac{3\sin A}{\sin B} = \frac{2\cos B}{\cos A}$,

then $A + 2B =$

A. 30°

B. 45°

C. 60°

D. 90°

Answer: D

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21. If $A + B + C = \frac{\pi}{3}$, then

$\sin\left(\frac{\pi - 6A}{6}\right) + \sin\left(\frac{\pi - 6B}{6}\right) + \sin C =$

A. $-1 + 4\cos\left(\frac{\pi - 6A}{12}\right)\sin\left(\left(\frac{\pi - 6B}{12}\right)\sin\frac{C}{2}\right.$

B. $4\sin\left(\frac{\pi + 6A}{12}\right)\sin\left(\frac{\pi + 6B}{12}\right)\cos\frac{C}{2}$

C. $1-4\cos\left(\frac{\pi-6A}{12}\right)\cos\left(\frac{\pi-6B}{13}\right)\cos\left(\frac{\pi-6C}{12}\right)$

D. $4\cos\left(\frac{\pi-6A}{12}\right)\cos\left(\left(\frac{\pi-6B}{12}\right)\sin\frac{C}{2}\right)$

Answer: D

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22. If $\sqrt{2}\sin^2 x+\left(3\sqrt{2}+1\right)\sin x+3>0$ and $x^2-7x+10<0$, then x lies in the interval

A. $\left(\frac{-\pi}{4},\frac{3\pi}{4}\right)$

B. $\left(2,\frac{5\pi}{4}\right)$

C. $\left(0,\frac{3\pi}{2}\right)$

D. $\left(\frac{5\pi}{4},5\right)$

Answer: B

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23. If $\cos^{-1} x + \cos^{-1} y + \cos^{-1} z = 3\pi$, then

A. $x + y + z - 3 = 0$

B. $x + y + z + 3 = 0$

C. $x + 2y + 3z - 5 = 0$

D. $x - y - z = 0$

Answer: B

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24. If $\sin h^{-1}(\sqrt{8}) + \sin h^{-1}(\sqrt{24}) = \alpha$, then sin h $= \alpha$

A. $6\sqrt{6} - 10\sqrt{2}$

B. $6\sqrt{6} + 10\sqrt{2}$

C. $16\sqrt{6}$

D. $16\sqrt{6} + 4\sqrt{2}$

Answer: B

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25. In a triangle ABC, if$\cos A \cos B + sinA \sin B + \sin C =$

A. $\frac{2+\sqrt{3}}{2}$

B. $1+\sqrt{2}$

C. $\left(2\sqrt{3}-1\right)(2)$

D. $\frac{3+\sqrt{3}}{2}$

Answer: B

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26. In a ΔABC , if the medians AD and BE are such that AD = 4 , $\angle DAB = \frac{\pi}{6}$ and $\angle ABE = \frac{\pi}{3}$ then the area of ΔABC (in square units) is

A. $\frac{16}{3\sqrt{3}}$

B. $\frac{48}{3\sqrt{3}}$

C. $\frac{64}{3\sqrt{3}}$

D. $\frac{32}{3\sqrt{3}}$

Answer: D

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27. In a ΔABC, if $r_1 = 2r_2 = 3r_3$, then a : b =

A. $3:5$

B. $5:3$

C. $4:5$

D. $5:4$

Answer: D

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28. If $\bar{a}$ and $\bar{b}$ are respectively the internal and external bisectors of the angles between the vectors $-\bar{i}+2\bar{j}-2\bar{k}$ and $3\bar{i}+4\bar{j}$ and $|\bar{a}|=\frac{2}{3}\sqrt{6}, |\bar{b}|=\frac{2}{3}\sqrt{3}$, then one of the values of $\bar{a}-\bar{b}$ is,

A. $\frac{1}{10}(-8\bar{i}+11\bar{j}-2\bar{k})$

B. $\frac{2}{3}(-\bar{i}+2\bar{j}-2\bar{k})$

C. $\frac{1}{15}(9\bar{i}-11\bar{j}+3\bar{k})$

D. $\frac{1}{12}(2\bar{i}-3\bar{j}-\bar{k})$

Answer: B

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29. If the angle between the vectors $2\alpha^2\bar{i}+4\alpha\bar{j}+\bar{k}$ and $7\bar{i}-2\bar{j}+\alpha\bar{k}$ is obtuse, then

A. $\alpha > \frac{1}{2}$

B. $0 < \alpha < \frac{1}{2}$

C. $\alpha < 0$

D. $-|\alpha| < \frac{1}{2}$

Answer: B

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30. Let L be the line parallel to the vector $\sqrt{2}\bar{i} - 5\bar{j} + 3\bar{k}$ and passing through the point A given by $\bar{i} + 2\bar{j} - 3\bar{k}$. If the distance between A and a point P on the line L is 18 units, then the position vector of such a point P is

A. $\left(1 - 3\sqrt{2}\right)\bar{i} + 17j - 12\bar{k}$

B. $\left(1 + 3\sqrt{2}\right)\bar{i} + 17\bar{j} + 12\bar{k}$

C. $\left(1 + 3\sqrt{2}\right)\bar{i} - 17\bar{j} - 12\bar{k}$

D. $\left(1 - 3\sqrt{2}\right)\bar{i} - 17\bar{j} + 12\bar{k}$

Answer: A

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31. Let $\bar{a} = p(\bar{i} + \bar{j} + \bar{k}), \bar{b} = \bar{i} + \bar{j} - 2\bar{k}$ and $\bar{c} = 2\bar{i} - \bar{j} + 2\bar{k}$ be three vectors. If the values of $[\bar{a}\bar{b}\bar{c}]$ is not more than 15 and not less then $-5,$ then p lies in the interval.

A. $\left[\frac{-5}{3}, \frac{5}{9}\right]$

B. $\left(\frac{-5}{9}, \frac{5}{9}\right)$

C. $\left(0, \frac{5}{9}\right)$

D. $\left(\frac{-5}{3}, \frac{5}{9}\right)$

Answer: D

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32. Let $a = \hat{i} + 2\hat{j} - \hat{k}$ and$b = \hat{i} + \hat{j} + \hat{k}$. If p is a unit vecotr such that [abp] is maximum then p =

A. $\frac{1}{\sqrt{6}}(\bar{i} - 2\bar{j} + \bar{k})$

B. $\frac{1}{\sqrt{3}}(\bar{i} + \bar{j} - \bar{k})$

C. $\frac{1}{\sqrt{14}}(3\bar{i} - 2\bar{j} - \bar{k})$

D. $\frac{1}{\sqrt{14}}(\bar{I} + 2\bar{j} + 3\bar{k})$

Answer: C

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33. If $\bar{a} = 2\bar{I} - 3\bar{j} + \bar{k}, \bar{b} = \bar{i} - \bar{j} + 2\bar{k}$ and $\bar{c} = 2\bar{i} + \bar{j} + \bar{k}$ are three vectors, then $\left|(\bar{a} \times \bar{b}) \times \bar{c}\right| =$

A. $\left|\bar{a} \times (\bar{b} \times \bar{x})\right|$

B. $\frac{\sqrt{39}}{\sqrt{11}}\left|\bar{a} \times (\bar{b} \times \bar{c})\right|$

C. $\sqrt{\frac{11}{39}}\left|\bar{a} \times (\bar{b} \times \bar{c})\right|$

D. $\sqrt{11}|\bar{a} \times (\bar{b} \times \bar{c})|$

Answer: C

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34. For a group of 100 observations, the arithmetic mean and standard deviation are 8 and $\sqrt{10.5}$ respectively. The mean and standard deviation of 50 items selected from these 100 observations are 10 and 2 respectively. Then the standard deviation of the remaining 50 observation is

A. 2

B. 3

C. 3.5

D. 4

Answer: B

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35. If a number is selected from the first 30 natural numbers, then the probability that the number selected is divisible by 4 or 7, is

A. $\frac{4}{3}$

B. $\frac{1}{5}$

C. $\frac{7}{30}$

D. $\frac{1}{3}$

Answer: D

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36. If 80% of flights depart on time, 70% of flights arrive on time and 65% of flights depart on time and arrive on time, then the probability that a flight that has just departed on time will arrive on time is

A. $\frac{13}{16}$

B. $\frac{11}{16}$

C. $\frac{13}{14}$

D. $\frac{11}{14}$

Answer: A

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37. A computer program has two modules X and Y and errors in them occur independently. X has an error with probability 0.1 and Y has an error with probability 0.3. If an error in X alone cause the program to crash with probability 0.5, an error in Y alone causes the program to crash with probability 0.7 and an error in both X and Y cause the program to crash with probability 0.8, then the probability that the program is crashed is

A. $\frac{23}{125}$

B. $\frac{26}{125}$

C. $\frac{29}{125}$

D. $\frac{31}{125}$

Answer: D

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38. Two dice are rolled. If a random variable X denotes the sum of the numbers on them and μ denotes the mean of X, then

$\mu + P(X < 5) + P(X > 9) + P(x = 7) =$

A. $\frac{15}{2}$

B. 17

C. $\frac{17}{2}$

D. 15

Answer: A

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39. A boy rolled a die once. If an even number appear on then the number of chocolates the boy gets is equal to two more then the number appeared. If an odd number appear on that die. Then the number of chocolates he gets is equal to three more than the number'appeared. If a random variable X represents the number of chocolates the boy receive, then the range of X is

A. $\{4, 6, 8\}$

B. $\{3, 5, 7\}$

C. $\{3, 4, 7\}$

D. $\{2, 3\}$

Answer: A

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40. When the origin is shifted to (1, -2) by translation of coordinate axes, the transformed coordinates of (3.-2) are (α, β) If the axes are rotated

about origin through an angle of 45° after the translation, then the transformed coordinates of (α, β) are

A. $(\sqrt{2}, 0)$

B. $(0, \sqrt{2})$

C. $(-\sqrt{2}, \sqrt{2})$

D. $(\sqrt{2}, -\sqrt{2})$

Answer: D

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41. If a straight line is passing through the point of intersection of the lines 3x - 4y + 1 = 0, 5x + y - 1 = 0 and making equal non-zero intercepts on the coordinate axes, then the area (in sq. units) of the triangle formed by this line with the coordinate axes, is

A. $\frac{121}{1058}$

B. $\frac{121}{529}$

C. $\frac{529}{121}$

D. $\frac{1058}{121}$

Answer: A

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42. If the equations of the perpendicular bisectors of the sides Ab and AC of a ΔABC are $x - y + 5 = 0$ and $x + 2y = 0$ respectively and if A is $(1, -2)$, then the equation of the perpendicular bisector of the side BC is,

A. $3x + 3y + 5 = 0$

B. $9x - 3y + 40 = 0$

C. $6x + 15 = 5$

D. $23x - 14y + 100 = 0$

Answer: D

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43. If the lines x + 3y - 5 = 0 , 5x +2y-12 = 0 and 3x -ky-1=0 do not form a triangle, then a value of k is

A. $\frac{1}{5}$

B. $\frac{-1}{5}$

C. $\frac{-6}{5}$

D. $\frac{6}{5}$

Answer: C

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44. If the combined equation of the diagonals of the square formed by the pairs of lines xy + 4x - 5y - 20 = 0 and xy - 5x + 4y - 20 =0 is $x^2 - y^2 - kx + ly = 0$, then k+l =

A. 0

B. 2

C. -1

D. 1

Answer: B

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45. The equation of the pair of bisectors of the angles between the pair of straight lines

A. $7(3x+5)^2 - 2(3x+5)(y+5) - 7(y+5)^2 = 0$

B. $7(3x-5)^2 - 2(3x-5)(y-5) - 7(y-5)^2 = 0$

C. $7(5x+3)^2 - 2(5x+3)(5y+1) - 7(5y+1)^2 = 0$

D. $7(5x-3)^2 - 2(5x-3)(5y-1) - 7(5y-1)^2 = 0$

Answer: C

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46. If $x = \frac{2at}{1+t^2}, y = \frac{a(1-t^2)}{1+t^2}$, where t is a parameter, then a is

A. the length of the latus rectum of a parabola

B. the radius of a circle

C. the length of the transverse axis of a hyperbola

D. the length of semi-major axis of an ellipse

Answer: B

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47. Consider the following statement :

I. $P(x_1, y_1)$ and $Q(x_2, y_2)$ are conjugate points with respect to the circle $x^2 + y^2 + 2gx + 2fy + c = 0$ then

$x_1x_2 + y_1y_2 + g(x_1 + x_2) + f(y_1 + y_2) + c = 0$

II. The pole of the line x + y + 1 =0 with respect to the circle $x^2 + y^2 = 9$ is

(9.9).

Then, which one of the following is true?

A. Both I and II are true

B. Neither I nor II is true

C. I is false and II is true

D. I is true and II is false

Answer: D

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48. If P is the point of contact of the circles $x^2 + y^2 + 4x + 4y - 10 = 0$ and $x^2 + y^2 - 6x - 6y + 10 = 0$ and Q is their external centre of similitude, then the equation of the circle with P and Q as the extremities of its diameter is

A. $x^2 + y^2 + 14x + 14y - 26 = 0$

B. $x^2 + y^2 + 5x + 5y - 8 = 0$

C. $x^2 + y^2 - 5x - 5y + 8 = 0$

D. $x^2 + y^2 - 14x - 14y + 26 = 0$

Answer: C::D

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49. The equation of the circle touching the line $2x + 3y + 1 = 0$ at the point $(1, -1)$ and ortogonal to the circle with has the line segmetn having end points

$(0, -1)$ and $(-1, 3)$ as diameter, is

A. $x^2 + y^2 - 10x + 5y + 1 = 0$

B. $x^2 + y^2 + 5x - 10y - 1 = 0$

C. $2x^2 + 2y^2 + 10x - 5y - 1 = 0$

D. $2x^2 + 2y^2 - 10x - 5y + 1 = 0$

Answer: A

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50. The angle between the tangents drawn from the point (1,4) to the parabola $y^2 = 4x$ is

A. $\frac{\pi}{3}$

B. $\frac{\pi}{2}$

C. $\frac{3\pi}{4}$

D. π

Answer: D

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51. If the line $y = -x + k$ is normal to the curve $y^2 = 16x$, then k is

A. 21

B. 14

C. 13

D. 12

Answer: D

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52. The normal drawn at the point

$\left(\sqrt{9}\cos\left(\frac{\pi}{4}\right), \sqrt{7}\sin\left(\frac{\pi}{4}\right)\right)$ to the ellipse $\frac{x^2}{9} + \frac{y^2}{7} = 1$

intersects its major axis at the point

A. $\left(0, \sqrt{\frac{2}{7}}\right)$

B. $\left(-\sqrt{\frac{2}{9}}, 0\right)$

C. $\left(0 - \sqrt{\frac{2}{7}}\right)$

D. $\left(\sqrt{\frac{2}{9}}, 0\right)$

Answer: C

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53. If $(1, -2)$ is the focus and $x + y - 2 = 0$ is the derectrix of the ellipse $17x^2 - 2xy + 17y^2 - 32x + 76y + 86 = 0$, then its eccentricity is

A. $\frac{1}{5}$

B. $\frac{1}{2}$

C. $\frac{1}{3}$

D. $\frac{1}{4}$

Answer: B

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54. The linme $2x + y = 1$ is a tangent to the jhyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2}(a > b)$. If this line passes through the point of intersection of a directrix and the positive X-axis, then the eccentricity of that hyperbola is

A. $\sqrt{2}$

B. 2

C. $\sqrt{3}$

D. 3

Answer: A

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55. If the orthocentre and the centroid of a triangle are at (5, 2, -6) and (9, 6, -4) respectively, then its circumcentre is

A. $(11, 8, -3)$

B. $(8, 8, -3)$

C. $(11, 8, 3)$

D. $(11, -8, -3)$

Answer: A

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56. If the direction ratios of two lines are given by a + 2b + c = 0 and 11 bc +6ca - 14 ab = 0 . then the angle between these lines is

A. $\frac{\pi}{3}$

B. $\cos^{-1}\left(\frac{1}{3}\right)$

C. $\cos^{-1}\left(\frac{2}{3}\right)$

D. $\frac{\pi}{2}$

Answer: D

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57. A plane cuts the coordinate axes X,Y,Z at A,B,C respectively such that the centroid of the ΔABC is (6,6,3). Then the equation of that plane is

A. $x + y + z = 18$

B. $x + 2y + \ = 18$

C. $x + y + 2z = 18$

D. $2x + y + z = 18$

Answer: C

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58. $\lim_{x \to \infty} x\left(\log\left(1 + \frac{x}{2}\right) - \log\frac{x}{2}\right) =$

A. 0

B. 1

C. 2

D. e

Answer: C

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59. The set of values of x for which the function $f(x) = \log\left(\frac{x-1}{x+2}\right)$ is continous , is

A. R

B. $(-\infty, -1) \cup (0, \infty)$

C. $(-\infty, -2) \cup (1, \infty)$

D. $(-2, -1)$

Answer: C

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60. If the function $f: R \to R$, defined by

$$f(x) = \begin{cases} 5 - 3x & , \text{if} x \leq \frac{5}{3} \\ & \\ x^2 - 3x + 20, \text{if } x > \frac{5}{3} \end{cases}$$, then 'f' is

A. continous at $x = \frac{5}{3}$

B. differentiable at $x = \frac{5}{3}$

C. differentiable at $x = 2$

D. discontinuous at $x = -2$

Answer: C

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61. If t is a parameter and $x = t + \frac{1}{t}, y = t - \frac{1}{t}$, then $\frac{d^2y}{dx^2} =$

A. $\frac{4t}{(t^2+1)^2}$

B. $\frac{t^2}{t^2+1}$

C. $\frac{4t^3}{(t^2+1)^3}$

D. $\frac{-4t^3}{(t^2-1)^3}$

Answer: D

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62. If $ax^2 + 2hxy + by^2 = 3$, then $\frac{d^2y}{dx^2} =$

A. $\frac{\left(hx^2 + by + ax\right)}{(ax + hy)^2}$

B. $\frac{\left(axy + hx^2 + byx\right)}{(ax + by)^2}$

C. $\frac{2\left(h^2 - ab\right)}{(hx + by)^3}$

D. $\frac{(ab + h)^2}{(ax + hy)^2}\left[h\left(x^2 + y^2\right) + xy(a + b)\right]$

Answer: C

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63. If the error in measuring the side l of an equilateral triangle is 0.01, then the percentage error in the area of the triangle, in terms of its side l is

A. $\frac{2}{l}$

B. $\frac{3}{l}$

C. $\frac{4}{l}$

D. $\frac{6}{l}$

Answer: A

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64. If at any point (x_1, y_1) on the curve $y = f(x)$, the lengths of the subtangent and subnormal are equal, then the length of the tangent drawn to that curve at that point is

A. $2|y_1|$

B. $\sqrt{2}|y_1|$

C. $\sqrt{5}|y_1|$

D. $\sqrt{2}\left|\frac{y_1}{x_2}\right|$

Answer: B

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65. The height of a right circular cylinder is decreassing while its diameter is increasing at a rate of 4 cm/sec so as to keep its volume unchanged. The rate of change in its lateral surface area (in cm^2/sec.) at the instant when its diameter is 8 cm and height is 12 cm, is

A. 24π

B. -24π

C. 48π

D. -48π

Answer: D

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66. If $x + y = 60, x > 0, y > 0,$ then the maximum vlaue of xy^3 is

A. $(15)^4 \frac{25}{3}$

B. $45(15)^3$

C. $\frac{(45)^3 9}{5}$

D. $\frac{(45)^4}{3}$

Answer: D

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67. $\int \sqrt{1+2\cot x(\cot x+\operatorname{cosec} x)}dx =$

A. $2\log\left|\sin\frac{x}{2}\right|+c$

B. $2\log\left|\cos\frac{x}{2}\right|+c$

C. $\log\left|\sin\frac{x}{2}+\cos\frac{x}{2}\right|+c$

D. $2\log|\sin x+\cos x|+c$

Answer: A

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68. If $\int e^{ax}\left(\frac{1-\beta\sin x}{1-\cos x}\right)dx = -e^{x}\cot\frac{x}{2}+c$, then $\frac{\alpha^2+\beta^2}{2\alpha\beta} =$

A. -1

B. 1

C. 2

D. -2

Answer: B

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69. $\int\frac{2x^3-4x^2-x-3}{x^2-2x-3}dx =$

A. $\frac{7}{2}\log|x-1|+\frac{3}{2}\log|x+3|+c$

B. $2\log|x-1|+\frac{7}{2}\log|x-3|+c$

C. $2x+\frac{1}{2}\log|x+1|+\frac{3}{4}\log|x-3|+c$

D. $x^2+2\log|x+1|+3\log|x-3|+c$

Answer: D

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70. $\int \cos ec^5 x dx =$

A. $\frac{\cos ecx \cot^3 x}{4} - \frac{5}{8}\cos ecx \cot x + \frac{3}{8}\log\left|\tan\frac{x}{2}\right| + c$

B. $-\frac{\cos ecx \cot^3 x}{4} - \frac{5}{8}\cos ecx \cot x + \frac{3}{8}\log\left|\tan\frac{x}{2}\right| + c$

C. $-\frac{\cos ecx \cot x}{4} - \frac{3}{8}\cos ecx \cot x + \frac{3}{8}\log\left|\tan\frac{x}{2}\right| + c$

D. $-\frac{\cos ecx \cot x}{4} - + \frac{3}{8}\cos ecx \cot x - \frac{3}{8}\log\left|\tan\frac{x}{2}\right| + c$

Answer: C

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71. $\int_{\frac{1}{3}}^{3} \frac{1}{x}\sin\left(\frac{1}{x} - x\right)dx =$

A. 0

B. $\frac{4}{3}$

C. $\frac{5}{3}$

D. $\frac{8}{3}$

Answer: A

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72. $\int^{\frac{3}{2}} \_(-1)|x\sin(\pi x)|dx = =$

A. $\frac{1}{\pi} - \frac{1}{\pi^2}$

B. $\frac{2}{\pi} + \frac{1}{\pi^2}$

C. $\frac{3}{\pi} - \frac{1}{\pi^2}$

D. $\frac{3}{\pi} + \frac{1}{\pi^2}$

Answer: D

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73. Area of the regin (in square units) bounded by the curve $y = x^2 + 4$ and the lijne $y = 5x - 2$ is

A. $\frac{1}{2}$

B. $\frac{1}{12}$

C. 2

D. $\frac{1}{6}$

Answer: D

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74. If m and n are the order and degree of the differential equation of the family of parabolas with focus at the origin and X-axis as its axis, then mn $-m + n =$

A. 1

B. 2

C. 3

D. 4

Answer: C

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75. The solution of the differential equation

$$\frac{dy}{dx} + \frac{x}{y} \cdot \frac{x^2 + y^2 - 1}{2(x^2 + y^2) + 1} = 0 \text{ is}$$

A. $x^2 + y^2 + 3\log\left(x^2 + y^2\right) = c$

B. $x^2 2y^2 - 3\log\left(x^2 + y^2 + 2\right) = c$

C. $x^2 + y^2 - 3\log\left(x^2 + y^2 + 2\right) = c$

D. $-x^2 - 2y^2 - 3\log\left(x^2 + y^2\right) = c$

Answer: C

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76. If $x \log x \frac{dy}{dx} + y = \log x^2$ and $y(e) = 0$, then $y(e^2) =$

A. 0

B. 1

C. $\frac{1}{2}$

D. $\frac{3}{2}$

Answer: D

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Physics

1. Identify the correct option.

A. The range of the gravitational force is large but not infinite.

B. The range of electromagnetic force is large but lesser than the range of gravitational force.

C. The range of weak nuclear force is smaller than the range of strong nuclear force, gravitation force and electron magnetic force.

D. The range of the weak as well as strong nuclear force is the order of 10^{-19} m

Answer: C

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2. A current carrying conductor obeys Ohm's law (V = RI). If the current passing through the conductor is $I = (5 \pm 0.2)$ A and voltage developed is$V = (60 \pm 6)$ then find the percentage of error is resistance, R

A. 18

B. 6

C. 14

D. 2

Answer: C

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3. A particle covers a distance from A to B over a period of time, the distance versus time plot is shown below. Then which of the following is true for the motion of the particle ?

A. Both average speed and instantansous speed are always zero.

B. Average speed is always non zero but average speed can be zero.

C. Instantaneous speed is always non zero but average speed can be zero.

D. Both average speed and instananeous speed aer always non zero.

Answer: B

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4. A boy standing on a moving truck throws a projectile such that he is able to catch it back after the truck has moved 100 m. If the truck is moving horizontally along a straight line with a constant speed 30 m/s, at what speed (relative to the truck) must the projectile is thrown. (Assume, $g = 10m/s^2$)

A. $\frac{55}{3}m/s$

B. $\frac{43}{2}m/s$

C. $\frac{50}{3}m/s$

D. $\frac{23}{2}m/s$

Answer: C::D

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5. In the pulley system shown in figure, the mass of A is half of that of rod B. The rod length is 500 cm.The mass of pulleys and the threads may b e neglected. The mass A is set at the same level as the lower end of the rod

and then released. After releasing the mass A, it would reach the top end of the rod B in time (Assume $g = 10m/s^2$)

A. $2.0s$

B. $1.0s$

C. $3.0s$

D. $4.0s$

Answer: B

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6. A light rigid wire of length 1 m is attached to a ball A of mass 500 g to one end. The other end of the wire is fixed, so that the wire can rotate freely in vertical plane about its fixed end. At the lowest point of the circular motion, the ball is given a horizontal velocity 6 m/s. Determinje the radial component of the acceleration of the ball, when this rigid wire

makes an angle 60° with the qpward vertical. (Assume $g = 10m/s^2$)

A. $10m/s^2$

B. $6m/s^2$

C. $18m/s^2$

D. $25m/s^2$

Answer: D

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7. A block of mass 2 kg is connected to an ideal spring and is placed on a smooth horizontal surface. The spring is pulled to move the block and at an instant, the speed of end A of the speing and speed of the block were messured to be 6 m/s and 3 m/s respectively. At this moment the potential energy stored in the spring is increasing at a rate 5 J/s. Find the acceleratin of the block at this instant.

A. $1.5m/s^2$

B. $3.0m/s^2$

C. $4.5m/s^2$

D. $2.5m/s^2$

Answer: D

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8. If the displacement of a body is given by $x = 3\cos\left[2\pi t + \frac{\pi}{4}\right]$ m, then the acceleration of the body at t=2s is

A. 0

B. $-6\sqrt{2}\pi^2 m/s^2$

C. $-10\pi^2 m/s^2$

D. $-12\sqrt{2}\pi^2 m/s^2$

Answer: B

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9. If the acceleration due to gravity g doubles and the radius of earth becomes half that of the present value, then the value of escape velocity is (Assume, $g = 10m/s^2$ and radius of earth, R = 6400 km)

A. $12km/s$

B. $16\sqrt{2}km/s$

C. $8\sqrt{2}km/s$

D. $4\sqrt{2}km/s$

Answer: C

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10. A uniform rod of length L is rotated in a horizontal plane about a vertical axis through one of its ends. The angular speed of rotation is ω .

Find increase in length of the rod, if ρ and Y are the density and Young's modulus of the rod respectively,

A. $\frac{\rho om\eta^3 Y}{4L^2}$

B. $\frac{4\rho\omega^2 L^3}{3Y}$

C. $\frac{\rho\omega^2 L^3}{3Y}$

D. $\frac{\rho\omega^3 L^3}{8Y}$

Answer: C

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11. A cylindrical vessel of height 50 cm is filled with water and rests on table. A small hole is made at the height 'h' from the bottom of the vessel so that the water jet could hit the table surface at a maximum distance $x_{\max}$ from the vessel as shown in the figure. The value of $x_{\max}$ will be (Neglect the visocity of water)

A. 15 cm

B. 35 cm

C. 50 cm

D. 40 cm

Answer: C

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12. A cubical block of wood, of length 10 cm, floats at the interface between oil of density $800kg/m^3$ and water. The lower surface of the block is $1.5cm$ below the interface. If the depth of water is 10 cm below the interface and oil is up to 10 cm above the interface then the difference in pressure at teh lower and teh upper face of the wooden block is (Assume density of water $= 1000kg/m^3$ and $g = 10m/s^2$)

A. 850 Pa

B. 780 Pa

C. 800 Pa

D. 830 Pa

Answer: D

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13. A thermally insulated vessel containing monatomic gas is moving with a speed of 30 m/s. If the vessel suddenly stops, the increase in gas temperature is (Molar mass of gas = 83 g/mol and R = 8.3J/K mol)

A. 1 K

B. 3 K

C. 4 K

D. 6 K

Answer: B

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14. A string of length 100 cm has three resonant frequencies, 120 Hz, 200 Hz and 280 Hz. If a node is formed at the end of the string, the speed of the transverse wave on this string is:

A. 60 m/s

B. 80 m/s

C. 100 m/s

D. 120 m/s

Answer: B

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15. Two particles executing simple harmonic motion as described by $y_1 = 30\sin\left(2\pi t + \frac{\pi}{3}\right)$ and $y_2 = 10\left(\sin 2\pi t + \sqrt{3}\cos 2\pi t\right)$ have amplitudes A_1 and A_2 respectively. The ratio $A_1 : A_2$ is

A. $2:1$

B. $1:1$

C. $3:1$

D. $1:\sqrt{3}$

Answer: C

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16. Two lenses A and B having focal lengths 2.0 cm and 5.0 cm, respectively are placed 14 cm apart. Lens A is placed to the left of lens B. An object is placed 3 cm to the left of lens A. The distance of the image from lens A will be

A. $\frac{40}{3}cm$

B. $\frac{82}{3}cm$

C. $\frac{112}{5}cm$

D. $\frac{92}{5}cm$

Answer: B

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17. A spherical drop of liquid carrying charge, Q has potential V_0 at its surface. If two drops of same charge and radius combine to form of single spherical drop, then the potential at the surface of new drop is (Assume, V = 0 at infinity.)

A. $2^{1/3}V_0$

B. $4^{1/3}V_0$

C. $6^{1/3}V_0$

D. $2^{-1/3}V_0$

Answer: B

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18. Calculate the Voltage across AB terminals in the given circuit

A. $\frac{3}{8}V$

B. $\frac{8}{3}V$

C. $\frac{3}{2}V$

D. $\frac{2}{3}V$

Answer: B

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19. When subjected to a voltage of 10 V, the current through a resistor at a temperature of $40^{\circ}C$ is 0.1 A. The temperature coefficient of resistance of the material of the resistor is $2 \times 10^{-4^{\circ}}C$. The temperature of the resistor in $^{\circ}C$ when the current drops to 0.098 A is

A. 142

B. 167

C. 181

D. 206

Answer: A

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20. A small bar magnet experiences a torque of 0.016 Nm when placed with its axis at 30° with an external field of 0.04 T. If the bar magnet is replaced by a solenoid of cross-sectional area of $1cm^2$ and 1000 turns but having the same magnetic moment as that of bar magnet, then the current flowing through the solenoid is

A. 0.083

B. 0.16

C. 0.25

D. 0.3

Answer: A

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21. A rod of length 80 cm rotates about its mid point with a frequency of 10 rev/s. The potential difference in volts) between two ends of the rod due to a magnetic field, B=0.5 T directed perpendicular to the rod is

A. π

B. 1.6π

C. 2π

D. 0.8π

Answer: B

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22. LCR circuit, the resonance frequency of circuit increases two times of the initial circuit by changing C and C' and R from $100\Omega \text{ to } 400\Omega$ while the inductance was kept the same. The ratio C/C', is

A. 2

B. 8

C. 16

D. 4

Answer: D

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23. The half life of neutron is 693 seconds. What fraction of neutrons will decay when a beam of neutrons, having kinetic energy of 0.084 eV, travells a distance of 1 km? (mass of neutron 1.68×10^{-27} kg, and In 2=0.693)

A. 60×10^{-5}

B. 15×10^{-5}

C. 25×10^{-5}

D. 50×10^{-5}

Answer: C

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24. For a given truth tableA,B,C are inputs and Y is the output, then the functional form of the circuit is

A. $\overline{A}$

B. $\overline{B}$

C. $\overline{A} + BC$

D. $A + B + C$

Answer: A

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25. Two diodes are connected in the following fashion. Provision is made to connect either $+5V$ or ground (0V) to the points A and B. The output Q will act as

A. OR gate

B. AND gate

C. XOR gate

D. NAND gate

Answer: C

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26. Carrier waves are used for communicating signals over long distance, because

A. Carrier waves can be generated very easily

B. Low frequencies can not be easily modulated by the carrier waves

C. Low frequencies can be transmitted over long distnces

D. Carrier waves that are generatea at higher frequencies can be transmitted over long distances

Answer: D

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Chemistry

1. In the Millikan's oil drop method, which of the following force does not act on the oil drop?

A. Gravitational force

B. Viscous force

C. Magnetic force

D. Electrostatic force

Answer: C

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2. Match the followig

The correct answer is

A. $\begin{matrix}(a) & (b) & (c) & (d)\\ (iv) & (v) & (iii) & (ii)\end{matrix}$

B. $\begin{matrix}(a) & (b) & (c) & (d)\\ (iii) & (iv) & (v) & (ii)\end{matrix}$

C. $\begin{matrix}(a) & (b) & (c) & (d)\\ (iv) & (ii) & (iii) & (i)\end{matrix}$

D. $\begin{matrix}(a) & (b) & (c) & (d)\\ (v) & (iv) & (ii) & (iii)\end{matrix}$

Answer: A

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3. Which one of the following represents Boyle's temperature of a gas?

A. The temperature at which an ideal gas obeys Boyle's law.

B. The temperature at which an ideal gas obeys Boyle's is less than 1 for a real gas.

C. The temperature at which a real gas obeys ideal gas law over an appreciable range of pressure.

D. The temperature at which the comperssibility factor deviates from 1 for an ideal gas.

Answer: C

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4. The order of stability of aromatic hydrocarbons given bwlow is

A. $A < D < B > C$

B. $D < A < B < C$

C. $B > C > D > A$

D. $A > D > B > C$

Answer: D

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5. match the following.

The correct answer is

A.
A	B	C	D
IV	II	I	III

B.
A	B	C	D
II	V	I	III

C. $\begin{matrix} A & B & C & D \\ III & II & I & V \end{matrix}$

D. $\begin{matrix} A & B & C & D \\ IV & V & I & III \end{matrix}$

Answer: A

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6. Arrange the following compounds in the correct order of their acid strength.

A. $a > d > c > d$

B. $a > b > c > d$

C. $b > c > d > a$

D. $b > a > d > c$

Answer: D

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7. What are the suitable conditions for the following transformation ?

A. $KMnO_4 - H_2SO_4 / \Delta$

B. $O_3 / O_2, Zn + H_2O$

C. OsO_4

D. $Pb(Oac)_4$

Answer: A

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8. The compound 'A' decolourises Br_2 / CCl_4 and releases N_2 gas with HNO_2 . The compound 'A' is

A. 

B. 

C. 

D. 

Answer: A

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