

(22 January 2026 Shift -2)

Q1. Among the statements:

(S1): If $A(5, -1)$ and $B(-2, 3)$ are two vertices of a triangle, whose orthocentre is $(0, 0)$, then its third vertex is $(-4, -7)$.

and

(S2): If positive numbers $2a, b, c$ are three consecutive terms of an A.P., then the lines $ax + by + c = 0$ are concurrent at $(2, -2)$.

(1) both are correct (2) only (S2) is correct

(3) both are incorrect (4) only (S1) is correct

Q2. Let n be the number obtained on rolling a fair die. If the probability that the system

$$x - ny + z = 6$$

$$x + (n - 2)y + (n + 1)z = 8$$

$$(n - 1)y + z = 1$$

has a unique solution is $\frac{k}{6}$, then the sum of k and all possible values of n is:

(1) 21 (2) 24

(3) 20 (4) 22

Q3. Let the domain of the function $f(x) = \log_3 \log_5 (7 - \log_2 (x^2 - 10x + 85)) + \sin^{-1} \left(\frac{|3x - 7|}{17 - x} \right)$ be $(\alpha, \beta]$. Then $\alpha + \beta$ is equal to:

(1) 9 (2) 12

(3) 8 (4) 10

Q4. Let $[\cdot]$ denote the greatest integer function, and let $f(x) = \min \{ \sqrt{2}x, x^2 \}$.

Let $S = \{x \in (-2, 2) : \text{the function } g(x) = |x|[x^2] \text{ is discontinuous at } x\}$.

Then $\sum_{x \in S} f(x)$ equals:

(1) $2 - \sqrt{2}$ (2) $1 - \sqrt{2}$

(3) $2\sqrt{6} - 3\sqrt{2}$ (4) $\sqrt{6} - 2\sqrt{2}$

Q5. If the mean deviation about the median of the numbers $k, 2k, 3k, \dots, 1000k$ is 500, then k^2 is equal to:

(1) 4 (2) 16

(3) 1 (4) 9

Q6. Let $P(10, 2\sqrt{15})$ be a point on the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$, whose foci are S and S' . If the length of its latus rectum is 8, then the square of the area of $\triangle PSS'$ is equal to:

(1) 4200 (2) 900

(3) 1462 (4) 2700

Q7. The area of the region $A = \{(x, y) : 4x^2 + y^2 \leq 8 \text{ and } y^2 \leq 4x\}$ is:

- (1) $\frac{\pi}{2} + 2$ (2) $\pi + 4$
 (3) $\pi + \frac{2}{3}$ (4) $\frac{\pi}{2} + \frac{1}{3}$

Q8. Let the locus of the mid-point of the chord through the origin O of the parabola $y^2 = 4x$ be the curve S . Let P be any point on S . Then the locus of the point, which internally divides OP in the ratio 3 : 1, is:

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

Q9. If $X = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$ is a solution of the system of equations $AX = B$, where $\text{adj } A = \begin{bmatrix} 4 & 2 & 2 \\ -5 & 0 & 5 \\ 1 & -2 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} 4 \\ 0 \\ 2 \end{bmatrix}$,

then $|x + y + z|$ is equal to:

- (1) 1 (2) $\frac{3}{2}$
 (3) 3 (4) 2

Q10. Let α, β be the roots of the quadratic equation $12x^2 - 20x + 3\lambda = 0$, $\lambda \in \mathbb{Z}$. If $\frac{1}{2} \leq |\beta - \alpha| \leq \frac{3}{2}$, then the sum of all possible values of λ is:

- (1) 1 (2) 6
 (3) 4 (4) 3

Q11. Let C_r denote the coefficient of x^r in the binomial expansion of $(1 + x)^n$, $n \in \mathbf{N}$, $0 \leq r \leq n$. If $P_n = C_0 - C_1 + \frac{2^2}{3}C_2 - \frac{2^3}{4}C_3 + \cdots + \frac{(-2)^n}{n+1}C_n$, then the value of $\sum_{n=1}^{25} \frac{1}{P_{2n}}$ equals:

- (1) 650 (2) 525
 (3) 675 (4) 580

Q12. The number of elements in the relation $R = \{(x, y) : 4x^2 + y^2 < 52, x, y \in \mathbb{Z}\}$ is:

- (1) 67 (2) 89
 (3) 86 (4) 77

Q13. Let $f(x) = [x]^2 - [x + 3] - 3$, $x \in \mathbb{R}$, where $[\cdot]$ is the greatest integer function. Then:

- (1) $f(x) > 0$ only for $x \in [4, \infty)$ (2) $f(x) < 0$ only for $x \in [-1, 3)$
 (3) $\int_0^2 f(x) dx = -6$ (4) $f(x) = 0$ for finitely many values of x

Q14. Let $S = \{z \in \mathbb{C} : 4z^2 + \bar{z} = 0\}$. Then $\sum_{z \in S} |z|^2$ is equal to:

- (1) $\frac{1}{16}$ (2) $\frac{3}{16}$
 (3) $\frac{5}{64}$ (4) $\frac{7}{64}$

Q15. Let $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}$ and $\vec{b} = \lambda\hat{j} + 2\hat{k}$, $\lambda \in \mathbb{Z}$ be two vectors. Let $\vec{c} = \vec{a} \times \vec{b}$ and $\vec{d}$ be a vector of magnitude 2 in

the yz -plane. If $|\vec{c}| = \sqrt{53}$, then the maximum possible value of $(\vec{c} \cdot \vec{d})^2$ is equal to:

- (1) 26 (2) 208
(3) 104 (4) 52

Q16. If $y = y(x)$ satisfies the differential equation $16(\sqrt{x} + \sqrt{9 + \sqrt{x}})(4 + \sqrt{9 + \sqrt{x}}) \cos y \, dy = (1 + 2 \sin y) \, dx$, $x > 0$ and $y(256) = \frac{\pi}{2}$, $y(49) = \alpha$, then $2 \sin \alpha$ is equal to:

- (1) $2(\sqrt{2} - 1)$ (2) $\sqrt{2} - 1$
(3) $2\sqrt{2} - 1$ (4) $3(\sqrt{2} - 1)$

Q17. If $\lim_{x \rightarrow 0} \frac{e^{(a-1)x} + 2 \cos bx + (c-2)e^{-x}}{x \cos x - \log_e(1+x)} = 2$, then $a^2 + b^2 + c^2$ is equal to:

- (1) 3 (2) 7
(3) 5 (4) 9

Q18. Let f and g be functions satisfying $f(x+y) = f(x)f(y)$, $f(1) = 7$ and $g(x+y) = g(xy)$, $g(1) = 1$, for all $x, y \in \mathbb{N}$. If $\sum_{x=1}^n \left(\frac{f(x)}{g(x)} \right) = 19607$, then n is equal to:

- (1) 5 (2) 4
(3) 6 (4) 7

Q19. Let L be the line $\frac{x+1}{2} = \frac{y+1}{3} = \frac{z+3}{6}$ and let S be the set of all points (a, b, c) on L , whose distance from the line $\frac{x+1}{2} = \frac{y+1}{3} = \frac{z-9}{0}$ along the line L is 7. Then $\sum_{(a,b,c) \in S} (a+b+c)$ is equal to:

- (1) 34 (2) 40
(3) 6 (4) 28

Q20. Let S and S' be the foci of the ellipse $\frac{x^2}{25} + \frac{y^2}{9} = 1$ and $P(\alpha, \beta)$ be a point on the ellipse in the first quadrant. If $(SP)^2 + (S'P)^2 - SP \cdot S'P = 37$, then $\alpha^2 + \beta^2$ is equal to:

- (1) 17 (2) 13
(3) 15 (4) 11

SECTION B – MATHEMATICS

Q21. Suppose a, b, c are in A.P. and $a^2, 2b^2, c^2$ are in G.P. If $a < b < c$ and $a+b+c = 1$, then $9(a^2 + b^2 + c^2)$ is equal to _____.

Q22. Let S be the set of the first 11 natural numbers. Then the number of elements in $A = \{B \subseteq S : n(B) \geq 2 \text{ and the product of all elements of } B \text{ is even}\}$ is _____.

Q23. Let $\cos(\alpha + \beta) = -\frac{1}{10}$ and $\sin(\alpha - \beta) = \frac{3}{8}$, where $0 < \alpha < \frac{\pi}{3}$ and $0 < \beta < \frac{\pi}{4}$. If $\tan 2\alpha = \frac{3(1 - r\sqrt{5})}{\sqrt{11}(s + \sqrt{5})}$, $r, s \in \mathbb{N}$, then $r + s$ is equal to _____.

Q24. Let $[\cdot]$ be the greatest integer function. If $\alpha = \int_0^{64} (x^{1/3} - [x^{1/3}]) dx$, then $\frac{1}{\pi} \int_0^{\alpha\pi} \left(\frac{\sin^2 \theta}{\sin^6 \theta + \cos^6 \theta} \right) d\theta$ is equal to _____.

Q25. Let a vector $\vec{a} = \sqrt{2}\hat{i} - \hat{j} + \lambda\hat{k}$, $\lambda > 0$, make an obtuse angle with the vector $\vec{b} = -\lambda^2\hat{j} + 4\sqrt{2}\hat{j} + 4\sqrt{2}\hat{k}$ and an angle θ , $\frac{\pi}{6} < \theta < \frac{\pi}{2}$, with the positive z -axis. If the set of all possible values of λ is $(\alpha, \beta) - \{\gamma\}$, then $\alpha + \beta + \gamma$ is equal to _____.

SECTION A – PHYSICS

Q26. Which of the following are true for a single slit diffraction?

- A. Width of central maxima increases with increase in wavelength keeping slit width constant.
- B. Width of central maxima increases with decrease in wavelength keeping slit width constant.
- C. Width of central maxima increases with decrease in slit width at constant wavelength.
- D. Width of central maxima increases with increase in slit width at constant wavelength.
- E. Brightness of central maxima increases for decrease in wavelength at constant slit width.

- (1) A, D, E only (2) B, C only
(3) A, D only (4) B, D only

Q27. In an open organ pipe ν_3 and ν_6 are 3rd and 6th harmonic frequencies, respectively. If $\nu_6 - \nu_3 = 2200$ Hz then length of the pipe is _____ mm.

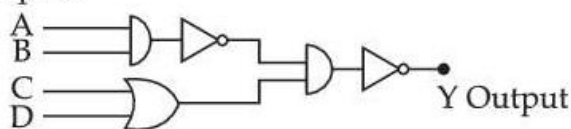
(Take velocity of sound in air is 330 m/s.)

- (1) 200 (2) 225
(3) 250 (4) 275

Q28. The correct truth table for the given input data of the following logic gate is:

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Inputs



Inputs: A, B connected to an AND gate; C, D connected to an OR gate; outputs combined into a NAND gate giving Y.

(1)	A	B	C	D	Y	(2)	A	B	C	D	Y
	1	1	0	1	1		1	1	0	1	1
	0	0	1	1	0		0	0	1	1	0
	1	0	1	0	0		1	0	1	0	1
	1	1	1	1	1		1	1	1	1	0
(3)	A	B	C	D	Y	(4)	A	B	C	D	Y
	1	1	0	1	0		1	1	0	1	0
	0	0	1	1	0		0	0	1	1	1
	1	0	1	0	1		1	0	1	0	1
	1	1	1	1	1		1	1	1	1	1

Q29. Given below are two statements:

Statement I: An object moves from position r_1 to position r_2 under a conservative force field $\vec{F}$. The work done by the force is $W = - \int_{r_1}^{r_2} \vec{F} \cdot d\vec{r}$.

Statement II: Any object moving from one location to another location can follow infinite number of paths. Therefore, the amount of work done by the object changes with the path it follows for a conservative force.

In the light of the above statements, choose the **correct answer**:

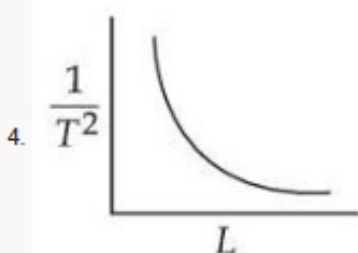
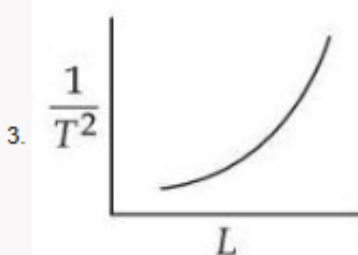
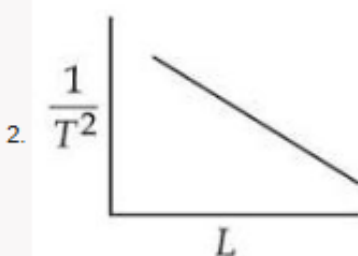
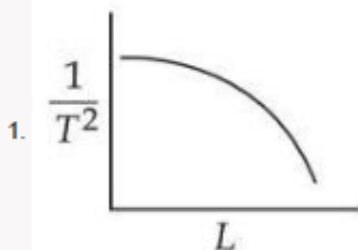
- (1) Statement I is true but Statement II is false (2) Statement I is false but Statement II is true
(3) Both Statement I and Statement II are true (4) Both Statement I and Statement II are false

Q30. Light is incident on a metallic plate having work function 110×10^{-20} J. If the produced photoelectrons have zero kinetic energy then the angular frequency of the incident light is _____ rad/s.

($h = 6.63 \times 10^{-34}$ J.s)

- (1) 1.66×10^{16} (2) 1.04×10^{13}
(3) 1.66×10^{15} (4) 1.04×10^{16}

Q31. Using a simple pendulum experiment g is determined by measuring its time period T . Which of the following plots represent the correct relation between the pendulum length L and time period T ?



- (1) $\frac{1}{T^2}$ vs L : concave curve decreasing (2) $\frac{1}{T^2}$ vs L : straight line decreasing
 (3) $\frac{1}{T^2}$ vs L : concave curve increasing (4) $\frac{1}{T^2}$ vs L : convex curve decreasing

Q32. The smallest wavelength of Lyman series is 91 nm. The difference between the largest wavelengths of *Paschen* and *Balmer* series is nearly _____ nm.

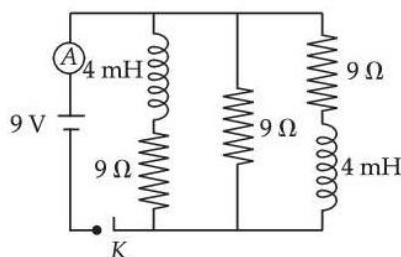
- (1) 1784 (2) 1217
 (3) 1875 (4) 1550

Q33. An electric power line having total resistance of $2\ \Omega$, delivers 1 kW of power at 250 V. The percentage efficiency of transmission line is _____.

- (1) 92.5 (2) 96.9
 (3) 86.5 (4) 100

Q34. Figure shows the circuit that contains three resistances ($9\ \Omega$ each) and two inductors (4 mH each). The reading of ammeter at the moment switch K is turned ON, is _____ A.

Figure shows the circuit that contains three resistances ($9\ \Omega$ each) and two inductors (4 mH each).
 The reading of ammeter at the moment switch K is turned ON, is _____ A.



- (1) zero (2) 2
 (3) 3 (4) 1

Q35. The wavelength of light, while it is passing through water is 540 nm. The refractive index of water is $\frac{4}{3}$.
 The wavelength of the same light when it is passing through a transparent medium having refractive index of $\frac{3}{2}$ is _____ nm.

- (1) 480 (2) 840
 (3) 380 (4) 540

Q36. Given below are two statements:

Statement I: For a mechanical system of many particles total kinetic energy is the sum of kinetic energies of all the particles.

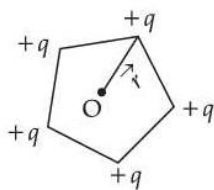
Statement II: The total kinetic energy can be the sum of kinetic energy of the center of mass w.r.t. the origin and the kinetic energy of all the particles w.r.t. the center of mass as the reference.

In the light of the above statements, choose the **correct answer**:

- (1) Both Statement I and Statement II are true (2) Both Statement I and Statement II are false
 (3) Statement I is false but Statement II is true (4) Statement I is true but Statement II is false

Q37. Five positive charges each having charge q are placed at the vertices of a pentagon as shown in the figure. The electric potential (V) and the electric field ($\vec{E}$) at the center O of the pentagon due to these five positive charges are:

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- (1) $V = \frac{5q}{4\pi\epsilon_0 r}$ and $\vec{E} = \frac{5\sqrt{3}q}{8\pi\epsilon_0 r^2} \hat{r}$ (2) $V = 0$ and $\vec{E} = 0$
 (3) $V = \frac{5q}{4\pi\epsilon_0 r}$ and $\vec{E} = \frac{5q}{4\pi\epsilon_0 r^2} \hat{r}$ (4) $V = \frac{5q}{4\pi\epsilon_0 r}$ and $\vec{E} = 0$

Q38. Consider two boxes containing ideal gases A and B such that their temperatures, pressures and number densities are same. The molecular size of A is half of that of B and mass of molecule A is four times that of B . If the collision frequency in gas B is 32×10^{18} /s then collision frequency in gas A is _____ /s.

- (1) 2×10^8 (2) 32×10^8
 (3) 4×10^8 (4) 8×10^8

Q39. Given below are two statements:

Statement I: A satellite is moving around earth in the orbit very close to the earth surface. The time period of revolution of satellite depends upon the density of earth.

Statement II: The time period of revolution of the satellite is $T = 2\pi\sqrt{\frac{R_e}{g}}$ (for satellite very close to the earth surface), where R_e radius of earth and g acceleration due to gravity.

In the light of the above statements, choose the **correct** answer:

- (1) Statement I is true but Statement II is false (2) Both Statement I and Statement II are true
 (3) Statement I is false but Statement II is true (4) Both Statement I and Statement II are false

Q40. In parallax method for the determination of focal length of a concave mirror, the object should always be placed:

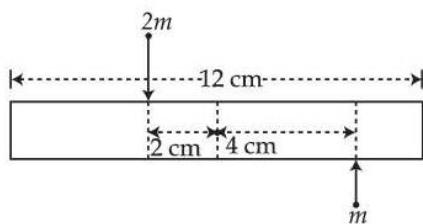
- (1) at any point beyond the focus (F) of the mirror (2) between the focus (F) and the centre of curvature
 (3) beyond the centre of the curvature (C) of the mirror ONLY (4) between the pole (P) and the focus (F) of the mirror

Q41. When a part of a straight capillary tube is placed vertically in a liquid, the liquid raises upto certain height h . If the inner radius of the capillary tube, density of the liquid and surface tension of the liquid decrease by 1% each, then the height of the liquid in the tube will change by _____ %.

- (1) -1 (2) -3
 (3) +1 (4) +3

Q42. A uniform bar of length 12 cm and mass $20m$ lies on a smooth horizontal table. Two point masses m and $2m$ are moving in opposite directions with same speed of v and in the same plane as the bar, as shown in figure. These masses strike the bar simultaneously and get stuck to it. After collision the entire system is rotating with angular frequency ω . The ratio of v and ω is:

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- (1) 32 (2) $2\sqrt{88}$
 (3) 66 (4) 33

Q43. A laser beam has intensity of $4.0 \times 10^{14} \text{ W/m}^2$. The amplitude of magnetic field associated with beam is _____ T.

(Take $\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2/\text{Nm}^2$ and $c = 3 \times 10^8 \text{ m/s}$)

- (1) 18.3 (2) 1.83
 (3) 5.5 (4) 2.0

Q44. Three small identical bubbles of water having same charge on each coalesce to form a bigger bubble. Then the ratio of the potentials on one initial bubble and that on the resultant bigger bubble is:

- (1) $1 : 2^{2/3}$ (2) $1 : 3^{1/3}$
 (3) $1 : 3^{2/3}$ (4) $3^{2/3} : 1$

Q45. If ϵ , E and t represent the free space permittivity, electric field and time respectively, then the unit of $\frac{\epsilon E}{t}$ will be:

- (1) A/m (2) Am^2
 (3) A/m^2 (4) Am

SECTION B – PHYSICS

Q46. A capacitor P with capacitance $10 \times 10^{-6} \text{ F}$ is fully charged with a potential difference of 6.0 V and disconnected from the battery. The charged capacitor P is connected across another capacitor Q with capacitance $20 \times 10^{-6} \text{ F}$. The charge on capacitor Q when equilibrium is established will be $\alpha \times 10^{-5} \text{ C}$ (assume capacitor Q does not have any charge initially), the value of α is _____.

Q47. A conducting circular loop is rotated about its diameter at a constant angular speed of 100 rad/s in a magnetic field of 0.5 T perpendicular to the axis of rotation. When the loop is rotated by 30° from the horizontal position, the induced EMF is 15.4 mV. The radius of the loop is _____ mm.

(Take $\pi = \frac{22}{7}$)

Q48. A cylindrical conductor of length 2 m and area of cross-section 0.2 mm^2 carries an electric current of 1.6 A when its ends are connected to a 2 V battery. Mobility of electrons in the conductor is $\alpha \times 10^{-3} \text{ m}^2/\text{V.s}$. The value of α is _____.

(electron concentration = $5 \times 10^{28}/\text{m}^3$ and electron charge = $1.6 \times 10^{-19} \text{ C}$)

Q49. Two masses m and $2m$ are connected by a light string going over a pulley (disc) of mass $30m$ with radius $r = 0.1$ m. The pulley is mounted in a vertical plane and it is free to rotate about its axis. The $2m$ mass is released from rest and its speed when it has descended through a height of 3.6 m is _____ m/s. (Assume string does not slip and $g = 10 \text{ m/s}^2$)

Q50. An insulated cylinder of volume 60 cm^3 is filled with a gas at 27°C and 2 atmospheric pressure. Then the gas is compressed making the final volume as 20 cm^3 while allowing the temperature to rise to 77°C . The final pressure is _____ atmospheric pressure.

SECTION A – CHEMISTRY

Q51. $[\text{Ni}(\text{PPh}_3)_2\text{Cl}_2]$ is a paramagnetic complex. Identify the **INCORRECT** statements about this complex.

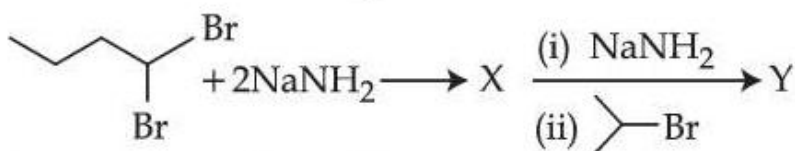
- A. The complex exhibits geometrical isomerism.
- B. The complex is white in colour.
- C. The calculated spin-only magnetic moment of the complex is 2.84 BM .
- D. The calculated CFSE (Crystal Field Stabilization Energy) of Ni in this complex is $-0.8 \Delta_o$.
- E. The geometrical arrangement of ligands in this complex is similar to that in $\text{Ni}(\text{CO})_4$.

Choose the **correct** answer from the options given below:

- (1) C, D and E Only (2) A and B Only
- (3) A, B and D Only (4) C and D Only

Q52. Consider the following reaction:

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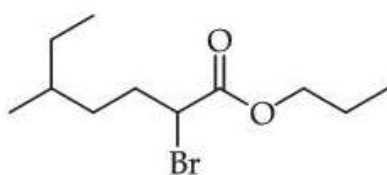
The product Y formed is :

A gem-dibromide reacts with 2NaNH_2 to give X; X reacts with (i) NaNH_2 , (ii) allyl bromide ($\text{CH}_2=\text{CH}-\text{Br}$) to give Y. The product Y formed is:

- (1) 2-methylhex-3-yne (2) 2-methylhex-2-yne
- (3) 5-methylhex-2-yne (4) Isopropylbut-1-yne

Q53. The IUPAC name of the following compound is:

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(The compound is an ester with a bromo substituent and methylheptanoate backbone.)

- (1) n-propyl-2-bromo-5-methylheptanoate (2) 2-bromo-5-methylhexylpropanoate
 (3) 2-bromo-5-methylpropanoate (4) n-propyl-1-bromo-4-methylhexanoate

Q54. Given below are two statements:

Statement I: The first ionization enthalpy of Cr is lower than that of Mn.

Statement II: The second and third ionization enthalpies of Cr are higher than those of Mn.

In the light of the above statements, choose the **correct** answer from the options given below:

- (1) Both Statement I and Statement II are true (2) Statement I is true but Statement II is false
 (3) Statement I is false but Statement II is true (4) Both Statement I and Statement II are false

Q55. At T(K), 100 g of 98% H_2SO_4 (w/w) aqueous solution is mixed with 100 g of 49% H_2SO_4 (w/w) aqueous solution. What is the mole fraction of H_2SO_4 in the resultant solution?

(Given: Atomic mass H = 1 u; S = 32 u; O = 16 u)

(Assume that temperature after mixing remains constant)

- (1) 0.337 (2) 0.1
 (3) 0.9 (4) 0.663

Q56. The compound A, $\text{C}_8\text{H}_8\text{O}_2$ reacts with acetophenone to form a single product via cross-Aldol condensation. The compound A on reaction with conc. NaOH forms a substituted benzyl alcohol as one of the two products. The compound A is:

- (1) 4-methyl benzoic acid (2) 2-hydroxy acetophenone
 (3) 4-hydroxy benzaldehyde (4) 4-methoxy benzaldehyde

Q57. Correct statements regarding Arrhenius equation among the following are:

A. Factor $e^{-E_a/RT}$ corresponds to fraction of molecules having kinetic energy less than E_a .

B. At a given temperature, lower the E_a , faster is the reaction.

C. Increase in temperature by about 10°C doubles the rate of reaction.

D. Plot of $\log k$ vs $\frac{1}{T}$ gives a straight line with slope = $-\frac{E_a}{R}$.

Choose the **correct** answer from the options given below:

- (1) A and C Only (2) B and D Only
 (3) A and B Only (4) B and C Only

Q58. Which of the following mixture gives a buffer solution with $\text{pH} = 9.25$?

Given: $\text{p}K_b(\text{NH}_4\text{OH}) = 4.75$

- (1) 0.2 M NH_4OH (0.5 L) + 0.1 M HCl (0.5 L) (2) 0.4 M NH_4OH (1 L) + 0.1 M HCl (1 L)
 (3) 0.2 M NH_4OH (0.4 L) + 0.1 M HCl (1 L) (4) 0.5 M NH_4OH (0.2 L) + 0.2 M HCl (0.5 L)

Q59. Among H_2S , H_2O , NF_3 , NH_3 and CHCl_3 , identify the molecule (X) with lowest dipole moment value. The number of lone pairs of electrons present on the central atom of the molecule (X) is:

- (1) 1 (2) 0
 (3) 3 (4) 2

Q60. Given below are two statements:

Statement I: Elements 'X' and 'Y' are the most and least electronegative elements, respectively among N, As, Sb and P. The nature of the oxides X_2O_3 and Y_2O_3 is acidic and amphoteric, respectively.

Statement II: BCl_3 is covalent in nature and gets hydrolysed in water. It produces $[\text{B}(\text{OH})_4]^-$ and $[\text{B}(\text{H}_2\text{O})_6]^{3+}$ in aqueous medium.

In the light of the above statements, choose the **correct** answer:

- (1) Statement I is true but Statement II is false (2) Both Statement I and Statement II are true
 (3) Statement I is false but Statement II is true (4) Both Statement I and Statement II are false

Q61.



Cyclohexylamine (NH_2) reacts with $\text{C}_6\text{H}_5\text{COCl}/\text{NaOH}$ to give [A]; [A] reacts with $\text{LiAlH}_4/\text{H}_2\text{O}$ to give [B]. The final product [B] is:

- (1) N-cyclohexyl benzamide (2) N-benzyl cyclohexyl amide
 (3) N-benzyl cyclohexylamine (4) N-benzyl cyclohexylamine with OH group

Q62. Match **List - I** with **List - II**.

List - I

Reaction of Glucose with

A. Hydroxylamine

B. Br_2 water

C. Excess acetic anhydride

D. Concentrated HNO_3

List - II

Product formed

I. Gluconic acid

II. Glucose pentaacetate

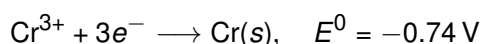
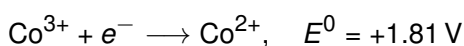
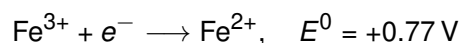
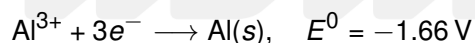
III. Saccharic acid

IV. Glucosime

(1) A-IV, B-I, C-II, D-III (2) A-IV, B-III, C-II, D-I

(3) A-I, B-III, C-IV, D-II (4) A-III, B-I, C-IV, D-II

Q63. Consider the following reduction processes:



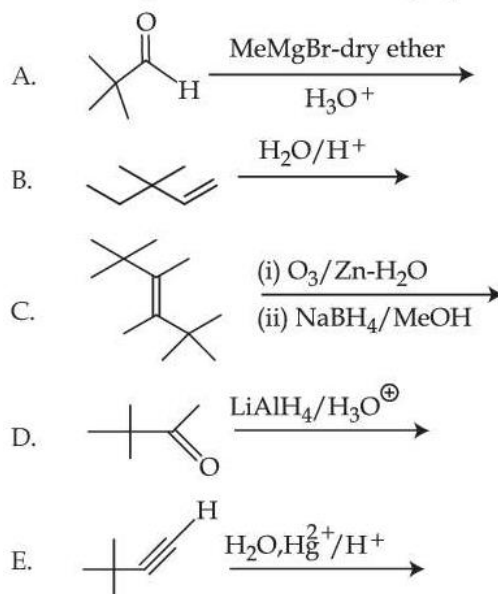
The tendency to act as reducing agent decreases in the order:

(1) $\text{Cr} > \text{Fe}^{2+} > \text{Al} > \text{Co}^{2+}$ (2) $\text{Al} > \text{Cr} > \text{Co}^{2+} > \text{Fe}^{2+}$

(3) $\text{Al} > \text{Cr} > \text{Fe}^{2+} > \text{Co}^{2+}$ (4) $\text{Al} > \text{Fe}^{2+} > \text{Cr} > \text{Co}^{2+}$

Q64. 3,3-Dimethyl-2-butanol **cannot** be prepared by:

3, 3-Dimethyl-2-butanol **cannot** be prepared by :



Choose the **correct** answer from the options given below :

- A. Reaction of pivaldehyde with MeMgBr-dry ether / H_3O^+
 B. Hydration of 3,3-dimethyl-1-butene with $\text{H}_2\text{O}/\text{H}^+$
 C. Ozonolysis with $\text{O}_3/\text{Zn-H}_2\text{O}$ followed by $\text{NaBH}_4/\text{MeOH}$
 D. Reduction of corresponding ketone with $\text{LiAlH}_4/\text{H}_3\text{O}^+$
 E. Hydration of 3,3-dimethyl-1-butyne with $\text{H}_2\text{O, Hg}^{2+}/\text{H}^+$

Choose the **correct** answer from the options given below:

- (1) B, C and E Only (2) B and C Only
 (3) B and E Only (4) B Only

Q65. $A + 2B \longrightarrow AB_2$

36.0 g of 'A' (Molar mass: 60 g mol^{-1}) and 56.0 g of 'B' (Molar mass: 80 g mol^{-1}) are allowed to react. Which of the following statements are **correct**?

- A. 'A' is the limiting reagent.
 B. 77.0 g of AB_2 is formed.
 C. Molar mass of AB_2 is 140 g mol^{-1} .
 D. 15.0 g of A is left unreacted after the completion of reaction.

- (1) A and B Only (2) A and C Only
 (3) B and D Only (4) C and D Only

Q66. When 1 g of compound (X) is subjected to Kjeldahl's method for estimation of nitrogen, 15 mL 1 M H_2SO_4 was neutralized by ammonia evolved. The percentage of nitrogen in compound (X) is:

- (1) 21 (2) 42
 (3) 0.21 (4) 0.42

Q67. The energy of first (lowest) Balmer line of H atom is x J. The energy (in J) of second Balmer line of H atom is:

- (1) $\frac{x}{1.35}$ (2) x^2
 (3) $1.35x$ (4) $2x$

Q68. Identify the **correct** statements:

- A. Hydrated salts can be used as primary standard.
- B. Primary standard should not undergo any reaction with air.
- C. Reactions of primary standard with another substance should be instantaneous and stoichiometric.
- D. Primary standard should not be soluble in water.
- E. Primary standard should have low relative molar mass.

Choose the **correct** answer from the options given below:

- (1) A, B and C Only (2) A, B, C and E Only
- (3) A, B and E Only (4) D and E Only

Q69. Given below are two statements:

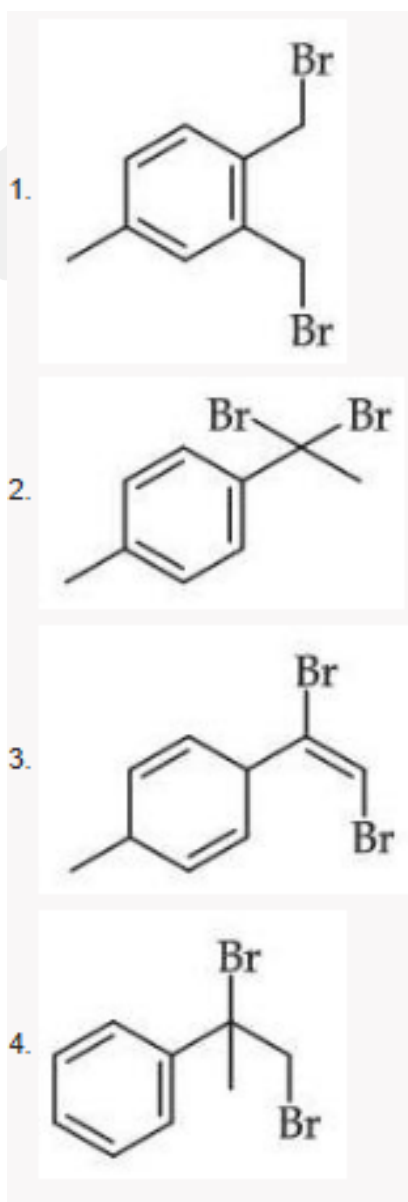
Statement I: $C < O < N < F$ is the correct order in terms of first ionization enthalpy values.

Statement II: $S > Se > Te > Po > O$ is the correct order in terms of the magnitude of electron gain enthalpy values.

In the light of the above statements, choose the **correct** answer from the options given below:

- (1) Statement I is false but Statement II is true (2) Both Statement I and Statement II are true
- (3) Both Statement I and Statement II are false (4) Statement I is true but Statement II is false

Q70. The dibromo compound [P] (molecular formula: $C_9H_{10}Br_2$) when heated with excess sodamide followed by treatment with dilute HCl gives [Q]. On warming [Q] with mercuric sulphate and dilute sulphuric acid yield [R] which gives positive Iodoform test but negative Tollen's test. The compound [P] is:



- (1) 1-bromomethyl-2-bromomethylbenzene (xylylene dibromide isomer) (2) gem-dibromide on benzylic position with
 (3) vinyl dibromide on toluene (4) 1-phenyl-1,1-dibromopropane

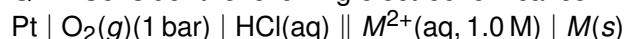
SECTION B – CHEMISTRY

Q71. If the enthalpy of sublimation of Li is 155 kJ mol^{-1} , enthalpy of dissociation of F_2 is 150 kJ mol^{-1} , ionization enthalpy of Li is 520 kJ mol^{-1} , electron gain enthalpy of F is -313 kJ mol^{-1} , standard enthalpy of formation of LiF is -594 kJ mol^{-1} . The magnitude of lattice enthalpy of LiF is _____ kJ mol^{-1} . (Nearest Integer)

Q72. Consider $A \xrightarrow{k_1} B$ and $C \xrightarrow{k_2} D$ are two reactions. If the rate constant (k_1) of the $A \rightarrow B$ reaction can be expressed by the following equation $\log_{10} k = 14.34 - \frac{1.5 \times 10^4}{T/K}$ and activation energy of $C \rightarrow D$ reaction (E_{a_2}) is $\frac{1}{5}$ th of the $A \rightarrow B$ reaction (E_{a_1}), then the value of (E_{a_2}) is _____ kJ mol^{-1} . (Nearest Integer)

Q73. Among the following oxides of 3d elements, the number of mixed oxides are _____.
 Ti_2O_3 , V_2O_4 , Cr_2O_3 , Mn_3O_4 , Fe_3O_4 , Fe_2O_3 , Co_3O_4

Q74. Consider the following electrochemical cell:



The pH above which, oxygen gas would start to evolve at anode is _____ (nearest integer).

Given: $E_{\text{M}^{2+}/\text{M}}^\circ = 0.994 \text{ V}$; $E_{\text{O}_2/\text{H}_2\text{O}}^\circ = 1.23 \text{ V}$ (standard reduction potential); $\frac{RT}{F}(2.303) = 0.059 \text{ V}$ at the given condition.

Q75. The mass of benzanilide obtained from the benzoylation reaction of 5.8 g of aniline, if yield of product is 82%, is _____ g (nearest integer).

(Given molar mass in g mol^{-1} : H: 1, C: 12, N: 14, O: 16)