PROVISIONAL ANSWER KEY

1. Let U be the universal set and let A and B be any two subsets of U. If $n(U) = 25, n(A) = 14$ $n(A \cap B) = 6$ and $n(A \cup B)$ =20, then $n(B')$ is equal to

A) 12

B) 13

C) 14

D) 15

E) 16

Correct Answer : Option B

2. $f(x) = \dfrac{1}{7 - \cos}, x \in \mathbb{R}$. Then the range of f is

A) $(-8, -7)$

B) $[-7, -4]$

C) $\left(1, \dfrac{5}{4}\right)$

D) $\left(\dfrac{5}{7}, 1\right)$

E) $\left[\dfrac{1}{8}, \dfrac{1}{6}\right]$

Correct Answer : Option E

3. The domain of the function $f(x) = \sqrt{7 - 11x}$ is

A) $(-\infty, -1]$

B) $\left[\dfrac{7}{11}, \infty\right)$

C) $\left(-\infty, \dfrac{7}{11}\right]$

D) $\left[\dfrac{7}{11}, 1\right]$

E) $[-1, 1]$

Correct Answer : Option C

4. Let A and B be two finite sets. If $n(A) = 7$ and the number of relations from A into B is 128, then $n(B) =$

A) 4

B) 3

C) 2

D) 1

E) 0

Correct Answer : Option D

5. The value of $(1 + i)^{10}$ is equal to

A) 16

B) $16i$

C) 32

D) $32i$

E) 64

Correct Answer : Option D

6. The value of $i^3 + i^4 + i^5 + \ldots i^{93}$, where $i = \sqrt{-1}$, is equal to

A) i

B) 1

C) $-i$

D) -1

E) 0

Correct Answer : Option B

7. Imaginary parts of $\left(\dfrac{3-2i}{2i}\right)^2$ is equal to

A) $\dfrac{5}{4}$

B) $\dfrac{-5}{4}$

C) 3

D) -3

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

Correct Answer : Option C

8. Let $z_1 = \dfrac{1}{2} + i\dfrac{\sqrt{3}}{2}$ and $z_2 = -\dfrac{1}{2} - i\dfrac{\sqrt{3}}{2}$ .If $w = z_1 + \overline{z_2}$,then $\overline{w}$ =

A) 1

B) $\sqrt{3}$

C) $i\sqrt{3}$

D) $-i\sqrt{3}$

E) $-\sqrt{3}$

9. Let $a_n = 2^{n-1}, n = 1, 2, 3. \ldots$ Then the value of the sum $\displaystyle\sum_{n=1}^{20} a_n$ is equal to

A) $\dfrac{2^{20} - 1}{2^5}$

B) $\dfrac{2^{21} - 1}{\sqrt{2}}$

C) $2^{20} - 1$

D) $\dfrac{2^{21} - 1}{2^{10}}$

E) $\dfrac{2^{20} - 1}{\sqrt{2}(2^{19} - 1)}$

10. $a_1, a_2 \ldots \ldots a_{10}$ are in G.P., and if $a_1 + a_2 = 6, a_9 + a_{10} = \dfrac{3}{128}$ then the common ratio of the G.P. is equal to

A) $\dfrac{1}{3}$

B) $\dfrac{1}{2}$

C) $\dfrac{1}{4}$

D) 2

E) 3

11. Three numbers *a, b,* and *c* are in G.P. If *abc* = 27 and $a + c$ = 10, then $a^2 + b^2 + c^2 =$

A) 81

B) 82

C) 91

D) 92

E) 99

12. The positive numbers α and β have geometric mean 6. If α and β are roots of the equation $2x^2 - 25x + \lambda = 0$ is equal to then the value of λ is equal to

A) 6

B) 36

C) 12

D) 72

E) 48

Correct Answer : Option D

13. Let S be the set of all 5-digit numbers having only the digits 0 and 1. Then $n(S) =$

A) 16

B) 32

C) 8

D) 64

E) 24

Correct Answer : Option A

14. The constant term in the binomial expansion of $\left(2x - \dfrac{5}{x^2}\right)^6$ is

A) 4800

B) 3200

C) 5600

D) 5400

E) 6000

Correct Answer : Option E

15. Let $A = \{a, b, c, d, e, f\}$ Then the number of subsets of A with an odd number of elements is

A) 8

B) 12

C) 16

D) 24

E) 32

Correct Answer : Option E

16. If $\displaystyle\sum_{k=0}^{n+1} {}^{n+1}C_k = 512$, then $\displaystyle\sum_{k=0}^{n} {}^{n}C_k =$

A) 512

B) 256

C) 511

D) 510

E) 128

Correct Answer : Option B

17. $\dfrac{8}{4}\left({}^7P_4\right)$

A) $\left({}^8P_3\right)$

B) $\left(^8C_3\right)$

C) $\left(^8P_5\right)$

D) $\left(^8P_4\right)$

E) $\left(^8C_5\right)$

Correct Answer : Option D

18. If $X = A^{-1}B$,Where $A = \begin{bmatrix} 1 & -1 \\ 2 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 3 \\ 6 \end{bmatrix}$ and $X = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$,then $x_1 + x_2 =$

A) 3

B) 4

C) 5

D) 6

E) 7

Correct Answer : Option A

19. The numbers $a_1, a_2, a_3, a_4, a_5 \ and \ a_6$ are in G.P. If $a_1 = 2$ and the common ratio r

$= \dfrac{1}{2}$, then the value of $\begin{vmatrix} a_1 & a_2 & 1 \\ a_3 & a_4 & 1 \\ a_5 & a_6 & 1 \end{vmatrix}$ is equal to

A) 1

B) 2

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

D) 4

E) 0

Correct Answer : Option E

20. If the matrix $A = \begin{bmatrix} 1 & -1 \\ 4\lambda & 8 \end{bmatrix}$ is singular, then the value of λ is equal to

A) -2

B) 2

C) 1

D) -1

E) 0

Correct Answer : Option A

21. Let $A = \begin{bmatrix} a & -1 & -a \\ 0 & 1 & -1 \\ 1 & 0 & 4 \end{bmatrix}$. If $|A| = 26$, then the value of a is equal to

A) 5

B) 4

C) 6

D) 7

E) 2

Correct Answer : Option A

22. The set of all x satisfying the inequality $|3 - 4x| \le 11$ is

A) $[-2, 7]$

B) $\left[-2, \frac{7}{2}\right]$

C) $[-7, 2]$

D) $\left[\frac{-7}{2}, 2\right]$

E) $[-2, -2]$

Correct Answer : Option B

23. If $x \ne 11$ satisfies the inequality $\frac{2x-2}{x-11} \ge 3$, then x lies in the interval

A) $(-\infty, 11)$

B) $(11, 12]$

C) $(11, 12)$

D) $(11, \infty)$

E) $[12, \infty)$

Correct Answer : Option B

24. $\frac{3tan1^\circ - tan^3 15^\circ}{1 - 3tan^2 15^\circ}$

A) 5

B) 4

C) 2

D) 0

E) 1

Correct Answer : Option E

25. $Sin\, 60^\circ - Sin80^\circ + Sin100^\circ - Sin120^\circ =$

A) $\sqrt{3}$

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

C) $2\sqrt{3}$

D) $\dfrac{\sqrt{3}}{4}$

E) 0

Correct Answer : Option E

26. If $cos^{-1}x - sin^{-1}x = \dfrac{\pi}{6}$,then x is equal to

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

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

C) $\dfrac{\sqrt{3}}{4}$

D) $\dfrac{-1}{\sqrt{2}}$

E) $\dfrac{1}{2}$

Correct Answer : Option E

27. $cot^{-1}(1) + cot^{-1}(2) + cot^{-1}(3) =$

A) $\dfrac{\pi}{4}$

B) $\dfrac{\pi}{2}$

C) $\dfrac{3\pi}{2}$

D) π

E) 0

Correct Answer : Option B

28. If $cos(2sin^{-1}\alpha) = \dfrac{47}{72}$, where $0 < \alpha < 1$, then the value of α

A) $\dfrac{5}{12}$

B) $\dfrac{7}{12}$

C) $\dfrac{12}{13}$

D) $\dfrac{5}{13}$

E) $\dfrac{7}{13}$

Correct Answer : Option A

29. If $\tan\left(\alpha - \dfrac{\pi}{12}\right) = \dfrac{1}{\sqrt{3}}$, where $0 < \alpha < \dfrac{\pi}{2}$, then the value of α is equal to

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

B) $\dfrac{4\pi}{9}$

C) $\dfrac{\pi}{4}$

D) $\dfrac{\pi}{6}$

E) $\dfrac{\pi}{8}$

Correct Answer : Option C

30. $x = \dfrac{1 + \cos 2\theta}{\tan\theta - \sec\theta}$ and $y = \dfrac{\tan\theta + \sec\theta}{\sec^2\theta}$, then $\dfrac{y}{x} =$

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

B) 2

C) -2

D) $\dfrac{-1}{2}$

E) 1

Correct Answer : Option D

31. The equation of the line passing through the point (-4,2) and the centre of the circle $2x^2 + 2y^2 - 8y = 7$ is

A) x+3y=2

B) y=2

C) x=-4

D) x+y=-2

E) y=-2

Correct Answer : Option B

32. Let A(-1,2), B(1,-2) and C(-2,-2) be vertices of the triangle ABC. The equation of the line passing through C and parallel to AB is

A) x+2y+6=0

B) 2x-y+6=0

C) 2x+y-6=0

D) 2x-y-6=0

E) 2x+y+6=0

Correct Answer : Option E

33. The area of the triangle bounded by the lines x=4, y=-4 and y=x is

A) 28

B) 42

C) 24

D) 32

E) 40

Correct Answer : Option D

34. The foci of an ellipse are at (-3,0) and (3,0). If the eccentricity of the ellipse is $\frac{1}{2}$,then the equation of the ellipse is

A) $\frac{x^2}{25} + \frac{y^2}{16} = 1$

B) $\frac{x^2}{16} + \frac{y^2}{7} = 1$

C) $\frac{x^2}{16} + \frac{y^2}{25} = 1$

D) $\frac{x^2}{36} + \frac{y^2}{16} = 1$

E) $\frac{x^2}{36} + \frac{y^2}{27} = 1$

Correct Answer : Option E

35. The coordinates of the focus and the vertex of a parabola, respectively, are (-1,4) and(3,4) Then the equation of the parabola is

A) $(x-3)^2 = 16(y-4)$

B) $(x-3)^2 = -16(y-4)$

C) $(y-4)^2 = -8(x-3)$

D) $(y-4)^2 = -16(x-3)$

E) $(y-4)^2 = 1(x-3)$

Correct Answer : Option D

36. The line segment joining the points (-3,1) and (1,1) is transverse axis of a hyperbola. If the length of the conjugate axis is 4, then the equation of the hyperbola is

A) $(x+2)^2 - (y-1)^2 = 4$

B) $(x+1)^2 - (y-1)^2 = 16$

C) $(x+1)^2 - (y-1)^2 = 4$

D) $(x+2)^2 - (y-1)^2 = 16$

E) $(x-1)^2 - (y+1)^2 = 4$

Correct Answer : Option C

37. The line $x + y = 2$ touches a circle. If the centre of the circle is at (-4,0) ,then the radius of the circle is

A) $2\sqrt{2}$

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

C) $\sqrt{2}$

D) $\dfrac{\sqrt{2}}{2}$

E) $3\sqrt{2}$

Correct Answer : Option E

38. Let *ABCD* be a rectangle. If $\overrightarrow{AB} = 5\hat{\imath} + 4\hat{\jmath} - 3\hat{k}$ and $\overrightarrow{AD} = 3\hat{\imath} + 2\hat{\jmath} - \hat{k}$, then the length of *BD* is

A) $2\sqrt{5}$

B) $3\sqrt{2}$

C) $4\sqrt{3}$

D) $2\sqrt{3}$

E) $3\sqrt{3}$

Correct Answer : Option D

39. Let $\vec{a} = \alpha\,\hat{\imath} - 3\hat{\jmath} - 2\hat{k}$ and $\vec{c} = \hat{\imath} - 2\hat{\jmath} + 2\hat{k}$. If the projection of $\vec{a}$ on $\vec{c}$ is 2, then the value of α is equal to

A) 2

B) 4

C) 3

D) 5

E) 6

Correct Answer : Option B

40. If $|\vec{a}| = 8$, $|\vec{b}| = 5$, and $|\vec{a} - \vec{b}| = 7$ then the angle between $\vec{a}$ and $\vec{b}$ is equal to

A) $\dfrac{3\pi}{4}$

B) $\dfrac{2\pi}{3}$

C) $\dfrac{\pi}{4}$

D) $\dfrac{\pi}{6}$

E) $\dfrac{\pi}{3}$

41. If $|\vec{a}| = 3$, $|\vec{b}| = 2$, then the value of $(2\vec{a} + 3\vec{b}) \cdot (2\vec{a} - 3\vec{b})$ is equal to

A) 6
B) -12
C) 12
D) -6
E) 0

42. The line $\dfrac{x+1}{2} = \dfrac{y-4}{4} = \dfrac{z-2}{5}$ passes through the point

A) (-3,0,-3)
B) (3,0,5)
C) (-3,0,5)
D) (3,4,5)
E) (3,-4,-5)

43. If the lines $\dfrac{x-4}{m} = \dfrac{y-3}{2} = \dfrac{z+2}{1}$ and $\dfrac{x-3}{1} = \dfrac{y-4}{1} = \dfrac{z+3}{m}$ are coplanar, then the values of m are

A) 4,1
B) 1,-4
C) 3,1
D) 5,-1
E) 3,-1

44. The angle between the lines $\dfrac{x-3}{-4} = \dfrac{y+2}{3} = \dfrac{z-1}{5}$ and $\dfrac{x-2}{2} = \dfrac{y-4}{1} = \dfrac{z+3}{3}$ is

A) $\cos^{-1}\left(\dfrac{1}{3\sqrt{7}}\right)$

B) $\cos^{-1}\left(\dfrac{\sqrt{2}}{1}\right)$

C) $\cos^{-1}\left(\dfrac{2}{7}\right)$

D) $\cos^{-1}\left(\dfrac{1}{2\sqrt{7}}\right)$

E) $\cos^{-1}\left(\dfrac{1}{\sqrt{7}}\right)$

45. If the line $\frac{x+1}{4} = \frac{y+2}{-3} = \frac{z-\alpha}{-2}$ passes through the point (-1,-2,-3) then the value of α is

A) 4

B) -4

C) 3

D) -3

E) -2

Correct Answer : Option D

46. Let X={a,b} and Y={1,3,4,5} . A subset of $X \times Y$ is selected at random. If A is an event of selecting a subset of $X \times Y$ containing exactly three elements, then P(A) =

A) $\frac{7}{32}$

B) $\frac{7}{64}$

C) $\frac{5}{32}$

D) $\frac{5}{64}$

E) $\frac{7}{128}$

Correct Answer : Option A

47. A box contains 8 red balls, 10 white balls and 17 black balls. Two balls are drawn one by one without replacement. The probability, that the first ball drawn is white and the second ball drawn is black, is

A) $\frac{17}{175}$

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

C) $\frac{5}{34}$

D) $\frac{2}{7}$

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

Correct Answer : Option E

48. Let S={2, 5,8,11,14,17, 20, 23}. Two integers *m, n* are chosen one by one from *S* with replacement. Then the probability, that *mn* is odd, is

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

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

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

D) $\dfrac{3}{7}$

E) $\dfrac{3}{5}$

Correct Answer : Option B

49. In a class there are *n* students. The mean of marks obtained by these *n* students in an exam is 65. If the mark of one student is increased from 50 to 75 and the new mean is 66, then the value of *n* is equal to

A) 10

B) 15

C) 20

D) 25

E) 30

Correct Answer : Option D

50. $\displaystyle\lim_{x\to0}\dfrac{1-cos4x}{tan^2 2x}=$

A) 3

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

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

D) 2

E) 0

Correct Answer : Option D

51. The domain of the function $f(x)=\left(\sqrt{8x-x^2-7}\right)^{3/2}$ is

A) $[1,7]$

B) $[-3,3]$

C) $[-7,-1]$

D) $[3,7]$

E) $[1,4]$

Correct Answer : Option A

52. $\displaystyle\lim_{x\to11}\dfrac{x-11}{\sqrt{x^2+48}-13}=$

A) $\dfrac{11}{13}$

B) $\dfrac{13}{11}$

C) $\dfrac{26}{11}$

D) $\dfrac{11}{26}$

E) 0

Correct Answer : Option B

53. Let $f(x) = \begin{cases} x + \alpha, & \text{if } x < 0 \\ max(2cosx, 2sinx), & \text{if } x \geq 0 \end{cases}$ If f is continuous at x = 0, then the value of α is equal to

A) 2

B) 3

C) 4

D) 1

E) 0

Correct Answer : Option A

54. If $[x]$ denotes the greatest integer less than or equal to x for $x \in \mathbb{R}$, then the value of $\lim\limits_{x \to 0^-} \left(2[x] - \dfrac{x}{|x|} \right)$ is equal to

A) 1

B) -1

C) -3

D) 3

E) 0

Correct Answer : Option B

55. If $y = sec(tan^{-1}x)$,then $\dfrac{dy}{dx}$ at $x = \sqrt{3}$ is equal to

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

B) $\dfrac{1}{2}$

C) 2

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

E) $2\sqrt{3}$

Correct Answer : Option D

56. Let $f(x) = \dfrac{\sqrt[3]{x^4}}{\sqrt[3]{x^2}}, x \neq 0$. Then the value of $f'(27)$ is equal to

A) $\dfrac{1}{9}$

B) $\dfrac{2}{9}$

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

D) $\dfrac{4}{9}$

E) $\dfrac{5}{9}$

Correct Answer : Option B

57. Let $f(x) = \begin{cases} 5x^2 + ax + 16, & \text{if } x < 2 \\ x^2, & if\, x \geq 2 \end{cases}$ is differentiable at $x = 2$, then the value of a is equal to

A) 16

B) -18

C) 32

D) -32

E) -16

Correct Answer : Option E

58. If $f(x) = \dfrac{\sqrt{2}\sin x}{\sqrt{1 + \cos 2x}}$, then $f'\left(\dfrac{\pi}{6}\right) =$

A) $\dfrac{1}{4}$

B) $\dfrac{2}{3}$

C) $\dfrac{4}{3}$

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

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

Correct Answer : Option C

59. Let $f(x) = \dfrac{1}{x^2}$ and let $u = f(x)f''(x)$. then $\dfrac{du}{dx} =$

A) $-36x^{-7}$

B) $36x^{-7}$

C) $42x^{-7}$

D) $-42x^{-7}$

E) $-30x^{-7}$

Correct Answer : Option A

60. The function $f(x) = 2\cos x - x + 3$ is

A) increasing in $(0, \pi)$

B) decreasing in $(0, \pi)$

C) increasing in $(0, \frac{\pi}{2})$ and decreasing in $(\frac{\pi}{2}, \pi)$

D) decreasing in $(0, \frac{\pi}{2})$ and increasing in , $(\frac{\pi}{2}, \pi)$

E) increasing in $(0, \frac{\pi}{4})$ and decreasing in $(\frac{\pi}{4}, \pi)$

Correct Answer : Option B

61. If $y = (x - 1)log_e(x - 1)$, then $\frac{d^2y}{dx^2}$ at $x = 3$ is

A) e

B) e^2

C) 3

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

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

Correct Answer : Option D

62. Let $f(x) = e^x(2x^2 + ax + 2 - a)$. If f has a local minimum at $x=2$. the value of a is equal to

A) -9

B) -8

C) -6

D) -11

E) 22

Correct Answer : Option A

63. If $e^x(y + 2\sqrt{1 + x}) = 5$, then $-\frac{dy}{dx}$ at (0,3) is

A) 2

B) -2

C) -3

D) 6

E) -6

Correct Answer : Option D

64. $\int \frac{1}{x(1+x^4)} dx$ is equal to

A) $\frac{1}{5} log_e | \frac{x}{1+x^4} | + C$

B) $\frac{1}{5} \log_e |1 + x^4| + C$

C) $\frac{1}{4} \log_e |1 + x^4| + C$

D) $\frac{1}{4} \log_e |\frac{x}{1+x^4}| + C$

E) $\frac{1}{4} \log_e |\frac{x^4}{1+x^4}| + C$

Correct Answer : Option E

65. $\int \frac{\sin 4\theta}{\sin 2\theta} d\theta =$

A) $\frac{\sin \theta}{2} + C$

B) $\cos 2\theta + C$

C) $2\sin 2\theta + C$

D) $\frac{\cos \theta}{2} + C$

E) $\sin 2\theta + C$

Correct Answer : Option E

66. $\int \frac{\sec^2(\sqrt{2x+5})}{\sqrt{2x+5}} dx =$

A) $2 \tan (\sqrt{2x+5}) + C$

B) $\frac{1}{2} \tan(\sqrt{2x+5}) + C$

C) $\tan (2x + 5) + C$

D) $\tan (\sqrt{2x+5}) + C$

E) $2 \tan (2x + 5) + C$

Correct Answer : Option D

67. $\int \frac{x}{5-x^2} dx =$

A) $\frac{-1}{2} \log_e |\frac{1}{5-x^2}| + C$

B) $\frac{1}{2} \log_e |5 - x^2| + C$

C) $-2\log_e |5 - x^2| + C$

D) $\frac{-1}{2} \log_e |5 - x^2| + C$

E) $2\log_e |\frac{1}{5-x^2}| + C$

Correct Answer : Option D

68. $\int \frac{e^x}{e^{-x}+3e^x} dx =$

A) $\frac{1}{6} \log_e |1+3e^{2x}| + C$

B) $\log_e |e^{-x}+3e^{2x}| + C$

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

D) $\frac{1}{3} \log_e |e^{-x}+3e^{2x}| + C$

E) $\log_e |1+3e^{2x}| + C$

Correct Answer : Option A

69. The value of $\int\limits_{-1}^{1} |x-3| \, dx$ is equal to

A) 5

B) 6

C) -5

D) -6

E) 0

Correct Answer : Option B

70. The area of the region bounded by $\frac{x^2}{16} + \frac{y^2}{25} = 1$ and the line segment joining (0,5) and (4, 0) in the first quadrant is

A) $10\pi - 5$

B) $5\pi - 8$

C) $4\pi - 10$

D) $4\pi - 8$

E) $5\pi - 10$

Correct Answer : Option E

71. $\int_0^2 \frac{x^4}{x^4+(2-x)^4} dx =$

A) 1

B) 2

C) 4

D) 8

E) 0

Correct Answer : Option A

72. The value of $\int\limits_0^{\pi/3} \frac{\tan t}{\cos t} dt$ is equal to

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

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

C) 2

D) -2

E) 1

Correct Answer : Option E

73. The general solution of the differential equation $(1 + y)dx - (1 - x)dy = 0$ is

A) $x^2 + y^2 + x - y = C$

B) $x + y - xy = C$

C) $x - y + xy = C$

D) $x - y - xy = C$

E) $x^2 - y^2 + x + y = C$

Correct Answer : Option C

74. The integrating factor of the differential equation $(1 + x^2)dy = (1 - 2xy)dx$ is

A) $x^2 + 1$

B) $log_e(x^2 + 1)$

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

D) $x(x^2 + 1)$

E) $log_e |x|$

Correct Answer : Option A

75. Consider the linear programming problem:

Maximize: $z = \alpha x + 6y$

Subject to the constraints

$3x + 2y \leq 60$

$x + 2y \leq 40$

$x, y \geq 0$

If every point in the line segment joining (20, 0) and (10, 15) is optimal solution of the L.P.P, then the value of α is equal to

A) 3

B) 4

C) 6

D) 8

E) 9

Correct Answer : Option E

76. The dimensional formula for the product of moment of inertia and the square of angular velocity is

A) MLT^{-2}

B) ML^2T^{-1}

C) ML^0T^{-2}

D) ML^2T^{-2}

E) MLT^{-1}

Correct Answer : Option D

77. The ratio of the distance of the sun from the earth to that of the moon from the earth is of the order of

A) 10^7

B) 10^3

C) 10^6

D) 10^8

E) 10^{-4}

Correct Answer : Option B

78. If a freely falling body from the top of a tower takes 3 s and 5 s to cross the 28th floor and 4th floor respectively, then the height difference between these floors is (g = 10 ms^{-2})

A) 80 m

B) 60 m

C) 100 m

D) 90 m

E) 70 m

Correct Answer : Option A

79. If θ is the angle of projection of an object for which the horizontal range is equal to the maximum height attained, then the value of tan θ is

A) $\sqrt{2}$

B) 1

C) 4

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

E) $\dfrac{1}{\sqrt{2}}$

Correct Answer : Option C

80. The velocity of a swimmer in the direction of flow of river is 10 kmh^{-1} and that against the flow of river is 6 kmh^{-1}. The velocity of the swimmer in still water in kmh^{-1} is

A) 6

B) 8

C) 7

D) 5

E) 9

Correct Answer : Option B

81. If a ball of mass 0.02 kg bowled by a bowler straight to a batsman is hit back with the same speed with an impulse of 2 Ns, then the speed of the ball bowled is

A) 20 ms^{-1}

B) 80 ms^{-1}

C) 50 ms^{-1}

D) 60 ms^{-1}

E) 40 ms^{-1}

Correct Answer : Option C

82. If f_s and f_k represent the coefficeints of static friction and kinetic friction of the relative motion between two surfaces in contact with area A , then

A) f_s depends on A

B) f_k depends on A

C) f_s and f_k are independent of A

D) f_k is greater than the maximum value of f_s

E) f_k opposes impending motion

Correct Answer : Option C

83. If the kinetic energy of a moving body reduces to 49 %, then its velocity is reduced to

A) 49 %

B) 70 %

C) 30 %

D) 25 %

E) 51 %

Correct Answer : Option B

84. The false statement is

A) Work energy theorem holds good in all inertial frames

B) Work energy theorem is not independent of Newton's second law

C) Work done is a scalar quantity

D) Work done by the friction over a closed path is zero

E) Work done by the friction on moving body is negative

Correct Answer : Option D

85. The ratio between the gravitational potential energies of 1 kg of mass on the surface of two planets having masses and radii in the ratio 1 : 2 and 1 : 3 respectively, is

A) 1 : 1

B) 2 : 3

C) 3 : 2

D) 9 : 4

E) 4 : 9

Correct Answer : Option C

86. With usual notations for a rigid body in rotational motion about a fixed axis, its

A) kinetic energy is $I\omega^2$

B) angular momentum is $I\omega$

C) work done is $\tau^2 \omega^2$

D) power is $\tau \omega^2$

E) angular velocity is $\dfrac{d\omega}{dt}$

Correct Answer : Option B

87. Four identical point masses are placed at the corners of a square ABCD and the centre of mass lies at the centre O of the square. If the mass at B is removed, then the centre of mass lies at the point

A) O

B) on OB

C) on OA

D) on OD

E) on OC

Correct Answer : Option D

88. If the moment of inertia of a solid sphere of mass M and radius R about its diameter is I, then that of another sphere of mass 2M and radius 2R about its diameter is

A) 2I

B) 4I

C) 8I

D) 16I

E) I

Correct Answer : Option C

89. If a satellite of mass M is spinning about its own axis and revolves around the earth in a circular orbit, then it does not have

A) moment of inertia

B) potential energy

C) rotational kinetic energy

D) vibrational energy

E) angular momentum

Correct Answer : Option D

90. If the ultimate strength and fracture points are far apart in a stress – strain curve of a material, then the material is said to be

A) ductile

B) brittle

C) perfectly elastic

D) non malleable

E) very hard

Correct Answer : Option A

91. Heat is conducted through a uniform rod ABC of length 1 m keeping the end A at 100°C. If the temperature at the point B at a distance 0.4m from the end A is 80°C and that at the other end is 40°C, then the ratio of heat conducted through AB to that through BC is

A) 3 : 4

B) 2 : 1

C) 1 : 2

D) 2 : 3

E) 1 : 1

Correct Answer : Option A

92. If a black body at a temperature T radiates the maximum energy at a wavelength λ_m then to radiate the maximum energy at the wavelength $\frac{\lambda_m}{3}$, its temperature should be

A) increased to 3T

B) increased to 9T

C) decreased to 3T

D) decreased to 9T

E) increased to √3T

Correct Answer : Option A

93. The amount of heat to be withdrawn from 3 kg of water at 0 °C to obtain 3 kg of ice at 0° C in an icemaker is (latent heat of fusion of ice is 80 kcal/kg)

A) 400 kcal

B) 160 kcal

C) 320 kcal

D) 80 kcal

E) 240 kcal

Correct Answer : Option E

94. If the heat supplied to an ideal gas is used up entirely to do work on the surrounding, then the process is called

A) isothermal compression

B) isothermal expansion

C) adiabatic compression

D) isobaric compression

E) isobaric expansion

Correct Answer : Option B

95. The product of the pressure P and volume V of an ideal gas in a container is related to the translational part of the internal energy, E as

A) E

B) $\sqrt{E}$

C) $\dfrac{2E}{3}$

D) $\dfrac{E}{3}$

E) $2\sqrt{E}$

Correct Answer : Option C

96. The mean free path of a molecule is inversely proportional to

A) its diameter

B) square of its diameter

C) square of the number of molecules

D) square root of the number of molecules

E) square root of its diameter

Correct Answer : Option B

97. If the period of the simple pendulum of length l is 5 second, then the period of the pendulum of length $\dfrac{l}{4}$ is

A) 3 s

B) 2 s

C) 2.5 s

D) 1.5 s

E) 4 s

Correct Answer : Option C

98. Two particles A and B move in concentric circles with radii in the ratio 2 : 1. If for every completion of one circle of A , B completes 5 circles , then the ratio of their respective orbital velocities is

A) 1 : 1

B) 1 : 2

C) 2 : 5

D) 5 : 2

E) 1 : 5

Correct Answer : Option C

99. If the ratio of the Young's modulii and densities of two rods of different materials are respectively, 3 : 2 and 3 : 1, then the ratio of the velocities of sound in the rods is

A) 1 : 2

B) 2 : 1

C) $\sqrt{2} : 1$

D) $1 : \sqrt{2}$

E) 1 : 3

Correct Answer : Option D

100. A conductor with an air core cavity inside, is charged to attain the surface charge density of σ. If E is the magnitude of electric field and V is the potential, then inside the cavity

A) $E \neq 0$

B) $V = 0$

C) $E \neq 0$ and $V = 0$

D) $V \neq 0$ and $E = 0$

E) $\sigma = 0$ and $E = 0$

Correct Answer : Option E

101. If the torque acting on an electric dipole when placed at an angle 30° with the direction of an uniform electric field is τ, then the torque acting on the same dipole when placed in the same field at an angle 45° is

A) 2τ

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

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

D) $\sqrt{2}\tau$

E) τ

102. Two identical isolated capacitors *A* and *B* are charged so that each has a charge of 4C . If a charge of -2C is added to *A* and + 2C to *B*, then the ratio of respective potentials is

A) 1 : 1

B) 1 : 2

C) 2 : 1

D) 3 : 1

E) 1 : 3

103. If τ is the average time between any two successive collisions for the electrons in a metal wire under the application of an electric field E, then the mobility μ of the electrons is

A) $\dfrac{Ee\tau}{m}$

B) $\dfrac{Ee\tau^2}{m}$

C) $\dfrac{e\tau^2}{m}$

D) $\dfrac{m\tau^2}{e}$

E) $\dfrac{e\tau}{m}$

104. The maximum current drawn from a battery of 12 V with internal resistance of 0.5 Ω is

A) 16 A

B) 12 A

C) 24 A

D) 30 A

E) 4 A

105. Three identical resistors are connected in the form of a triangular mesh ABC. If a battery of 12 V is connected across AB, then the ratio of the current flowing through AB to that through ACB is

A) 2 : 1

B) 1 : 1

C) 1 : 3

D) 3 : 1

E) 1 : 2

106. According to Biot-Savart's law, the magnetic field **B** is

A)   inversely proportional to the current

B)   produced by vector source$(\vec{Idl})$

C)   of short range

D)   directly proportional to the square of the distance

E)   independent of the distance

107. If a rectangular loop carrying a current I and area ab is placed such that a uniform magnetic field B is in the plane of the loop, then the magnitude of torque on it is

A)   IB ab

B)   IB ab/2

C)   IB

D)   IB/2

E)   2IB ab

108. The diamagnetic and paramagnetic materials at 300 K are respectively,

A)   Al and Mg

B)   Cu and Si

C)   Hg and Ca

D)   Li and Ag

E)   Cr and Pb

109. The mismatched pair regarding the induced emf is

A)   Eddy current : Induction furnace

B)   Transformer : Laminated core

C)   Induced emf : Biot – Savart law

D)   Ac generator : Electromagnetic induction

E)   Coaxial coils : Mutual inductance

110. If an electric bulb of resistance 400 Ω is connected to an ac source of peak voltage 282.8 V, then the electric power of the bulb is

A)   200 W

B)   150 W

C)   300 W

D)   100 W

E) 250 W

Correct Answer : Option D

111. The velocity of light in a medium of relative permittivity 2 and relative permeability 4.5 is (velocity of light in free space is c)

A) c

B) $\dfrac{c}{2}$

C) $\dfrac{c}{3}$

D) $\dfrac{c}{4}$

E) $\dfrac{c}{\sqrt{3}}$

Correct Answer : Option C

112. The distance of an object placed in front of a concave mirror of radius of curvature 24 cm that gives its magnification as 3 is

A) 8 cm

B) 16 cm

C) 12 cm

D) 24 cm

E) 32 cm

Correct Answer : Option B

113. The ratio of the speed of light in vacuum to that in a medium is called

A) luminous intensity

B) luminous flux

C) magnification factor

D) refractive index of the medium

E) transparency index

Correct Answer : Option D

114. In Young's double slit experiment using a source of wavelength λ interference bands are observed on a screen. If the separation between the slits alone is halved in this experiment, then the angular separation ω of the fringes on the screen becomes

A) 2ω

B) $\sqrt{2}\omega$

C) $\dfrac{\omega}{2}$

D) ω

E) $\dfrac{\omega}{\sqrt{2}}$

Correct Answer : Option A

115. If light waves of wavelengths λ and λ/3 are incident on the surface of a material, photoelectronsare emitted with maximum kinetic energy E and 4E respectively, then the work function of the material is

A) $\dfrac{hc}{2\lambda}$

B) $\dfrac{hc}{3\lambda}$

C) $\dfrac{hc}{\lambda}$

D) $\dfrac{3hc}{2\lambda}$

E) $\dfrac{2hc}{\lambda}$

Correct Answer : Option B

116. If 2E is the kinetic energy of a moving particle of mass m , then the wavelength of the de Broglie wave associated with it is

A) $\dfrac{h}{2mE}$

B) $\dfrac{h}{mE}$

C) $\dfrac{h}{2\sqrt{mE}}$

D) $\dfrac{h}{\sqrt{2}mE}$

E) $\dfrac{h}{4\sqrt{mE}}$

Correct Answer : Option C

117. If N is the initial number of atoms in a radioactive sample, then the number of atoms decayed after the five half life periods is

A) $\dfrac{31}{32}N$

B) $\dfrac{15}{16}N$

C) $\dfrac{7}{8}N$

D) $\dfrac{N}{32}$

E) $\dfrac{N}{16}$

Correct Answer : Option A

118. In a hydrogen atom, the transition of an electron from the energy level, $n_2 = \infty$ and $n_1 = 3$ is the

A)   shortest wavelength of Paschen series
B)   longest wavelength of Paschen series
C)   shortest wavelength of Balmer series
D)   longest wavelength of Balmer series
E)   shortest wavelength of Bracket series

Correct Answer : Option A

119. Semiconductors are

A)   having positive temperature coefficients
B)   having forbidden energy gap Eg > 3 eV
C)   made to conduct more by adding impurity elements
D)   placed in the VI group of elements in periodic table
E)   having electrons and ions as charge carriers

Correct Answer : Option C

120. In a full wave rectifier, for an input ac voltage

A)   the output voltage appears across the load for positive cycle only
B)   both diodes conduct during positive cycle
C)   both diodes conduct during negative cycle
D)   one diode is always forward biased and the other is always reverse biased
E)   a centre tapped transformer is used

Correct Answer : Option E

121. What is the mass of the substance 'X' required to prepare 250 mL of 0.5 molar aqueous solution? (Molar mass of 'X 'is 40 g mol^{-1})

A)   2 g
B)   4 g
C)   5 g
D)   10 g
E)   0.5 g

Correct Answer : Option C

122. A 150 watt bulb emits monochromatic light of wavelength 662 nm. How many number of photons emitted per second by the bulb?
(Planck's constant, h = 6.62 × 10^{-34} J s, c = 3 × 10^8 m s^{-1})

A) $4 \times 10^{20} s^{-1}$
B) $3 \times 10^{20} s^{-1}$
C) $6 \times 10^{20} s^{-1}$
D) $5 \times 10^{20} s^{-1}$

E) $1 \times 10^{20} s^{-1}$

Correct Answer : Option D

123. The orbital described by the quantum numbers n=4 and l = 2 is

A) 4s

B) 3d

C) 2d

D) 4f

E) 4d

Correct Answer : Option E

124. The correct order of metallic character of the following elements is

A) Na > Mg > Si > P

B) Mg > Na > Si > P

C) Na > Mg > P > Si

D) Si > P > Mg > Na

E) P > Si > Mg > Na

Correct Answer : Option A

125. Which of the following statement is incorrect about bond order?

A) Bond order is the number of bonds between the two atoms in a molecule.

B) Isoelectronic molecules and ions have identical bond orders.

C) Bond enthalpy decreases with increase in bond order.

D) Bond length decreases with increase in bond order.

E) Bond enthalpy increases with increase in bond order.

Correct Answer : Option C

126. Which of the following molecules have dsp^2 hybridisation?

(i) $[Ni(CN)_4]^{2-}$ (ii) BrF_5 (iii) $[Co(NH_3)_6]^{3+}$ (iv) $[CrF_6]^{3-}$ (v) $[Pt(Cl)_4]^{2-}$

A) (i) and (ii)

B) (i) and (iii)

C) (ii) and (iii)

D) (i) and (v)

E) (iii) and (v)

Correct Answer : Option D

127. What is the log K of the following reaction,

$2NH_{3(g)} + CO_{2(g)} \rightleftharpoons NH_2CONH_{2(aq)} + H_2O_{(l)}$ at 298K

If $\Delta rG° = $ - 11.4 kJ mol^{-1} and 2.303RT = 5.7 kJ mol^{-1}

A) 2.5

B) 1.5

C) 4

D) 3

E) 2

Correct Answer : Option E

What is the heat of the following reaction (in kJ mol^{-1})?

128. $Fe_2O_{3(s)} + 3H_{2(g)} \rightarrow 2Fe_{(s)} + 3H_2O_{(l)}$
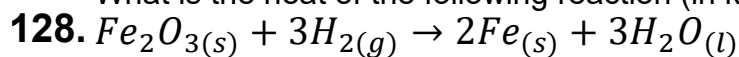
(Given: $\Delta_fH^\ominus$ ($H_2O_{(l)}$) = –285.83 kJ mol⁻¹, $\Delta_fH^\ominus$ ($Fe_2O_{3(s)}$) = –824.2 kJ mol⁻¹)

A) -33.29

B) +33.29

C) +3.33

D) -3.33

E) -30.29

Correct Answer : Option A

Which of the following reaction proceeds nearly to completion?

129.

Reaction	K_c value
A) $N_{2(g)} + O_{2(g)} \rightleftharpoons 2NO_{(g)}$ at 298 K	4.8×10^{-3}
B) $H_{2(g)} + Cl_{2(g)} \rightleftharpoons 2HCl_{(g)}$ at 300 K	4.0×10^{31}
C) Decomposition of H_2O into H_2 and O_2 at 500 K.	4.1×10^{-48}
D) Reaction of H_2 with I_2 to give HI at 700 K.	57.0
E) Gas phase decomposition of N_2O_4 to NO_2 at 298K.	4.64×10^{-3}

Correct Answer : Option B

Which of the following solutions of salts are neutral?

130. (i) KBr (ii) $NaNO_2$ (iii) KF (iv) NH_4NO_3 (v) NaCl

A) (ii) and (iii)

B) (i) and (iv)

C) (i) and (v)

D) (iv) and (v)

E) (iii) and (v)

Correct Answer : Option C

The molar conductivity (Λ_m) acetic acid is 78.1 S $cm^2 mol^{-1}$. Its degree of

131. dissociation (α) is

(Λ_m^0) for acetic acid= 390.5 S $cm^2 mol^{-1}$

A) 0.12

B) 0.40

C) 0.02

D) 0.20

E) 0.04

Correct Answer : Option D

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132. Which of the following reaction is used to prepare dihydrogen gas in the laboratory?

A) $2Fe_{(s)} + 3H_2O_{(l)} \underline{\Delta} \rightarrow Fe_2O_{3(s)} + 3H_{2(g)}$

B) $2Na_{(s)} + 2H_2O_{(l)} \rightarrow 2NaOH_{(aq)} + H_{2(g)}$

C) $Fe_{(s)} + 2HCl_{(aq)} \rightarrow FeCl_{2(aq)} + H_{2(g)}$

D) $Mg_{(s)} + 2H_2O_{(l)} \underline{\Delta} \rightarrow Mg(OH)_{2(s)} + H_{2(g)}$

E) $Ca_{(s)} + 2H_2O_{(l)} \rightarrow Ca(OH)_{2(aq)} + H_{2(g)}$

Correct Answer : Option C

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133. In which of the following solutions X-Y interactions are weaker than X-X or Y-Y interactions?

(Where, X and Y are pure components)

A) Bromoethane and Chloroethane

B) Carbon disulphide and Acetone

C) Chloroform and Acetone

D) Nitric acid and Water

E) Benzene and Toluene.

Correct Answer : Option B

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134. What is the half life period of the first order reaction whose rate constant is $2.31 \times 10^{-12}s^{-1}$

A) $3 \times 10^{11}s$

B) $3 \times 10^{12}s$

C) $6.3 \times 10^{-13}s$

D) $4 \times 10^{-13}s$

E) $3 \times 10^{-13}s$

Correct Answer : Option A

---

135. In the Arrhenius equation, $k = Ae^{-Ea/RT}$, which factor corresponds to the fraction of molecules

that have kinetic energy greater than activation energy ?

A) $e^{-Ea/RT}$

B) $e^{-Ea/R}$

C) $e^{-Ea/T}$

D) e^{-Ea}

E) $Ae^{-Ea\,/\,R}$

Correct Answer : Option A

136. Which of the following transition metal does not exhibit variable oxidation state?
A)   Copper
B)   Scandium
C)   Vanadium
D)   Nickel
E)   Cobalt

Correct Answer : Option B

137. The magnetic moment of a divalent ion in aqueous solution is 3.87 BM. The number of unpaired electrons present in it is
A)   4
B)   5
C)   3
D)   2
E)   1

Correct Answer : Option C

138. Chromite ore is
A) $FeCrO_4$
B) $FeCr_2O_3$
C) Cr_2O_4
D) $FeCr_2O_4$
E) $Fe_2Cr_2O_4$

Correct Answer : Option D

139. Which of the following pair of actinoids exhibit maximum oxidation state of +7?
A)   Th and Pa
B)   Cm and Bk
C)   Pa and Fm
D)   Pa and U
E)   Np and Pu

Correct Answer : Option E

140. The IUPAC name of $[Co(en)_3]_2(SO_4)_3)$ is
A)   tris(ethane-1,2-diamine)cobalt(III) sulphate
B)   bis(ethane-1,2-diamine)cobalt(III) sulphate
C)   bis(ethane-1,2-diamine)cobalt(II) sulphate

D)   tris(ethane-1,2-diamine)cobaltate(II) sulphate

E)   tris(ethylene-1,2-diamine)cobalt(III) sulphate

Correct Answer : Option A

141. The IUPAC name of the compound $HOCH_2(CH_2)_3CH_2COCH_3$ is

A)   7-Hydroxyheptan-2-one

B)   2-Oxoheptan-7-ol

C)   1-Hydroxyheptan-2-one

D)   5-Oxoheptan-2-ol

E)   6-Hydroxyheptan-3-one

Correct Answer : Option A

142. Which of the following is a electron donating group?

A) $-NO_2$

B) $-CH_3$

C) $-COOH$

D) $-CN$

E) $-OC_6H_5$

Correct Answer : Option B

143. Bromoethane on treatment with sodium metal in dry ethereal solution gives

A)   Ethanal

B)   Propane

C)   n-Butane

D)   n-Pentane

E)   n-Hexane

Correct Answer : Option C

144. The order of reactivity of the following compounds towards SN2 displacement reaction is
(i) $C_6H_5CH(CH_3)Br$ (ii) $C_6H_5CH(C_6H_5)Br$ (iii) $C_6H_5C(CH_3)(C_6H_5)Br$ (iv) $C_6H_5CH_2Br$

A)   (ii) > (i) > (iii) > (iv)

B)   (iv) > (ii) > (i) > (iii)

C)   (ii) > (iii) > (i) > (iv)

D)   (i) > (ii) > (iii) > (iv)

E)   (iv) > (i) .> (ii) > (iii)

Correct Answer : Option E

145. The major product obtained in the dehydration of ethanol in the presence of H_2SO_4 at 413 K is

A) Ethanoic acid

B) Ethanal

C) Ethyne

D) Ethoxyethane

E) Ethane

Correct Answer : Option D

146. The product formed in the following reaction is
$$CH_3 - CH_2 - CH(CH_3) - CH(CH_3) - ONa + C_2H_5Br \rightarrow$$

A) 2-Ethoxy-3-methylpentane

B) 2-Ethoxy-4-methylpentane

C) 1-Ethoxy-2-methylpentane

D) 2-Ethoxy-2-methylpentane

E) 5-Ethoxy-3-methylpentane

Correct Answer : Option A

147. Which of the following compound has the highest boiling point?

A) n-Butane

B) Propan-1-ol

C) Methoxy methane

D) Propanal

E) Acetone

Correct Answer : Option B

148. Which of the following acid is highly acidic?

A) Fluoroacetic acid

B) Formic acid

C) Dichloroacetic acid

D) Benzoic acid

E) Acetic acid.

Correct Answer : Option C

149. Which of the following is Hinsberg's reagent?

A) Nitrous acid

B) Ethanolic potassium hydroxide

C) Benzenesulphonyl chloride

D) 2,4-Dinitrophenyl hydrazine

E) Ammoniacal silver nitrate

Correct Answer : Option C

150. The activation energy for the hydrolysis of sucrose by the enzyme sucrose is (in kJ mol^{-1})

A) 7.14

B) 6.22

C) 8.60

D) 1.5

E) 2.15

Correct Answer : Option E