COMEDK 2023 Shift 2 Question Paper

Time Allowed :3 Hour	Maximum Marks :180	Total Questions :180

1. The particular solution of $e^{\frac{dy}{dx}} = 2x + 1$ **given that** $y = 1$ **when** $x = 0$ **is:**

A. $y = \left(x + \frac{1}{2}\right)\log|2x + 1| - x + 1$

B. $y = (x + 1)\log|2x + 1| - x + 1$

C. $y = \left(x + \frac{1}{2}\right)\log|2x + 1| - \frac{1}{2}x + 1$

D. $y = \left(x - \frac{1}{2}\right)\log|2x + 1| - x - 1$

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2. If $A = \begin{pmatrix} 1 & 2 \\ 0 & 1 \end{pmatrix}$, $P = \begin{pmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{pmatrix}$, $Q = P^T AP$**, then** PQ^{2014} **is:**

A. $\begin{pmatrix} 1 & 2^{2014} \\ 0 & 1 \end{pmatrix}$

B. $\begin{pmatrix} 1 & 4028 \\ 0 & 1 \end{pmatrix}$

C. $\left(P^T\right)^{2013} A^{2014} P^{2013}$

D. $P^T A^{2014} P$

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3. A **and** B **are invertible matrices of the same order such that** $(AB)^{-1} = 8$**, if** $|A| = 2$**, then** $|B|$ **is:**

A. 6

B. 16

C. 4

D. $\frac{1}{16}$

---

4. The centre of the circle passing through $(0, 0)$ **and** $(1, 0)$ **and touching the circle** $x^2 + y^2 = 9$ **is:**

A. $\left(\frac{1}{2}, \frac{1}{2}\right)$

B. $\left(\frac{1}{2}, \frac{3}{2}\right)$

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

D. $\left(\frac{3}{2}, \frac{1}{2}\right)$

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5. If the direction ratios of two lines are given by $3lm - 4ln + mn = 0$ **and** $l + 2m + 3n = 0$**, then the angle between the lines is:**

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

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

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

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

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6. Which of the following is a singleton set?

A. $\{x : x^2 = 4, \ x \in \mathbb{R}\}$

B. $\{x : |x| < 4, \ x \in \mathbb{N}\}$

C. $\{x : |x| < -4, \ x \in \mathbb{N}\}$

D. $\{x : x^2 = 4, \ x \in \mathbb{N}\}$

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7. If the conjugate of $(x + iy)(1 - 2i)$ be $1 + i$, then:

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

B. $y = \frac{3}{5}$

C. $x - iy = \frac{1-i}{1+2i}$

D. $x + iy = \frac{1-i}{1-2i}$

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8. If the length of the major axis of an ellipse is 3 times the length of the minor axis, then its eccentricity is:

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

B. $\frac{2\sqrt{5}}{3}$

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

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

---

9. A die is thrown twice and the sum of numbers appearing is observed to be 8. What is the conditional probability that the number 5 has appeared at least once?

A. $\frac{5}{36}$

B. $\frac{2}{5}$

C. $\frac{1}{18}$

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

10.

$$\int x^x (1 + \log x)\, dx \text{ is equal to:}$$

A. $x \log x + c$

B. $x^x + c$

C. $x^x \log x + c$

D. $x^{x-1} + c$

---

11. The minimum value of $Z = 3x + 5y$, given subject to the constraints $x + y \geq 2$, $x + 3y \geq 3$, $x, y \geq 0$, is:

A. 6

B. 8

C. 9

D. 7

12.

$$\lim_{x \to 0} \frac{a^x - b^x}{x} \text{ is equal to:}$$

A. $\log ab$

B. $\log b$

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

D. $\log a$

---

13. The coordinates of the vertices of the triangle are $A(-2, 3, 6)$, $B(-4, 4, 9)$, and $C(0, 5, 8)$. The direction cosines of the median BE are:

A. $\left\langle \frac{3}{4}, 0, -\frac{2}{4} \right\rangle$

B. $\left\langle -\frac{3}{\sqrt{13}}, 0, -\frac{2}{\sqrt{13}} \right\rangle$

C. $\left\langle 1, 0, -\frac{2}{3} \right\rangle$

D. $\left\langle \frac{3}{\sqrt{13}}, 0, -\frac{2}{\sqrt{13}} \right\rangle$

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14. How many factors of $2^5 \times 3^6 \times 5^2$ are perfect squares?

A. 16

B. 24

C. 12

D. 22

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15. The general solution of the differential equation

$$(1 + y^2)\, dx = (\tan^{-1} y - x)\, dy$$

is:

A. $x = \tan^{-1} y - 1 + ce^{\tan^{-1} y}$

B. $x = \tan^{-1} y - 1 + ce^{-\tan^{-1} y}$

C. $x = \tan^{-1} y + ce^{\tan^{-1} y}$

D. $x = c\tan^{-1} y + e^{-\tan^{-1} y}$

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16. The function $f(x) = \frac{x}{2} + \frac{2}{x}$ has a local minimum at:

A. $x = 2$

B. $x = -2$

C. $x = 0$

D. $x = 1$

---

17. The scalar components of a unit vector which is perpendicular to each of the vectors $\hat{i} + 2\hat{j} - \hat{k}$ and $3\hat{i} - \hat{j} + 2\hat{k}$ are:

A. $\left(\frac{-3}{\sqrt{83}}, \frac{-5}{\sqrt{83}}, \frac{7}{\sqrt{83}} \right)$

B. $(-3, -5, 7)$

C. $\left(\frac{-3}{\sqrt{83}}, \frac{-5}{\sqrt{83}}, \frac{-7}{\sqrt{83}} \right)$

D. $(3, -5, -7)$

---

18. A candidate is required to answer 7 questions out of 12 questions which are divided into two groups, each containing 6 questions. He is not permitted to attempt more than 5 questions from either group. The number of ways in which he can choose the 7 questions is:

A. 1272

B. 780

C. 640

19. Evaluate the integral

$$\int \sqrt{\csc x - 1}\, dx =$$

(1) $\log \sin x + \sqrt{\sin^2 x + \sin x} + c$

(2) $\log \sin x + 1 + 2\sqrt{\sin^2 x + \sin x} + c$

(3) $\log \sin x + \frac{1}{2} + \sqrt{\sin^2 x + \sin x} + c$

(4) $\log \sin x + \frac{1}{2} + \sqrt{\sin^2 x + \frac{1}{2}} + \sin x + c$

20. Evaluate the integral

$$\int_0^2 x^2 + 2x - 3\, dx$$

(1) 3

(2) 6

(3) 2

(4) 4

21. Bag A contains 3 white and 2 red balls. Bag B contains only 1 white ball. A fair coin is tossed. If head appears then 1 ball is drawn at random from bag A and put into bag B. However if tail appears then 2 balls are drawn at random from bag A and put into bag B. Now one ball is drawn at random from bag B. Given that the drawn ball from B is white, the probability that head appeared on the coin is

(1) $\frac{23}{30}$

(2) $\frac{12}{23}$

(3) $\frac{11}{23}$

(4) $\frac{19}{30}$

22. Let X and Y be the set of all positive divisors of 400 and 1000 respectively (including 1 and the number). Then $n(X \cap Y)$ is equal to

(1) 12

(2) 10

(3) 8

6

(4) 6

---

23. In a 12 storey house, 10 people enter a lift cabin. It is known that they will leave the lift in pre-decided groups of 2, 3, and 5 people at different storeys. The number of ways they can do so if the lift does not stop up to the second storey is

(1) 120

(2) 78

(3) 132

(4) 720

---

24. If three numbers a, b, c constitute both an A.P and G.P, then

(1) $a = b = c$

(2) $a = b + c$

(3) $ab = c$

(4) $a = b - c$

---

25. $\cos^6$ A - $\sin^6$ A is equal to

(1) $\cos 2A \left(1 - \frac{1}{4}\sin^2 2A\right)$

(2) $\cos 2A \left(1 - \frac{3}{4}\sin^2 2A\right)$

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

(4) $\cos 2A \left(1 + \frac{1}{4}\sin^2 2A\right)$

---

26. The distance between the foci of a hyperbola is 16 and its eccentricity is $\sqrt{2}$. Then its equation is

(1) $x^2 - y^2 = 32$

(2) $3x^2 - 2y^2 = 7$

(3) $2x^2 - 3y^2 = 7$

(4) $\frac{x^2}{4} - \frac{y^2}{9} = 1$

---

27. The ratio in which the line $3x + 4y + 2 = 0$ divides the distance between the lines $3x + 4y + 5 = 0$ and $3x + 4y - 5 = 0$ is

(1) 3 : 7

(2) 2 : 3

(3) 1 : 2

(4) 2 : 5

---

28. If $2A + 3B = \begin{bmatrix} 2 & -1 & 4 \\ 3 & 2 & 5 \end{bmatrix}$ **and** $A + 2B = \begin{bmatrix} 5 & 0 & 3 \\ 1 & 6 & 2 \end{bmatrix}$ **, then** $B =$

(1) $\begin{bmatrix} -8 & -1 & -2 \\ 1 & -10 & 1 \end{bmatrix}$

(2) $\begin{bmatrix} 8 & 1 & -2 \\ 1 & 10 & -1 \end{bmatrix}$

(3) $\begin{bmatrix} 8 & 1 & 2 \\ -1 & 10 & -1 \end{bmatrix}$

(4) $\begin{bmatrix} 8 & -1 & 2 \\ -1 & 10 & -1 \end{bmatrix}$

---

29. If $\csc(90° + A) + x \cos A \cot(90° + A) = \sin(90° + A)$**, then the value of**

(1) $\cot A$

(2) $\csc A$

(3) $\tan A$

(4) $\sin A$

---

30. P is a point on the line segment joining the points $(3, 2, -1)$ **and** $(6, 2, -1)$**.**

(1) -1

(2) 1

(3) 2

(4) -2

---

31. The area of the upper half of the circle whose equation is $(x - 1)^2 + y^2 = 1$ **is given by**

(1) $\frac{\pi}{4}$ sq units

(2) $\int_0^2 \sqrt{2 - x^2}\, dx$ sq units

(3) $\int_0^2 \sqrt{2x - x^2}\, dx$ sq units

(4) $\int_0^1 \sqrt{2x - x^2}\, dx$ sq units

---

32. In the set W of whole numbers, an equivalence relation R is defined as follows: aRb iff both a and b leave the same remainder when divided by 5. The equivalence class of 1 is given by

(1) $\{2, 7, 12, 17, \dots\}$

(2) $\{1, 6, 11, 16, \dots\}$

(3) $\{4, 9, 14, 19, \dots\}$

(4) $\{0, 5, 10, 15, \dots\}$

---

33. If $P(B) = \frac{3}{5}$, $P(A/B) = \frac{1}{2}$, and $P(A \cup B) = \frac{4}{5}$, then $P(A \cup B)' + P(A')$ is

(1) $\frac{4}{5}$

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

(3) 1

(4) $\frac{1}{5}$

---

34. The function defined by

$$f(x) = \begin{cases} \frac{\sin x}{x} + \cos x & \text{if } x > 0 \\ -5k & \text{if } x = 0 \\ \frac{4(1 - \sqrt{1-x})}{x} & \text{if } x < 0 \end{cases}$$

is continuous at

(1) $\frac{-2}{5}$

(2) -2

(3) 2

(4) $\frac{-5}{2}$

---

35. If

$$f(x) = 2x - \tan^{-1} x - \log(x + \sqrt{x^2 + 1})$$

is monotonically increasing, then

(1) $x < 0$

(2) $x \in \mathbb{R} - \{0\}$

(3) $x \in \mathbb{R}$

(4) $x > 0$

---

36. Consider the first 10 natural numbers. If we multiply each number by -1 and add 1 to each number, the variance of the numbers so obtained is

(1) 6.5

(2) 8.25

(3) 2.87

(4) 3.87

---

37. A triangular park is enclosed on two sides by a fence and on the third side by a straight river bank. The two sides having fence are of same length x. The maximum area enclosed by the park is

(1) $\sqrt{\frac{x^3}{8}}$

(2) πx^2

(3) $\frac{3}{2}x^2$

(4) $\frac{1}{2}x^2$

---

38. Let

$$f(x) = \cos^{-1}(3x - 1)$$

then the domain of $f(x)$ is equal to

(1) $[0, \frac{2}{3}]$

(2) $(0, \frac{2}{3})$

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

(4) $\left[-\frac{2}{3}, \frac{2}{3}\right]$

---

39. The solution of the differential equation

$$\frac{dy}{dx} + y \cos x = \frac{1}{2} \sin 2x$$

10

is

(1) $ye^{\sin x} = e^{\sin x + 1} + c$

(2) $ye^{\sin x} = e^{\sin x (sinx - 1)} + c$

(3) $ye^{\sin 2x} = e^{\sin 2x (sinx - 1)} + c$

(4) $ye^{\cos x} = e^{\sin x (cosx - 1)} + c$

---

40. The area bounded by the curve

$$y^2 = 4a^2(x - 1)$$

and the lines

$$x = 1, \quad y = 4a$$

is

(1) $\frac{16}{3}a$ sq units

(2) $\frac{16}{3}a^2$ sq units

(3) $16a^2$ sq units

(4) $4a^2$ sq units

---

41. If

$$f(x) = \sin^{-1}\left(\frac{2x + 1}{1 + 4x^2}\right)$$

then $f'(0)$ is equal to

(1) $2\log 2$

(2) $\frac{2}{3}\log 2$

(3) 0

(4) $\log 2$

---

42. If

$$\begin{bmatrix} 2+x & 3 & 4 \\ 1 & -1 & 2 \\ x & 1 & -5 \end{bmatrix}$$

is a singular matrix, then x is

(1) $\frac{5}{13}$

(2) $\frac{-25}{13}$

(3) $\frac{13}{25}$

(4) $\frac{25}{13}$

---

43. The sum of the degree and order of the following differential equation

$$\left(1 - \left(\frac{dy}{dx}\right)^2\right)^{\frac{3}{2}} = kx\frac{d^2y}{dx^2}$$

is

(1) $\frac{5}{2}$

(2) 4

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

(4) 3

---

45. Solution of

$$x - y + z = 4, \quad x - 2y + 2z = 9, \quad 2x + y + 3z = 1$$

is

(1) $x = 3$, $y = 6$, $z = 9$

(2) $x = -4$, $y = -3$, $z = 2$

(3) $x = -1$, $y = -3$, $z = 2$

(4) $x = 2$, $y = 4$, $z = 6$

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46. If

$$\cos \alpha = k \cos \beta$$

then

$$\cot\left(\frac{\alpha+\beta}{2}\right)$$

is equal to

(1) $\frac{k+1}{k-1}\tan\left(\frac{\alpha-\beta}{2}\right)$

(2) $\frac{k+1}{k-1}\tan\left(\frac{\beta-\alpha}{2}\right)$

(3) $\frac{k+1}{k+1}\tan\left(\frac{\alpha-\beta}{2}\right)$

(4) $\frac{k-1}{k+1}\tan\left(\frac{\alpha-\beta}{2}\right)$

---

47. The integral

$$\int e^x\left(1+\tan x+\tan^2 x\right)dx$$

is equal to

(1) $e^x\cos x + c$

(2) $e^x\sin x + c$

(3) $e^x\tan x + c$

(4) $e^x\sec x + c$

---

48. In a $\triangle ABC$, if coordinates of point A are $(1,2)$ and the equations of the medians through B and C are

$$x+y=5 \quad\text{and}\quad x=4 \quad\text{respectively, then the coordinates of B are}$$

(1) $(4,1)$

(2) $(7,-2)$

(3) $(1,4)$

(4) $(-2,7)$

---

50. The altitude of a cone is 20 cm and its semi vertical angle is 30°. If the semi vertical angle is increasing at the rate of 2° per second, then the radius of the base is increasing at the rate of

(1) 160 cm/sec

(2) 10 cm/sec

(3) $\frac{160}{3}$ cm/sec

(4) 30 cm/sec

---

51. If the position vector of a point A is $\vec{A} = \vec{a} + 2\vec{b}$ and $\vec{a}$ divides AB in the ratio 2 : 3, then the position vector of B is

(1) $\vec{b}$

(2) $2\vec{a} - \vec{b}$

(3) $\vec{b} - 2\vec{a}$

(4) $\vec{a} - 3\vec{b}$

---

52. The value of

$$\sin^{-1}\left[\cos\left(\frac{39\pi}{5}\right)\right]$$

is

(1) $\frac{\pi}{2}$

(2) $\frac{3\pi}{10}$

(3) $\frac{3\pi}{5}$

(4) $-\frac{3\pi}{10}$

---

53. The probability distribution of a discrete random variable X is given as

X	1	2	4	$2A$	$3A$	$5A$
$P(X)$	$\frac{1}{2}$	$\frac{1}{5}$	$\frac{3}{25}$	K	$\frac{1}{25}$	$\frac{1}{25}$

Then the value of A if $E(X) = 2.94$ is

(1) 3

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

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

(4) 2

---

54. 18 Points are indicated on the perimeter of a triangle ABC as shown below. If three points are chosen then probability that it will form a triangle is

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

(2) $\frac{355}{408}$

(3) $\frac{331}{816}$

(4) $\frac{711}{816}$

---

55. If $\vec{a}$ and $\vec{b}$ are unit vectors, then the angle between $\vec{a}$ and $\vec{b}$ for which $\vec{a} - \vec{b} = 0$

(1) $\frac{\pi}{3}$

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

(3) $\frac{\pi}{6}$

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

---

56. If the volume of a sphere is increasing at a constant rate, then the rate at which its radius is increasing is

(1) inversely proportional to its surface area

(2) proportional to the radius

(3) a constant

(4) inversely proportional to the radius

---

57. What can be said regarding a line if its slope is negative?

(1) θ is an obtuse angle

(2) θ is equal to zero

(3) Either the line is the x-axis or it is parallel to the x-axis

(4) θ is an acute angle

---

58. The range of x which satisfy the inequality

$$-5 \leq \frac{2 - 3x}{4} \leq 9$$

is

(1) $\left(-\frac{34}{3}, -\frac{22}{3}\right)$

(2) $\left[-\frac{34}{3}, \frac{22}{3}\right]$

(3) $\left[-\frac{34}{3}, 8\right]$

(4) $\left[-\frac{34}{3}, \frac{22}{3}\right)$

---

59. Evaluate the integral

$$\int \frac{\cos 4x + 1}{\cot x - \tan x}\, dx$$

(1) $-\frac{1}{2}\cos 2x + c$

(2) $-\frac{1}{8}\cos 4x + c$

(3) $-\frac{1}{4}\cos 4x + c$

(4) $-\frac{1}{16}\cos 8x + c$

---

60. Let x be the arithmetic mean and y, z be the two geometric means between any two positive numbers, then

$$\frac{y^3 + z^3}{xyz} = \text{\textemdash\textemdash\textemdash}$$

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

(2) 1

(3) $\frac{1}{7}$

(4) 2

---

61. Identify the starting compound from the following data:

$C_6H_{14}O(X)$ on reaction with HI yields a haloalkane (A) and an alcohol (B).

Compound (A) on reaction with aqueous NaOH gives an alcohol (C). Compounds (B) and (C) on reaction with CrO_3 in anhydrous medium yields Butanone and Ethanal respectively.

(1) 2-Methoxypentane

(2) 2-Ethyxbutane

(3) Hexan-1-ol

(4) Hexan-2-ol

---

62. 5.8 g of a gas maintained at $95°C$ occupies the same volume as 0.368 g of hydrogen gas maintained at a temperature of $17°C$ and pressure being the same atmospheric pressure for both the gases. What is the molecular mass of the unknown gas?

(1) 44 g/mol

(2) 32 g/mol

(3) 71 g/mol

(4) 40 g/mol

---

63. A first order reaction proceeds to 90% completion. What will be the approximate time taken for 90% completion in relation to $t_{1/2}$ of the reaction?

(A) 5.02 times of $t_{1/2}$

(B) 4.54 times of $t_{1/2}$

(C) 5 times of $t_{1/2}$

(D) 3.32 times of $t_{1/2}$

---

64. What would be the volume of water required to dissolve 0.2 g of PbCl$_2$ of molar mass 278 g/mol to prepare a saturated solution of the salt? (K_{sp} of PbCl$_2$ = 3.2 × 10^{-8})

(A) 1000 ml

(B) 359.7 ml

(C) 278.8 ml

(D) 360.4 ml

---

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(D) 360.4 ml

---

65. Which one of the following compounds would not undergo Aldol condensation?

(A) Phenyl ethanal

(B) 1-Phenyl propanone

(C) 2,2-Dimethyl butanal

(D) 2-Methyl pentanal

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66. Match the following characteristics of transition metals given in Column I with the examples listed in Column II

S. No.	Characteristic properties	S. No.	Examples
W	Chemically inert, non-stoichiometric compound	A	WO_3
X	Higher oxidation states are more stable	B	$TiCl_4$
Y	Due to inert pair effect, lower oxidation state is more stable	C	Mn_4N
Z.	Colourless compound of transition metal	D	$SnCl_2$

(A) $W = B$, $X = C$, $Y = D$, $Z = A$

(B) $W = C$, $X = D$, $Y = A$, $Z = B$

(C) $W = C$, $X = A$, $Y = D$, $Z = B$

(D) $W = A$, $X = D$, $Y = C$, $Z = B$

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67. Gaseous Nitrous oxide decomposes at 298 K to form Nitrogen gas and Oxygen gas.

The ΔH for the reaction at 1.0 atm pressure and 298 K is $-$
163.15 kJ. Calculate Internal energy change for the decomposition of 100 g of Nitrous oxide gas under th

(1) -166 kJ

(2) -188.2 kJ

(3) -230.3 kJ

(4) -376.43 kJ

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68. In neutral medium $KMnO_4$ oxidises $MnSO_4$ to

(1) Mn_2O_3

(2) Mn_3O_4

(3) MnO_2

(4) K_2MnO_4

---

69. What would be the van't Hoff factor for a solution prepared by dissolving 3.42 g of $CaCl_2$ in 2500 ml of water having an Osmotic pressure equal to 0.75 atm at 27°C? Molar mass of $CaCl_2$ = 111 amu.

(1) 2.7

(2) 3.15

(3) 2.47

(4) 3.0

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70. The Molar conductivity of 0.05M solution of $MgCl_2$ is 194.5 ohm^{-1} cm^2 per mole at room temperature. A Conductivity cell with electrodes having 3.0 cm^2 surface area and 1.0 cm apart is filled with the solution of $MgCl_2$. What would be the resistance offered by the conductivity cell?

(1) 114.25 ohms

(2) 0.00291 ohms

(3) 402.6 ohms

(4) 34.27 ohms

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71. The equilibrium constants for the reactions a, b, and c are as given:

a) $N_2 + 3H_2 = 2NH_3$: K_1

b) $N_2 + O_2 = 2NO$: K_2

c) $2H_2 + O_2 = 2H_2O$: K_3

What would be the equilibrium constant for the reaction:

$4NH_3 + 5O_2 = 4NO + 6H_2O$; K_x

(1) $K_x = K_2^2 \, K_3^3/K_1^2$

(2) $K_x = K_1/K_2 \, K_3$

(3) $K_x = 1/K_1^2 + K_2^2 + K_3^3$

(4) $K_x = K_1^2/K_2 \, K_3$

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72. Identify the correct IUPAC name of $[CoCl_2(NO_2)(NH_3)_3]$

(1) Triamminedichloridonitrito-N-cobalt(III)

(2) Dichloridotriamminenitrito-O-cobaltat(II)

(3) Dichlorortriamminenitrito-N-cobalt(II)

(4) Triamminedichloronitrito-O-cobalt(III)

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73. From among the following, identify the compound which forms two moles of a ketone on ozonolysis.

(A) 2,3-Dimethylbutane.

(B) 3-Methyl-1-pentene.

(C) 2,3-Dimethyl-2-butene.

(D) 2-Methyl-2-pentene.

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74. If electrolysis of water is carried out for a time duration of 2 hours, how much electric current in amperes would be required to liberate 100 ml of O_2 gas measured under standard conditions of temperature and pressure?

(A) 0.1723 A

(B) 4.178 A

(C) 0.8616 A

(D) 0.2393 A

---

75. For a reaction of the type, $2X + Y \rightarrow A + B$, the following is the data collected:

Experiment	[X]	[Y]	Initial rate of formation of A
1	0.2	0.2	12.0×10^{-3}
2	0.6	0.4	14.4×10^{-2}
3	0.6	0.8	5.76×10^{-1}
4.	0.8	0.2	4.8×10^{-2}

(A) 2.5

(B) 3

(C) 2

(D) 1.5

---

76. Select the strongest base from the given compounds:

([A]) p- NO_2- $C_6H_4NH_2$

([B]) $C_6H_5CH_2$- NH_2

([C]) m- NO_2- $C_6H_4NH_2$

([D]) $C_6H_5NH_2$

77. The conversion of Propyne to Benzene can be brought out in 4 steps.

Choose the reagents to be used, in the proper sequential order, to bring out the conversion.

([A]) Na/ Ether, Cr_2O_3 (high T and P), HBr, H_2/Pd

([B]) HBr, alc. KOH, HBr/$(C_6H_5CO)_2O_2$, Cr_2O_3 (high T and P)

([C]) Cr_2O_3 (high T and P), Na/ dry ether, HBr, Conc. H_2SO_4

([D]) H_2/Pd, HBr/$(C_6H_5CO)_2O_2$, $Na/dry ether$, Cr_2O_3 (high T and P)

---

78. Para and ortho hydrogen differ in:

([A]) Atomic number

([B]) Number of neutrons

([C]) Size

([D]) Spins of protons

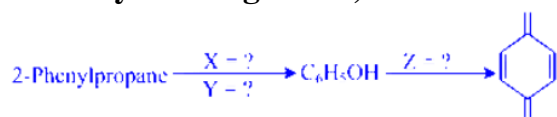**79. What is the mole fraction of solute in a 5 m aqueous solution?**

([A]) 0.038

([B]) 0.593

([C]) 0.082

([D]) 0.751

---

80. Identify the reagents X, Y and Z used to bring out the following reactions.

([A]) X = Alkaline KMnO4, Y = dil HCl, Z = CrO3

([B]) X = Air, Y = dil H2SO4, Z = $Cr2O7^{2-}/H+$

([C]) X = H2O2, Y = Conc. HCl, Z = O3

([D]) X = DIBAL-H, Y = Conc. HNO3, Z = CrO2Cl2

---

81. A proton having mass equal to 1.66×10^{-27} kg is accelerated to one tenth of the velocity of light. If its velocity can be measured to an accuracy of $\pm 2\%$, what would be the uncertainty in its position?

([A]) 7.9×10^{-5} m

([B]) 5.29×10^{-14} m

([C]) 6.0×10^{-5} m

([D]) 1.06×10^{-13} m

---

82. Match the details given in Column I with those given in Column II:

S. No.	Column I	Column II
A	For complex reactions order is determined by	Rate of reaction
B	For zero order reaction unit of k is same as that of	Slope = k/2.303
C	Mathematical expression which gives relationship	Slowest rate determining step.
D	For a first order reaction plot of log $[R_0]/[R]$ vs time gives	Rate law.

([A]) A = S, B = R, C = P, D = Q

([B]) A = S, B = Q, C = D, D = P

([C]) A = R, B = S, C = D, D = Q

([D]) A = P, B = S, C = Q, D = P

---

83. Match the items in Column I with their description in Column II:

S. No.	Column I	Column II
A	Kappa K	Intensive property
B	E^0cell	Extensive property
C	Molar conductivity	Decreases with decrease in concentration of both strong and weak electro
D	G_{cell}	Increases with dilution

([A]) A = R, B = Q, C = S, D = P

([B]) A = R, B = P, C = S, D = Q

([C]) A = Q, B = S, C = P, D = R

([D]) A = S, B = Q, C = D, D = P

---

84. Choose the incorrect statement.

([A]) m - Cresol is a weaker acid than Phenol.

([B]) Acidic nature of Phenol is due to -I effect of oxygen of the hydroxyl group.

([C]) Acetylation of Salicylic acid produces 2-Acetoxybenzoic acid.

([D]) Phenol on heating with Conc. H_2SO_4 yields sulphaniilic acid.

---

86. The group number of the element in the periodic table with the electronic configuration $(n-1)d^2ns^2$. For $n=4$ is:

([A]) 4

([B]) 13

([C]) 3

([D]) 5

---

87. Identify the final product formed during the course of the given reactions.

Pentan-2-one $\xrightarrow{\text{NaCN/HCl}}$ $[X]$ $\xrightarrow{\Delta, 95\% H_2SO_4}$ $[Y]$
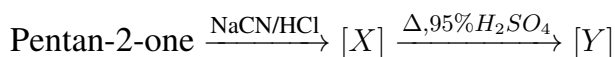
([A]) $CH_3 - C = CH - CH_2CH_3$

CH_2NH_2

([B]) $CH_2 = C - CH_2\text{-}CH_2\text{-}CH_3$

CN

([C]) $CH_2 = C - CH_2\text{-}CH_2\text{-}CH_3$

$COOH$

([D]) $CH_3 - C = CH - CH_2CH_3$

CN

---

88. Which one of the following will give a positive result when it is warmed with Chloroform and alcoholic solution of KOH?

([A]) N - Methyl-o-Methylaniline

([B]) N,N-Dimethylaniline

([C]) p-Methylbenzylamine

([D]) N-Methyl-p-Methylaniline

89. Choose the incorrect statement:

([A]) Higher the K_H value for a gas at a given pressure, higher is its solubility in that solvent.

([B]) K_H value for a gas present in a given solvent depends on the nature of solute and solvent.

([C]) K_H value is temperature dependent.

([D]) K_H value changes with change in the partial pressure of the gas.

90. What would be the products obtained when a mixture of p-Methoxy benzaldehyde and Methanal are heated with 50% concentrated Caustic soda solution?

([A]) p-Methoxy sodium benzoate and sodium acetate.

([B]) p-Methoxy benzyl alcohol and sodium formate.

([C]) p-Methoxy benzyl alcohol and methanol.

([D]) p-Methoxy sodium benzoate and sodium formate.

91. Which of the following will show geometrical isomerism?

([A]) 2-methylbut-2-ene

([B]) 2-methylpropene

([C]) Cyclohexene

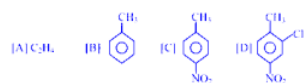([D]) 1,2-dibromopropene

92. Identify the compounds A, B, C, and D.

93. Match the Coordination compounds given in Column I with their characteristic features listed in Column II.

Coordination Compounds	Characteristic Features
$W.[Co(NH_3)_6]Cl_3$	$P. Oxidation state = +3, Configuration = d^6, \mu = 5.92 BM$
$X.K_4[Mn(CN)_6]$	$Q. Oxidation state = +3, Configuration = d^3, \mu = 3.87 BM$
$Y.[CrCl_3(py)_3]$	$R. Oxidation state = +3, Configuration = d^3, \mu = 0 BM$
$Z.Cs[FeCl_4]$	$S. Oxidation state = +2, Configuration = d^6, \mu = 1.732 BM$

---

94. Choose the correct order of increasing acidic strength of the following compounds.

A. $CH_3CH_2OH < CCL_3CH_2OH < CF_3CH_2OH$

B. $CF_3CH_2OH < CCL_3CH_2OH < CH_3CH_2OH$

C. $CH_3CH_2OH < CF_3CH_2OH < CCL_3CH_2OH$

D. $CCL_3CH_2OH < CF_3CH_2OH < CH_3CH_2OH$

---

95. Mg(OH)$_2$ is used as an antacid. If a person, suffering from acidity, produces 2.5 L of Gastric juice in a day, approximately how many antacid tablets, each containing 600 mg of Mg(OH)$_2$, will be required to completely neutralize the whole HCl produced in the stomach in one day? (Gastric juice contains 3.0 g of HCl per L). (Atomic masses: Mg = 24 g/mol, O = 16 g/mol, and H = 1 g/mol.)

A. 10 tablets

B. 4 tablets

C. 7 tablets

D. 6 tablets

---

96. Given below are graphs showing the variation in velocity constant with temperature on the Kelvin scale. Identify the graph which represents the Arrhenius equation.

A. D

B. C

C. A

D. B

---

96. Given below are graphs showing the variation in velocity constant with temperature on the Kelvin scale. Identify the graph which represents the Arrhenius equation.

A. D

B. C

C. A

D. B

---

97. Identify the correct statement describing the characteristics of C_2 molecule.

A. Bond order = 2.0; Paramagnetic in nature; One sigma and one pi bond formed.

B. Bond order = 0; C_2 molecule is non-existent.

C. Bond order = 2.0; Diamagnetic in nature; Both bonds formed are pi bonds.

D. Bond order = 1.5; Paramagnetic in nature; Both bonds formed are sigma bonds (σ).

---

98. One among the 4 Vitamins belonging to B Complex, can be stored in our body. Identify the Vitamin.

A. Pyridoxine

B. Thiamine

C. Cyanocobalamin

D. Riboflavin

---

99. Which one of the following statements is correct?

A. The order of stability of Carbonions is $C_6H_5CH_2^-$ ¡ $(C_6H_5)_2CH^-$ ¡ $(C_6H_5)_3C^-$

B. In CH_3^+, Carbon carrying positive charge is sp^3 hybridised.

C. In CH_3^-, Carbon carrying negative charge is sp^2 hybridised.

D. The order of stability of Carbocations is $(C_6H_5)_3C^+$ ¡ $(C_6H_5)_2CH^+$ ¡ $C_6H_5CH_2^+$

---

100. In the given Redox equation, identify the stoichiometric coefficients w, x, y, and z.

The given equation:

$$ClO_3^- + wCl^- + xH^+ \rightarrow yH_2O + zCl_2$$

A. $w = 3$, $x = 6$, $y = 3$, $z = 2$

B. $w = 5$, $x = 6$, $y = 3$, $z = 3$

C. $w = 6$, $x = 6$, $y = 3$, $z = 4$

D. $w = 6$, $x = 5$, $y = 2.5$, $z = 3$

---

101. In the following question, Assertion (A) is given followed by a statement of Reason (R). Choose the correct answer.

Assertion (A): $\pi(2p_z), \pi(2p_y), \pi^*(2p_z), \pi^*(2p_y)$ molecular orbitals have one nodal plane each.

Reason (R): All the molecular orbitals formed by the sideways overlapping have one nodal plane.

A. Both assertion and reason are true and reason is the correct explanation of the assertion.

B. Both assertion and reason are false.

C. Assertion is true but reason is false.

D. Both assertion and reason are true and reason is not the correct explanation of the assertion.

---

102. Structures of 3 Monosaccharides are given below. Two of them are Anomers. Identify the two Anomers.
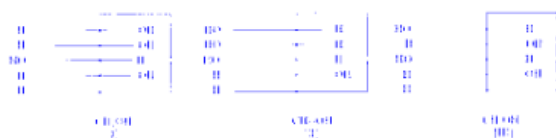
A. II is the anomer of both I and II.

B. I and II are Anomers.

C. II and III are Anomers.

D. I and III are Anomers.

---

103. Which one of the following is an incorrect statement pertaining to the properties of Coordination compounds?

A. A square planar complex of the type Mabcd, where a, b, c, and d are unidentate ligands, exhibits geometrical isomerism and exists in one cis-form and two trans-forms.

B.

$[Co(NH_3)_5NO_2]Cl_2 exists in 2 forms, the red form and the yellow form which are linkage isomers.$

C. $[Fe(CN)_6]^{3-} is called a Low spin complex.$

D. Out of cis-$[CrCl_2(ox)_2]^{3-} and trans - [CrCl_2(ox)_2]^{3-}, the trans isomer is optically inactive.$

---

104. X is an electrolyte with a concentration of 0.04M whose formula is of the type X$_2$A. Y is a non-electrolyte solution with a concentration of 0.2M and has an osmotic pressure equal to P$_2$ at room temperature. What is the relationship between the Osmotic pressure π of X and P$_2$?

A. $\pi = 0.6P_2$

B. $\pi = 0.12P_2$

C. $\pi = 0.04P_2$

D. $\pi = 0.8P_2$

---

105. Identify the catalyst used in the reaction between iodide and persulphate ions.

A. Cr^{3+}

B. Fe^{3+}

C. Ni^{2+}

D. Fe^{2+}

---

106. Find the correct matches of the substances, given in Column I, from their characteristic properties given in Column II.

S. No.	Column I
S. No.	Column II
W	T1
A	Decomposes steam to form its dioxide and dihydrogen gas.
X	CCl_4
B	Consists of twenty 6-membered rings and twelve 5-membered rings.
Y	Sn
C	+3 oxidation state is highly oxidising.
Z	C_{60}
D	Electron precise species, neither acts as electron donor nor as electron acceptor.

A. W = C   X = D   Y = A   Z = B

B. W = B   X = D   Y = C   Z = A

C. W = A   X = C   Y = B   Z = D

D. W = D   X = C   Y = A   Z = B

---

107. A gas taken in a closed vessel is heated from 54°C to 1254°C. The pressure of the gas becomes   .

A. 8.92 times P_1

B. 23.2 times P_1

C. 4.67 times P_1

D. 9.6 times P_1

---

108. Which one of the following correctly represents the decreasing order of acidic nature of the given carboxylic acids:

[A] 2-Hydroxybenzoic acid

[B] Benzoic acid

[C] 3-Hydroxybenzoic acid

[D] 4-Hydroxybenzoic acid

A. [D] ¿ [C] ¿ [B] ¿ [A]

B. [A] ¿ [C] ¿ [B] ¿ [D]

C. [D] ¿ [B] ¿ [C] ¿ [A]

D. [B] ¿ [A] ¿ [C] ¿ [D]

---

109. If the depression in freezing point of an aqueous solution containing a solute, which is neither dissociated nor associated, is aK with $K_f = b$ K · kg mol^{-1}, what would be the elevation in boiling point (X) for this solution if its $K_b = K$ K · kg mol^{-1}?

A. $X = 2c \times \frac{b}{a}$

B. $X = c \times \frac{a}{2b}$

C. $X = c \times \frac{a}{b}$

D. $X = c \times \frac{b}{a}$

---

110. The rate constant for a First order reaction at 560 K is 1.5×10^{-6} per second. If the reaction is allowed to take place for 20 hours, what percentage of the initial concentration would have converted to products?

A. 11.14 %

B. 10.23 %

C. 12.46 %

D. 21.2 %

---

111. What would be the final product [X] formed when p-Toluene undergoes the following series of reactions?

(A) CH

(B) CH

(C) CH

(D) CH

---

112. The energy of an electron in the ground state of Hydrogen atom is -2.18×10^{-18} J. What would be the energy associated with the second excited state of Li$^+$?

(A) -2.18×10^{-18} J

(B) -4.905×10^{-18} J

(C) -0.242×10^{-18} J

(D) -3.26×10^{-18} J

---

113. Identify the incorrect statement.

(A) Ability of Fluorine to stabilise higher oxidation states in transition metals is due to the low lattice enthalpy of the fluorides.

(B) The second and third ionisation enthalpies of Mn^{2+} and Fe^{3+} respectively have lower values than expected.

(C) Transition metals readily form alloys because their metallic radii are within about 15% of each other.

(D) C^{2+} acts as reducing agent while Mn^{2+} acts as an oxidising agent though both the ions have $d\hat{4}$ configuration.

---

114. Choose the incorrect statement regarding Cellulose.

(A) It does not reduce Fehling's solution nor Tollens' reagent.

(B) On heating with dil. H_2SO_4, under pressure, Cellulose gets hydrolyzed to D-Glucose.

(C) It is a straight chain polysaccharide made of β - D-glucose units.

(D) The βglycosidic linkages are between C_1 of one Glucose unit and C_5 of the next Glucose unit.

---

115. Which one of the following Coordination entities exhibits Facial and Meridional isomerism?

(A) $[Co(H_2O)_3(NO_3)_3]$

(B) $[Co(en)_3Cl]^+$

(C) $[Co(NH_3)_4]Br_2NO_3$

(D) $[Co(en)_3]Cl_3$

---

116. Arrange the following in the decreasing order of their Dipole moments.

a. Chlorobenzene

b. 1,2-Dichlorobenzene
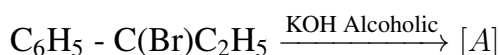
c. 1,3-Dichlorobenzene

d. 1,4-Dichlorobenzene

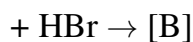A. $d > c > b > a$

B. $c > d > b > a$

C. $a > b > c > d$

D. $b > a > c > d$

---

117. The reactions taking place with 2 - Phenyl - 2 - bromopropane as the starting material is shown below. Identify [A] and [B] formed in the reaction.

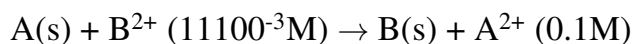C_6H_5 - $C(Br)C_2H_5$ $\xrightarrow{\text{KOH Alcoholic}}$ $[A]$

A

+ HBr → [B]

A. [A] = 2-Phenylpropene [B] = 2-Phenyl-1-bromopropane

B. [A] = 2-Phenylpropene-2-ol [B] = 2-Phenyl-2-bromopropene

C. [A] = 2-Bromopropene [B] = 1-Bromopropane

D. [A] = 4-Hydroxyphenyl-2-bromopropane [B] = 4-Hydroxyphenylpropene

---

118. The reaction taking place in a galvanic cell is as given

$A(s) + B^{2+}$ $(11100^{-3}M)$ → $B(s) + A^{2+}$ (0.1M)

The emf of the cell is +2.651 V. If the standard emf of the cell is +2.71 V, what is the value of X?

A. X = 6

B. X = 2

C. X = 3

D. X = 4

---

119. Which one of the following will undergo Nucleophilic substitution, by S_N^1 mechanism, fastest?

A. $Br^- - CH_2 = CH - CH_2$

B. C_6H_5Br

C. $CH_3 - CH = CHBr$

D. $C_6H_{11}Br$

---

120. A man grows into a giant such that his height increases to 8 times his original height. Assuming that his density remains the same, the stress in the leg will change by a factor of

A. $2\sqrt{2}$

B. 4

C. 16

D. 8

---

121. The mass number of two nuclei P and Q are 27 and 125 respectively. The ratio of their radii $R_P : R_Q$ is given by: A. 9 : 25

B. 3 : 5

C. 27 : 25

D. 5 : 3

---

122. The current sensitivity of a galvanometer having 20 divisions is $10\mu A/$div. If the resistance of the galvanometer is 100, then the value of the resistance to be used to convert this galvanometer into a voltmeter to read up to 1 V is:

A. $4 \times 10^4 \, \Omega$ in series with the galvanometer.

B. $4900 \, \Omega$ in parallel with the galvanometer.

C. $4 \times 10^4 \, \Omega$ in series with the galvanometer.

D. $49000 \, \Omega$ in series with the galvanometer.

---

123. In a nuclear reaction, 2 deuteron nuclei combine to form a helium nucleus. The energy released in MeV will be: (Given mass of deuteron = 2.01355 amu and mass of helium nucleus = 4.0028 amu.) A. 24.3 MeV

B. 2.262 MeV

C. 22.62 MeV

D. 0.0243 MeV

---

124. Two point charges $20\,\mu C$ **and** $-10\,\mu C$ **are separated by a distance of 1 m in air. At what point on the line joining the two charges, the electric potential is zero. Options:**

A. 0.5 m from the charge $10\,\mu C$

B. 0.76 m from the charge $20\,\mu C$

C. 0.67 m from the charge $20\,\mu C$

D. 0.25 m from the charge $10\,\mu C$

---

125. The critical angle of a medium having the refractive index $\sqrt{2}$ **is:**

A. $30°$

B. $45°$

C. $60°$

D. $90°$

---

126. A spherical metal ball of density ρ **and radius** r **is immersed in a liquid of density** σ**. When an electric field is applied in the upward direction the metal ball remains just suspended in the liquid. Then the expression for the charge on the metal ball is:** A.
$q = \frac{4\pi r^3 \rho}{\varepsilon}$
B. $q = \frac{4\pi r^3 (\rho-\sigma)}{\varepsilon}$
C. $q = \frac{4\pi r^3 \sigma}{\varepsilon}$
D. $q = \frac{4\pi r^3 (\rho-\sigma)}{\varepsilon}$

---

127. In an adiabatic expansion of air, the volume is increased by 6.2%. The percentage change in pressure is $(\gamma = 1.4)$

A. 8.68 B. 4.84 C. 6.48 D. 2.24

---

128. Water from a tap of cross-sectional area $1\,\text{cm}^2$**, falls vertically downwards at** $2\,\text{m/s}$**. The cross-sectional area of the stream, 20 cm below the tap is (assume that pressure is constant throughout and the flow is streamlined;** $g = 10\,\text{m/s}^2$**).**

(1) $7.07\,\text{cm}^2$

(2) $1\,\text{cm}^2$

(3) $0.707\,\text{cm}^2$

(4) $2\,\text{cm}^2$

---

129. In the figure, first the capacitors are fully charged by closing the key K. Then after opening the Key, a dielectric material with dielectric constant $\kappa = 2$ is filled in the space between the plates of both the capacitors. At this state the ratio of the charge on the capacitor C_1 to that of C_2 is:
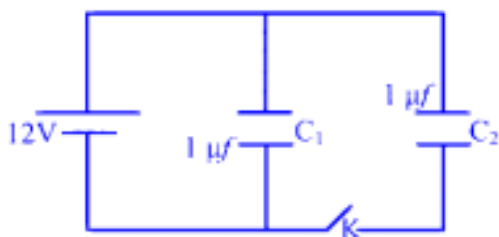
(1) $1 : 1$

(2) $3 : 2$

(3) $2 : 1$

(4) $1 : 2$

---

130. The energy gap between valence band and the conduction band for a given material is 6 eV. What would be the energy associated with the second excited state of Li?

(1) $-2.18 \times 10^{-18}\,\text{J}$

(2) $-4.905 \times 10^{-18}\,\text{J}$

(3) $-0.242 \times 10^{-18}\,\text{J}$

(4) $-3.26 \times 10^{-18}\,\text{J}$

---

131. PQRS is square of side 1 m. A charge of $100\,\mu C$ is placed at the centre of the square. Then the work done to take $3\,\mu C$ charge from the corner P to the corner R.

(1) $9\sqrt{2} \times 10^5\,\text{J}$

(2) $4.5 \times 10^5 \, \text{J}$

(3) Zero

(4) $1.8 \times 10^5 \, \text{J}$

---

132. When the angle of incidence on one face of the equilateral glass prism is $\frac{3}{4}$ of the angle of the prism, the ray of light undergoes minimum deviation. If the velocity of light in vacuum is c, then the velocity of light in the glass is:

(1) $\frac{c}{\sqrt{2}}$

(2) $\frac{c}{\sqrt{3}}$

(3) $\sqrt{2}c$

(4) $\frac{c}{\sqrt{5}}$

---

133. If the ratio of specific heat of a gas at constant pressure to that at constant volume is γ, the change in internal energy of a mass of a gas when the volume changes from V to $3V$ at constant pressure is:

(1) $\frac{R}{T(\gamma-1)}$

(2) $2PV$

(3) $2PV$

(4) $\frac{2PV}{(\gamma-1)}$

---

134. A magnetic field does not interact with:

(1) An electric charge at rest

(2) A moving electric charge

(3) A current-carrying straight conductor

(4) A moving permanent magnet

---

(3) A current-carrying straight conductor

(4) A moving permanent magnet

---

136. If reaction is R and coefficient of friction is μ, what is the work done against friction in moving a body by distance d?

(1) $\mu R d$

(2) $\frac{\mu R d}{2}$

(3) $2\mu R d$

(4) $\frac{\mu R d}{4}$

---

137. The electric flux from a cube of side 1 m is Φ. When the side of the cube is made 3 m and the charge enclosed by the cube is made one-third of the original value, then the flux from the bigger cube will be:

(1) Φ

(2) $\Phi/3$

(3) 3Φ

(4) 9Φ

---

138. An uniform sphere of mass M and radius R exerts a force of F on a small mass m placed at a distance of $3R$ from the centre of the sphere. A spherical portion of diameter R is cut from the sphere as shown in the fig. The force of attraction between the remaining part of the disc and the mass m is:
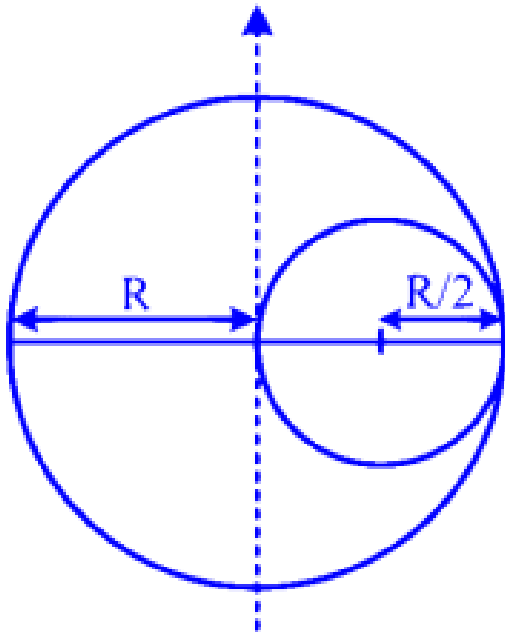
(1) $\frac{7}{12}F$

(2) $\frac{1}{3}F$

(3) $\frac{41}{50}F$

(4) $\frac{7}{9}F$

---

139. The magnetic permeability μ of a paramagnetic substance is:

(1) $\mu > 1$

(2) $\mu = 1$

(3) $\mu = 0$

(4) μ is infinite

---

140. A lens of power $+1\,$D is made in contact with another lens of power $-2\,$D. The combination will then act as:

(1) Diverging lens of focal length 100 cm

(2) Diverging lens of focal length 33.3 cm

(3) Converging lens of focal length 33.3 cm

(4) Converging lens of focal length 100 cm

---

141. A particle at rest decays into two particles of mass m_1 and m_2 and move with velocities v_1 and v_2. The ratio of their de Broglie wave lengths $\lambda_1 : \lambda_2$ is:

(1) 1 : 4

(2) 1 : 1

(3) 1 : 2

(4) 2 : 1

---

142. An electron and a proton having mass m_e and m_p respectively, initially at rest, move through the same distance s in a uniform electric field E. If the time taken by them to cover that distance is t_e and t_p respectively, then $\frac{t_e}{t_p}$ is equal to:

(1) $\sqrt{\frac{m_p}{m_e}}$

(2) $\sqrt{\frac{m_e}{m_p}}$

(3) $\frac{m_e}{m_p}$

(4) $\frac{m_p}{m_e}$

---

143. 220 V ac is more dangerous than 220 V dc. Why?

(1) The peak value of ac is greater than the given value of dc

(2) Shock received from ac is always repulsive

(3) The frequency of ac is more than that of dc

(4) The speed of ac is more than that of dc

---

144. The ground state energy of hydrogen atom is -13.6 eV. If the electron jumps from the 3rd excited state to the ground state, then the energy of the radiation emitted will be:

(1) 1.275 MeV

(2) 12.75 eV

(3) 12.75 J

(4) 12.75 MeV

145. In the Young's double slit experiment the fringe width of the interference pattern is found to be 3.2×10^{-4} m, when the light of wavelength 6400 Å is used. What will be the change in fringe width if the light is replaced with a light of wavelength 4800 Å?

(1) 2.4×10^{-4} m

(2) 1.6×10^{-4} m

(3) 0.8×10^{-4} m

(4) 5.6×10^{-4} m

---

146. What will be the change in wave length, if a light of wave length 600 nm travels from air enters a medium of refractive index 1.5 and continues its journey through that medium?

(1) 300 nm

(2) 200 nm

(3) 600 nm

(4) 400 nm

---

147. A resistor of wire 24 cm length and resistance 8 is stretched into a uniform wire of 48 cm length, then the new resistance will be:

(1) 32

(2) 8

(3) 16

(4) 4

---

148. A metallic rod of 10 cm is rotated with a frequency 100 revolution per second about an axis perpendicular to its length and passing through its one end in a uniform transverse magnetic field of strength 1 T. The emf developed across its ends is:

(1) 628 V

(2) 3.14 V

(3) 31.4 V

(4) 6.28 V

149. Two open organ pipes A and B of length 22 cm and 22.5 cm respectively produce 2 beats per sec when sounded together. The frequency of the shorter pipe is:

(1) 92 Hz

(2) 90 Hz

(3) 88 Hz

(4) 86 Hz

150. The time dependence of a physical quantity P is given by

$$P = P_0 \exp(-\alpha t^2)$$

where α is a constant and t is time. The constant α will:

(1) Have dimensions as that of P

(2) Have dimensions equal to that of Pt^2

(3) Have no dimensions

(4) Have dimensions of t^{-2}

151. The molecules of a given mass of a gas have root mean square speed of 120 m/s at 88°C and 1 atmospheric pressure. The root mean square speed of the molecules at 127°C and 2 atmospheric pressure is:

(1) 105.2 m/s

(2) 1.443 m/s

(3) 126.3 m/s

(4) 88/127 m/s

152. The acceleration due to gravity at a height of 7 km above the earth is the same as at a depth d below the surface of the earth. Then d is:

(1) 7 km

(2) 2 km

(3) 3.5 km

(4) 14 km

---

153. A tentative explanation of observations without assuming that it is true is called:

(1) Hypothesis

(2) Physical laws

(3) Theory

(4) Model

---

154. Find the pole strength of a magnet of length 2 cm, if the magnetic field strength B at distance 10 cm from the centre of a magnet on the axial line of the magnet is 10^{-4} T.

(1) 25 Am

(2) 100 Am

(3) 5×10^{-2} Am

(4) 1×10^{-4} Am

---

155. In the head-on collision of two alpha particles α_1 and α_2 with the gold nucleus, the closest approaches are 31.4 fermi and 94.2 fermi respectively. Then the ratio of the energy possessed by the alpha particles α_2/α_1 is:

(1) 1 : 3

(2) 9 : 1

(3) 3 : 1

(4) 1 : 9

---

156. Two black bodies P and Q have equal surface areas and are kept at temperatures $127°C$ and $27°C$ respectively. The ratio of thermal power radiated by A to that by B is:

(1) 81 : 256

(2) 177 : 127

(3) 127 : 177

(4) 256 : 81

157. The SI unit of electrical conductivity is:

(1) S m

(2) Ω m

(3) S m^{-1}

(4) Ω m^{-1}

158. What should be the inductance of an inductor connected to 200 V, 50 Hz source so that the maximum current of $\sqrt{2}$ A flows through it?

(1) $\frac{1}{2}$ H

(2) 2 H

(3) $\frac{1}{4}$ H

(4) $\frac{1}{8}$ H

159. The nucleus of a helium atom travels along the inside of a straight hollow tube 4 m long which forms part of a particle accelerator. If one assumes uniform acceleration, how long is the particle in the tube if it enters at a speed of 2000 m/s and leaves at 8000 m/s?

(1) 0.6×10^{-4} s

(2) 4×10^{-4} s

(3) 8×10^{-4} s

(4) 3.3×10^{-4} s

160. In the given circuit the diode D_1 and D_2 have the forward resistance 250 Ω and infinite backward resistance. When they are connected to the source as shown, the

current passing through the 175 Ω resistor is:

10V | 50Ω
D₁ ▷| 55Ω
◁| D₂ 175Ω
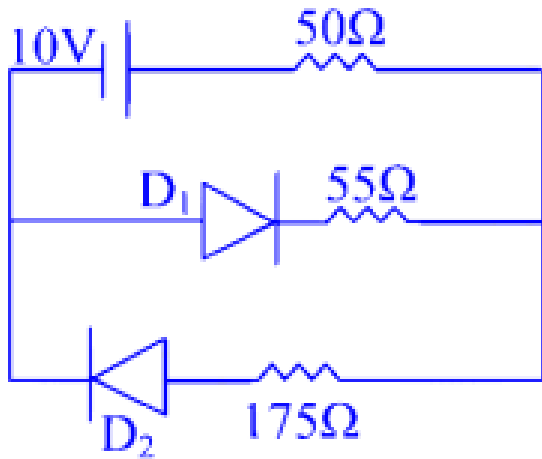
(1) 0.095 A

(2) 0.044 A

(3) 0.028 A

(4) 0.004 A

---

161. The radius of the current carrying circular coil is doubled keeping the current passing through it the same. Then the ratio of the magnetic field produced at the centre of the coil before the doubling of the radius to the magnetic field after doubling of the radius is:

(1) 1 : 2

(2) 2 : 1

(3) 3 : 2

(4) 3 : 1

---

162. If the resultant of all external forces acting on a system of particles is zero, then from an inertial frame one can surely say that:

(1) Linear momentum of the system does not change in time

(2) Kinetic energy of the system does not change in time

(3) Potential energy of the system does not change in time

(4) Angular momentum of the system does not change in time

---

163. The reverse current in the semiconductor diode changes from 20 μA to 40 μA when the reverse potential is changed from 10 V to 15 V, then the reverse resistance of the junction diode will be:

(1) 250 kΩ

(2) 400 Ω

(3) 400 kΩ

(4) 2500 Ω

---

164. A drone is flying due west, a little above the train, with a speed of 10 m/s. A 270 meter long train is moving due east at a speed of 20 m/s. The time taken by the drone to cross the train is:

(1) 27 s

(2) 13.5 s

(3) 20 s

(4) 9 s

---

165. $F_A, F_B,$ and F_C are three forces acting at point P as shown in the figure. The whole system is in equilibrium state. The magnitude of F_A is:
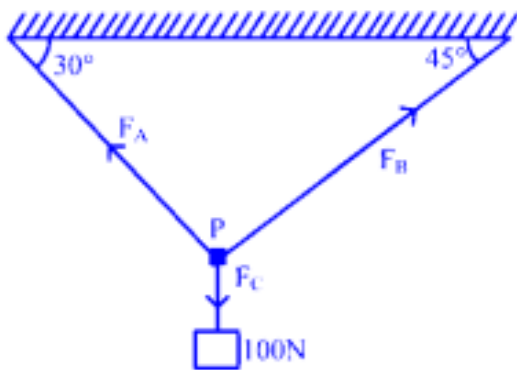
(1) 100 N

(2) 83.3 N

(3) 73.3 N

(4) 89.6 N

166. A wheel is free to rotate about a horizontal axis through O. A force of 200 N is applied at a point P_2 from the center O. OP makes an angle of 55° with the x-axis and the force is in the plane of the wheel making an angle of 25° with the horizontal axis. What is the torque?

(1) 4 N m

(2) 3.2 N m

(3) 2 N m

(4) 3.4 N m

---

167. A hockey player hits the ball at an angle of 37° from the horizontal with an initial speed of 40 m/s (a right-angled triangle with one of the angles being 37° and their sides in the ratio of 6 : 8 : 10). Assume that the ball is in a vertical plane. The time at which the ball reaches the highest point of its path is:

(A) 2.4 s

(B) 0.32 s

(C) 3.2 s

(D) 0.24 s

---

168. What feature of the infrared waves make it useful for the haze photography?

(A) Since it is invisible

(B) Since it has large wavelength

(C) Since it is absorbed by the medium

(D) Since it has high frequency

---

169. A spring of force constant k is cut into lengths of ratio $1 : 3 : 4$. They are connected in series and the new force constant is k'. Then they are connected in parallel and force constant is k''. Then $k' : k''$ is:

(A) 38.3

(B) 3.38

(C) 1.38

(D) 38.1

---

170. A light having wavelength 6400 Å is incident normally on a slit of width 2 mm. Then the linear width of the central maximum on the screen kept 2 m from the slit is:

(A) 2.4 cm

(B) 1.28 mm

(C) 1.28 cm

(D) 2.4 mm

---

171. Which of the following statement is true when a gamma decay occurs from the nucleus of an atom?

(A) Mass number is reduced by 4 and atomic number remains the same

(B) Mass number remains the same and atomic number increases by 1

(C) Mass number and atomic number are not changed

(D) Mass number is reduced by 4 and atomic number is reduced by 2

---

172. The current passing through the 100Ω resistor in the given electrical circuit is:
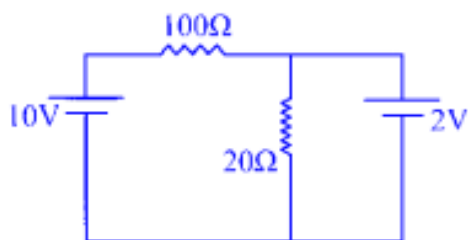
(A) 0.08 A

(B) 0.01 A

(C) 0.1 A

(D) 0.12 A

---

173. The force between two electric point charges at rest in air is F_1. When the same arrangement is kept inside water, the force between them is F_2. Which of the following statement is correct?

(A) $F_2 = 0$

(B) $F_2 > F_1$

(C) $F_2 = F_1$

(D) $F_2 < F_1$

---

174. A neutron makes a head-on elastic collision with a lead nucleus. The ratio of nuclear mass to neutron mass is 206. The fractional change in kinetic energy of a neutron is:

(A) 3% increase

(B) 2% decrease

(C) 2% increase

(D) 3% decrease

---

175. A battery is made of 12 cells having emf 5 V each. If three cells are unknowingly connected wrong, the resultant emf of the battery will be:

(A) 90 V

(B) 30 V

(C) 60 V

(D) 45 V

---

176. A circular loop of area 0.04 m^2 carrying a current of 10 A is held with its plane perpendicular to a magnetic field induction of 0.4 T. Then the torque acting on the circular loop is:

(A) 0.004 Nm

(B) zero

(C) 0.04 Nm

(D) 0.02 Nm

---

177. In the photoelectric experiment, the frequency of the incident radiation is doubled. What will be its effect on the photoelectric current?

(A) Photoelectric current will be halved

(B) Photoelectric current will be doubled

(C) Photoelectric current will not change

(D) Photoelectric current will become zero

---

178. One volt induced emf is produced in the secondary coil when the current through the primary coil is changed from 3 A to 1 A in 100 milliseconds. The mutual inductance of the two coils is:

(A) 0.5 H

(B) 0.25 H

(C) 0.005 H

(D) 0.05 H

---

179. The current drawn by the primary coil of an ideal transformer, which steps up 22 V into 220 V, to operate a device having a load resistance of 110 Ω is:

(A) 20 A

(B) 1 A

(C) 2 A

(D) 10 A