PROVISIONAL ANSWER KEY

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1. Two finite sets *A* and *B* have m and n elements, respectively. The total number of subsets of *A* is 48 more than the number of subsets of *B*. The values of m and n, respectively, are

A) 6,3

B) 6,4

C) 5,6

D) 2,6

E) 7,1

Correct Answer : Option B

2. Let *A* and *B* be subsets of universal set U such that $n(U)$ 800,$n(A) = 300, n(B) = 400$ and $n(A \cap B)$. Then the number of elements in the set $A' \cap B'$is

A) 50

B) 100

C) 700

D) 400

E) 200

Correct Answer : Option E

3. If $f(x) = \frac{x}{x-1}$ then $\frac{f(a)}{f(a+1)}$ is equal to

A) $f(a^2)$

B) $f(-a)$

C) $f(-a^2)$

D) $f\left(\frac{1}{a}\right)$

E) $f\left(\frac{1}{a^2}\right)$

Correct Answer : Option A

4. If $f: \mathbb{R} \to \mathbb{R}$ satisfies the relation $f(x+y) = f(x) + f(y), \forall\, x, y \in \mathbb{R}$ and $f(1) = 3$ then $f(0) + f(1) + f(2) + f(3)$ is equal to

A) 12

B) 14
C) 16
D) 18
E) 22

Correct Answer : Option D

5. If $z = 2 + i, i^2 = -1$, then the value of $z^2 - 4z + 15$

A) 2
B) 6
C) 15
D) 12
E) 10

Correct Answer : Option E

6. The modulus of the complex number $\left(\frac{i}{2} - \frac{2}{i}\right)$ is equal to

A) $\frac{2}{5}$
B) $\frac{5}{4}$
C) $\frac{2}{3}$
D) $\frac{3}{2}$
E) $\frac{5}{2}$

Correct Answer : Option E

7. If the complex number z varies so that the real and imaginary parts of $z - 2 - 3i$ are equal, then the locus of z is

A) a circle
B) a straight line
C) a parabola
D) an ellipse
E) a hyperbola

Correct Answer : Option B

8. If $k = 4n + 3$, where n is an integer and $i^2 = -1$ then i^k is equal to

A) 0
B) 1
C) -1
D) i
E) $-i$

Correct Answer : Option E

9. The sum of first three terms of a G.P. is 14 and the sum of next three terms is 112. Then 100^{th} term of the G.P. is

A) 2^{99}

B) 2^{101}

C) 2^{100}

D) $2^{98}-1$

E) $2^{99}+1$

Correct Answer : Option C

10. The product of first four terms of a G.P. is 324 and the product of first three terms of the G.P. is 216. Then the first term is

A) 3

B) 6

C) 9

D) 16

E) 12

Correct Answer : Option E

11. The product of first four terms of a G.P. is $\frac{1}{1024}$. Then the product of second and third terms is,

A) $\frac{1}{28}$

B) $\frac{1}{16}$

C) $\frac{1}{64}$

D) $\frac{1}{32}$

E) $\frac{1}{128}$

Correct Answer : Option D

12. If the A.M. of a and c is 16 and if $a=8$, then the G.M. of a and c is

A) $8\sqrt{3}$

B) $6\sqrt{3}$

C) $5\sqrt{3}$

D) $4\sqrt{3}$

E) $2\sqrt{3}$

Correct Answer : Option A

13. If ${}^{n}P_5 = 42{}^{n}P_3$ then n is equal to

A) 3
B) 5
C) 7
D) 12
E) 10

Correct Answer : Option E

14. The number of arrangements of the letters of the word INDEPENDENCE such that the first letter is I and the last letter is P, is

A) 12400
B) 12420
C) 12440
D) 12600
E) 12620

Correct Answer : Option D

15. If four coins are tossed, then the number of possible ways of getting 2 or 3 heads, is

A) 12
B) 10
C) 8
D) 6
E) 4

Correct Answer : Option B

16. The value of $\frac{{}^{5}C_r}{{}^{6}C_r}$ when the numerator and denominator take their greatest value, is

A) 2
B) $\frac{1}{2}$
C) 1
D) $\frac{5}{6}$
E) $\frac{6}{5}$

Correct Answer : Option B

17. If $\left(1 + x - 2x^2\right)^6 = 1 + a_1x + a_2x^2 + \ldots\ldots + a_{12}x^{12}$ then the sum $a_2 + a_4 + a_6 + \ldots\ldots + a_{12}$ has the value

A) 31
B) 32
C) 33
D) 63
E) 64

Correct Answer : Option A

18. If $A=\begin{bmatrix}5 & 2 & x\\ y & 2 & -3\\ 4 & t & -7\end{bmatrix}$ is a symmetric matrix, then the values of x, y and t, respectively, are

A) 4,2,3
B) 4,2,-3
C) 4,2,-7
D) 2,4,-7
E) 4,3,2

Correct Answer : Option B

19. If $A=\begin{bmatrix}X & 0\\ 1 & 1\end{bmatrix}$ and $B=\begin{bmatrix}16 & 0\\ 5 & 1\end{bmatrix}$ and if $A^2=B$ then the value X is equal to

A) 2
B) 3
C) 4
D) 5
E) 6

Correct Answer : Option C

20. If $\alpha+\beta+\gamma=0$, then $\begin{vmatrix}e^{\alpha} & e^{2\alpha} & e^{3\alpha}-1\\ e^{\beta} & e^{2\beta} & e^{3\beta}-1\\ e^{\gamma} & e^{2\gamma} & e^{3\gamma}-1\end{vmatrix}=$

A) e^{-1}
B) e
C) e^2
D) e^3
E) 0

Correct Answer : Option E

21. If the points (2,-3),(x,1) and (0,5) are collinear, then the value of x is

A) 2
B) -2
C) -1

D) 1

E) 0

Correct Answer : Option D

22. If x satisfies the inequality $\frac{x-3}{x-5} > 3$ then x lies in the interval

A) (3,8)

B) (0,5)

C) (5,6)

D) $(-\infty, 3)$

E) (5,8)

Correct Answer : Option C

23. The solution set of the inequation $\left|\frac{1}{x}-2\right| < 4$ is

A) $\left(-\infty, \frac{-1}{2}\right) \cup \left(\frac{1}{6}, \infty\right)$

B) $\left(-\infty, \frac{-1}{2}\right)$

C) $\left(\frac{1}{6}, \infty\right)$

D) $\left(-\infty, \frac{1}{6}\right) \cup \left(\frac{1}{2}, \infty\right)$

E) $(-\infty, -\infty)$

Correct Answer : Option A

24. If $\cos x = \frac{4}{5}$, where $x \in \left[0, \frac{\pi}{2}\right]$, then the value of $\cos\left(\frac{x}{2}\right)$ is equal to

A) $\frac{1}{\sqrt{10}}$

B) $\frac{-1}{\sqrt{10}}$

C) $\frac{3}{\sqrt{10}}$

D) $\frac{\sqrt{3}}{1}$

E) $\frac{-3}{\sqrt{10}}$

Correct Answer : Option C

25. The value of $\sin \frac{5\pi}{12} \sin \frac{\pi}{12}$ is equal to

A) 1

B) $\frac{1}{4}$

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

D) $\frac{\sqrt{3}}{2}$

E) 0

Correct Answer : Option B

26. $\frac{1-sin^6\theta-cos^6\theta}{cos^2 2\theta} =$

A) $\frac{1}{4}tan^2 2\theta$

B) $\frac{1}{2}tan^2 2\theta$

C) $\frac{3}{2}tan^2 2\theta$

D) $\frac{3}{4}tan^2 2\theta$

E) $tan^2 2\theta$

Correct Answer : Option D

27. If $\frac{cosA}{cosB} = \alpha$, then $\frac{\alpha+1}{\alpha-1}$ is equal to

A) $\cot\left(\frac{A+B}{2}\right)\cot\left(\frac{A-B}{2}\right)$

B) $-\cot\left(\frac{A+B}{2}\right)\tan\left(\frac{A-B}{2}\right)$

C) $-\tan\left(\frac{A+B}{2}\right)\cot\left(\frac{A-B}{2}\right)$

D) $-\cot\left(\frac{A+B}{2}\right)\cot\left(\frac{A-B}{2}\right)$

E) $-\cot\left(\frac{A+B}{2}\right)$

Correct Answer : Option D

28. If $tan^{-1}2x + tan^{-1}3x = \frac{\pi}{4}$, then the value of x is equal to

A) $\frac{1}{6}$

B) $\frac{1}{4}$

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

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

E) 1

Correct Answer : Option A

29. The domain of the function $f(x) = cos^{-1}([x])$ (where[x] denotes the greatest integer function) is

A) [-1,2]

B) [-1,2)

C) (-2,2)

D) (-2,1)

E) (-1,1)

Correct Answer : Option B

30. If $\sin^{-1}\left(\frac{3\sin 2\alpha}{5+4\cos 2\alpha}\right)=\frac{\pi}{2}$, then $3\sin 2\alpha - 4\cos 2\alpha$ is equal to

A) 3

B) 6

C) 4

D) 1

E) 5

Correct Answer : Option E

31. If the angle between two lines is $\frac{\pi}{4}$ and the slope of one of the lines is $\frac{1}{2}$, then the slope of other line is

A) $3\ or\ \frac{-1}{3}$

B) $2\ or\ \frac{-1}{2}$

C) 1 or -1

D) -3 or 2

E) $3\ or\ \frac{1}{2}$

Correct Answer : Option A

32. If a straight line passes through the points $\left(\frac{-1}{2},1\right)$ and $(1,2)$, then its y-intercept is

A) 4

B) 3

C) -4

D) $\frac{-4}{3}$

E) $\frac{4}{3}$

Correct Answer : Option E

33. If the base of an equilateral triangle is along the straight line $2x - y = 1$ and the opposite vertex is (-1,2) , then the length of the side of the triangle is

A) $\frac{20}{3}\ units$

B) $2\sqrt{\frac{5}{3}}$units

C) $\frac{\sqrt{20}}{3}$units

D) $\frac{2}{\sqrt{15}}$units

E) $\sqrt{\frac{3}{20}}$units

Correct Answer : Option B

34. A circle passes through (4,0) and (0,2) with centre on the y-axis. The radius of the circle is

A) 5

B) 10

C) 15

D) 20

E) 25

Correct Answer : Option A

35. If the length of major axis of an ellipse is twice the length of minor axis, then its eccentricity is equal to

A) $\frac{\sqrt{2}}{3}$

B) $\frac{\sqrt{3}}{2}$

C) $\frac{1}{\sqrt{2}}$

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

E) $\frac{2\sqrt{2}}{3}$

Correct Answer : Option B

36. The lengths of the transverse axis and conjugate axis of the hyperbola $\frac{x^2}{9} - \frac{y^2}{25} = 1$ respectively, are

A) 3,5

B) 4,5

C) 6,10

D) 9,25

E) 6,5

Correct Answer : Option C

37. The equation of the directrix of the parabola $(x-1)^2 = 2(y-2)$ is

A) $2y - 3 = 0$

B) $2y + 3 = 0$

C) $3y - 2 = 0$

D) $3y + 2 = 0$

E) $2x - 1 = 0$

Correct Answer : Option A

38. The vectors $-\hat{\imath} + \frac{1}{4}\hat{\jmath} + 2\hat{k}$ and $\hat{\imath} + \frac{1}{4}\hat{\jmath} + 2\hat{k}$,are the adjacent sides of a parallelogram. The area of the parallelogram is

A) $\frac{\sqrt{65}}{4}$

B) $\sqrt{65}$

C) $\sqrt{\frac{65}{2}}$

D) $\frac{\sqrt{65}}{2}$

E) $\frac{\sqrt{65}}{3}$

Correct Answer : Option D

39. Let the vectors $\vec{a}$ and $\vec{b}$ be such that $|\vec{a}| = 3$ and $|\vec{b}| = \frac{\sqrt{2}}{3}$ .If $\vec{a} \times \vec{b}$ is a unit vector, then the angle between a $\vec{a}$ and $\vec{b}$

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

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

C) $\frac{\pi}{6}$

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

E) $\frac{3\pi}{4}$

Correct Answer : Option B

40. The projection of the vector $\vec{a} = 3\hat{\imath} - \hat{\jmath} - 2\hat{k}$ on $\vec{b} = \hat{\imath} + 2\hat{\jmath} - 3\hat{k}$ is

A) $\frac{\sqrt{14}}{2}$

B) $\frac{14}{\sqrt{2}}$

C) $\sqrt{14}$

D) $14\sqrt{2}$

E) $2\sqrt{14}$

Correct Answer : Option A

41. **If $|\vec{a}| = 4$ and $-1 \leq \lambda \leq 3$, then $|\lambda\vec{a}|$ lies in the interval**

A) [1,4]

B) [1,3]

C) [4,14)

D) (3,12)

E) [4,12]

Correct Answer : Option E

42. Question42 :- **The angle between the lines $\vec{r} = (3\hat{\imath} + 2\hat{\jmath} - 4\hat{k}) + \lambda(\hat{\imath} + 2\hat{\jmath} + 2\hat{k})$ and $\vec{r} = (5\hat{\imath} - 2\hat{\jmath}) + \mu(3\hat{\imath} + 2\hat{\jmath} + 6\hat{k})$ is**

A) $\cos^{-1}\left(\frac{9}{13}\right)$

B) $\cos^{-1}\left(\frac{3}{19}\right)$

C) $\cos^{-1}\left(\frac{19}{21}\right)$

D) $\cos^{-1}\left(\frac{13}{17}\right)$

E) $\cos^{-1}\left(\frac{3}{17}\right)$

Correct Answer : Option C

43. The equation of line joining the points (-3,4,11) and (1,-2,7) is

A) $\frac{x+3}{2} = \frac{y-4}{3} = \frac{z-11}{4}$

B) $\frac{x+3}{-2} = \frac{y-4}{3} = \frac{z-11}{2}$

C) $\frac{x+3}{-2} = \frac{y+4}{3} = \frac{z+11}{4}$

D) $\frac{x+3}{2} = \frac{y+4}{-3} = \frac{z+11}{2}$

E) $\frac{x+3}{-2} = \frac{y-4}{-3} = \frac{z-11}{-4}$

Correct Answer : Option B

44. The lines $\frac{x-1}{2} = \frac{y+1}{-3} = \frac{z+10}{8}$ and $\frac{x-4}{1} = \frac{y+3}{k} = \frac{z+1}{7}$ are coplanar. Then the value of k is

A) 0

B) -2

C) 2

D) 4

E) -4

Correct Answer : Option E

45. Which one of the following points lies on the line $\vec{r} = \left(\hat{\imath} + 2\hat{\jmath} - 3\hat{k}\right) + t\left(4\hat{\imath} + 5\hat{\jmath} - 7\hat{k}\right)$, $t \in \mathbb{R}$?

A) (9,12,-15)

B) (9,15,12)

C) (12,9,-17)

D) (9,12,-17)

E) (-9,-12,17)

Correct Answer : Option D

46. If the mean of $12 + x$, $17 + x$, $25 + x$, $34 + x$ is 22 then the mean of $38 + x$, $42 + x$, $52 + x$, $60 + x$ is

A) 42

B) 22

C) 48

D) 46

E) 50

Correct Answer : Option C

47. The standard deviation of 3, 8, 6, 10, 12, 9, 11, 10, 12, 7 is 2.71 . The standard deviation of 30, 80, 60, 100, 120, 90, 110, 100, 120, 70 is

A) 2.17

B) 0.271

C) 27.1

D) 271

E) $2.71\sqrt{10}$

Correct Answer : Option C

48. If *A* and *B* are mutually exclusive events and $P(B)=\frac{1}{5}, P(A \cup B) = \frac{13}{35}$,then $P(A)$ is equal to

A) $\frac{1}{35}$

B) $\frac{3}{35}$

C) $\frac{1}{7}$

D) $\frac{6}{35}$

E) $\frac{1}{5}$

Correct Answer : Option D

49. If *A* and *B* are two independent events and $P(A') = 0.8, P(B) = 0.6,$ then $P(A \cup B)$ is equal to

A) 0.86

B) 0.8

C) 0.68

D) 0.52

E) 0.48

Correct Answer : Option C

50. $\lim_{x \to 1} \frac{(x+x^2+x^3+x^4+x^5)-5}{x-1} =$

A) 5

B) 12

C) 14

D) 0

E) 15

Correct Answer : Option E

51. $\lim_{x \to 0} \frac{sin2x+3x}{4x+sin6x} =$

A) 1

B) $\frac{1}{4}$

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

D) 2

E) 3

Correct Answer : Option C

52. The domain of $f(x) = \sqrt{|x\ | - 1} + \sqrt{4 - \ |x|}$ is

A) $[-4, -1] \cup (1, 4)$

B) $(-4, -1) \cup (1, 4)$

C) $[-4, -1]$

D) $[-4, -1) \cup (1, 4)$

E) $[-4, -1] \cup [1, 4]$

Correct Answer : Option E

53. The range of $f(x) = sinx + cosx + 3$

A) $\left[-1 + \sqrt{3}, 1 + \sqrt{3}\right]$

B) $\left[-\sqrt{2} + 3, \sqrt{2} + 3\right]$

C) $\left[-\sqrt{3} + 3, 3 + \sqrt{3}\right]$

D) $\left[-\sqrt{2} - 3, 2 + \sqrt{3}\right]$

E) $\left[-2 + \sqrt{3}, 2 + \sqrt{3}\right]$

Correct Answer : Option B

54. If $F(x) = -\sqrt{9 - x^2}$, then $\lim\limits_{x \to 1} \frac{F(x) - F(1)}{x - 1} =$ is equal to

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

B) $\frac{1}{\sqrt{2}}$

C) $\frac{-1}{2\sqrt{2}}$

D) $\frac{1}{2\sqrt{2}}$

E) 1

Correct Answer : Option D

55. If $log_2 y = x$, then $\frac{dy}{dx}$ is equal to

A) $2^x log_e 2$

B) 2^x

C) x^2

D) $2x$

E) $\frac{2^x}{log_e y}$

Correct Answer : Option A

56. The derivative of $y = (x-1)(2x-1)(3-x)(4-x)$ at $x = \frac{1}{2}$ is equal to

A) 35

B) $\frac{-35}{4}$

C) $\frac{-35}{2}$

D) $\frac{35}{4}$

E) $\frac{35}{2}$

Correct Answer : Option B

57. If $f(x) = |\cos x - \sin x|$, then $f'\left(\frac{\pi}{6}\right)$ is equal to

A) $\frac{-(\sqrt{3}+1)}{2}$

B) $\frac{(\sqrt{3}+1)}{2}$

C) $\frac{\sqrt{3}}{2}$

D) $\frac{2}{\sqrt{3}}$

E) $\frac{2}{\sqrt{3}+1}$

Correct Answer : Option A

58. Let $f: (0, \infty) \to \mathbb{R}$ and $F(x) = \int_0^x f(t)dt$. If $F(x) = x^2(1+x)$,then $f(2)$ is equal to

A) -4

B) 4

C) -16

D) 16

E) 12

Correct Answer : Option D

59. If $f(x) = |x^2 - 1|$, then $f'\left(\frac{3}{2}\right)$ is equal to

A) 3

B) 1

C) 4

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

E) 2

Correct Answer : Option A

60. A critical point of the function $f(x) = \frac{x^3}{3} + 3x^2 - 7x$,is

A) $\left(1, \frac{-11}{3}\right)$

B) (0,0)

C) $\left(-1, \frac{29}{3}\right)$

D) $\left(2, \frac{2}{3}\right)$

E) $\left(-2, \frac{70}{3}\right)$

Correct Answer : Option A

61. The function $f(x) = 2x^3 + 9x^2 + 12x - 1$ is decreasing in the interval is

A) (-1,1)

B) (-3,1)

C) (-2,-1)

D) [-2,1]

E) (-1,3)

Correct Answer : Option C

62. The radius of a right circular cylinder is increasing at the rate of 2 cm/s and its height is decreasing at the rate of 3 cm/s. The rate of change of volume when radius is 4 cm and height 6 cm, is (in cm^3/s)

A) 24π

B) 28π

C) 42π

D) 44π

E) 48π

Correct Answer : Option E

63. The sum of two positive numbers is 12. If the sum of whose square is minimum, then the numbers are

A) 3,9

B) 4,8

C) 5,7

D) 6,6

E) 2,10

Correct Answer : Option D

64. $\int \frac{dx}{\sqrt{x}+\sqrt{x-2}}$ is equal to

A) $\frac{1}{2}\left(x^{3/2}-(x-1)^{3/2}\right)+C$

B) $\frac{1}{3}\left(x^{3/2}-(x-2)^{3/2}\right)+C$

C) $\frac{1}{3}\left(x^{2/3}-(1-x)^{2/3}\right)+C$

D) $\frac{1}{2}\left(x^{2/3}-(1-x)^{2/3}\right)+C$

E) $\frac{1}{3}\left(x^{2/3}-(x-2)^{2/3}\right)+C$

Correct Answer : Option B

65. $\int \frac{dx}{cosx\sqrt{2sin2x}} =$

A) $\frac{1}{2}\sqrt{tanx}+C$

B) $\sqrt{tanx}+C$

C) $2\sqrt{tanx}+C$

D) $4\sqrt{tanx}+C$

E) $3\sqrt{tanx}+C$

Correct Answer : Option B

66. If $f'(x)=3x^2-\frac{2}{x^3}$ and $f(1)=0,$ then $f(x)=$

A) $x^2+\frac{1}{x^3}+1$

B) $x^3+\frac{1}{x^2}+1$

C) $x^3+\frac{1}{x^2}+2$

D) $x^3+\frac{1}{x^2}-2$

E) $x^3+\frac{1}{x^2}-1$

Correct Answer : Option D

67. $\int\left[\frac{1}{logx}-\frac{1}{(logx)^2}\right]dx=$

A) $logx+C$

B) x $logx+C$

C) $\frac{logx}{x} + C$

D) $\frac{x}{logx} + C$

E) $x + logx + C$

Correct Answer : Option D

68. $\int \sqrt{x^2 + 2x + 3}\ \mathrm{d}x =$

A) $(x+1)\sqrt{x^2+2x+3} + \log\left|(x+1)+\sqrt{x^2+2x+3}\right| + C$

B) $\frac{x+1}{2}\sqrt{x^2+2x+3} - \log\left|(x+1)+\sqrt{x^2+2x+3}\right| + C$

C) $\frac{x+1}{2}\sqrt{x^2+2x+3} - \frac{1}{2}\log\left|(x+1)-\sqrt{x^2+2x+3}\right| + C$

D) $\frac{x+1}{2}\sqrt{x^2+2x+3} + \log\left|(x+1)+\sqrt{x^2+2x+3}\right| + C$

E) $\frac{x+1}{2}\sqrt{x^2+2x+3} + \frac{1}{2}\log\left|(x+1)-\sqrt{x^2+2x+3}\right| + C$

Correct Answer : Option D

69. $\int_3^5 \frac{e^{(1+x^2)}}{e^{(1+x^2)} + e^{(1+(8-x)^2)}}\,dx =$

A) 5

B) 1

C) 2

D) 3

E) 0

Correct Answer : Option B

70. $\int_{-a}^{a} \left(x^3 + x\cos^2 2x + \tan^3 x + 3\right)dx =$

A) 2a

B) 3a

C) 4a

D) 6a

E) a

Correct Answer : Option D

71. The area bounded by the curve $y = 3x - x^2$ and the x- axis is

A) $\frac{21}{2}$sq.units

B) 18 sq.units

C) $\frac{27}{2}$sq.units

D) 9 sq.units

E) $\frac{9}{2}$sq.units

Correct Answer : Option E

72. Area of the region bounded by $y = |x|$ and $x = 4$ is

A) 4 sq.units

B) 6 sq.units

C) 8 sq.units

D) 12 sq.units

E) 13 sq.units

Correct Answer : Option C

73. The order and degree of differential equation $\sqrt[5]{1+\frac{d^2y}{dx^2}} = \sqrt[4]{\left(y+\left(\frac{dy}{dx}\right)^5\right)}$, respectively, are

A) 2,5

B) 2,4

C) 2,3

D) 4,5

E) 4,4

Correct Answer : Option B

74. The order and degree of differential equation $x\frac{dy}{dx} + y = e^x$ is

A) $y = \frac{e^x}{x} + Cx$

B) $y = xe^x + Cx$

C) $y = \frac{e^x}{x} + C$

D) $y = \frac{e^x}{x} + \frac{C}{x}$

E) $y = \frac{1}{x} + Cxe^x$

Correct Answer : Option D

75. Let $z = ax + by$, where $a, b > 0$ .The corner points of the feasible region determined by the system of linear constraints are(0,10), (5, 5) , (15,15) , (0, 20) . Condition on a and b so that the minimum of z occurs at both the points (15,15) and (0, 20) , is

A) $a = b$

B) $2a = b$

C) $a = 2b$

D) $3a = b$

E) $a = 3b$

Correct Answer : Option D

76. A distance of 50 cm is measured using a metre stick with the smallest division 1 mm. The percentage error involved in the measurement is

A) 2%

B) 0.5%

C) 0.2%

D) 0.1%

E) 5%

Correct Answer : Option C

77. The value of (200 m + 200 mm) with regard to significant figures is

A) 200.2 m

B) 200 m

C) 202 m

D) 200.200 m

E) 202.2 m

Correct Answer : Option B

78. The angle subtended by the vector $\vec{A} = \hat{\imath} + \hat{\jmath} + \hat{k}$ with the y-axis is

A) $\cos^{-1}\left(\frac{2}{\sqrt{3}}\right)$

B) $\sin^{-1}\left(\frac{1}{\sqrt{3}}\right)$

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

D) $\sin^{-1}\left(\frac{2}{\sqrt{3}}\right)$

E) $\frac{\pi}{2}$

Correct Answer : Option C

79. When a body with its initial velocity non-zero, moves with constant retardation, the velocity-time graph is

A) an oblique straight line with positive slope

B) a straight line parallel to time axis

C) a straight line parallel to velocity axis

D) an oblique straight line with negative slope

E) a curve with bend upwards

Correct Answer : Option D

80. If two bodies are projected with angles of projection θ and (90 - θ) with the same speed, then the ratio between their times of flight T_1 and T_2 is

A) cot θ

B) cos θ

C) sec θ

D) sin θ

E) tan θ

Correct Answer : Option E

81. A machine gun having mass 5 kg fires 40 gram bullet at the rate of 25 bullets per minute at a speed of 300 ms^{-1} . The force required to keep the gun in position is

A) 7 N

B) 4 N

C) 2.5 N

D) 10 N

E) 5 N

Correct Answer : Option E

82. A force $\vec{F} = \hat{\imath} + 2\hat{j} - 2\,\hat{k}$ applied on a body, accelerates the body with 2 ms^{-2}. Then the mass of the body is

A) 0.5 kg

B) 10 kg

C) 5 kg

D) 1.5 kg

E) 7 kg

Correct Answer : Option D

83. A body moving with kinetic energy *E* is stopped by applying a stopping force *F*. The stopping distance is

A) FE

B) $\frac{F}{E}$

C) $\frac{E}{F}$

D) F^2E

E) FE^2

Correct Answer : Option C

84. The work done by the applied force in changing the elongation of a spring of spring constant K, from x_1 to x_2 is

A) $\frac{1}{2}K(x_2^2 - x_1^2)$

B) $\frac{1}{2}Kx_1x_2$

C) $\frac{1}{4}K(x_1^2 - x_2^2)$

D) $\frac{1}{4}Kx_1x_2$

E) $\frac{1}{2}K(x_1^2x_2^2)$

Correct Answer : Option A

85. In the uniform circular motion of a particle, the point about which the angular momentum of the particle is conserved is

A) on the circumference of the circle

B) inside the circle

C) outside the circle

D) the centre of the circle

E) anywhere on the rotation axis

Correct Answer : Option D

86. A wheel of moment of inertia $4 \times 10^{-3}\ kgm^2$ rotates with an angular speed of 25 rev. s $^{-1}$. The torque (in *Nm*) required to stop it in 10s is

A) $4\pi \times 10^{-4}$

B) $2\pi \times 10^{-2}$

C) $6\pi \times 10^{-3}$

D) $\pi \times 10^{-1}$

E) $3\pi \times 10^{-5}$

Correct Answer : Option B

87. A force $\vec{F}$ acting on a particle, having position vector $\vec{r}$ exerts a torque $\vec{\tau}$ about the origin on the particle. Then the angle between $\vec{r}$ and $\vec{\tau}$ is

A) 60°

B) 45°

C) 0°

D) 90°

E) 180°

Correct Answer : Option D

88. The gravitational potential energy between two bodies each of mass 1 kg kept at a distance of 1 *m* is (G - Gravitational constant)

A) G

B) $-G$

C) $\frac{-G}{2}$

D) $\frac{G}{2}$

E) $\frac{-G}{4}$

Correct Answer : Option B

89. If the acceleration due to gravity on the surface of a planet of mass *m* and radius *r* is g, then the escape velocity of a body from the surface of the planet is

A) $\sqrt{2gr}$

B) $\sqrt{\frac{2g}{r}}$

C) $\sqrt{gr}$

D) gr^2

E) $2gr^2$

Correct Answer : Option A

90. The wall between two thermal systems that allows the flow of heat from one to another to bring thermal equilibrium is called

A) adiabatic wall

B) insulated wall

C) diathermic wall

D) semiconducting wall

E) non-conducting wall

Correct Answer : Option C

91. If dV is the change in volume of a liquid of density ρ under the pressure P, then the pressure energy per unit mass of the liquid is

A) PdV

B) $\frac{PdV}{\rho}$

C) $\frac{PdV}{\rho^2}$

D) $\frac{P}{\rho}$

E) $P\rho$

Correct Answer : Option D

92. If F_1 is the force exerted by air on a small piston of area of cross-section A_1 in a car lift , then the force F_2 realised on the second piston of area of cross-section A_2due to the transfer of pressure is

A) $F_1 \frac{A_1}{A_2}$

B) $F_1 \frac{A_2}{A_1}$

C) $F_1\sqrt{(A_1A_2)}$

D) $F_1\sqrt{\frac{A_1}{A_2}}$

E) $\sqrt{\frac{A_1}{A_2}}$

Correct Answer : Option B

93. Find the mismatch pair in the thermodynamic process

A) Isothermal : Absorption or emission of heat

B) Isobaric : Pressure constant

C) Isochoric : Volume constant

D) Irreversible : Loss of heat

E) Adiabatic : Heat exchange

Correct Answer : Option E

94. In a Carnot engine if the ratio of the heat rejected to the sink to the heat absorbed from the source is 1 : 4, then the efficiency of the engine is

A) 75 %

B) 60 %

C) 50 %

D) 25 %

E) 45 %

Correct Answer : Option A

95. The mean free path of a gas is directly proportional to its

A) pressure

B) density

C) molecular diameter

D) absolute temperature

E) square of molecular diameter

Correct Answer : Option D

96. The condition for real gases to obey the ideal gas equation PV = RT is that the gases should be at

A) high pressure

B) low temperature

C) low pressure and low temperature

D) high pressure and low temperature

E) low pressure and high temperature

Correct Answer : Option E

97. A particle is executing simple harmonic motion with *A* and *B* as its extreme positions and O as its mean position. If a and v represent the acceleration and velocity, then

A) at *A* , a = 0

B) at B, a = 0

C) at *O*, a is maximum

D) at *O*, a and v are maximum

E) at *O*, a = 0

Correct Answer : Option E

98. The equation for the displacement x (in m) of a particle executing simple harmonic motion in SI unit is $x(t) = 5cos4\ \pi t$ Its displacement after 3 s is

A) 2 m

B) 5 m

C) 3 m

D) 4 m

E) 10 m

Correct Answer : Option B

99. Two sound sources produce 24 beats in 3 s . The difference between the two frequencies of the sources is

A) 2

B) 4

C) 8

D) 12

E) 3

Correct Answer : Option C

100. Electric potential due to an electric dipole on its axis at a distance r from its centre is inversely proportional to

A) r

B) r^3

C) r^2

D) r^{-2}

E) r^{-1}

Correct Answer : Option C

101. If the potential difference between two conductors separated by a distance of 2 cm is 4×10^3 V then the electric field between them (in Vm^{-1}) is

A) $8 \times 10^3 Vm^{-1}$

B) $4 \times 10^5 Vm^{-1}$

C) $8 \times 10^5 Vm^{-1}$

D) $2 \times 10^3 Vm^{-1}$

E) $2 \times 10^5 Vm^{-1}$

Correct Answer : Option E

102. The electrostatic energy density of the electric field E in a capacitor is directly proportional to

A) E^2

B) E

C) $\sqrt{E}$

D) E^3

E) E^{-2}

Correct Answer : Option A

103. In an electrolyte, the mobile charge carriers are

A) electrons only

B) negative ions only

C) positive ions only

D) negative and positive ions

E) electrons and positive ions

Correct Answer : Option D

104. If both the length and area of cross-section of a linear conductor are halved, its resistance would

A) be doubled

B) remain unchanged

C) be halved

D) be tripled

E) be quadrupled

Correct Answer : Option B

105. The power dissipated in the transmission cables of 0.03 Ω resistance, when 11 kW of power is transmitted at 220 V is

A) 0.025 kW
B) 0.050 kW
C) 0.075 kW
D) 1.075 kW
E) 1.025 kW

Correct Answer : Option C

106. If the horizontal and the vertical component of earth's magnetic field are, respectively, 0.26 G and (0.26) $\sqrt{3}G$, then the dip angle is

A) 0º
B) 30º
C) 45º
D) 60º
E) 90º

Correct Answer : Option D

107. The maximum torque experienced by a rectangular coil carrying a steady current I placed in a uniform magnetic field B is (l- length; A - area of cross-section)

A) IBA
B) IlB
C) IBA^2
D) IlB^2
E) Il^2B

Correct Answer : Option A

108. In a television, the required magnetic field is produced by a/an

A) toroid
B) electromagnet
C) permanent magnet
D) circular coil
E) solenoid

Correct Answer : Option E

109. If the flux linked with the coil of area of cross-section 0.5 m^2 placed in a magnetic field of 16 T is 4 Wb, then the angle between the magnetic field and the area vector of the coil is

A) 0º
B) 30º
C) 45º
D) 60º
E) 90º

Correct Answer : Option D

110. The self-inductance of a coil does not depend on

A) its radius
B) its number of turns
C) its area of cross-section
D) the current through it
E) permeability of the medium

Correct Answer : Option D

111. Which one of the following proves the transverse nature of electromagnetic waves?

A) Interference of light
B) Dispersion of light
C) Polarization of light
D) Photoelectric effect
E) Diffraction of light

Correct Answer : Option C

112. If the angle of a prism A is equal to the angle of minimum deviation, then the refractive index of the material of the prism is

A) $2cos\frac{A}{2}$
B) $cos\frac{A}{2}$
C) $2cosA$
D) $cosA$
E) $sin\frac{A}{2}$

Correct Answer : Option A

113. According to Huygens Principle, a wavefront is

A) a single ray of light
B) a surface of constant phase
C) a surface of varying phase
D) a random arrangement of waves
E) a region where crests and troughs overlap

Correct Answer : Option B

114. In Young's experiment, the wavelength of light is 600 nm, the slit separation is 0.5 mm, and the screen is 2 m away. The fringe width of the interference pattern with the same set up becomes 3 times if the wavelength of light used is

A) tripled

B) doubled
C) halved
D) made one-third
E) made one-sixth

Correct Answer : Option A

115. If the frequency of the incident radiation f increases above the threshold frequency f_0 of a photo-sensitive material, then the stopping potential
A) increases linearly with f
B) decreases linearly with f
C) is independent of f
D) increases with intensity of light
E) decreases with intensity of light

Correct Answer : Option A

116. The emission of electrons from a metal by applying a very strong electric field is called
A) photoelectric emission
B) field emission
C) thermionic emission
D) beta emission
E) gamma emission

Correct Answer : Option B

117. The size of a nucleus is of the order of
A) $10^{-1}\ m$
B) $10^{-10}m$
C) $10^{-5}m$
D) $10^{-6}m$
E) $10^{10}m$

Correct Answer : Option A

118. The radiations of extremely short wavelength are
A) alpha rays
B) beta rays
C) gamma rays
D) X rays
E) ultra-violet rays

Correct Answer : Option C

119. The naturally occurring crystal which was used as a detector of radio waves is

A) Ruby

B) Galena

C) silicon

D) germanium

E) zinc selenide

Correct Answer : Option B

120. If n_h and n_e represent the concentrations of holes and electrons, respectively, then in a p-type semiconductor,

A) $n_e = n_h$

B) $n_e \gg n_h$

C) $n_h \gg n_e$

D) $n_e = 2n_h$

E) $n_h + n_e = n_h n_e$

Correct Answer : Option C

121. 149 g of KCl is dissolved in 10 litres of an aqueous solution. The molarity of the solution is (molar mass of KCl = 74.5)

A) 1M

B) 0.1M

C) 2 M

D) 0.2M

E) 0.002 M

Correct Answer : Option D

122. Which of the following statement is NOT true?

A) The energies of the orbitals in the same subshell increases with increase in the atomic number

B) The probability density function is zero on the plane where the two lobes touch each other.

C) The lower the value of $(n + l)$ for an orbital, the lower is its energy.

D) The total number of nodes is given by $(n - 1)$.

E) The maximum number of electrons in the shell with principal quantum number 'n' is equal to 'n^2'

Correct Answer : Option E

123. Which of the following quantum numbers determines the orientation of the orbital?

A) n

B) l

C) m_l

D) m_s

E) both n and l

Correct Answer : Option C

124. Which of the following statement is INCORRECT regarding f-block elements?

A) The elements of the periodic table in which the last electron gets filled up in the f-orbital.

B) The f-block elements are from atomic number 58 to 71 and from 90 to 103.

C) Actinoid elements are radioactive.

D) There are 28 f-block elements in the periodic table.

E) The outer electronic configuration of Actinoids is $(n-1)f^{1-14}(n-1)d^{0-1}ns^2$.

Correct Answer : Option E

125. The H-C-H bond angle in ethene is

A) 117.6°

B) 121°

C) 110°

D) 105°

E) 119°

Correct Answer : Option A

126. For the process to occur under adiabatic conditions, the correct condition is

A) ΔT = 0

B) ΔP = 0

C) q = 0

D) w = 0

E) ΔU = 0

Correct Answer : Option C

127. For the following gas phase decomposition, the magnitude of ΔH and ΔS is

$$PCl_5\,(g) \rightleftharpoons^{\Delta} PCl_3\,(g) + Cl_2\,(g)$$

A) ΔH< 0 and ΔS < 0

B) ΔH > 0 and ΔS > 0

C) ΔH > 0 and ΔS < 0

D) ΔH < 0 and ΔS > 0

E) ΔH = 0 and ΔS = 0

Correct Answer : Option B

128. What is the value of Kc for the following equilibrium, if the value of Kp for the reaction at 1000 K is 8.21×10^{-2}? (R = 0.0821)
$2NOCl(g) \rightleftharpoons 2NO(g) + Cl_2(g)$ at 1000 K.

A) 10^{-3}

B) 10^{-8}

C) 10^{-9}

D) 10^{-1}

E) 10^{-5}

Correct Answer : Option A

129. Which of the following statement is true for the effect of catalyst in equilibrium?

A) Lowers activation energy for forward reaction only.

B) Lowers activation energy for reverse reaction only.

C) When K is small catalyst has greater effect.

D) It effects to equilibrium composition of reaction mixture.

E) Lowers activation energy for forward and reverse reaction by same amount.

Correct Answer : Option E

130. Which of the following is INCORRECT for the concept of reduction?

A) Removal of oxygen

B) Addition of hydrogen

C) Addition of electron

D) Decrease in oxidation number

E) Removal of an electron

Correct Answer : Option E

131. The conductivity (k) of a decinormal solution of KCl is 0.012 ohm^{-1} cm^{-1}. The resistance of a cell containing this solution was found to be 50 ohm at 298 K. The cell constant value is

A) 0.02 cm^{-1}

B) 0.5 cm^{-1}

C) 0.8 cm^{-1}

D) 0.1 cm^{-1}

E) 0.6 cm^{-1}

Correct Answer : Option E

132. When 1 g of a non-electrolyte solute dissolved in 50 g of benzene lowered the freezing point of benzene by 0.20 K. The freezing point depression constant of benzene is 5 K kg mol^{-1}. The molar mass (g /mol) of the solute is

A) 500

B) 400
C) 300
D) 200
E) 100

Correct Answer : Option A

133. The pre-exponential factor in the Arrhenius equation is called as
A) probability factor
B) activation energy
C) collision frequency
D) reaction coordinate
E) frequency factor

Correct Answer : Option E

134. In a first order reaction, A→ Products, the half-life period is found to be 10 minutes. The rate of the reaction in mol lit^{-1} min^{-1} at [A] = 0.1 mol lit^{-1} is
A) 0.693×10^{-3} mol lit^{-1} min^{-1}
B) 6.93×10^{-3} mol lit^{-1} min^{-1}
C) 69.3×10^{-3} mol lit^{-1} min^{-1}
D) 693.3×10^{-3} mol lit^{-1} min^{-1}
E) 6932×10^{-3} mol lit^{-1} min^{-1}

Correct Answer : Option B

135. The correct statement/s about Cr^{2+} and Mn^{3+} is/are
[Atomic numbers of Cr = 24 and Mn = 25]
(i) Cr^{2+} is a reducing agent
(ii) Mn^{7+} is an oxidising agent in acidic medium
(iii) Both Cr^{2+} and Mn^{3+} exhibit d^4 electronic configuration
(iv) The highest oxide of Mn is Mn_3O_4 .
(v) Cr^{2+} and Mn^{3+} have the same magnetic moment as both have four unpaired electrons.
A) Only (i)
B) (i), (ii) and (iii)
C) (i), (iv) and (v)
D) (i) and (v) only
E) (i), (ii), (iii) and (v)

Correct Answer : Option E

136. Which of the following metal ion is diamagnetic?
A) Zn^{2+}

B) Ni^{2+}

C) Co^{2+}

D) Cu^{2+}

E) Mn^{2+}

Correct Answer : Option A

137. Match the Column-I with Column-II.

Column-I (Catalyst)	**(Column-II) Used in**
(a) $TiCl_4 + Al(CH_3)_3$	(i) Oxidation of SO_2 in the manufacture of H_2SO_4.
(b) $PdCl_2$	(ii) Hydrogenation of fats
(c) Fe	(iii) Zeigler catalyst
(d) Ni	(iv) Wacker process
(e) V_2O_5	(v) Haber process

A) (a)-(iii), (b)-(iv), (c)-(v), (d)-(ii), (e)-(i)

B) (a)-(ii), (b)-(iv), (c)-(v), (d)-(iii), (e)-(i)

C) (a)-(iii), (b)-(ii), (c)-(v), (d)-(iv), (e)-(i)

D) (a)-(iii), (b)-(iv), (c)-(i), (d)-(ii), (e)-(v)

E) (a)-(iii), (b)-(v), (c)-(iv), (d)-(ii), (e)-(i)

Correct Answer : Option A

138. The common oxidation state of the elements of lanthanoid series is

A) +1

B) +2

C) +3

D) +4

E) +5

Correct Answer : Option C

139. The complex ions $[NiCl_4]^{2-}$ and $[Ni(CN)_4]^{2-}$ differ by

(i) Magnetic moment (ii) Geometry

(iii) Hybridisation of central metal ion (iv) Oxidation state of nickel

A) (i), (ii) and (iv)

B) (i), (ii) and (iii)

C) (ii), (iii) and (iv)

D) (ii) and (iii)

E) (i), (ii), (iii) and (iv)

Correct Answer : Option B

140. Four complex ions are given in Column I and the colours of light absorbed are given in Column II. Match the correct answer from the codes given below.

Complex	Colour of light absorbed
(a) $[Ti(H_2O)_6]^{3+}$	(i) Blue
(b) $[Cu(H_2O)_4]^{2+}$	(ii) Yellow
(c) $[CoCl(NH_3)_5]^{2+}$	(iii) Blue green
(d) $[Co(NH_3)_6]^{3+}$	(iv) Red

A) (a)-(iii), (b)-(iv), (c)-(ii), (d)-(i)
B) (a)-(ii), (b)-(iv), (c)-(iii), (d)-(i)
C) (a)-(iii), (b)-(ii), (c)-(iv), (d)-(i)
D) (a)-(i), (b)-(iv), (c)-(ii), (d)-(iii)
E) (a)-(iii), (b)-(iv), (c)-(i), (d)-(ii)

Correct Answer : Option A

141. The number of α -hydrogens in tertiary butyl chloride, isopropyl chloride, ethyl chloride and methyl chloride are respectively

A) 0, 1, 2 and 3
B) 0, 3, 6 and 9
C) 1, 3, 6 and 9
D) 9, 6, 3 and 0
E) 3, 6, 9 and 12

Correct Answer : Option A

142. The correct order of the rate of β-elimination reaction among the alkyl halides is

A) Secondary > Tertiary > Primary
B) Tertiary > Primary > Secondary
C) Tertiary > Secondary > Primary
D) Primary > Tertiary > Secondary
E) Primary > Secondary > Tertiary

Correct Answer : Option C

143. Alkyl iodides are normally prepared by the following reaction:
$CH_3CH_2Cl + NaI \rightarrow CH_3CH_2I + NaCl$
This reaction is known as

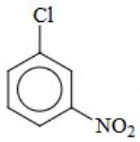
A) Wurtz reaction
B) Wurtz-Fittig reaction
C) Williamson synthesis
D) Finkelstein reaction
E) Etard reaction

Correct Answer : Option D

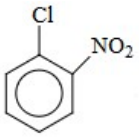
144. Which of the following is most reactive towards nucleophilic aromatic substitution?

A)

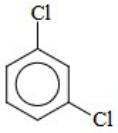
B)



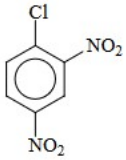
C)



D)



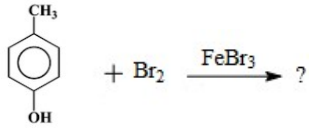
E)



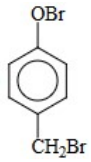
Correct Answer : Option E

What is the major product of the following reaction?

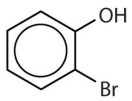
145.



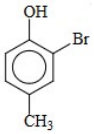
A)



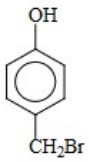
B)



C)



D)



E)

Correct Answer : Option C

146. Benzophenone and Acetophenone are distinguished by treating with

A) Fehling's reagent

B) Lucas reagent

C) Iodine and alkali

D) Aqueous CrO_3

E) Tollens' reagent

Correct Answer : Option C

147. The product of the following reaction is

$$C_6H_5CHO + C_6H_5COCH_3 \xrightarrow[293\,K]{NaOH}$$

A) $C_6H_5CH = CHCOC_6H_5$

B) $C_6H_5COCH2C_6H_5$

C) $C_6H_5CH = CHC_6H_5$

D) $C_6H_5CH(OH)COC_6H_5$

E) $C_6H_5COCOC_6H_5$

Correct Answer : Option A

148. Which of the following is the strongest acid?

A) FCH_2COOH

B) CF_3COOH

C) $NC\text{-}CH_2COOH$

D) $Br\text{-}CH_2COOH$

E) CH_3COOH

Correct Answer : Option B

149. Choose the correct combinations for the column I with column II.

Column-I	Column-II
(a) Benzenesulphonyl chloride	(i) Carbylamine reaction
(b) Conversion of amide to amine	(ii) Secondary amine
(c) Conversion of primary amine to isocyanide	(iii) Hinsberg's reagent
(d) Diethylamine	(iv) Hofmann's bromamide reaction

A) (a)-(ii), (b)-(iv), (c)-(i), (d)-(iii)

B) (a)-(i), (b)-(ii), (c)-(iii), (d)-(iv)

C) (a)-(iii), (b)-(iv), (c)-(i), (d)-(ii)

D) (a)-(i), (b)-(iii), (c)-(ii), (d)-(iv)

E) (a)-(iii), (b)-(iv), (c)-(ii), (d)-(i)

Correct Answer : Option C

150. Peptide on hydrolysis gives

A) glucose

B) fatty acids

C) amino acids

D) ribose sugar, H_3PO_4 and base

E) heterocyclic base and sugar

Correct Answer : Option C