PROVISIONAL ANSWER KEY

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1. Let A, B, C be any three finite sets.
If $n(A \times B) = 160, n(B \times C) = 80$ and $n(C \times A) = 200$, then $n(A) =$

A) 10

B) 18

C) 16

D) 12

E) 20

Correct Answer : Option E

2. Let $f(x) = x^2 - 10x - 19, x \in \mathbb{R}$ .Then the inverse image of 5, $f^{-1}(5) =$

A) $\{-2, -12\}$

B) $\{-2, 12\}$

C) $\{2, -12\}$

D) $\{2, 12\}$

E) ϕ

Correct Answer : Option B

3. Let $f(x) = cosx$. Then the value of $\frac{1}{2}[f(x+y) + f(y-x)] - f(x)f(y)$ is equal to

A) 2

B) -2

C) 1

D) -1

E) 0

Correct Answer : Option E

4. Let f(x)=$\log_5 x$(x>0) and g(x)=$\cos^{-1} x$(−1≤x≤1). Then the domain of g∘f is

A) (0,1]

B) [−1,α)

C) [0,α)

D) $\left[\frac{1}{5}, 5\right]$

E) $[-1, 5]$

Correct Answer : Option D

5. Let $z = 1 + \frac{1}{i}$.Then the value of z^4 is equal to

A) 4
B) -4
C) $1 - i$
D) $1 + i$
E) i

Correct Answer : Option B

6. The modulus of the complex number $\left(2\sqrt{2} + i2\sqrt{2}\right)^2$ is equal to

A) 64
B) 4
C) 32
D) 8
E) 16

Correct Answer : Option E

7. If $z + \bar{z} = 6$ and $z - \bar{z} = 4i$, then $|z|^2$=

A) 36
B) 16
C) 15
D) 13
E) 9

Correct Answer : Option D

8. Let z=$\frac{2-i}{\alpha + i}$, where α is a real number. If $4Re(z) = 3Im(\bar{z})$ then the value of α is

A) 5
B) -5
C) 3
D) 2
E) -2

Correct Answer : Option D

9. In a G.P., the first and third terms are 4 and 8 respectively. Then the 21^{st} term is

A) 4012
B) 4064
C) 4098

D) 2048

E) 4096

Correct Answer : Option E

10. Let $a_1, a_2, a_3, \ldots$ be in G.P. If $a_1 \cdot a_2 \cdot a_3 = 64$ and $a_1 \cdot a_2 \cdot a_3 \cdot a_4 \cdot a_5 = 32$, then common ratio is

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

B) $\frac{1}{8}$

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

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

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

Correct Answer : Option D

11. The general term of a sequence is $t_n = \frac{n(n+6)}{n+4}$,n$= 1, 2, 3, \ldots .$ If $t_n = 5$, then the value of n is

A) 2

B) 3

C) 4

D) 5

E) 6

Correct Answer : Option C

12. The product of first 5 terms of a G.P., whose terms are increasing, is 32. The third term of the G.P. is

A) 2

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

C) 4

D) $\frac{1}{8}$

E) 8

Correct Answer : Option A

13. Let $\alpha = \sum_{k=0}^{5} {}^{10}C_{2k}$ and $\beta = \sum_{k=0}^{4} {}^{10}C_{2k+1}$.Then $\alpha - \beta$ is equal to

A) 32

B) 64

C) 128

D) 256

E) 0

Correct Answer : Option E

14. If $\alpha = {}^{n}C_{r}$ and $\beta = {}^{n}C_{r-1}$, then $1 + \frac{\alpha}{\beta}$ is equal to

A) $\frac{n+1}{r-1}$

B) $\frac{n+1}{r}$

C) $\frac{n-1}{1}$

D) $\frac{n-r+1}{r}$

E) $\frac{n+1}{r+1}$

Correct Answer : Option B

15. If ${}^{11}P_{r} = 7920$, then the value of r is equal to

A) 7

B) 6

C) 5

D) 4

E) 3

Correct Answer : Option D

16. In the binomial expansion of $(2x + \alpha)^{8}$, the co-efficients of x^{2} and x^{3} are equal. Then the value of α is equal to

A) 2

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

C) 4

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

E) 3

Correct Answer : Option C

17. Let $A = \{0, 2, 4, 6, 8\}$. The number of 5-digit numbers that can be formed using the digits in A without replacement, is

A) 120

B) 96

C) 88

D) 64

E) 32

Correct Answer : Option B

18. Let A be a 3×3 matrix and let B=3A . If |A|=5 , then the value of $\frac{|\text{adj } B|}{|3A|}$ is equal to

A) 27
B) 125
C) 25
D) 135
E) 81

Correct Answer : Option D

19. If $\begin{pmatrix} -1 & 2 \\ 3 & -4 \\ -5 & 6 \end{pmatrix}\begin{pmatrix} 7 \\ 8 \end{pmatrix}=\begin{pmatrix} \alpha \\ \beta \\ 13 \end{pmatrix}$, then the value of $\alpha+\beta$ is equal to

A) -18
B) 18
C) 21
D) -21
E) -2

Correct Answer : Option E

20. If the matrix $\begin{bmatrix} 8-k & 2 \\ -2 & 4-k \end{bmatrix}$ is singular, then the value of k is equal to

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

Correct Answer : Option A

21. The following system of equations

$$x+y+z=1$$
$$2x+3y-mz=2$$
$$3x+5y+3z=3$$

has no unique solution. Then the value of m is equal to

A) 3
B) 5
C) 2
D) -2
E) -3

Correct Answer : Option D

22. The set of all x satisfying the inequalities $-4 \leq 2 - 3x < 7$ is

A) $\left(2, \frac{5}{3}\right)$

B) $\left[2, \frac{5}{3}\right)$

C) $\left[\frac{-11}{3}, 2\right]$

D) $\left(\frac{-5}{3}, 2\right]$

E) $\left[\frac{-7}{3}, 2\right)$

Correct Answer : Option D

23. $-5 < x \leq -1$ implies $-21 < 5x + 4 \leq \mathrm{b}$, the least value of b is

A) 5

B) -5

C) -4

D) 4

E) -1

Correct Answer : Option E

24. $tan15^\circ + tan75^\circ =$

A) $\sqrt{5} + 1$

B) 2

C) $\sqrt{7} - 1$

D) 4

E) 0

Correct Answer : Option D

25. If $x + z = 2y$ and $y = \frac{\pi}{4}$,then tan x tan y tan z=

A) 1

B) $tan(x - y)$

C) $tan(z - y)$

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

E) 0

Correct Answer : Option A

26. If $\sin x + \sin y = a$,$\cos x + \cos y = b$ and $x + y = \frac{2\pi}{3}$, then the value of $\frac{a}{b}$ is equal to

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

B) $2\sqrt{3}$

C) $\sqrt{3}$

D) $4\sqrt{3}$

E) $\frac{\sqrt{3}}{6}$

Correct Answer : Option C

27. If $\sin \alpha = \frac{12}{13}$, where $\frac{\pi}{2} < \alpha < \frac{3\pi}{2}$ then the value of $\tan \alpha$ is equal to

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

B) $\frac{13}{5}$

C) $\frac{-12}{5}$

D) $\frac{-13}{5}$

E) $\frac{-1}{12}$

Correct Answer : Option C

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

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

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

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

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

E) 0

Correct Answer : Option C

29. if 5 $sin^{-1}\alpha + 3cos^{-1}\alpha = \pi$,then α is equal to

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

B) 1

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

D) -1

E) 0

Correct Answer : Option C

30. If $\theta = cot^{-1}\sqrt{\frac{1-x}{1+x}}$, then $\sec^2\theta$

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

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

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

D) x

E) $2x$

Correct Answer : Option C

31. The straight line $ax + by + c = 0$ passes through the point $(-10, 7)$.If the line is perpendicular to $11x - 7y = 13$, then the value of c is equal to

A) 8

B) -7

C) 13

D) -13

E) 5

Correct Answer : Option B

32. Let ABC be an equilateral triangle. If the coordinates of A are $(-2, 2)$ and the side BC is along the line $x + y = 6$, then the length of the side of the triangle is

A) $2\sqrt{3}$

B) $3\sqrt{2}$

C) $4\sqrt{6}$

D) $6\sqrt{6}$

E) $2\sqrt{6}$

Correct Answer : Option E

33. The focus of the parabola $x^2 - 4x + 8y + 4 = 0$ is

A) $(-2, -2)$

B) $(1, 1)$

C) $(2, 1)$

D) $(2, -2)$

E) $(1, 2)$

Correct Answer : Option D

34. A circle touches the $x-$ axis at (9, 0). If it also touches the straight line $y = 14$, then the equation of the circle is

A) $(x-9)^2 + (y-7)^2 = 49$

B) $x^2 + (y-7)^2 = 49$

C) $(x-9)^2 + y^2 = 49$

D) $(x-9)^2 + (y-7)^2 = 81$

E) $(x-7)^2 + (y-9)^2 = 49$

Correct Answer : Option A

35. The length of major axis and minor axis of an ellipse are, respectively, m and n. If $m^2 - n^2$ =45 and the eccentricity of the ellipse is $\frac{\sqrt{5}}{3}$, then the length of the major axis is

A) 13

B) 6

C) 12

D) 18

E) 9

Correct Answer : Option E

36. The vertex of the parabola $4y = x^2 - 6x + 17$ is

A) $(3, 2)$

B) $(4, 3)$

C) $(4, 2)$

D) $(3, 7)$

E) $(7, 2)$

Correct Answer : Option A

37. The eccentricity of the hyperbola $\frac{(2x-6)^2}{2} - \frac{(4y+7)^2}{16} = 1$ is

A) $\sqrt{5}$

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

C) $\sqrt{3}$

D) $\sqrt{10}$

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

Correct Answer : Option C

38. Let $\vec{a}+\vec{b}=\lambda\,\hat{i}+16\hat{j}-18\hat{k}$ and $\vec{a}-\vec{b}=2\hat{i}+8\hat{j}+\lambda\,\hat{k}$. If $\vec{a}+\vec{b}$ is perpendicular to $\vec{a}-\vec{b}$,then $|\vec{a}\,|=$

A) $5\sqrt{13}$

B) $\sqrt{174}$

C) $\sqrt{184}$

D) $13\sqrt{5}$

E) $\sqrt{194}$

Correct Answer : Option E

39. If $|\vec{a}\,|=12$ and the projection of $\vec{a}$ on $\vec{b}$ is $6\sqrt{3},$ then the angle between $\vec{a}$ and $\vec{b}$ is

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

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

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

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

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

Correct Answer : Option B

40. Let $\vec{a}=6\hat{i}+2\hat{j}+3\hat{k}$. If $\vec{b}$ is parallel to $\vec{a}$ and $\vec{a}.\vec{b}=\frac{49}{2}$, then $|\vec{b}|=$

A) 49

B) 7

C) 14

D) $7\sqrt{2}$

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

Correct Answer : Option E

41. If $|\vec{a}+\vec{b}\,|=\frac{\sqrt{14}}{2}$ where $\vec{a}$ and $\vec{b}$ are unit vectors, then the value of $|\vec{a}+\vec{b}\,|^2-|\,\vec{a}-\vec{b}|^2$ is equal to

A) 3

B) 4

C) $\sqrt{5}$

D) $\sqrt{7}$

E) 7

Correct Answer : Option A

42. Let α , β and γ be the angles made by a straight line with the x-axis, y-axis and z-axis respectively. If $cos\,\alpha + cos\,\beta + cos\,\gamma = \frac{5}{3}$,then the value of $cos\,\alpha\ cos\,\beta + cos\,\beta\ cos\,\gamma + cos\,\gamma\ cos\,\alpha$ is equal to

A) $\frac{11}{3}$

B) $\frac{8}{9}$

C) $\frac{11}{9}$

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

E) $\frac{7}{9}$

Correct Answer : Option B

43. A straight line passing through (6,1,3) meets the line $\frac{x-1}{2} = \frac{y}{1} = \frac{z-2}{3}$ at Q. If the lines are perpendicular to each other, then the coordinates of Q are

A) (2,1,3)

B) (1,2,3)

C) (3,1,5)

D) (2,-1,3)

E) (-1,2,3)

Correct Answer : Option C

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

A) $\cos^{-1}\left(\frac{\sqrt{2}}{6}\right)$

B) $\cos^{-1}\left(\frac{\sqrt{6}}{6}\right)$

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

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

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

Correct Answer : Option D

45. A straight line passes through the points (10,8, 6) and (13,9, 4) . A unit vector parallel to this line is

A) $\frac{1}{\sqrt{17}}(3\hat{\imath}+2\hat{\jmath}+2\hat{k})$

B) $\frac{1}{\sqrt{6}}(\hat{\imath}+\hat{\jmath}-2\hat{k})$

C) $\frac{1}{\sqrt{14}}(3\hat{\imath}+\hat{\jmath}+2\hat{k})$

D) $\frac{1}{\sqrt{17}}(3\hat{\imath}+\hat{\jmath}+2\hat{k})$

E) $\frac{1}{\sqrt{14}}(3\hat{\imath}+\hat{\jmath}-2\hat{k})$

Correct Answer : Option E

46. A box contains 4 red and 6 white marbles. Two successive draws of 3 balls are made without replacement. The probability that in the first draw, all the 3 balls are white and in the second draw, all the 3 balls are red, is

A) $\frac{2}{105}$

B) $\frac{1}{70}$

C) $\frac{4}{105}$

D) $\frac{1}{105}$

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

Correct Answer : Option A

47. Let A and B be two events. If $P(A \mid B)$ = 0.4, P (A | B ')= 0.7 and $P(B)$ = 0.7, then $P($ $A)$ =

A) 0.44

B) 0.54

C) 0.49

D) 0.5

E) 0.65

Correct Answer : Option C

48. The standard deviation of the numbers -3, 0, 3, 8 is

A) $\frac{\sqrt{60}}{2}$

B) $\frac{\sqrt{62}}{2}$

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

D) $\frac{\sqrt{66}}{2}$

E) $\frac{\sqrt{67}}{2}$

Correct Answer : Option D

49. An unbiased die is tossed until 5 appears. If X denotes the number of tosses required, then $\frac{P(X=2)}{P(X=5)}$ =

A) $\frac{25}{36}$

B) $\frac{125}{216}$

C) $\frac{216}{125}$

D) $\frac{36}{25}$

E) $\frac{216}{25}$

Correct Answer : Option C

50. $\lim_{x\to 0} \frac{x^2}{\sqrt{2}-\sqrt{1+cosx}}$ is equal to

A) $4\sqrt{2}$

B) 4

C) $2\sqrt{2}$

D) $\sqrt{2}$

E) 0

Correct Answer : Option A

51. Let $f(x)=\begin{cases}\frac{\tan\alpha x+(\beta+1)\tan x}{x}, & \text{for } x\neq 0\\ 5, & \text{for } x=0\end{cases}$ be continuous at $x=0$. Then the value of $\alpha+\beta$ is equal to

A) 2

B) 3

C) 4

D) 5

E) 6

Correct Answer : Option C

52. The domain of the function $f(x)=\sqrt{x-3}+4\sqrt{5-x}$ is

A) [1,2]

B) [2,4]

C) [3,5]

D) [3,20]

E) [12,20]

Correct Answer : Option C

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

A) $\sqrt{3}$

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

C) $2\sqrt{3}$

D) 1

E) 0

Correct Answer : Option D

54. $\lim_{x \to 0} \frac{\sqrt{cos^2x+3}-\sqrt{cos^2x+sinx+3}}{x}$=

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

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

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

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

E) -1

Correct Answer : Option B

55. If $f(x) = |x^2 + x - 6|$ is not differentiable at $x = a$ and $x = b$, then $a^2 + b^2 =$

A) 11

B) 14

C) 12

D) 13

E) 16

Correct Answer : Option D

56. Let $f(x) = |\sin 3x| - |\cos 3x|$, where $\frac{\pi}{6} \le x \le \frac{\pi}{3}$. Then the value of $f'\left(\frac{\pi}{4}\right)$ is equal to

A) $-3\sqrt{2}$

B) $3\sqrt{2}$

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

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

E) 0

Correct Answer : Option A

57. Let $h(x) = f\left(\sqrt{g(x)}\right)$. If $f'(3) = 6, g'(3) = 3$ and $g(3) = 9$, then the value of $h'(3)$ is equal to

A) 1
B) 3
C) 6
D) 9
E) 18

Correct Answer : Option B

58. Let $f(x) = \left(cos^2 x\right)(a + \cos x)$.If $f'\left(\frac{\pi}{3}\right)$=0 then the value of a is equal to

A) $\frac{\sqrt{3}}{2}$
B) $\frac{3}{4}$
C) $\frac{-3}{4}$
D) $\frac{-3}{2}$
E) -1

Correct Answer : Option C

59. If $y = tan^{-1}\left(x^2 - x\right)$, then $\frac{dy}{dx}$=

A) $\frac{2x}{1+\left(x^2-x\right)^2}$
B) $\frac{2x-1}{1+\left(x^2-x\right)^2}$
C) $\frac{2x-1}{1-\left(x^2-x\right)^2}$
D) $\frac{-2x+1}{1+\left(x^2-x\right)^2}$
E) $(2x-1)\left(1+(x^2-x)^2\right)$

Correct Answer : Option B

60. The function $f(x) = x^2(x-2)$ is strictly decreasing in

A) (1,2)
B) (-1.1)
C) $\left(\frac{4}{3}, \infty\right)$

D) (-1,0)

E) $\left(0,\frac{4}{3}\right)$

Correct Answer : Option E

61. The surface area of a solid hemisphere is increasing at the rate of $8\ cm^2$ / sec (retaining its shape). Then the rate of change of its volume (in cm^3 / sec), when the radius is $5cm$, is

A) $\frac{50}{3}$

B) $\frac{20}{3}$

C) $\frac{40}{3}$

D) $\frac{25}{3}$

E) $\frac{80}{3}$

Correct Answer : Option C

62. The function $f(x) = 2x^3 - 3x^2 - 36x + 28$ is increasing in

A) $(-\infty, -1] \cup [3, \infty)$

B) $(-\infty, -2] \cup [3, \infty)$

C) $(-\infty, -2] \cup [5, \infty)$

D) $(-\infty, -5] \cup [3, \infty)$

E) $(-\infty, -2] \cup [8, \infty)$

Correct Answer : Option B

63. Let $f(x) = x^2 + \alpha x + \beta$. If f has a local minimum at (2, 6), then $f(0)$ is equal to

A) 10

B) -6

C) 8

D) -8

E) 6

Correct Answer : Option A

64. $\int \frac{2x^2+4x+3}{x^2+x+1} dx =$

A) $2log_e \mid x^2 + x + 1 \mid + C$

B) $2xlog_e \mid x^2 + x + 1 \mid + C$

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

D) $2x + log_e \mid x^2 + x + 1 \mid + C$

E) $x + 2log_e \mid x^2 + x + 1 \mid + C$

Correct Answer : Option D

65. $\int \frac{sin^{-1}x}{\sqrt{1-x^2}} dx =$

A) $\frac{1}{2}(sin^{-1}x)^2 + C$

B) $-(sin^{-1}x)\sqrt{1-x^2} + C$

C) $(sin^{-1}x)\sqrt{1-x^2} + x + C$

D) $(sin^{-1}x)\sqrt{1-x^2} - x + C$

E) $(sin^{-1}x)^2 + C$

Correct Answer : Option A

66. $\int x^7\left(x^8+1\right)^{-3/4} dx =$

A) $\frac{1}{2}\left(1+\frac{1}{x^8}\right)^{1/4} + C$

B) $4\left(1+\frac{1}{x^8}\right)^{1/4} + C$

C) $\left(x^8+1\right)^{1/4} + C$

D) $4\left(x^8+1\right)^{1/4} + C$

E) $\frac{1}{2}\left(x^8+1\right)^{1/4} + C$

Correct Answer : Option E

67. $\int e^x \sec x(1 + tanx) dx$

A) $e^x sec^2 x + C$

B) $e^x tanx + C$

C) $e^x \sec x + C$

D) $e^x tan^2 x + C$

E) $e^x \sec\ x\ tanx + C$

Correct Answer : Option C

68. $\int e^x(x^2-2)cos\left(e^x(x^2-2x)\right)$ dx=

A) $sin\left(e^x(x^2-2x)\right) + C$

B) $sin\left(e^x(x^2-2)\right) + C$

C) $x^2e^xsin\left(e^x(x^2-2)\right)+C$

D) $e^xsin\left(e^x(x^2-2)\right)+C$

E) $e^xsin\left(x^2e^x-2xe^x\right)+C$

Correct Answer : Option A

69. If $\int_{-\sqrt{3}}^{1}(-6x^2+18)dx=\alpha+\beta\sqrt{3}$ then the value of $\alpha+\beta$ is equal to

A) 12

B) 18

C) 24

D) 28

E) 32

Correct Answer : Option D

70. The value of $\int_{\pi/10}^{2\pi/5}\frac{cot^3x}{1+cot^3x}dx$ is equal to

A) $\frac{\pi}{20}$

B) $\frac{\pi}{10}$

C) $\frac{3\pi}{20}$

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

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

Correct Answer : Option C

71. The area of the region bounded by $y=x^{5/2}$ and $y=x$ (in square units) is

A) $\frac{3}{7}$

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

C) $\frac{3}{14}$

D) $\frac{5}{14}$

E) $\frac{4}{7}$

Correct Answer : Option C

72. $\int_0^1 \frac{3^{2x}}{3^{2x}+1} dx =$

A) $\frac{log_e 5}{2log_e 3}$

B) $\frac{log_e 5}{9log_e 3}$

C) $\frac{log_e 5}{3log_e 3}$

D) $\frac{2log_e 5}{3log_e 3}$

E) $\frac{2log_e 5}{9log_e 3}$

Correct Answer : Option A

73. If $y(x) = 2y'(x), y(x) \geq 0$ and $y(0) = e^2$ then $y(x) =$

A) $e^{x/2} + 2$

B) e^{2x}

C) $e^{x/2}$

D) $e^2 e^{x/2}$

E) $e^{2x} + 2$

Correct Answer : Option D

74. The integrating factor of the differential equation $sinx\ dy = \frac{1}{2}(sin2x + 2y\ cosx)dx$ is

A) sec x

B) sin x

C) tan x

D) cos x

E) cosec x

Correct Answer : Option E

75. In the graphical method of a linear programming problem, the optimal solution lies

A) at the centre of the feasible region

B) at a corner point of the feasible region

C) at a point on the x-axis
D) at the origin
E) at the point where the objective function is zero

Correct Answer : Option B

76. If 2.7×10^{-6} is added to 4.3×10^{-5}, giving due regard to significant figures, the result will be

A) 4.57×10^{-5}
B) 4.6×10^{-5}
C) 4.5×10^{-5}
D) 7.0×10^{-5}
E) 4.57×10^{-6}

Correct Answer : Option B

77. $[L^0M^0T^{-1}]$ is the dimensional formula for

A) angular velocity
B) activity of radioactive substance
C) time period of oscillation
D) half life period of a radioactive substance
E) impulse of the force

Correct Answer : Option B

78. If the velocity (in ms^{-1}) of a particle at any instant t is given by $2.0\hat{i}+3.0t\hat{j}$ then the magnitude of its acceleration (in ms^{-2}) is

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

Correct Answer : Option B

79. Among the following pairs of vectors, if the resultant of two vectors can never have magnitude 4 units, then the magnitudes of the vectors are

A) 2 units and 2 units
B) 1 unit and 3 units
C) 5 units and 1 unit
D) 7 units and 2 units
E) 5 units and 8 units

Correct Answer : Option D

80. The ratio of angular speeds of the minute hand and second hand of a watch is

A) 1 : 12

B) 1 : 6

C) 1 : 60

D) 12 : 1

E) 60 : 1

Correct Answer : Option C

81. When a body is thrown vertically upwards, from the ground, the time of ascent is t_1 and the time of descent is t_2 in the absence of air resistance. Then t_1 is equal to

A) $2t_s$

B) $0.5t_2$

C) $0.25t_2$

D) t_2

E) $4t_2$

Correct Answer : Option D

82. When a person of mass m climbs up or down a rope with uniform speed v , the tension in the rope is (g = acceleration due to gravity)

A) mg

B) $m(g+v)$

C) $m(g-v)$

D) mgv

E) $m(\frac{g}{v})$

Correct Answer : Option A

83. A body of mass 0.2 kg travels along a straight line path with velocity $v = (2x^2 + 2)m\ s^{-1}$. The net work done by the driving force during its displacement from $x = 0$ to $x = 2m$ is

A) 5.4 J

B) 4.8 J

C) 9.6 J

D) 10.8 J

E) 6.5 J

Correct Answer : Option C

84. Two colliding particles after collision move together. Then the collision is

A) partial elastic collision

B) perfectly inelastic collision

C) perfectly elastic collision

D) partial inelastic collision

E) collision without any transfer of energy

Correct Answer : Option B

85. A solid cylinder, a solid sphere, a disc and a ring are released from the top of an inclined plane (frictionless) so that they slide down the plane without rolling. The maximum acceleration down the plane is

A) for the disc

B) for the solid cylinder

C) for the solid sphere

D) for the ring

E) the same for all

Correct Answer : Option E

86. When a particle is rotating with constant angular momentum, then

A) torque acting on it is constant

B) force acting on it is constant

C) linear momentum is constant

D) torque acting on it is zero

E) linear velocity is constant

Correct Answer : Option D

87. Two objects of masses 1 kg and 2 kg are moving towards each other with accelerations 2 ms^{-2} and 3 ms^{-2} respectively on a smooth horizontal surface. The acceleration of centre of mass of the system is

A) $\left(\frac{4}{3}\right)ms^{-2}$ in in the direction of acceleration of 2 kg mass

B) $\left(\frac{2}{3}\right)ms^{-2}$ in in the direction of acceleration of 1 kg mass

C) $\left(\frac{2}{3}\right)ms^{-2}$ in in the direction of acceleration of 2 kg mass

D) $\left(\frac{4}{3}\right)ms^{-2}$ in in the direction of acceleration of 1 kg mass

E) zero

Correct Answer : Option A

88. There is a mine of depth about 3.0 km. Conditions prevailing in this mine as compared to those at the surface of earth are

A) higher air pressure, lower acceleration due to gravity

B) higher air pressure, higher acceleration due to gravity

C) lower air pressure, higher acceleration due to gravity

D) lower air pressure, lower acceleration due to gravity

E) same air pressure and acceleration due to gravity

Correct Answer : Option A

89. The period of revolution of the planet A around the sun is 27 times that of another planet B. If the distance of A from the sun is x times greater than that of B from the sun, then the value of x is

A) 8
B) 4
C) 9
D) 3
E) 12

Correct Answer : Option A

90. The work done in splitting a spherical liquid drop of radius 'a' into eight liquid droplets of the same size is (surface tension of the liquid = S)

A) $8\pi\ Sa^2$
B) $\pi\ Sa^2$
C) $2\pi\ Sa^2$
D) $4\pi\ Sa^2$
E) $16\pi\ Sa^2$

Correct Answer : Option D

91. vessel containing a liquid of density d moves down with an acceleration $a(a < g)$. The pressure due to the liquid at a depth of h below the free surface of the liquid is

A) hgd
B) $h(g-a)d$
C) $h(g+a)d$
D) $h\left(\frac{g}{a}\right)d$
E) $h\left(\frac{a}{g}\right)d$

Correct Answer : Option B

92. An incompressible liquid flows through a horizontal pipe having cross-sectional areas A at one end and $2A$ at the other end. If the pressure and velocity of the liquid at the lower cross- sectional end are *P* and *v,* then those values at the other end are (density of the liquid =ρ)

A) $\frac{v}{2}, P+\frac{3}{8}\rho\ v^2$
B) $v, P+\frac{1}{8}\rho\ v^2$

C) $\frac{v}{4}, P + \frac{1}{4}\rho\ v^2$

D) $v, P + \frac{1}{2}\rho\ v^2$

E) $2P + \rho\ v^2$

Correct Answer : Option A

93. Efficiency of a Carnot engine

A) depends on the nature of the working substance

B) does not depend on the nature of the working substance

C) depends only on the temperature of the source T^1

D) depends only on the temperature of the sink T^2

E) does not depend on both temperature of the source T^1 and temperature of the sink T^2

Correct Answer : Option B

94. A cylindrical vessel contains 16 kg of gas at a pressure of 1 atmosphere. A certain amount of gas is taken out and the pressure of gas in the vessel becomes 0.75 atmosphere. The amount of gas taken out is

A) 2.5 kg

B) 4 kg

C) 7.5 kg

D) 8.25 kg

E) 10 kg

Correct Answer : Option B

95. The number of degrees of freedom for monoatomic gas molecule is

A) 3

B) 4

C) 5

D) 7

E) 1

Correct Answer : Option A

96. Pick out the INCORRECT STATEMENT

A) Internal energy of an ideal gas depends only on its temperature

B) Change in the internal energy in a cyclic process is not zero

C) Change in the internal energy of a gas depends only on its initial and final states

D) Internal energy depends upon state of matter

E) Change in the internal energy in a cyclic process is zero

Correct Answer : Option B

97. The distance travelled by a particle executing linear S.H.M. from its mean position in 2s is equal to $\frac{1}{\sqrt{2}}$ times its amplitude. Then its time period in seconds is

A) 10
B) 8
C) 9
D) 12
E) 16

Correct Answer : Option E

98. Time periods of pendulums *A* and *B* are *T* and $\frac{5T}{2}$. If they start executing S.H.M. at the same time from the mean position, the phase difference between them after the bigger pendulum has completed one oscillation is

A) $\pi / 4$
B) $(\pi / 2)$
C) $\pi / 8$
D) $\pi / 16$
E) π

Correct Answer : Option E

99. string of length l is divided into three segments of lengths l_1, l_2 and l_3 with the fundamental frequencies n_1, $n_2$and n_3 respectively. The original fundamental frequency of
the string n is given by

A) $n = n_1 + n_2 + n_3$
B) $\frac{1}{n} = \frac{1}{n_1} + \frac{1}{n_2} + \frac{1}{n_3}$
C) $\sqrt{n} = \sqrt{n_1} + \sqrt{n_2} + \sqrt{n_3}$
D) $\frac{1}{\sqrt{n}} = \frac{1}{\sqrt{n_1}} + \frac{1}{\sqrt{n_2}} + \frac{1}{\sqrt{n_3}}$
E) $n = n_1 n_2 n_3$

Correct Answer : Option B

100. The inward and outward electric flux from a closed surface are $6 \times 10^4 NM^2C^{-1}$ and $3 \times 10^4 NM^2C^{-1}$. Then the net charge (in coulomb) inside the closed surface is

A) $-6 \times 10^4 \varepsilon_0$
B) $6 \times 10^4 \varepsilon_0$

C) $3 \times 10^4 \varepsilon_0$

D) $9 \times 10^4 \varepsilon_0$

E) $-3 \times 10^4 \varepsilon_0$

Correct Answer : Option E

101. In a circuit, the capacitance C is connected. The effective capacitance of the circuit can be reduced by

A) introducing a metal plate between the plates of the capacitor

B) introducing a dielectric slab between the plates

C) reducing the potential difference between the plates

D) connecting another capacitor in series with it

E) connecting another capacitor in parallel with it

Correct Answer : Option D

102. A given charge Q is divided into two parts which are then kept at a distance *'d'* apart. The electrostatic force between them will be maximum if the two parts are

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

B) $\frac{7Q}{8}$ and $\frac{Q}{8}$

C) $\frac{Q}{3}$ and $\frac{2Q}{3}$

D) $\frac{5Q}{6}$ and $\frac{Q}{6}$

E) $\frac{Q}{2}$ each

Correct Answer : Option E

103. The dependence of drift velocity v_d on the electric field *E*, for which Ohm's law is obeyed is

A) $v_d \propto E^2$

B) $v_d \propto E$

C) $v_d \propto \sqrt{E}$

D) $v_d \propto \frac{1}{E}$

E) $v_d \propto \frac{1}{E^2}$

Correct Answer : Option B

104. If an equilateral triangle is made of a uniform wire of resistance *R*, then the equivalent resistance between the ends of a side is

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

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

C) $\frac{R}{9}$

D) $\frac{2R}{9}$

E) $\frac{R}{6}$

Correct Answer : Option D

105. When $'n'$ identical cells are connected in parallel,

A) net voltage increases

B) net current increases

C) net voltage decreases

D) net current decreases

E) total internal resistance increases

Correct Answer : Option B

106. In a cyclotron, if the frequency of the accelerating field is doubled, then the radius of the charged particle moving in a circular path will be

A) doubled

B) quadrupled

C) the same

D) halved

E) reduced to one fourth of the original radius

Correct Answer : Option C

107. A galvanometer of resistance 100Ω gives a full scale deflection for a current of 1mA through it. The resistance required to convert it into a voltmeter which can read upto 2 V is

A) 1175 Ω

B) 1200 Ω

C) 1525 Ω

D) 1900 Ω

E) 2025 Ω

Correct Answer : Option D

108. If a magnetic material has magnetic susceptibility $\chi = -0.5$, then its relative magnetic permeability μ_r and the type of material is

A) 0, diamagnetic

B) 2, ferromagnetic

C) 1, paramagnetic
D) –1, ferromagnetic
E) 0.5, diamagnetic

Correct Answer : Option E

109. The self-inductance of an air core solenoid is *L*. If the number of turns in the solenoid is doubled, keeping all other factors constant, then its self-inductance will be

A) L
B) $\frac{L}{2}$
C) $2L$
D) $4L$
E) $8L$

Correct Answer : Option D

110. An alternating current having the peak value $10\sqrt{2}A$ is used to heat a metal wire. To produce the same heating effect, the constant current required is

A) $10\sqrt{2}A$
B) 5A
C) 14A
D) 7A
E) 10A

Correct Answer : Option E

111. If $v_r, v_X \, and \, v_v$ are the speeds of gamma rays, X-rays and visible light respectively in vacuum, then

A) $v_g > v_v > v_X$
B) $v_g < v_v < v_X$
C) $v_g = v_v = v_X$
D) $v_g > v_v < v_X$
E) $v_X < v_g < v_v$

Correct Answer : Option C

112. When a ray of light moves from one medium to another medium,

A) its frequency remains unchanged
B) its frequency alone changes
C) its wavelength remains unchanged
D) both its frequency and wavelength change
E) its velocity remains constant

Correct Answer : Option A

113. The Brewster's angle i_B for any interface should lie between

A) 30° and 45°

B) 45° and 90°

C) 0° and 30°

D) 0° and 90°

E) 30° and 60°

Correct Answer : Option B

114. In an Young's double slit experiment, the band width of the fringes observed is β , when light of wave length λ is used. With same experimental set up, to double the band width of the fringes, the wave length of light required is

A) λ

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

C) 2λ

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

E) $\frac{\lambda}{8}$

Correct Answer : Option C

115. Pick out the INCORRECT statement from the following :
In photoelectric phenomenon,

A) the value of stopping potential is the same for radiations of all frequencies

B) the stopping potential is more negative for the incident radiation of higher frequency

C) the value of saturation current depends on the intensity of incident radiation

D) the value of saturation current is independent of frequency of incident radiation

E) the emission of electrons is instantaneous

Correct Answer : Option A

116. If λ be the wavelength of any electromagnetic radiation, the de-Broglie wavelength of its quantum (photon) is

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

B) λ

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

D) 2λ

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

Correct Answer : Option B

117. The half-life periods of two radioactive materials A and B are 1500 years and 1200 years respectively. If their mean life periods are τ_A and τ_B respectively, then the value of the ratio $\frac{\tau_A}{\tau_B}$

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

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

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

D) $\frac{5}{7}$

E) $\frac{2}{5}$

Correct Answer : Option A

118. The greatest wavelength of the radiation that will ionize unexcited hydrogen atom is

A) 1820 Å

B) 450 Å

C) 910 Å

D) 700 Å

E) 1400 Å

Correct Answer : Option C

119. An alternating voltage of 250 V, 50 Hz is applied to a full wave rectifier. If the internal resistance of each diode is 10Ω and the load resistance is $5k\,\Omega$, the peak value of output current is

A) 0.05 A

B) 0.07 A

C) 0.02 A

D) 0.03 A

E) 0.04 A

Correct Answer : Option B

120. The reverse biasing in a junction diode,

A) increases the number of majority charge carriers

B) increases the number of minority charge carriers

C) reduces the number of minority charge carriers

D) decreases the potential barrier

E) increases the potential barrier

Correct Answer : Option E

121. The density of 3 M aqueous solution of a solute 'X' is 1.86 g mL^{-1} . The molality of the solution is (Molar mass of solute 'X' is 120 g mol^{-1})

A) 3m
B) 4m
C) 2m
D) 5m
E) 1m

Correct Answer : Option C

122. The Vividh Bharati station of All India Radio, Kozhikode, broadcasts on a frequency of 1500 kHz. What is the wavelength of the electromagnetic radiation emitted by transmitter?(c = 3 × $10^8 ms^{-1}$)

A) 200 m
B) 300 m
C) 100 m
D) 250 m
E) 150 m

Correct Answer : Option A

123. Which of the following experimental phenomenon is explained by the wave nature of electromagnetic radiation?

A) Black-body radiation
B) Photoelectric effect
C) Diffraction
D) Variation of heat capacity of solids as a function of temperature
E) Line spectra of atoms with reference to hydrogen

Correct Answer : Option C

124. Which of the following pair of oxides is neutral?

A) Al_2O_3 and Na_2O
B) Al_2O_3 and As_2O_3
C) Cl_2O_7 and Na_2O
D) Cl_2O_7 and Al_2O_3
E) CO and N_2O

Correct Answer : Option E

125. The correct increasing order of dipole moment of $NF_3, H_2S, CHCl_3$ and NH_3 molecules is

A) $NF_3 < H_2S < CHCl_3 < NH_3$
B) $NH_3 < H_2S < CHCl_3 < NF_3$

C) $NF_3 < CHCl_3 < H_2S < NH_3$

D) $NH_3 < CHCl_3 < H_2S < NF_3$

E) $CHCl_3 < H_2S < NF_3 < NH_3$

Correct Answer : Option A

126. Choose the **INCORRECT** pair of ***MOLECULE*** and its **SHAPE** among the following:

A) SF_4 Seesaw

B) BrF_5 Trigonal bipyramidal

C) NH_3 Trigonal pyramidal

D) XeF_4 Square planar

E) ClF_3 T-shape

Correct Answer : Option B

127. In the reaction 3/2 $O_{2(g)} \rightarrow O_{3(g)}$, the value of $\Delta_r G^{\Theta}$ at 298 K is approximately ($K_p = 10^{-30}$ and $2.303RT = 5.7kJmol^{-1}$)

A) 171 kJ mol^{-1}

B) 191 kJ mol^{-1}

C) -171 kJ mol^{-1}

D) -191 kJ mol^{-1}

E) 100 kJ mol^{-1}

Correct Answer : Option A

128. Which of the following has least mean multiple bond enthalpy (in kJ mol^{-1}) at 298 K?

A) $N \equiv N$

B) $C \equiv N$

C) C = C

D) $C \equiv O$

E) C = N

Correct Answer : Option C

129. Which of the following can act as Lewis acid?

A) H_2O

B) HO^-

C) F^-

D) NH_3

E) $AlCl_3$

Correct Answer : Option E

130. The concentration of hydrogen ions in a sample of soft drink is $2\times10^{-4}\text{mol}\,lit^{-1}$. Its pH value is (log 2 = 0.3010)

A) 4.369
B) 3.699
C) 2.369
D) 5.301
E) 3.301

Correct Answer : Option B

131. Which of the following is the correct order of conductivity (in S m^{-1})?

A) Fe < Na < Cu < Ag
B) Fe < Cu < Na < Ag
C) Ag < Na < Cu < Fe
D) Ag < Cu < Na < Fe
E) Na < Fe < Cu < Ag

Correct Answer : Option A

132. 'Layer Test' is used to identify

A) Bromide
B) Fluoride
C) Potassium
D) Water
E) Chloride

Correct Answer : Option A

133. Which of the following solvent has highest value of Molal elevation constant, K_b?

A) Cyclohexane
B) Carbon disulphide
C) Carbon tetrachloride
D) Acetic acid
E) Chloroform

Correct Answer : Option C

134. The initial concentration of N_2O_5 in the first order reaction, $N_2O_{5(g)} \rightarrow 2NO_{2(g)} + ½\ O_{2(g)}$, was $1.68\times10^{-2}\text{mol}\ L^{-1}$ at 310 K. The concentration of N_2O_5 after 10 minutes was $0.84\times10^{-2}\text{mol}\,L^{-1}$. What is the rate constant of the reaction at 310 K ? (log 2 = 0.3010)

A) 0.0693 min^{-1}

B) 0.693 min^{-1}

C) 6.93 min^{-1}

D) 0.0639 min^{-1}

E) 0.0963 min^{-1}

Correct Answer : Option A

135. Which of the following statement is not true about a catalyst?

A) It catalyses the spontaneous reactions

B) A small amount of the catalyst can catalyse the large amount of reactants.

C) It does not alter the Gibbs energy of a reaction.

D) It catalyses the non-spontaneous reactions.

E) It does not change the equilibrium constant of a reaction.

Correct Answer : Option D

136. The most common oxidation states of chromium are

A) +2,+7

B) +3,+6

C) +2,+4

D) +2,+5

E) +3,+5

Correct Answer : Option B

137. Which of the following statement is true about potassium permanganate?

A) It is isostructural with $KClO_3$.

B) It is paramagnetic in nature.

C) It oxidizes oxalates to carbon monoxide.

D) The structure of permanganate ion is square planar.

E) It is prepared by fusion of MnO_2 with an alkali metal hydroxide and an oxidising agent.

Correct Answer : Option E

138. The type of sulphide formed by Lanthanoids is

A) LnS_3

B) LnS_2

C) LnS

D) Ln_2S_3

E) Ln_2S

Correct Answer : Option D

139. In which of the following compound, Mn has +7 oxidation state?

A) $MnOF$

B) MnO_2F

C) MnO_3F_2

D) $MnOF_2$

E) MnO_3F

Correct Answer : Option E

140. Which of the following is a heteroleptic complex?

A) $[Co(NH_3)_6]^{3+}$

B) $[Fe(CN)_6]^{4-}$

C) $[Co(SCN)_4]^{2-}$

D) $[Co(NH_3)_4Cl_2]^{+}$

E) $[Co(CN)_6]^{3-}$

Correct Answer : Option D

141. Which of the following technique is used to separate chloroform and aniline?

A) Fractional distillation

B) Distillation under reduced pressure

C) Steam distillation

D) Continuous extraction

E) Distillation

Correct Answer : Option E

142. In Kolbe's electrolytic method, when sodium acetate is electrolysed, the gases generated at anode are

A) ethane and H_2

B) H_2 and CO_2

C) methane and ethane

D) ethane and CO_2

E) methane and H_2

Correct Answer : Option D

143. The number of sigma (σ) and pi (π) bonds present in 3-Methylbut-1-ene are respectively

A) 1 and 14

B) 18 and 2

C) 16 and 2

D) 17 and 1

E) 14 and 1

Correct Answer : Option E

144. The order of reactivity of the following compounds towards S_N2 displacement reaction is
(i) 2-Bromo-2-methylbutane (ii) 1-Bromopentane (iii) 2-Bromopentane

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

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

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

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

E) (iii) > (ii) > (i)

Correct Answer : Option C

145. The IUPAC name of phenyl isopentyl ether is

A) 3-Methtylbutoxybenzene

B) 2-Methylbutoxybenzene

C) 2-Methylphenoxybutane

D) 4-Methylbutoxybenzene

E) 1-Methylbutoxybenzene

Correct Answer : Option A

146. Phenol on treatment with chloroform in the presence of NaOH, a -CHO group is introduced at ortho position of benzene ring. The reaction is known as

A) Kolbe's reaction

B) Reimer-Tiemann reaction

C) Gattermann-Koch reaction

D) Stephen reaction

E) Sandmeyer reaction

Correct Answer : Option B

147. Toluene on treatment with chromic oxide in presence of acetic anhydride at 273 - 283 K gives compound(X). Compound(X) on hydrolysis with aqueous acid gives compound(Y). The compounds (X) and (Y) are respectively

A) Benzylidene diacetate and phenol

B) Benzylalcohol and benzene

C) Benzylidene diacetate and benzaldehyde

D) Benzene and phenol

E) Benzaldehyde and phenol

Correct Answer : Option C

148. Fehling's reagent is a mixture of

A) aqueous $CuSO_4$ and ammonical $AgNO_3$ solution

B) aqueous $CuSO_4$ and 2,4-DNP

C) aqueous KOH and ammonical $AgNO_3$ solution

D) aqueous $CuSO_4$ and alkaline sodium potassium tatarate

E) aqueous KOH and alkaline sodium potassium tatarate

Correct Answer : Option D

149. The order of basic strength of following amines is
(i) CH_3NH_2 (ii) $(C_2H_5)_2NH$ (iii)$C_6H_5NH_2$ (iv)$C_6H_5NHCH_3$

A) (ii) < (i) < (iv) < (iii)

B) (iii) < (iv) < (ii) < (i)

C) (ii) < (iii) < (iv) < (i)

D) (i) < (ii) < (iii) < (iv)

E) (iii) < (iv) < (i) < (ii)

Correct Answer : Option E

150. The disease caused by the deficiency of riboflavin is

A) Cheilosis

B) Rickets

C) Beri beri

D) Scurvy

E) Xerophthalmia

Correct Answer : Option A