CUSAT 2019

Solved Paper

Question 1

The function $f(x) = \sin\left(\frac{\pi x}{n!}\right) - \cos\left(\frac{\pi x}{(n+1)!}\right)$ is

Options:

A. not periodic

B. periodic, with period 2n !

C. periodic, with period 2(n + 1) !

D. constant

Answer: C

Solution:

Solution:

Question 2

If $\Delta(n) = \begin{vmatrix} x^n & \sin x & \cos x \\ n! & \sin\frac{n\pi}{2} & \cos\frac{n\pi}{2} \\ \alpha & \alpha^2 & \alpha^3 \end{vmatrix}$

If then the value of $\frac{d^n}{dx^n} - [\Delta(x)]$ at x = 0 is

Options:

A. -1

B. 0

C. 1

D. 2

Answer: B

Solution:

Solution:

Question 3

If $i = \sqrt{-1}$, then he value of i^{21} is

Options:

A. 1

B. -1

C. i

D. $-i$

Answer: C

Solution:

Solution:

Question 4

The value of $\begin{vmatrix} 1 & 0 & 0 & 0 & 0 \\ 2 & 2 & 0 & 0 & 0 \\ 4 & 4 & 3 & 0 & 0 \\ 5 & 5 & 5 & 4 & 0 \\ 0 & 0 & 0 & 0 & 5 \end{vmatrix} =$

Options:

A. 5!

B. 6!

C. $1.2^2 \cdot 3 \cdot 4^3 \cdot 5 \cdot 6^4$

D. $1.2^2 \cdot 3^3 \cdot 4^4$

Answer: A

Solution:

Solution:

Question 5

Which of the following statements are correct?

(i) If $\lim_{x \to a} \frac{f(x) - f(a)}{x - a}$ exists, then f is differentiable at a
(ii) If f is continuous at a, then f is differentiable at a
(iii If limit of f at x = a exists, then f is differentiable at a)
(iv) If f is differentiable at a, then f is continuous at a

Options:

A. i and ii

B. ii and iii

C. iii and iv

D. i and iv

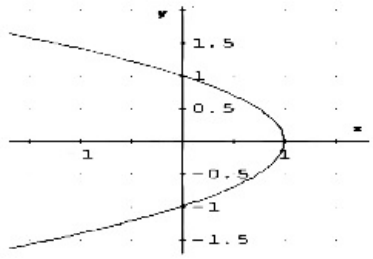
Answer: D

Solution:

Solution:

Question 6

The function corresponding to ti graph shown below is r. w is



Options:

A. $y^2 = (1 - x)$

B. $y^2 = (x - 1)$

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

D. $y^2 = (1 + x)$

Answer: A

Solution:

Solution:

Question 7

$\lim_{x \to 0} \left(\frac{a^x - b^x}{x} \right) =$

Options:

A. $\log \left(\frac{a}{b} \right)$

B. $\log \left(\frac{b}{a} \right)$

C. $\frac{b}{a}$

D. $\log a^b$

Answer: A

Solution:

Solution:

Question 8

Let $f(x) = x^2 - 1$ and $g(x) = 4x + 2$. The composition of two functions $(f \circ g)|x|$ is given by

Options:

A. $8x^2 + 8x + 3$

B. $16x^2 + 16x + 3$

C. $4x^2 - 2$

D. $4x^2 + 2$

Answer: B

Solution:

Solution:

Question 9

The partial fraction decomposition of $f(x) = \frac{x^4 + 10x^2 + 3x^2 + 36}{(x-1)(x^2+1)}$ is of the form

Options:

A. $\frac{A}{x-1} + \frac{Bx + C}{x^2 + 1} + \frac{Cx + D}{(x^2 + 1)^2}$

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

C. $\frac{A}{x-1}+\frac{B}{x^2+1}+\frac{Cx+D}{(x^2+1)^2}$

D. $\frac{A}{x-1}+\frac{Bx+C}{x^2+1}+\frac{\Gamma}{(x^2+1^{'2}.}$

Answer: A

Solution:

Solution:

Question 10

The equation $|z-i| = |z+i| = k$, represents a hyperbola, if

Options:

A. $0 < k < 2$

B. $k < 0$

C. $k > 2$

D. $0 < |k| < 2$

Answer: D

Solution:

Solution:

Question 11

$\log_3 \log \sqrt{\sqrt{7\sqrt{7}}}$ is equal to

Options:

A. $3\log_2 7$

B. $\log_7 2$

C. $1-3\log_7 2$

D. $1-3\log_2 7$

Answer: C

Solution:

Solution:

Question 12

If $\sin^2\theta = \frac{1}{4}$ and $0 < \theta < 90^\circ$, then the value of $\tan\theta$ is equal to

Options:

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

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

C. 1

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

Answer: D

Solution:

Solution:

Question 13

The sum of all three digit numbers which are odd is

Options:

A. 247500

B. 155700

C. 175500

D. 156500

Answer: A

Solution:

Solution:

Question 14

The $(n + 1)^{th}$ differentiation of an n^{th} order polyomial is

Options:

A. zero

B. a polynomial of order n

C. a non-zero constant

D. a polynomial of or'. 2

Answer: A

Solution:

Solution:

Question 15

Last two digits of the natural number 19^{9^4} is

Options:

A. 99

B. 39

C. 20

D. 19

Answer: D

Solution:

Solution:

Question 16

If $\int_a^b f(x)\,dx = a + 2b$, then $\int_a^b |f(x) + 5|\,dx$ = ??

Options:

A. a + 2b + 5

B. 5b − 5a

C. 7b − 4a

D. 7b − 6a

Answer: C

Solution:

Solution:

Question 17

The number of ways that a circle can be made out of 6 black and 4 white men standing on a ring, so that all the white men come together is

Options:

A. 8564

B. 8640

C. 8644

D. 8665

Answer: B

Solution:

Solution:

Question 18

If $f(9) = 9$ and $f'(9) = 4$, then $\lim_{x \to 9} \frac{\sqrt{f(x)} - 3}{\sqrt{x} - 3}$ is equal to

Options:

A. 2

B. -2

C. -4

D. 4

Answer: D

Solution:

Solution:

Question 19

The equation $z\bar{z} + 2(z + \bar{z}) - 1 = 0$ represents

Options:

A. a hyperbola

B. a straight line

C. an ellipse

D. a circle

Answer: D

Solution:

Solution:

Question 20

Let f be a polynomial T T the second derivative of f (e^x) is

Options:

A. $f'(e^2)$

B. $f''(e^x)e^{2x} + f'(e^x)e^x$

C. $f''(e^x)e^x) + f'(e^x)$

D. $f''(e^x)e^{2x} + f'(e^x)$

Answer: B

Solution:

Solution:

Question 21

The eccentricity of the hyperbola whose length of the latus rectum is equal to 8 and the length of its conjugate axis is equal! to half of the distance between its foci, is

Options:

A. $\sqrt{3}$

B. 4 / 3

C. 4 / $\sqrt{3}$

D. 2 / $\sqrt{3}$

Answer: D

Solution:

Solution:

Question 22

$\int [\sin(\log x) + \cos(\log x)]\,dx$ is equal to

Options:

A. $x\cos(\log x) + c$

B. $\sin(\log x) + c$

C. $\cos(\log x) + c$

D. $x\sin(\log x) + c$

Answer: D

Solution:

Solution:

Question 23

Thousand tickets are sold in a lottery in which . here is one top prize of Rs.500, four prizes of Rs.100 each and five prizes of Rs. 10 each. A ticket costs Rs.1. The expected gain when you buy a ticket is

Options:

A. Rs. 2

B. -0.25 of a rupee

C. -0.5 of a rupee

D. Rs.1

Answer: C

Solution:

Solution:

Question 24

If $f : R \to R$ and $g : R \to R$ are one to one real valued functions, then the value of the integral $\int_{-\pi}^{\pi} [f(x) + f(-x)]\,[(g(x) - g(-x)]\,dx$ is

Options:

A. $-\pi$

B. π

C. 1

D. 0

Answer: D

Solution:

Solution:

Question 25

If E (X), = 276 and Variance of X = 20, then the value of E (X) is

Options:

A. 0

B. 16

C. 20

D. 256

Answer: B

Solution:

Solution:

Question 26

$\lim_{x \to \frac{\pi}{4}} \frac{1-\tan x}{1-\sqrt{2}\sin x}$ =

Options:

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

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

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

D. 2

Answer: D

Solution:

Solution:

Question 27

Let f (x) = sin $\frac{1}{x}$, x ≠ 0. Then f (x) can be continuous at x = 0

Options:

A. if f (0) = 1

B. if f (0) = 0

C. if f (0) = −1

D. for no definite value of f (0)

Answer: D

Solution:

Solution:

Question 28

If one of the diameters f the circle, given by the equation $x^2 + y^2 + 4x + 6y - 12 = 0$, is a chord of a circle S, whose centre is at (−3, 2), then the radius of S is

Options:

A. 10

B. $5\sqrt{2}$

C. $5\sqrt{3}$

D. 5

Answer: C

Solution:

Solution:

Question 29

Let f (−x) = f (x). Then f ′(x) must be

Options:

A. an even function

B. an odd function

C. a periodic function

D. neither even nor odd

Answer: B

Solution:

Solution:

Question 30

Let u be a vector coplanar with the vectors a = 2i + 3j − k and b = j + k If u is perpendicular to a and u · b = 24, then $|u|^2$ is equal to

Options:

A. 84

B. 336

C. 315

D. 256

Answer: B

Solution:

Solution:

Question 31

The expression of d y/ dx of the function $y = a^{x^{-1}}$ is

Options:

A. $\frac{y^2}{x(1 - y \log x)}$

B. $\frac{y^2 \log y}{x(1 - y \log x)}$

C. $\frac{y^2 \log y}{x(1 - y \log x \log y)}$

D. $\frac{y^2 \log y}{x(1 + y \log x \log y)}$

Answer: C

Solution:

Solution:

Question 32

The fixed point P on the curve $^{y} = x^{2} - 4x + 5$ such that the tangent at P is perpendicular to the line $x + 2y - 7 = 0$ is given by

Options:

A. (1, 2)

B. (2, 1)

C. (3, 2)

D. (2, 3)

Answer: C

Solution:

Solution:

Question 33

If the tangent at $^{(1, 7)}$ to the curve $x^{2} = y - 0$ touches the circle $x^{2} + y^{2} + 10x + 12y + c = 0$, then the value of c is

Options:

A. 85

B. 195

C. 185

D. 95

Answer: D

Solution:

Solution:

Question 34

Let y = y(x) be the solution of the differential equation

$\sin x \frac{dy}{dx} + y \cos x = 4x$, $x \in (0, \pi)$. If $y\left(\frac{\pi}{2}\right) = 0$, then $y\left|\frac{\pi}{0}\right|$ is equal to

Options:

A. $-\frac{4}{9}\pi^2$

B. $\frac{4}{9\sqrt{3}}\pi^2$

C. $-\frac{8}{9\sqrt{3}}\pi^2$

D. $-\frac{8}{9}\pi^2$

Answer: D

Solution:

Solution:

Question 35

The value of b for which the function $f(x) = \sin x - bx + c$ is decreasing in the interval $(-\infty, \infty)$ is given by

Options:

A. $b < 1$

B. $b > 1$

C. $b \geq 1$

D. $b \leq 1$

Answer: B

Solution:

Solution:

Question 36

The least value of $f(x) = \frac{x^3}{3} - abx$ occurs at x =

Options:

A. G.M. of a, b

B. A.M. of a, b

C. H.M. of a, b

D. square of a and b

Answer: A

Solution:

Solution:

Question 37

Let a = j − k and c = i − j − k. Then the vector b satisfying a × b + c = 0 and a □ b = 3 is

Options:

A. $-i + j - 2k$

B. $2i - j + 2k$

C. $i - j - 2k$

D. $i + j - 2k$

Answer: A

Solution:

Solution:

Question 38

If f (a + x) = f (x), then $\int_0^{na} f(x)\,dx$, where n ∈ N , is equal to

Options:

A. $(n-1)\int_0^a f(x)\,dx$

B. $n\int_0^a f(x)\,dx$

C. $\int_0^{(n-1)} f(x)\,dx$

D. $\int_0^{na/2} f(x)\,dx$

Answer: B

Solution:

Solution:

Question 39

The area of the region bounded by the curves $y = x^2$ and $x = y^2$ is

Options:

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

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

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

D. 3

Answer: A

Solution:

Solution:

Question 40

The differential equation of the family of circles with centre on the x axis is

Options:

A. $y\frac{d^2y}{dx^2} + \frac{dy}{dx})^2 + 1 = 0$

B. $\frac{d^2y}{dx^2} + \left|\frac{dy}{dx}\right|^2 + 1 = 0$

C. $y\frac{d^2y}{dx^2} - \left(\frac{dy}{dx}\right)^2 + 1 = 0$

D. $y\frac{d^2y}{dx^2} + \frac{dy}{dx} + 1 = 0$

Answer: A

Solution:

Solution:

Question 41

The value of the integral $\int_0^1 e^x \, dx$ lies in the interval

Options:

A. (0, 1)

B. $(-1, 0)$

C. (1, e)

D. $(-1, e)$

Answer: C

Solution:

Solution:

Question 42

The equation of a plane passing through the line of intersection of the planes $x + 2y + 3z = 2$ and $x - y + z = 3$ and at distance $\frac{2}{\sqrt{3}}$ from the point $(3, 1, -1)$ is

Options:

A. $5x - 11y + z = 17$

B. $\sqrt{2}x + y = 3\sqrt{2} - 1$

C. $x + y + z = \sqrt{3}$

D. $x - \sqrt{2}y = 1 - \sqrt{2}$

Answer: A

Solution:

Solution:

Question 43

The integrating factor of the differential equation $\frac{dy}{dx} + y \tan x = \sec x$ is

Options:

A. secx

B. $\tan x$

C. $\sin x$

D. $\cos x$

Answer: A

Solution:

Solution:

Question 44

Consider the system of equations $x - 2y + 3z = -1; -x + y - 2z = k; x - 3y + 4z = 1$. STATEMENT-1: The system of equations has no solution for $k \neq 3$ and

STATEMENT -2: The determinant $\begin{vmatrix} 1 & 3 & -1 \\ -1 & -2 & k \\ 1 & 4 & 1 \end{vmatrix}$ **$\neq 0$, for $k \neq 3$.**

Then

Options:

A. Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1

C. Statement-1 is True and Statement-2 is False

D. Statement-1 is False and Statement-2 is True

Answer: A

Solution:

Solution:

Question 45

Seven people seat themselves indiscriminately at round table. The probability that two distinguished persons will be next to each other is

Options:

A. 1 / 3

B. 1 / 2

C. 1 / 4

D. 1 / 8

Answer: A

Solution:

Solution:

Question 46

For a normal curve, the greatest ordinate is

Options:

A. $2 \cdot \pi\sigma$

B. $\sigma\sqrt{2\pi}$

C. $\frac{1}{\sqrt{2\pi\sigma}}$

D. $\frac{1}{\sigma\sqrt{2\tau}}$

Answer: D

Solution:

Solution:

Question 47

If lines $\frac{x-1}{-3} = \frac{y-2}{2k} = \frac{z-3}{2}$ and $\frac{x-1}{3k} = \frac{y-5}{1} = \frac{z-6}{-5}$ are mutually perpendicular, then k is equal to

Options:

A. $-10 / 7$

B. $-7 / 10$

C. -10

D. -7

Answer: A

Solution:

Solution:

Question 48

If A is an 3 × 3 non-singular matrix such that $AA^t = A^tA$ and $B = A^{-1}A^t$, then BB^t equals

Options:

A. I + B

B. I

C. B^{-1}

D. $(B^{-1})^t$

Answer: B

Solution:

Solution:

Question 49

If the median of 21 observations is 40 and if the observations greater than the median are increased by 5 , then the median of the new data will be

Options:

A. 45

B. 40

C. $40 + \frac{50}{21}$

D. $40 - \frac{50}{21}$

Answer: B

Solution:

Solution:

Question 50

The area (in sq. units) of the quadrilateral formed by the tangents at the end points of the latus rectum to the ellipse $\frac{x^2}{9} + \frac{y^2}{5} = 1$, is

Options:

A. 18

B. 27

C. 27 / 2

D. 27 / 4

Answer: B

Solution:

Solution:

Question 51

Let A and B be two events such that $P(\overline{A \cup B}) = \frac{1}{6}$, $P(A \cap B) = \frac{1}{4}$ and $P(\overline{A}) = \frac{1}{4}$, where $\overline{A}$ stands for the complement of the event A. Then the events A and B are

Options:

A. mutually exclusive and independent

B. equally likely but not independent

C. independent but not equally likely

D. independent and equally likely

Answer: C

Solution:

Solution:

Question 52

Solution of the equation $\sin x - \cos x = \sqrt{2}$ is

Options:

A. $2n\pi + \frac{3\pi}{4}$, $n \in \mathbb{Z}$

B. $2n\tau$, $n \in \mathbb{Z}$

C. $2 . \pi$, $n \in \mathbb{Z}$

D. $(2n + 1), T$, $n \in \mathbb{Z}$

Answer: A

Solution:

Solution:

Question 53

Which of the following functions is not one to one?

Options:

A. $f : \mathbb{R} \to \mathbb{R}, f(x) = 2x + 5$

B. $f : [0, \tau] \to [-1, 1], f(x) = \cos x$

C. $f : -\pi / 2, \pi / 2 \to [1, 7], f(x) = 3\sin x + 4$

D. $f : \mathbb{R} \to [-1, 1], \quad f(x) = \sin x$

Answer: D

Solution:

Solution:

Question 54

If $u = e^{\left|\frac{x^2}{y^2}\right|} + e^{\left|\frac{y^2}{x^2}\right|}$, then $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} =$

Options:

A. u

B. $\frac{\partial^2 u}{\partial x \partial y}$

C. $\frac{1}{x} + \frac{1}{y}$

D. 0

Answer: D

Solution:

Solution:

Question 55

The value of the sum $\sum_{n=1}^{13}(i^n + i^{n+1})$ where $i = \sqrt{-1}$ is equal to

Options:

A. i

B. $i - 1$

C. $-i$

D. 0

Answer: B

Solution:

Solution:

Question 56

Let A and B be two 2 × 2 matrices. Consider the statements
(i) AB = 0 ⇒ A = 0 or B = 0
(ii) AB = I ⇒ A = B^{-1}
(iii) $(A + B)^2 = A^2 + 2AB + B^2$. Then

Options:

A. (i) is false, (ii) and (iii) are true

B. (i) and (iii) are false, (ii) is true

C. (i) and (ii) are false, (iii) is true

D. (ii) and (iii) are false, (i) is true

Answer: B

Solution:

Solution:

Question 57

The remainder when x = 1! + 2! + 3! + ... + 100! is divided by 240 , is

Options:

A. 187

B. 33

C. 73

D. 153

Answer: D

Solution:

Solution:

Question 58

A black and a red dice are rolled. The conditional probability of obtaining a sum greater than 9 , given that the black die resulted in a 5 is

Options:

A. 1 / 6

B. 1 / 9

C. 3 / 4

D. 1 / 3

Answer: D

Solution:

Solution:

Question 59

The area bounded by the curve |x|+ | y | = 1 is

Options:

A. 1

B. 3

C. 2

D. 4

Answer: C

Solution:

Solution:

Question 60

If $a_n = \sqrt{7 + \sqrt{7 + \sqrt{7 + \ldots}}}$ having n radical signs, then by methods of mathematical induction which of the following is true?

Options:

A. $a_n < 4$, for every $n \geq 1$

B. $a_n < 3$, for every $n \geq 1$

C. $a_n < 7$, for every $n \geq 1$

D. $a_n > 3$, for every $n \geq 1$

Answer: A

Solution:

Solution:

Question 61

The period of $\sin^2\theta$ is

Options:

A. π^2

B. π

C. π^3

D. $\pi / 2$

Answer: B

Solution:

Solution:

Question 62

Consider the function $f(x) = (x - 1)^{\frac{1}{7}}$. The value of $f(2)$ so that f is continuous at $x = 2$ is

Options:

A. 1

B. e

C. 1 / e

D. $1 / c^2$

Answer: C

Solution:

Solution:

Question 63

If f (x) = x˝, then the value of $f(1) - \frac{f'(1)}{1!} + \frac{f''(1)}{2!} - \frac{f'''(1)}{3!} + \ldots + (-1)^n \frac{f^{(n)}(1)}{n!}$ is

Options:

A. 2

B. 2^{n-1}

C. 0

D. 1

Answer: C

Solution:

Solution:

Question 64

The sine of the angle between the pair of lines represented by the equation $x^2 - 7xy + 12y^2 = 0$ is

Options:

A. $1 / \sqrt{170}$

B. 1 / 12

C. 1/13

D. $-1 / 13$

Answer: A

Solution:

Solution:

Question 65

If the tangent at the point P on the circle $x^2 + y^2 + 0x + 0y = 2$ meets the straight line $5x - 2y + 0 = 0$ at a point Q on the y-axis, then the length of PQ is

Options:

A. 4

B. 5

C. $2\sqrt{5}$

D. $3\sqrt{5}$

Answer: B

Solution:

Solution:

Question 66

Let the matrix F (x) = $\begin{bmatrix} \cos x & -\sin x & 0 \\ \sin x & \cos x & 0 \\ 0 & 0 & 1 \end{bmatrix}$ **. Then F (x)F (y) =**

Options:

A. F (xy)

B. F (x + y)

C. F (x) + F (y)

D. F (x − y)

Answer: B

Solution:

Solution:

Question 67

If a line is equally inclined with the coordinate axes, then the angle of inclination is

Options:

A. $\cos^{-1}(1 / 2)$

B. $\cos^{-1}(1 / \sqrt{2})$

C. $\cos^{-1}(1 / \sqrt{3})$

D. $\cos^{-1}(\sqrt{3} / 2)$

Answer: C

Solution:

Solution:

Question 68

If N = m ! (where m is a fixed positive integer >2), then
$\frac{1}{\log_2 N} + \frac{1}{\log_1 N} + \frac{1}{\log_4 N} + \ldots + \frac{1}{\log_m N} =$

Options:

A. -2

B. -1

C. 0

D. 1

Answer: D

Solution:

Solution:

Question 69

The monthly sales for the first 11 months of the year of a certain salesman were Rs.12,000. But due to his illness during the last month the average sales for the whole year came down to Rs. 11,375 . The value of the sale during the last month was

Options:

A. Rs 4,500

B. Rs 6,000

C. Rs 10,000

D. Rs 8, 000

Answer: A

Solution:

Solution:

Question 70

If
$\sin^{-1}x + \sin^{-1}y + \sin^{-1}z = 3\pi/2$
, then the value of
$x^{100} + y^{100} + z^{100} - \frac{9}{x^{101} + y^{101} + z^{101)}}$
is

Options:

A. -1

B. 0

C. 1

D. 3

Answer: B

Solution:

Solution:

Question 71

The sum of the series $\frac{1}{1!} + \frac{1+2}{2!} + \frac{1+2+3}{3!} + \ldots$ is

Options:

A. e

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

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

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

Answer: C

Solution:

Solution:

Question 72

Using the fact that $\sum_{1}^{\infty} \frac{1}{n^2} = \frac{\pi^2}{6}$, the value of $\sum_{1}^{\infty} \frac{1}{(2n+1)^2}$ is

Options:

A. $\frac{\pi^2}{12}$

B. $\frac{\pi^2}{12} - 1$

C. $\frac{\pi^2}{8}$

D. $\frac{\pi^2}{8} - 1$

Answer: D

Solution:

Solution:

Question 73

If x_1, x_2, x_3 and y_1, y_2, y_3 are both in G.P. with the same common ratio, then the points (x_1, y_1), (x_2, y_2) and (x_3, y_3)

Options:

A. lie on a straight line

B. lie on an ellipse

C. lie on a circle

D. are vertices of a triangle

Answer: A

Solution:

Solution:

Question 74

A peacock perched on the top of a 12m high tree spots a snake moving towards its hole at the base of the tree from a distance equal to thrice the height of the tree. The peacock flies towards the snake in a straight line and they both move at the same speed. At what distance from the base of the tree will the peacock catch the snake?

Options:

A. 16m

B. 18m

C. 14m

D. 12m

Answer: A

Solution:

Solution:

Question 75

Let $M = (a_1, a_2, a_3) \mid a_i \in \{1, 2, 3, 4\}, a_1 + a_2 + a_3 = 6$. Then number of elements in M is

Options:

A. 8

B. 9

C. 10

D. 12

Answer: C

Solution:

Solution:

Question 76

A solution curve of the differential equation $x' = 2y$ passing through (1, 2) also passes through

Options:

A. (2, 1)

B. (0, 0)

C. (4, 24)

D. (24, 4)

Answer: B

Solution:

Solution:

Question 77

If the line $x + 3y + 2 = 0$ and its perpendicular line are conjugate with respect to $3x^2 - 5y^2 = 15$, then the equation to conjugate line is

Options:

A. $3x - y = 15$

B. $3x - y + 10 = 0$

C. $3x - y = 4$

D. $3x - y + 12 = 0$

Answer: D

Solution:

Solution:

Question 78

An event A is independent of itself if and only if $P(A)$ is(A)

Options:

A. 0 or 1

B. 1 / 2

C. 0

D. 0, 1 / 2

Answer: A

Solution:

Solution:

Question 79

The order and degree of the differential equation $\left(1+3\frac{dy}{dx}\right)^{-/3}=4\frac{d^{'}y}{dx^{1}}$ are respectively

Options:

A. 1, 2 / 3

B. 3,1

C. 3,3

D. 1,2

Answer: C

Solution:

Solution:

Question 80

The differential equation whose linearly independent solutions are $\cos 2x \cdot \sin 2x \cdot c^{-x}$ is

Options:

A. $(D^3 + D^2 + 4D + 4)y = 0$

B. $(D^3 - D^2 + 4D - 4)y = 0$

C. $(D^3 + D^2 - 4D - 4)y = 0$

D. $(D^3 - D^2 - 4D + 4)y = 0$

Answer: A

Solution:

Solution:

Question 81

An example of a function which is continuous but not differentiable is

Options:

A. $f(x) = x$

B. $f(x) = x$

C. $f(x) = \log x$

D. $f(x) = -x$

Answer: A

Solution:

Solution:

Question 82

If three distinct numbers are chosen randomly from the first 100 natural numbers, then the probability that all three of them are divisible by both 2 and 3 is

Options:

A. $\frac{4}{55}$

B. $\frac{4}{35}$

C. $\frac{4}{33}$

D. $\frac{4}{1155}$

Answer: D

Solution:

Solution:

Question 83

The family of curves that is orthogonal to $xy = c^2$ is

Options:

A. $y = c_1 x$

B. $y = c_1 / x$

C. $x^2 + y^2 = c_1$

D. $x^2 - y^2 = c_1$

Answer: D

Solution:

Solution:

Question 84

If $a_1 \cdot a_2, \ldots . a_n$ are in a group, then the inverse of $a_1 \cdot a_2 \ldots a_n$ is

Options:

A. $a_n + a_2 + \ldots + a_n$

B. identity element

C. $a_1^{-1} \ldots a_n^{-1}$

D. $a_n^{-1} \cdot a_n^{-1} \ldots a_1^{-1}$

Answer: D

Solution:

Solution:

Question 85

Let $\mathbb{Z}$ be the set of all integers and let * be a binary operation in $\mathbb{Z}$ defined by $a * b = a + b + 10$ for all $a, b \in \mathbb{Z}$ The identity element of this group is

Options:

A. 0

B. 10

C. -10

D. 1

Answer: C

Solution:

Solution:

Question 86

The angle between the lines 0x = 3y = 4z and 2x = −y = z is

Options:

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

B. 0

C. $\frac{.7}{4}$

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

Answer: D

Solution:

Solution:

Question 87

The equation of the tangent at (3, −6) to the parabola $y^2 = 12x$ is

Options:

A. x − y − 3 = 0

B. x + y − 3 = 0

C. x − y + 3 = 0

D. x + y + 3 = 0

Answer: D

Solution:

Solution:

Question 88

Let f : [0 . π / 2 → ℝ be continuous and satisfy $\int_0^{\sin x} f(t)\,dt = \sqrt{3}x / 2$ for 0 ≤ x ≤ π / 2. Then f (1 / 2) equals

Options:

A. 1 / 2

B. 1 / $\sqrt{2}$

C. $1 / \sqrt{3}$

D. 1

Answer: D

Solution:

Solution:

Question 89

The value of $\lim_{n \to x} \left(1 - \frac{1}{n}\right)^{2n}$ is

Options:

A. e^{2}

B. e^{-2}

C. 1

D. 0

Answer: B

Solution:

Solution:

Question 90

The shortest distance of the point (2, 10, 1) from the plane $\mathbf{r} \cdot (3\mathbf{i} - \mathbf{j} + 4\mathbf{k}) = 2\sqrt{26}$ is

Options:

A. $2\sqrt{26}$

B. $\sqrt{20}$

C. 2

D. $\frac{1}{\sqrt{26}}$

Answer: C

Solution:

Solution:

Question 91

The equation of the plane passing through the point (2, 1, −1) and the line of intersection of the planes r · (i + 3j − k) = 0 and r · (j + 2k) = 0 is

Options:

A. x + 4y− = = 0

B. x + 9y + 11z = 0

C. 2x + y − z + 5 = 0

D. 2x − y + z = 0

Answer: B

Solution:

Solution:

Question 92

If $(1 + x)^n = C_0 + C_1x + C_2x^2 + \ldots + C_nx^n$, then the value of $C_0 + 2C_1 + 3C_2 + \ldots + (n + 1)C_n$ is

Options:

A. $(n + 2)2^{n-1}$

B. $(n + 2)2^n$

C. $(n + 1)2^{n-1}$

D. $(n + 1)(n + 2)2^n$

Answer: A

Solution:

Solution:

Question 93

The value of x for which the matrix $\begin{bmatrix} 8 & x & 0 \\ 4 & 0 & 2 \\ 12 & 6 & 0 \end{bmatrix}$ **is singular, is**

Options:

A. 8

B. 6

C. 4

D. 12

Answer: C

Solution:

Solution:

Question 94

The determinant of the matrix $\begin{bmatrix} 1 & 1+x & 1+x+x^2 \\ 1 & 1+y & 1+y+y^2 \\ 1 & 1+z & 1+z+z^2 \end{bmatrix}$ **is equal to**

Options:

A. $(z-y)(z-x)(y-x)$

B. $(x-y)(x-z)(y-z)$

C. $(x-y)^2(y-z)^2(z-x)^2$

D. $(x^2-y^2)(y^2-z^2)(z^2-x^2)$

Answer: A

Solution:

Solution:

Question 95

The probability of obtaining 'no head' in an infinite sequence of independent tosses of a coin is

Options:

A. 0

B. 1

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

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

Answer: A

Solution:

Solution:

Question 96

If X is a Poisson random variable such that $E(X^2) = 30$, then the variance of X is

Options:

A. 6

B. 5

C. 30

D. 25

Answer: C

Solution:

Solution:

Question 97

A problem in Mathematics is given to three students A, B, C and their respective probability of solving the problem is $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{4}$. Probability that the problem is solved is

Options:

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

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

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

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

Answer: A

Solution:

Solution:

Question 98

The value of the constant c for which the function defined by

$f(x) = \begin{cases} cx(1-x). & \text{if } 0 < x < 1 \\ 0. & \text{otherwise} \end{cases}$. is a probability density function, is

Options:

A. 1

B. 0

C. 3

D. 6

Answer: D

Solution:

Solution:

Question 99

If $(1.05)^{50} = 11.658$, then $\sum_{n=1}^{49} (1.05)^n$ equals

Options:

A. 208.34

B. 212.12

C. 212.16

D. 213.16

Answer: C

Solution:

Solution:

Question 100

The value of $(\sqrt{3} + i)^{14} + (\sqrt{3} - i)^{14}$ is

Options:

A. 2^{14}

B. $(2i)^{14}$

C. 2^{7}

D. $(2i)^{7}$

Answer: A

Solution:

Solution:

Question 101

If $-1 \leq x \leq 2$ and $1 \leq y \leq 3$, then least possible value of $2y - 3x$ is

Options:

A. 0

B. -4

C. -5

D. -3

Answer: B

Solution:

Solution:

Question 102

The solution set of $|x - 1| \geq x - 3|$ is

Options:

A. $(-\square, 2)$

B. $(0, 2)$

C. $[2, \square]$

D. $[0, 2]$

Answer: D

Solution:

Solution:

Question 103

If a, b, c are the position vectors of the vertices of an equilateral triangle whose orthocenter is at the origin, then

Options:

A. $a + b + c = 0$

B. $a^2 = b^2 + c^2 = 0$

C. $a + b = c$

D. $a = b + c$

Answer: A

Solution:

Solution:

Question 104

The number of ways in which 6 men and 5 women can sit at a round table if no two women are to sit together is given by

Options:

A. $6! \times 5!$

B. 30

C. $4! \times 5!$

D. $7! \times 5!$

Answer: A

Solution:

Solution:

Question 105

If z_1 and z_2 are any two complex numbers, then $Re(z_1z_2)$ is

Options:

A. $\mathrm{Re}(z_1)\,\mathrm{Re}(z_2) + \mathrm{Im}(z_1)\,\mathrm{Im}(z_2)$

B. $\mathrm{Re}(z_1)\,\mathrm{Re}(z_2) - \mathrm{Im}(z_1)\,\mathrm{Im}(z_2)$

C. $\mathrm{Re}(z_1)\,\mathrm{Im}(z_2) + \mathrm{Re}(z_2)\,\mathrm{Im}(z_1)$

D. $\mathrm{Re}(z_1)\,\mathrm{Im}(z_1) - \mathrm{Re}(z_2)\,\mathrm{Im}(z_2)$

Answer: B

Solution:

Solution:

Question 106

If $x^{2/3} + y^{2/3} = a^{2/3}$, then dy / dx is

Options:

A. $\sqrt{\frac{x}{y}}$

B. $-\sqrt[3]{\frac{y}{x}}$

C. $-\sqrt{\frac{y}{x}}$

D. $\frac{y^2}{x}$

Answer: B

Solution:

Solution:

Question 107

If a, b and c are in arithmetic progression, then the value of the determinant

$$\begin{vmatrix} x+2 & x+3 & x+2a \\ x+3 & x+4 & x+2b \\ x+4 & x+5 & x+2c \end{vmatrix}$$ **is**

Options:

A. 0

B. 1

C. x

D. 2x

Answer: A

Solution:

Solution:

Question 108

The solution of $\tan^{-1}(2x) + \tan^{-1}(3x) = \frac{\pi}{4}$ is

Options:

A. -1

B. 1 / 6

C. 0

D. $-1 / 2$

Answer: B

Solution:

Solution:

Question 109

Which of the following statements is false?

Options:

A. An equation of form a * x = b has a unique solution for x in a group

B. An equation of form a * x = e has a unique solution for x in a group

C. Given n ≠ N , there exist a group with n elements

D. If H and K are abelian groups, then H ⋄ K need not be abelian

Answer: D

Solution:

Solution:

Question 110

Define $a \otimes b = \text{lcm}(a, b) + \text{gcd}(a, b)$ and $a \oplus b = a^b + b^a$. The value of $(1 \oplus 2) \otimes (3 \oplus 4)$ is

Options:

A. 145

B. 286

C. 436

D. 572

Answer: C

Solution:

Solution:

Question 111

In a Poisson distribution, $P(X = 2) = P(X = 3)$. Given that $e^{-3} = 0.050$. Then $P(X = 5)$ is

Options:

A. 0.202

B. 0.352

C. 0.125

D. 0.101

Answer: D

Solution:

Solution:

Question 112

There are four prime numbers written in ascending order. The product of the first three is 385 and that of the last three is 1001 . The last number is

Options:

A. 11

B. 13

C. 17

D. 19

Answer: B

Solution:

Solution:

Question 113

If the area of a triangle is 4 sq. units with vertices at (−2, 0), (0, 4) and (0, k), then the value of k is

Options:

A. 2

B. 0

C. 8

D. 4

Answer: C

Solution:

Solution:

Question 114

The value of sin (15˚) is

Options:

A. $\frac{\sqrt{3}+1}{2\sqrt{2}}$

B. $\frac{\sqrt{3}-1}{\sqrt{2}}$

C. $\frac{\sqrt{3}-1}{2\sqrt{2}}$

D. $\frac{\sqrt{3}-1}{3\sqrt{2}}$

Answer: C

Solution:

Solution:

Question 115

If $x - 3$ and $x + 3$ are the factors of $4x^3 + ax^2 + bx$, then the values of a and b are respectively

Options:

A. 3,18

B. 6,12

C. $0, -36$

D. $12, -5$

Answer: C

Solution:

Solution:

Question 116

The point at which the tangent to the curve $y = \sqrt{4x - 3} - 1$ has its slope 2 / 3 is

Options:

A. (2, 3)

B. (3, 2)

C. (1, 3)

D. (3, 1)

Answer: B

Solution:

Solution:

Question 117

The area enclosed by the graph of $2x | + 3y | = 0$ above the x-axis is

Options:

A. 12

B. 10

C. 6

D. 24

Answer: C

Solution:

Solution:

Question 118

If $\alpha, \beta \in C$ are the distinct roots of the equation $x^2 - x + 1 = 0$, then $\alpha^{101} + \beta^{107}$ is equal to

Options:

A. 2

B. -1

C. 0

D. 1

Answer: D

Solution:

Solution:

Question 119

The solution of the differential equation $\frac{dy}{dx} = y \log y \cot x$ is

Options:

A. $y = c \cos x$

B. $y = c \sin x$

C. $y = c \log \sin x$

D. $y = e^{c \sin x}$

Answer: D

Solution:

Solution:

Question 120

A polynomial of odd degree with real coefficients must have

Options:

A. at least one real root

B. no real root

C. only real roots

D. at least one root which is not real

Answer: A

Solution:

Solution:

Question 121

The length of the latus rectum of the rectangular hyperbola xy = 32 is

Options:

A. $8\sqrt{2}$

B. 32

C. 8

D. 16

Answer: D

Solution:

Solution:

Question 122

The foci of the ellipse $10x^2 + 25y^2 = 400$ are

Options:

A. (0, ±3)

B. (±3, 0)

C. (0, ±5)

D. (±5, 0)

Answer: B

Solution:

Solution:

Question 123

If f (x) = $\int_0 \frac{dt}{1+t}$, then f ′(2) is

Options:

A. $\frac{4}{65}$

B. $-\frac{1}{9}$

C. $\ln \frac{65}{2}$

D. $\ln \frac{9}{2}$

Answer: A

Solution:

Solution:

Question 124

If ^{a}=i − 2j + k, b = 2i + j + k and c = i + 2j − k, then a × (b × c) is

Options:

A. −9i − 0j − 3k

B. 9i + 0j + 3k

C. −9i + 0j − 3k

D. 9i − 0j − 3k

Answer: A

Solution:

Solution:

Question 125

If A = $\begin{bmatrix} x & 1 \\ -1 & -x \end{bmatrix}$, then the value x satisfying $A^2 = 0$, is

Options:

A. 0

B. ± 1

C. -1

D. 1

Answer: B

Solution:

Solution:

Question 126

The average translational kinetic energy of O_2 molecules at a particular temperature is 0.048 eV. The translational kinetic energy of N_2 molecules at the same temperature is

Options:

A. 0.0015 eV

B. 0.048 eV

C. 0.003 eV

D. 0.768 eV

Answer: B

Solution:

Solution:

Question 127

Arrange the following electromagnetic radiation per quantum in the

order of increasing energy: (i) Red light (ii) γ-ray (iii) X-ray (iv) Radiowave

Options:

A. i, ii, iv, iii

B. iii, i, ii, iv

C. ii, i, iv, iii

D. iv, i, iii, ii

Answer: D

Solution:

Solution:

Question 128

^{22}Ne nucleus decays into two α-particles and an unknown nucleus. The unknown nucleus is

Options:

A. nitrogen

B. carbon

C. boron

D. oxygen

Answer: B

Solution:

Solution:

Question 129

Which of the following cannot be accelerated in a cyclotron?

Options:

A. Protons

B. Deuterons

C. Alpha particles

D. Neutrons

Answer: D

Solution:

Solution:

Question 130

For a paramagnetic material, the dependence of the magnetic susceptibility χ on the absolute temperature T is given by

Options:

A. $x = CT$

B. $x = C / T$

C. $x = CT^{2}$

D. $x = C / T^{-2}$

Answer: B

Solution:

Solution:

Question 131

The unit of power of a lens is

Options:

A. metre

B. watt

C. watt /m

D. dioptre

Answer: A

Solution:

Solution:

Question 132

The momentum of an X-ray photon is $3 \times 10^{-23} kgms^{-1}$. The energy of this photon is

Options:

A. $9 \times 10^{-15} J$

B. $3 \times 10^{-15} J$

C. $3 \times 10^{-23} J$

D. $12 \times 10^{-15} J$

Answer: A

Solution:

Solution:

Question 133

To convert a galvanometer into an ammeter, one should connect

Options:

A. a low resistance ∈ series with it

B. a high resistance ∈ series with it

C. a low resistance ∈ with it

D. a high resistance in parallel with it

Answer: C

Solution:

Solution:

Question 134

The wavelength of blue light (λ = 420 nm) in water (refractive index 1.33) is about

Options:

A. 420 nm

B. 390 nm

C. 315 nm

D. 560 nm

Answer: C

Solution:

Solution:

Question 135

The root mean square speed of the molecules of an enclosed gas is v. What will be the root mean square speed if the pressure is doubled, the temperature remaining the same?

Options:

A. v / 2

B. v

C. 2v

D. 4v

Answer: B

Solution:

Solution:

Question 136

Which one of the following forms a virtual and erect image for all positions of the object?

Options:

A. Convex lens

B. Concave lens

C. Plano-convex lens

D. Concave mirror

Answer: B

Solution:

Solution:

Question 137

If the distance between two masses is doubled, the gravitational attraction between them is

Options:

A. reduced to half

B. reduced to a quarter

C. doubled

D. unaltered

Answer: B

Solution:

Solution:

Question 138

A piece of copper and another of germanium are cooled from room temperature to 80K. The resistance of

Options:

A. each of them increases

B. each of them decreases

C. copper increases ∧ germanium decreases

D. copper decreases and germanium increases

Answer: D

Solution:

Solution:

Question 139

When $_{3}^{7}$Li nuclei are bombarded by protons, the resultant nuclei is $_{4}^{8}$Be. The emitted particles will be

Options:

A. gamma photons

B. neutrons

C. alpha particle

D. beta particle

Answer: A

Solution:

Solution:

Question 140

Let $\hat{i} \wedge \hat{j}$ be the unit vectors along x and y directions. Then the magnitude of $\hat{i} + \hat{j}$ is

Options:

A. 1

B. 2

C. 0

D. $\sqrt{2}$

Answer: D

Solution:

Solution:

Question 141

A projectile has a maximum range of 100m. Neglecting air resistance, what is the maximum height attained by it?

Options:

A. 50m

B. 100m

C. 5m

D. 25m

Answer: D

Solution:

Solution:

Question 142

The frequency of the charged particle circulating at right angles to a uniform magnetic field does not depend upon the

Options:

A. speed of the particle

B. mass of the particle

C. charge of the particle

D. magnetic field

Answer: A

Solution:

Solution:

Question 143

The following four gases are at the same temperature. In which gas do the molecules have the maximum root mean square speed?

Options:

A. Carbon dioxide

B. Oxygen

C. Nitrogen

D. Hydrogen

Answer: D

Solution:

Solution:

Question 144

In the following, column I lists some physical quantities and the column II gives approximate energy values associated with those. Choose appropriate values of energies as per the choices given below

Column I	Column II
(i) Energy of thermal neutrons	a 3 eV
(ii) Binding energy per nucleon	b 10 keV
(iii) Energy of X-rays	c 8 MeV
(iv) Photoelectric threshold of a metal	d 0.025 eV
	e 1 eV
	f 0.8 eV

Options:

A. i → d , ii → c, iii → b, i →a

B. i → f , ii → c, iii → e, iv → a

C. i → c, ii → c, iii → f , iv → b

D. i → d , ii → c, ii → f , ii → e

Answer: A

Solution:

Solution:

Question 145

The unit of momentum is

Options:

A. Nm

B. Ns

C. Nm^{-1}

D. Ns^{-1}

Answer: B

Solution:

Solution:

Question 146

The ratio of electrostatic force and gravitational force between a proton

and an electron is

Options:

A. 2.4×10^{39}

B. 2.4×10^{-39}

C. 2.4×10^{-37}

D. 2.4×10^{37}

Answer: A

Solution:

Solution:

Question 147

The charge carriers in an electrolyte are

Options:

A. Negative ions

B. Positive ions

C. Negative and positive ions

D. None of the above

Answer: C

Solution:

Solution:

Question 148

A spherical black body with a radius of 12 cm radiates 450 watt power at 500K. If the radius were halved and the temperature doubled, the power radiated in watt would be

Options:

A. 225

B. 450

C. 1800

D. 1000

Answer: C

Solution:

Solution:

Question 149

The ratio of resolving powers of an optical microscope for two wavelengths λ_1 = 4000Å and λ_2 = 6000Å is

Options:

A. 8 : 27

B. 3 : 2

C. 9 : 4

D. 16 : 81

Answer: B

Solution:

Solution:

Question 150

The centripetal acceleration required for a particle to move on a circle of radius r with speed v is

Options:

A. v^2 / r

B. v / r

C. v / r^2

D. Vr^2 / 2

Answer: A

Solution:

Solution:

Question 151

The ratio of wavelengths of the last line of Balmer series and the last line of Lyman series is

Options:

A. 2

B. 4

C. 1

D. 0.5

Answer: B

Solution:

Solution:

Question 152

Two cars moving in opposite directions approach each other with speed of 22m / s and 16.5m / s respectively. The driver of the first car blows a horn having a frequency 400 Hz. The frequency heard by the driver of the second car is [velocity of sound 340m / s]

Options:

A. 350 Hz

B. 361 Hz

C. 411 Hz

D. 448 Hz

Answer: D

Solution:

Solution:

Question 153

The magnetic susceptibility is negative for

Options:

A. diamagnetic material only

B. paramagnetic material only

C. ferromagnetic material only

D. paramagnetic and ferromagnetic materials

Answer: A

Solution:

Solution:

Question 154

If the magnitude of sum of two vectors is equal to the magnitude of difference of the two vectors, the angle between these vectors is

Options:

A. 0°

B. 90°

C. 45°

D. 180°

Answer: B

Solution:

Solution:

Question 155

Given the value of Rydberg constant is $1 \times 10^{7}\mathrm{m}^{-1}$, the wave number of the last line of the Balmer series in hydrogen spectrum will be

Options:

A. $0.025 \times 10^{4}\mathrm{m}^{-1}$

B. $0.5 \times 10^{7}\mathrm{m}^{-1}$

C. $0.25 \times 10^{7}\mathrm{m}^{-1}$

D. $2.5 \times 10^{7}\mathrm{m}^{-1}$

Answer: C

Solution:

Solution:

Question 156

The vectors 2ri + 3rj + 4rk, ari + brj + crk are normal to each other only if

Options:

A. a = 2, b = 3, c = −4

B. a = 4, b = 4, c = −5

C. a = 4, b = 4, c = 5

D. a = −2, b = 3, c = 4

Answer: B

Solution:

Solution:

Question 157

The order and degree of the differential equation $y'' - y' + y^3 = 0$ are

Options:

A. (3, 2)

B. (2, 3)

C. (2, 2)

D. (3, 3)

Answer: B

Solution:

Solution:

Question 158

A bag contains 6 green balls, 8 white balls and 10 black balls. If a ball is drawn from the bag, what is the probability of it being either white or black?

Options:

A. 1 / 18

B. 1 / 8

C. 3 / 4

D. 1 / 12

Answer: C

Solution:

Solution:

Question 159

The value of ħ (h bar) is erg-sec.

Options:

A. 6.6253×10^{-27}

B. 1.0545×10^{-27}

C. 6.6253×10^{-31}

D. 1.0544×10^{-34}

Answer: B

Solution:

Solution:

Question 160

According to Bohr's postulates, which of the following quantity takes discrete values?

Options:

A. Kinetic energy

B. Angular momentum

C. Potential energy

D. Momentum

Answer: B

Solution:

Solution:

Question 161

A chain reaction is possible when the mass of the fuel is greater than the

Options:

A. critical mass

B. neutron mass

C. proton mass

D. electron mass

Answer: A

Solution:

Solution:

Question 162

In Raman effect, the spectral line with lower frequency than the incident frequency is

Options:

A. Anti-Stokes' line

B. Fraunhofer line

C. Rayleigh line

D. Stokes' line

Answer: D

Solution:

Solution:

Question 163

In n-type semiconductor, Silicon is doped with

Options:

A. Aluminium

B. Arsenic

C. Indium

D. Germanium

Answer: B

Solution:

Solution:

Question 164

The Bragg's equation $2d\sin\theta = n\lambda$ has no solution for

Options:

A. $\lambda < d$

B. $\lambda < 2d$

C. $\lambda > 2d$

D. $\lambda = 2d$

Answer: C

Solution:

Solution:

Question 165

A long solenoid has 1000 turns. When a current of 4A flows through it, the magnetic flux linked with each turn of the solenoid is 4×10^{-3} Wb. The self-inductance of the solenoid is

Options:

A. 4H

B. 2H

C. 3H

D. 1H

Answer: D

Solution:

Solution:

Question 166

The acceleration due to gravity at a height 1 km above the earth is the same as at a depth 'd' below the surface of earth. Then

Options:

A. d = 05 km

B. 1 km

C. 0.75 km

D. 2 km

Answer: D

Solution:

Solution:

Question 167

The least distance of distinct vision for a normal eye is

Options:

A. 100m

B. 5m

C. 0.25m

D. infinity

Answer: C

Solution:

Solution:

Question 168

Sound travels fastest in

Options:

A. vacuum

B. liquids

C. gases

D. solids

Answer: D

Solution:

Solution:

Question 169

The law that states “The induced e.m.f. is proportional to the rate of change of its number of lines of magnetic force linking the circuit” is

Options:

A. Lenz’s law

B. Faraday law

C. Ohms law

D. Joule-Thomson law

Answer: A

Solution:

Solution:

Question 170

Two charges are placed a certain distance apart in air. When a dielectric sheet is placed between them, the electrostatic force between them will

Options:

A. become zero

B. increase

C. remain unchanged

D. decrease

Answer: D

Solution:

Solution:

Question 171

The resistance of a conductor carrying a current 3 A which has a potential difference of 15 V between its two ends is

Options:

A. 15 Ohm

B. 5 Ohm

C. 0.5 Ohm

D. 1/5 Ohm

Answer: B

Solution:

Solution:

Question 172

The value of $A \cdot B + \overline{A} + A$ is

Options:

A. B

B. always 0

C. always 1

D. $\overline{B}$

Answer: C

Solution:

Solution:

Question 173

Which of the following flip-flops does not have race problem?

Options:

A. D-flip-flop

B. T-flip-flop

C. Master-slave flip-flop

D. JK flip-flop

Answer: C

Solution:

Solution:

Question 174

A microprocessor with a 12 bit address bus will be able to access_____ kilobytes of memory.

Options:

A. 8

B. 4

C. 1

D. 2

Answer: B

Solution:

Solution:

Question 175

The displacement of a particle is given by
$x = A^2 \sin^2 kt$
where t denotes time. The unit of k is

Options:

A. Hertz

B. Meter

C. Radian

D. Second

Answer: A

Solution:

Solution:

Question 176

Planck’s constant has the dimension of

Options:

A. Force

B. Energy

C. Linear momentum

D. Angular momentum

Answer: D

Solution:

Solution:

Question 177

The statement that the velocity of light in vacuum = velocity of light in the medium is

Options:

A. Dimensionally correct

B. Dimensionally incorrect

C. Numerically incorrect

D. Both (A) and (C)

Answer: D

Solution:

Solution:

Question 178

Two vectors have magnitude 3 and 5. If the angle between them is 60°, then the dot product of two vectors will be

Options:

A. 6.5

B. 7.5

C. 7.9

D. 8

Answer: B

Solution:

Solution:

Question 179

If the distance covered by a particle happens to be zero, then the displacement of the particle

Options:

A. must be zero

B. may or may not be zero

C. cannot be zero

D. depends upon the particle

Answer: A

Solution:

Solution:

Question 180

Two bullets are fired horizontally with different velocities from the same height. Which one will reach the ground first?

Options:

A. The slower one

B. Faster one

C. It cannot be predicted

D. Both will reach simultaneously

Answer: D

Solution:

Solution:

Question 181

The angular velocity of a particle rotating in a circular orbit 100 times per minute is

Options:

A. 60 deg/s

B. 1.66 rad/s

C. 1.66 deg/s

D. 1.66 rad/minute

Answer: B

Solution:

Solution:

Question 182

Frictional forces act in a direction

Options:

A. perpendicular to the surface in contact

B. parallel to surface in contact

C. parallel to normal reaction

D. inclined at 45° to normal reaction

Answer: B

Solution:

Solution:

Question 183

Which one of the following is true for an elastic collision between two bodies?

Options:

A. Kinetic energy of the system is conserved

B. Total momentum of the system is conserved

C. Both kinetic energy and momentum of the system are conserved

D. Neither kinetic energy nor momentum of the system is conserved

Answer: B

Solution:

Solution:

Question 184

When a mass is rotating in an orbit about a fixed axis, its angular momentum is directed

Options:

A. along the radius of the orbit

B. tangential to the orbit

C. along the axis of rotation

D. perpendicular to the plane of the orbit.

Answer: C

Solution:

Solution:

Question 185

In practice, Poisson's ratio σ lies between

Options:

A. $-\infty$ to $+\infty$

B. 0 and $+\infty$

C. 0 and 0.5

D. -0.5 and 0

Answer: C

Solution:

Solution:

Question 186

Two wires of the same material and length but cross sectional area in the ratio 1 : 2 are used to suspend the same loads. The extension in them will be in the ratio

Options:

A. 1 : 2

B. 2 : 1

C. 4 : 1

D. 1 : 4

Answer: B

Solution:

Solution:

Question 187

A liquid will not wet the surface of a solid, if the angle of contact is

Options:

A. 0˚

B. 45˚

C. 60˚

D. >90˚

Answer: D

Solution:

Solution:

Question 188

When two capillary tubes of different diameters are dipped in liquid vertically, the rise of
the liquid in the capillary tube is

Options:

A. same in both the tubes

B. more in the tube of larger diameter

C. more in the tube of smaller diameter

D. less in the tube of smaller diameter

Answer: C

Solution:

Solution:

Question 189

Pyrometer is a device for measuring

Options:

A. pressure

B. temperature

C. density

D. viscosity

Answer: B

Solution:

Solution:

Question 190

The internal energy of a gas during isothermal expansion

Options:

A. increases

B. remains constant

C. decreases

D. becomes zero

Answer: B

Solution:

Solution:

Question 191

Which one of the following expressions does not represent simple harmonic motion (SMH) ?

Options:

A. $A\sin \omega t$

B. $A\sin 2\omega t$

C. $A\sin \omega t + A\cos \omega t$

D. $A\sin ^{2}\omega t$

Answer: D

Solution:

Solution:

Question 192

If x is the displacement of the particle from the mean position, the total energy of a particle executing simple harmonic motion is

Options:

A. proportional to x

B. proportional to x^{2}

C. independent of x

D. proportional to $\sqrt{x}$

Answer: C

Solution:

Solution:

Question 193

If the refractive index of water is 1.33 , the speed of light in water will be

Options:

A. $3 \times 10^{8} m / s$

B. $0.44 \times 10^8 m / s$

C. $1.33 \times 10^8 m / s$

D. $2.25 \times 10^8 m / s$

Answer: D

Solution:

Solution:

Question 194

The correct arrangement of colors in the descending order of their wavelength

Options:

A. yellow, violet, green, orange

B. orange, yellow, green, violet

C. violet, green, yellow, orange

D. orange, green, violet, yellow

Answer: B

Solution:

Solution:

Question 195

Field inside a solenoid is

Options:

A. directly proportional to its length

B. directly proportional to the current

C. inversely proportional to the number of turns

D. inversely proportional to the current

Answer: B

Solution:

Solution:

Question 196

L, C and R represent the quantities inductance, capacitance and resistance respectively.
The combination which has the dimensions of frequency is

Options:

A. (1/RC)

B. (C/L)

C. (R/LC)

D. (RL/C)

Answer: A

Solution:

Solution:

Question 197

Poynting vector of a plane electromagnetic wave propagating in the direction $\hat{k}$ is

Options:

A. perpendicular to $\hat{k}$

B. parallel to $\hat{k}$

C. antiparallel to $\hat{k}$

D. at an angle $\pi / 4$ to $\hat{k}$

Answer: B

Solution:

Solution:

Question 198

Two identical fuses are rated at 10 A

Options:

A. in parallel, the combination acts as a fuse of rating 10 A

B. in parallel, the combination acts as a fuse of rating 20 A

C. in series, the combination acts as a fuse of rating 20 A

D. in series, the combination acts as a fuse of rating 5 A

Answer: B

Solution:

Solution:

Question 199

A half-wave rectifier is being used to rectify an alternating voltage of frequency 50 Hz.
The number of pulses of rectified current obtained in one second is

Options:

A. 50

B. 25

C. 100

D. 1

Answer: A

Solution:

Solution:

Question 200

Two coils of inductances L_1 and L_2 are linked such that their mutual inductance is M. Then

Options:

A. $M = L_1 - L_2$

B. $M = L_1 + L_2$

C. $M = (L_1 + L_2) / 2$

D. the maximum value of M is $\sqrt{L_1 L_2}$

Answer: D

Solution:

Solution:

Question 201

For how many orbitals, the quantum numbers n = 3, 1 = 2, m = +2 are possible?

Options:

A. 1

B. 2

C. 3

D. 4

Answer: A

Solution:

Solution:

Question 202

Which of the following ions has maximum magnetic moment?

Options:

A. Mn^{2+}

B. Fe^{2+}

C. Ti^{2+}

D. Cr^{2+}

Answer: A

Solution:

Solution:

Question 203

Arrange the following molecular species in increasing order of stability.

Options:

A. $N_2^+ > N_2 > N_2^- > N_2^{2-}$

B. $N_2^{2-} > N_2^- > N_2 > N_2^+$

C. $N_2 > N_2 = N_2 > N_2^2$

D. $N_2 > N_2 > N_2^2 > N_2^2$

Answer: C

Solution:

Solution:

Question 204

The compound formed by elements A and B crystallizes in the cubic structure where A atoms are at the corners of a cube and B atoms are at the face centers. The formula of the compound is

Options:

A. AB_3

B. AB

C. A_3B

D. A_2B_2

Answer: A

Solution:

Solution:

Question 205

Schottky defect in crystals is observed when

Options:

A. unequal number of cations and anions are missing from the lattice

B. equal number of cations and anions are missing from the lattice

C. an ion leaves its normal site and occupies an interstitial site

D. density of the crystal is increased

Answer: B

Solution:

Solution:

Question 206

Which one of the following octahedral complexes does not show geometric isomerism? (A and B are monodentate ligands)

Options:

A. $[MA_2B_4]$

B. $[MA_3B_3]$

C. $[MA_4B_2]$

D. $[MA_5B]$

Answer: D

Solution:

Solution:

Question 207

Which of the following is the strongest ligand?

Options:

A. Cl^-

B. F^-

C. NO_2^-

D. CN^-

Answer: D

Solution:

Solution:

Question 208

The product obtained after positron emission from $_{31}Ga^{68}$ is

Options:

A. $_{31}Ge^{68}$

B. $_{30}Zn^{68}$

C. $_{30}Zn^{69}$

D. $_{31}Ga^{69}$

Answer: B

Solution:

Solution:

Question 209

Which of the following is not a mineral of aluminum?

Options:

A. Bauxite

B. Cryolite

C. China clay

D. Malachite

Answer: D

Solution:

Solution:

Question 210

When bismuth chloride is dissolved in water a white precipitate appears. The whiteprecipitate is

Options:

A. $Bi(OH)_3$

B. BiOH

C. BiO(OH)

D. BiOCl

Answer: D

Solution:

Solution:

Question 211

Which of the following compound is formed when I_2 is dissolved in ammonium hydroxide (density = 0.88g / cm^3)?

Options:

A. NH_4I

B. $NI_3 \cdot 6NH_3$

C. $NI_3 \cdot 4NH_3$

D. $NI_3 \cdot NH_4OH$

Answer: B

Solution:

Solution:

Question 212

Which of the following is NOT a metal ion indicator?

Options:

A. Bromocresol blue

B. Murexide

C. Calmagite

D. Solochrome black T

Answer: A

Solution:

Solution:

Question 213

In brown ring test for nitrate ions, brown ring is formed having composition

Options:

A. $[Fe(H_2O)_6]^{2+}$

B. $[Fe(H_2O)_5NO]^{2+}$

C. $[Fe(H_2O)_5NO]^{3+}$

D. $[Fe(H_2O)_5NO_2]^{2+}$

Answer: B

Solution:

Solution:

Question 214

Which is mismatched regarding the shape?

Options:

A. XeF_4- Square planar

B. $XeOF_4$ - Square pyramidal

C. XeF_6 - Distorted octahedral

D. XeO_3- Bent T shape

Answer: D

Solution:

Solution:

Question 215

Which of the following is not a product of the breakdown of organic matter in water by aerobic bacteria?

Options:

A. CO_2

B. H_2O

C. NO

D. H_2S

Answer: D

Solution:

Solution:

Question 216

Addition of phosphate containing fertilizers in water bodies causes
(i) enhanced growth of algae
(ii) increase in amount of dissolved oxygen
(iii) deposition of calcium phosphate
(iv) decrease in fish population

Options:

A. (i) and (ii)

B. (i) and (iv)

C. (ii) and (iii)

D. (i) and (iii)

Answer: B

Solution:

Solution:

Question 217

The compound which is not isomeric with methoxypropane

Options:

A. diethyl ether

B. butan-1-ol

C. butanone

D. 2-methylpropan-2-ol

Answer: C

Solution:

Solution:

Question 218

Which of the following will evolve CO_2 on reaction with $NaHCO_3$? I Salicylic acid, II Benzoic acid, III Ascorbic acid, IV Phenol

Options:

A. I, II, III and IV

B. I, II and III

C. I and III

D. II and IV

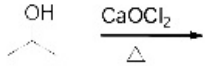
Answer: B

Solution:

Solution:

Question 219

What is the product formed in the following reaction?



Options:

A. $CHCl_3$

B.

C. CH_3CHO

D.

Answer: A

Solution:

Solution:

Question 220

Which of the following reagent does not convert propanone to propane?

Options:

A. $Zn - Hg$ / HCl

B. $NH_2 - NH_2$ / KOH

C. $HS - CH_2 - CH_2 - SH$, Raney Ni

D. $NaBH_4$

Answer: D

Solution:

Solution:

Question 221

Arrange the following $^{+}CH_3$, CH_4 and $^{-}CH_3$ in order of increasing H − C − H bond angles

Options:

A. $\overline{C}H_3 < CH_4 < \overset{+}{C}H_3$

B. $\overline{C}H_3 < \overset{+}{C}H_3 < CH_4$

C. $\overset{+}{C}H_3 < CH_4 < \overline{C}H_3$

D. $\overline{C}_4 < CH_3 \approx \overset{+}{C}H_3$

Answer: A

Solution:

Solution:

Question 222

IUPAC name of the below compound is

Options:

A. N-Phenylcyclohexanecarboxamide

B. N-Cyclohexylbenzamide

C. N-Phenylcyclohexylmethanamide

D. N-Cyclohexyl-N-phenylmethanamide

Answer: A

Solution:

Solution:

Question 223

Arrange n-pentane (I), isopentane (II) and neopentane (III) in the decreasing order of their boiling point.

Options:

A. III > II > I

B. I> II > III

C. II > III > I

D. III > I > II

Answer: B

Solution:

Solution:

Question 224

Which of the following reagent is not useful for direct oxidation of toluene to benzaldehyde?

Options:

A. CrO_2Cl_2 / CCl_4

B. MnO_2 / CCl_4

C. Alkaline $KMnO_4$

D. Cl_2/hv followed by treatment with $Cu(NO_3)_2$

Answer: C

Solution:

Solution:

Question 225

The material used by dentists in root canals is

Options:

A. gutta-percha

B. neoprene

C. ebonite

D. dynel

Answer: A

Solution:

Solution:

Question 226

A polymer sample is made up of 30% molecules of mass 20,000, 40% of 30,000 and the rest mass of 60,000. Its number average molecule mass is

Options:

A. 36,000

B. 46,000

C. 50,000

D. 3,60,000

Answer: A

Solution:

Solution:

Question 227

False statement about synthetic detergents is:

Options:

A. It has a non-polar organic part and a polar group

B. It is a surface active reagent

C. It is not easily biodegradable

D. It is a sodium salt of fatty acid

Answer: D

Solution:

Solution:

Question 228

The transition metal ion present in vitamin B_{12} is

Options:

A. Mg^{2+}

B. Fe^{2+}

C. Zn^{2+}

D. Co^{2+}

Answer: D

Solution:

Solution:

Question 229

Which of the following reactions would give the best yield of t-butylmethyl ether?

Options:

A. $(CH_3)_3C-OH + CH_3OH \xrightarrow[140°C]{H_2SO_4}$

B. $(CH_3)_3C-Br + CH_3\bar{O}\overset{+}{N}a \xrightarrow{\Delta}$

C. $(CH_3)_3C-Br + CH_3OH \xrightarrow{\Delta}$

D. $(CH_3)_3C-\bar{\overset{+}{O}} + CH_3Br \xrightarrow{\Delta}$

Answer: D

Solution:

Solution:

Question 230

The Cannizzaro's reaction is not given by

Options:

A. CCl_3CHO

B. $(CH_3)_3C-CHO$

C. $H-CHO$

D. CD_3CHO

Answer: D

Solution:

Solution:

Question 231

When p-nitrobenzenesulphonic acid and picric acid are treated with $NaHCO_3$, the gases released respectively are

Options:

A. SO_2, NO_2

B. NO_2, NO

C. NO_2, H_2

D. CO_2, CO_2

Answer: D

Solution:

Solution:

Question 232

The following reaction is known as

$$R-CH_2Br + AgF \xrightarrow[\Delta]{\text{ethylene glycol}} R-CH_2F + AgBr$$

Options:

A. Finkelstein reaction

B. Swarts reaction

C. Darzen reaction

D. Hunsdiecker reaction

Answer: B

Solution:

Solution:

Question 233

Benzene diazonium chloride on treatment with H_3PO_2 in the presence of cuprous ions gives

Options:

A. Phenol

B. Aniline

C. Benzene

D. Chlorobenzene

Answer: C

Solution:

Solution:

Question 234

A compound is formed by two elements M and N. The element N forms ccp and M atom occupies 1 / 3 of the tetrahedral voids. The formula of the compound is

Options:

A. M_3N

B. M_2N_2

C. M_2N_3

D. MN

Answer: C

Solution:

Solution:

Question 235

An element with molar mass $2.7 \times 10^{-2}\,\mathrm{kg\,mol^{-1}}$ forms a cubic unit cell with edge length 407 pm. If the density is $2.7 \times 10^{-3}\,\mathrm{kg\,m^{-3}}$, the nature of the cubic unit cell is

Options:

A. fcc

B. ccp

C. simple cubic

D. bcc

Answer: B

Solution:

Solution:

Question 236

In a solid lattice, the cation has left a lattice site and is located at an interstitial position.
The lattice defect is

Options:

A. n-type

B. p-type

C. Schottky defect

D. Frenkel defect

Answer: D

Solution:

Solution:

Question 237

The resistance of a conductivity cell containing 0.001M KCl solution at 298K is 1500Ω. What is the cell constant if the conductivity of 0.001M KCl solution at 298K is $0.146 \times 10-3$ Scm − 1

Options:

A. $0.119 cm^{-1}$

B. $0.169 cm^{-1}$

C. $0.129 cm^{-1}$

D. $0.159 cm^{-1}$

Answer: C

Solution:

Solution:

Question 238

An iron wire is immersed in a solution containing $ZnSO_4$ and $NiSO_4$. When the concentration of each salt is 1M, predict which of the following reaction is likely to proceed.
Given $E0(Zn^{+2} / Zn) = -0.76V$
$E0(Fe^{+2} / Fe) = -0.44V$ and
$E0(Ni^{+2} Ni) = -0.25V$

Options:

A. Iron reduces Zn^{+2} ions

B. Zn^{+2} reduces Iron ions

C. Iron reduces Ni^{+2} ions

D. Ni^{+2} reduces Iron ions

Answer: C

Solution:

Solution:

Question 239

The amount of silver (At mass 108) deposited from a solution of silver

nitrate when a current of 965 coulombs was passed is,

Options:

A. 10.8g

B. 1.08g

C. 0.108g

D. 1.08×10^3g

Answer: B

Solution:

Solution:

Question 240

Which of the following statements are not correct regarding rate of catalyst in a chemical reaction?
i. Changes the ΔH of the reaction
ii. Decrease the activation energy for the forward and backward reaction equally
iii. Provides a new path of higher activation energy
iv. Increases the average kinetic energy of reacting molecules

Options:

A. (i) and (ii)

B. (i) and (iii)

C. (i) and (iv)

D. (ii) and (iii)

Answer: B

Solution:

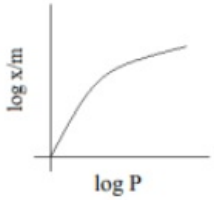
Solution:

Question 241

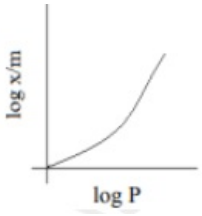
Which of the following curve is in accordance with Freundlich adsorption isotherm?

Options:

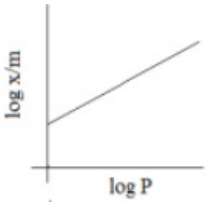
A.



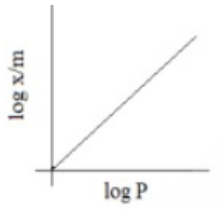
B.



C.



D.



Answer: C

Solution:

Solution:

Question 242

Freshly prepared precipitate sometimes gets converted to colloidal solution by

Options:

A. coagulation

B. diffusion

C. electrolysis

D. peptisation

Answer: D

Solution:

Solution:

Question 243

Ammonia and oxygen react at high temperature as;
$4NH_{3(g)} + 5O_{2(g)} \rightarrow 4NO_{(g)} + 6H_2O_{(g)}$
In an experiment rate of formation of NO is $3 \times 10^{-3}\,mol\,L^{-1}\,s^{-1}$.
Calculate rate of disappearance of ammonia.

Options:

A. $3.6 \times 10^{-3}\,mol\,L^{-1}\,s^{-1}$

B. $3.6 \times 10^{-6}\,mol\,L^{-1}\,s^{-1}$

C. $0.36\,mol\,L^{-1}\,s^{-1}$

D. $7.2 \times 10^{3}\,mol\,L^{-1}\,s^{-1}$

Answer: A

Solution:

Solution:

Question 244

The average energy per molecule of a gas at a given temperature, T is

Options:

A. $\frac{3}{2}RT$

B. $\sqrt{\frac{3RT}{M}}$

C. $\sqrt{\frac{3\left(\frac{R}{N_A}\right)T}{\pi M}}$

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

Answer: D

Solution:

Solution:

Question 245

The exothermic formation of ClF_3 is represented by the reaction $Cl_2(g) + 3F_2(g) \quad 2ClF_3(g)\ \Delta H = -329\,kJ$
Which of the following will increase the quantity of ClF 3 in an equilibrium mixture of Cl_2, F_2 and ClF_3 ?

Options:

A. Increasing temperature

B. Removing Cl_2

C. Increasing volume of the container

D. Adding F_2

Answer: D

Solution:

Solution:

Question 246

Which of the following options will be correct for the stage of half completion of the reaction A B ?

Options:

A. $\Delta G^\circ = 0$

B. $\Delta G^\circ < 0$

C. $\Delta G^\circ > 0$

D. $\Delta G^\circ = -RT\ln 2$

Answer: A

Solution:

Solution:

Question 247

A system gives out 30J of heat and does 75J of work. What is the internal energy change?

Options:

A. +105J

B. −105J

C. +45J

D. −45J

Answer: B

Solution:

Solution:

Question 248

For the reaction at 298K $2A + B \rightarrow C$ $\Delta H = 40 kJmol^{-1}$ and $\Delta S = 0.02 kJmol^{-1}$. At what temperature will the reaction becomes spontaneous considering ΔH and ΔS to be constant over the temperature range,

Options:

A. 20K

B. 200˚C

C. 2000K

D. 2000˚C

Answer: C

Solution:

Solution:

Question 249

Equilibrium constructs K_1 and K_2 for the following equilibria $NO(g) + 1_2O_2]Nt\ NO_2(g)$ and $2NO_2(g)$ k $2\,NO(g) + O_2(g)$ are related a

Options:

A. $K_2 = 1 / K_1$

B. $K_2 = K_1^2$

C. $K_2 = 1 / K_1^2$

D. $K_2 = K_1 / 2$

Answer: C

Solution:

Solution:

Question 250

The pH of a solution increase from 1 to 2. The concentration of H+ ion

Options:

A. decreases

B. increases

C. remains the same

D. becomes zero

Answer: A

Solution:

Solution:
