Q1. Group A consists of 7 boys and 3 girls, while group B consists of 6 boys and 5 girls. The number of ways, 4 boys and 4 girls can be invited for a picnic if 5 of them must be from group *A* and the remaining 3 from group *B*, is equal to :

(1) 8750 (3) 8925 (2) 9100 (4) 8575

Q2. If the system of equations $x+2y-3z=2$, $2x+\lambda y+5z=5$, $14x+3y+\mu z=33$ has infinitely many solutions, then $\lambda+\mu$ is equal to :

(1) 13 (2) 10

(3) 12 (4) 11

Q3. Let $A=\{x\in(0,\pi)-\{\pi/2\}:\log(2/\pi)|\sin x|+\log(2/\pi)|\cos x|=2\}$ and $B=\{x\geqslant 0:\sqrt{x}(\sqrt{x}-4)-3|\sqrt{x}-2|+6=0\}$. Then $n(A\cup B)$ is equal to :

(1) 4 (2) 8

(3) 6 (4) 2

The area of the region enclosed by the curves $y=e^x, y=|e^x-1|$ and y-axis is:

(1) $1-\log_e 2$ (3) $1+\log_e 2$ (2) $\log_e 2$ (4) $2\log_e 2-1$

The equation of the chord, of the ellipse $\frac{x^2}{25}+\frac{y^2}{16}=1$, whose mid-point is (3,1) is :

(1) $48x+25y = 169$ (2) $5x+16y = 31$

(3) $25x+101y = 176$ (4) $4x+122y = 134$

Let the points $(11-2,\alpha)$ lie on or inside the triangle with sides $x+y=11, x+2y=16$ and $2x+3y=29$. Then the product of the smallest and the largest values of α is equal to :

(1) 44 (2) 22

(3) 33 (4) 55

Q7. Let $f:(0,\infty)\to\mathbf{R}$ be a function which is differentiable at all points of its domain and satisfies the condition $x^2f'(x)=2xf(x)+3$, with $f(1)=4$. Then $2f(2)$ is equal to :

(1) 39 (2) 19

(3) 29 (4) 23

Q8. If $7=5+\frac{1}{7(5+\alpha)+\frac{1}{7^2(5+2\alpha)+7^3(5+3\alpha)+\infty}}$, then the value of α is :

(1) $\frac{6}{7}$ (2) $\frac{6}{1}$

(3) $\frac{1}{7}$ (4) 1

Q9. Let $[x]$ denote the greatest integer function, and let m and n respectively be the numbers of the points, where the function $f(x)=[x]+|x-2|, -2<x<3$, is not continuous and not differentiable. Then m+n is equal to :

(1) 6 (2) 8

(3) 9 (4) 7

Q10. Let $A=[a_{ij}]$ be a square matrix of order 2 with entries either 0 or 1 . Let E be the event that A is an invertible matrix. Then the probability P(E) is :

(1) 7 (2) 9
(3) 8 (4) 6

Q20. If $\alpha > \beta > \gamma > 0$, then the expression $\cot^{-1}\left\{\beta+\frac{(1+\beta^2)}{(\alpha-\beta)}\right\}+\cot^{-1}\left\{\gamma+\frac{(1+\gamma^2)}{(\beta-\gamma)}\right\}+\cot^{-1}\left\{\alpha+\frac{(1+\alpha^2)}{(\gamma-\alpha)}\right\}$ is equal to :

(1) π (2) 0
(3) $\frac{\pi}{2}-(\alpha+\beta+\gamma)$ (4) 3π

Q21. Let P be the image of the point Q(7,−2,5) in the line $L: \frac{x-1}{2}=\frac{y+1}{3}=\frac{z}{4}$ and R(5,p,q) be a point on L. Then the square of the area of $\triangle PQR$ is ________.

Q22. If $\int \frac{2x^2+5x+9}{\sqrt{x^2+x+1}}dx = x\sqrt{x^2+x+1}+\alpha\sqrt{x^2+x+1}+\beta\log_e\left|x+\frac{1}{2}+\sqrt{x^2+x+1}\right|+C$, where C is the constant of integration, then $\alpha+2\beta$ is equal to _______.

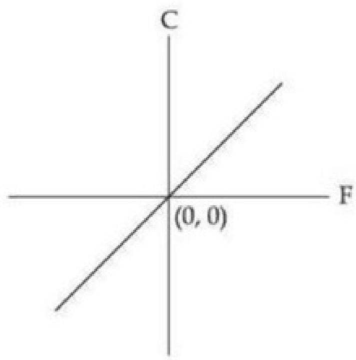
Let $y=y(x)$ be the solution of the differential equation $2\cos x\frac{dy}{dx}=\sin 2x-4y\sin x, x\in\left(0,\frac{\pi}{2}\right)$. If $y\left(\frac{\pi}{3}\right)=0$, then $y'\left(\frac{\pi}{4}\right)+y\left(\frac{\pi}{4}\right)$ is equal to ________.

Q24. Number of functions $f:\{1,2,\ldots,100\}\to\{0,1\}$, that assign 1 to exactly one of the positive integers less than or equal to 98 , is equal to ________.

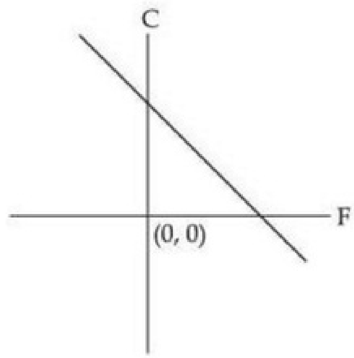
Q25. Let $H_1: \frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ and $H_2: -\frac{x^2}{A^2}+\frac{y^2}{B^2}=1$ be two hyperbolas having length of latus rectums $15\sqrt{2}$ and $12\sqrt{5}$ respectively. Let their ecentricities be $e_1=\sqrt{\frac{5}{2}}$ and e_2 respectively. If the product of the lengths of their transverse axes is $100\sqrt{10}$, then $25e_2^2$ is equal to ________.

Q26. Which of the following figure represents the relation between Celsius and Fahrenheit temperatures ?

(1)



(2)



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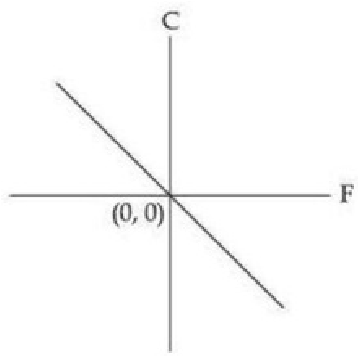
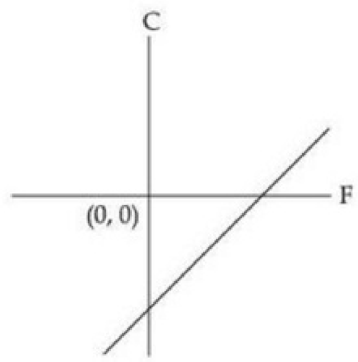


(4)



Q27. The position vector of a moving body at any instant of time is given as $\vec{r} = (t^2\hat{i} - 5\hat{j})$ m. The magnitude and direction of velocity at t=2 s is,

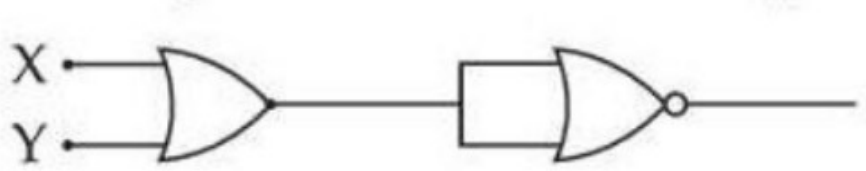
(1)5√15 m/s, making an angle of $\tan^{-1}4$ with + ve *Y* axis

(2)5√15 m/s, making an angle of $\tan^{-1}4$ with - ve X axis

(3)5√17 m/s, making an angle of $\tan^{-1}4$ with + ve *X* axis

(4)5√17 m/s, making an angle of $\tan^{-1}4$ with - ve *Y* axis

Q28. The output of the circuit is low (zero) for :



(A) X=0,Y=0 (B) *X*=0,*Y*=1 (C) *X*=1,*Y*=0 (D) X=1,Y=1 Choose the correct answer from the options given below : (1)(B), (C) and (D) only (3)(A), (C) and (D) only

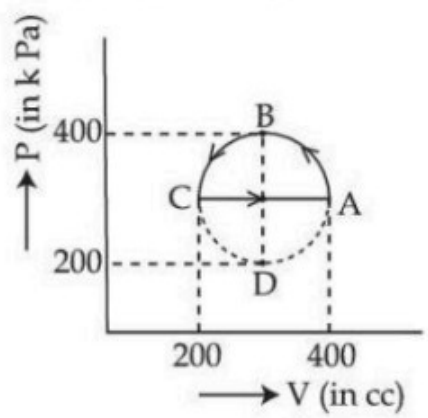
(2)(A), (B) and (C) only (4) (A), (B) and (D) only

Q29. Young's double slit inteference apparatus is immersed in a liquid of refractive index 1.44. It has slit separation of 1.5 mm . The slits are illuminated by a parallel beam of light whose wavelength in air is 690 nm . The fringe-width on a screen placed behind the plane of slits at a distance of 0.72 m , will be :

(1)0.23 mm (2)0.33 mm

(3)0.63 mm (4)0.46 mm

Q30. The magnitude of heat exchanged by a system for the given cyclic process ABCA (as shown in figure) is (in SI unit) :

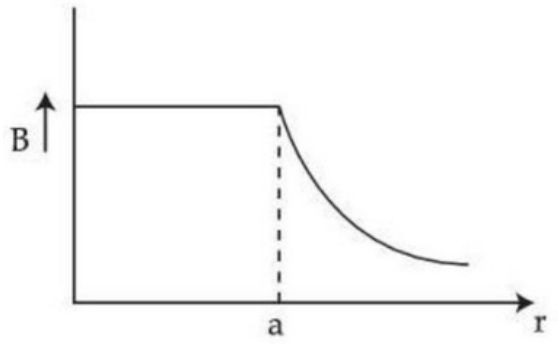


(1) 5π (2) 40π

(3) 10π (4) zero

Q31. A long straight wire of a circular cross-section with radius ' a ' carries a steady current I. The current I is uniformly distributed across this cross-section. The plot of magnitude of magnetic field B with distance r from the centre of the wire is given by

(1)



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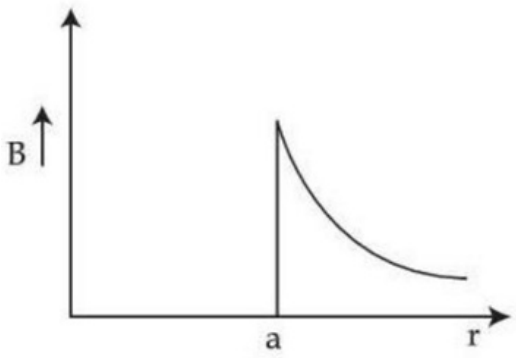

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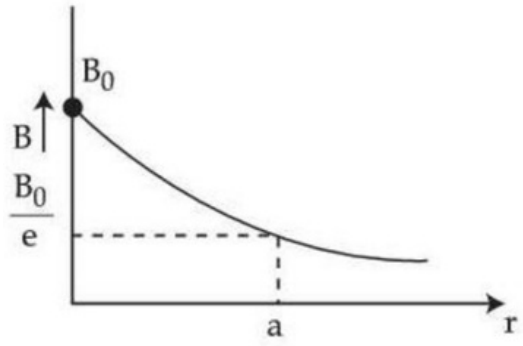
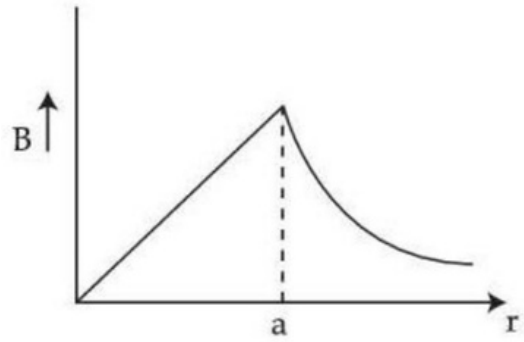


(4)



Q32. In photoelectric effect, the stopping potential (V0)v/s frequency (ν) curve is plotted. (h is the Planck's constant and $\phi 0$ is work function of metal) (A) V0v/sν is linear. (B) The slope of V0v/sν curve = $\frac{\phi 0}{h}$ (C) h constant is related to the slope of V0v/sν line. (D) The value of electric charge of electron is not required to determine h using the V0v/sν curve. (E) The work function can be estimated without knowing the value of h. Choose the correct answer from the options given below :

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

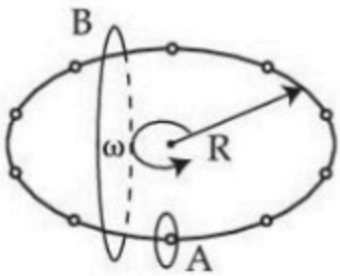
Q33. A solid sphere and a hollow sphere of the same mass and of same radius are rolled on an inclined plane. Let the time taken to reach the bottom by the solid sphere and the hollow sphere be $t1$ and $t2$, respectively, then

(1) $t1 > t2$
(2) $t1 = t2$
(3) $t1 < t2$
(4) $t1 = 2t2$

Q34. A small uncharged conducting sphere is placed in contact with an identical sphere but having 4×10−8C charge and then removed to a distance such that the force of repulsion between them is 9×10−3 N. The distance between them is (Take $\frac{1}{4\pi\epsilon_0}$ as 9×10^{9} in SI units)

(1)3 cm
(2)2 cm
(3)4 cm
(4)1 cm

Q35.

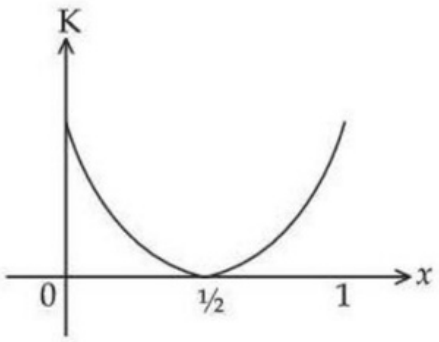


N equally spaced charges each of value q , are placed on a circle of radius R . The circle rotates about its axis with an angular velocity ω as shown in the figure. A bigger Amperian loop B encloses the whole circle where as a smaller Amperian loop A encloses a small segment. The difference between enclosed currents, $I_A - I_B$, for the given Amperian loops is

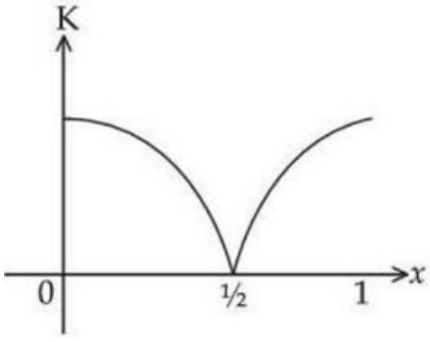
(1) $\frac{2\pi}{N} q\omega$
(2) $\frac{N2}{2\pi} q\omega$
(3) $\frac{N}{\pi} q\omega$
(4) $\frac{N}{2\pi} q\omega$

Q36. A particle oscillates along the x-axis according to the law, $x(t) = x_0 \sin(\omega t + 2)$ where $x_0 = 1$ m. The kinetic energy (K) of the particle as a function of x is correctly represented by the graph

(1)



(2)



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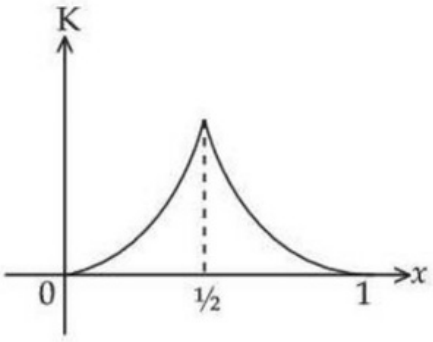
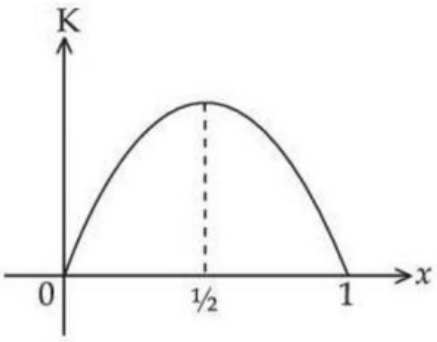


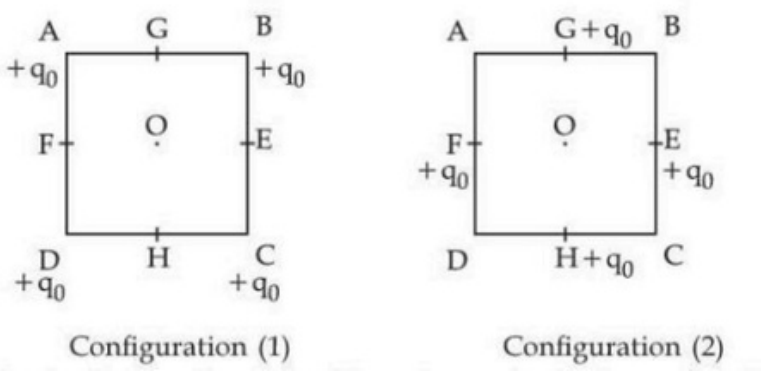
(4)



Q37. A photograph of a landscape is captured by a drone camera at a height of 18 km . The size of the camera film is 2 cm×2 cm and the area of the landscape photographed is 400 km2. The focal length of the lens in the drone camera is : (1)1.8 cm (3)2.8 cm

(2)0.9 cm
(4)2.5 cm

Q38.



(1) $\frac{Kq^2}{a^2}(4-2\sqrt{2})$ (2) $\frac{Kq^2}{a^2}(3-\sqrt{2})$

(3) $\frac{Kq^2}{a^2}(4\sqrt{2}-2)$ (4) $\frac{Kq^2}{a^2}(3\sqrt{2}-2)$

Q39. Arrange the following in the ascending order of wavelength (λ) : (A) Microwaves ($\lambda 1$) (B) Ultraviolet rays ($\lambda 2$) (C) Infrared rays ($\lambda 3$) (D) X-rays ($\lambda 4$) Choose the most appropriate answer from the options given below :

(1) $\lambda 4 < \lambda 3 < \lambda 2 < \lambda 1$ (2) $\lambda 3 < \lambda 4 < \lambda 2 < \lambda 1$

(3) $\lambda 4 < \lambda 3 < \lambda 1 < \lambda 2$ (4) $\lambda 4 < \lambda 2 < \lambda 3 < \lambda 1$

Q40. The energy E and momentum p of a moving body of mass m are related by some equation. Given that c represents the speed of light, identify the correct equation

(1) $E^2 = pc^2 + m^2c^2$ (2) $E^2 = p^2c^2 + m^2c^2$

(3) $E^2 = pc^2 + m^2c^4$ (4) $E^2 = p^2c^2 + m^2c^4$

Q41. The temperature of a body in air falls from 40∘C to 24∘C in 4 minutes. The temperature of the air is 16∘C. The temperature of the body in the next 4 minutes will be:

(1) $\frac{14}{3}^\circ C$ (2) $\frac{23}{4}^\circ C$

(3) $\frac{28}{3}^\circ$ (4) $\frac{53}{5}^\circ C$

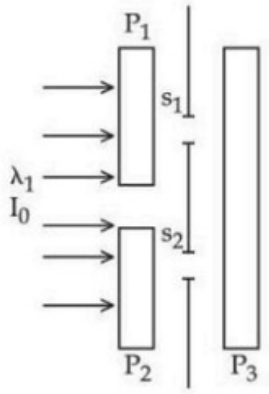
A solid sphere is rolling without slipping on a horizontal plane. The ratio of the linear kinetic energy of the centre of mass of the sphere and rotational kinetic energy is :

(1) $\frac{3}{4}$ (2) $\frac{4}{5}$

(3) $\frac{5}{2}$ (4) $\frac{3}{5}$

Q43. In a Young's double slit experiment, three polarizers are kept as shown in the figure. The transmission axes of $P1$ and $P2$ are orthogonal to each other. The polarizer $P3$ covers both the slits with its transmission axis at 45∘ to those of $P1$ and $P2$. An unpolarized light of wavelength λ and intensity $I0$ is incident on $P1$ and $P2$. The

intensity at a point after $P3$ where the path difference between the light waves from s_1 and s_2 is $\frac{\lambda}{3}$, is



(1) $\frac{I0}{2}$
(2) $\frac{I0}{4}$
(3) $\frac{I0}{3}$
(4) $I0$

Q44. Given below are two statements. One is labelled as Assertion (A) and the other is labelled as Reason (R). Assertion (A) : In an insulated container, a gas is adiabatically shrunk to half of its initial volume. The temperature of the gas decreases. Reason (R): Free expansion of an ideal gas is an irreversible and an adiabatic process. In the light of the above statements, choose the correct answer from the options given below :

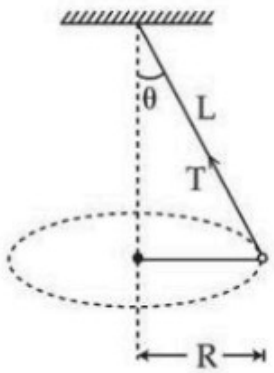
(1)Both (**A**) and (**R**) are true but (**R**) is NOT the correct explanation of (**A**)
(2)(A) is false but (R) is true
(3)(A) is true but (R) is false
(4)Both (**A**) and (**R**) are true and (**R**) is the correct explanation of (**A**)

Given below are two statements. One is labelled as Assertion (A) and the other is labelled as Reason (R). Assertion (A) : A electron in a certain region of uniform magnetic field is moving with constant velocity in a straight line path. Reason (R): The magnetic field in that region is along the direction of velocity of the electron. In the light of the above statements, choose the correct answer from the options given below :

(1)(A) is true but (R) is false
(2)Both (A) and (R) are true but (R) is NOT the correct explanation of (A)
(3)Both (**A**) and (**R**) are true and (**R**) is the correct explanation of (**A**)
(4)(A) is false but (R) is true

Q46. The ratio of the power of a light source $S1$ to that the light source $S2$ is 2.$S1$ is emitting 2×1015 photons per second at 600 nm . If the wavelength of the source $S2$ is 300 nm , then the number of photons per second emitted by $S2$ is ..... $\times1014$.

Q47.



A string of length *L* is fixed at one end and carries a mass of *M* at the other end. The mass makes $\frac{(3)}{\pi}$ rotations per second about the vertical axis passing through end of the string as shown. The tension in the string is ..... ML.

Q48. The increase in pressure required to decrease the volume of a water sample by 0.2% is P×105Nm−2. Bulk modulus of water is 2.15×109Nm−2. The value of P is .....

Q49. A tightly wound long solenoid carries a current of 1.5 A . An electron is executing uniform circular motion inside the solenoid with a time period of 75 ns . The number of turns per metre in the solenoid is ..... -.

[Take mass of electron $m_e=9\times10^{-31}$ kg, charge of electron $|q|_e=1.6\times10^{-19}$ C, $\mu0=4\pi\times10^{-7}\ \frac{N}{A^2}$, 1ns=10−9s]

Acceleration due to gravity on the surface of earth is ' *g* '. If the diameter of earth is reduced to one third of its original value and mass remains unchanged, then the acceleration due to gravity on the surface of the earth is ..... g.

Q51. For hydrogen atom, the orbital/s with lowest energy is/are : (A) 4 s (B) 3p*x* (C) 3 d*x*2−*y*2 (D) 3 d*z*2 (E) 4p*z*
Choose the correct answer from the options given below :

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

Match List - I with List - II.

Q52.

	List - I (Transition metal ion)		List - II (Spin only magnetic moment (B.M.))
(A)	Ti^{3+}	(I)	3.87
(B)	V^{2+}	(II)	0.00
(C)	Ni^{2+}	(III)	1.73
(D)	Sc^{3+}	(IV)	2.84

Choose the correct answer from the options given below :
(1)(A) −(III),(B)−(I),(C)−(IV),(D)−(II) (3)(A) −(IV),(B)−(II),(C)−(III),(D)−(I)
(2)(A) −(III),(B)−(I),(C)−(II),(D)−(IV)
(4)(A)−(II),(B)−(IV),(C)−(I),(D)−(III)

Q53. Given below are two statements : Statement (I): Experimentally determined oxygen-oxygen bond lengths in the O3 are found to be same and the bond length is greater than that of a O=O (double bond) but less than

that of a single (*O–O*) bond. Statement (II) : The strong lone pair-lone pair repulsion between oxygen atoms is solely responsible for the fact that the bond length in ozone is smaller than that of a double bond (O=O) but more than that of a single bond (O–O). In the light of the above statements, choose the correct answer from the options given below :

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

Q54. When Ethane-1,2-diamine is added progressively to an aqueous solution of Nickel (II) chloride, the sequence of colour change observed will be :

(1)Violet → Blue → Pale Blue → Green
(2)Pale Blue → Blue → Green → Violet
(3)Green → Pale Blue → Blue → Violet
(4)Pale Blue → Blue → Violet → Green

Q55. Given below are two statements :
Statement (I) : The first ionization energy of Pb is greater than that of Sn .
Statement (II) : The first ionization energy of Ge is greater than that of Si .
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)Statement I is true but Statement II is false
(3)Both Statement I and Statement II are true
(4)Both Statement I and Statement II are false

Q56. Identify correct statement/s : (A) –OCH3 and –NHCOCH3 are activating group. (B) -CN and -OH are meta directing group. (C) -CN and –SO3H are meta directing group. (D) Activating groups act as ortho - and para directing groups. (E) Halides are activating groups. Choose the correct answer from the options given below :

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

Based on the data given below : $E^\circ_{Cr_2O_7^{2-}/Cr^{3+}} = 1.33\ V$ $E^\circ_{Cl_2/Cl^-} = 1.36\ V$ $E^\circ_{MnO_4^-/Mn^{2+}} = 1.51\ V$ $E^\circ_{Cr^{3+}/Cr} = -0.74\ V$ the strongest reducing agent is :

(1) Cr
(2) Cl^-
(3) MnO_4^-
(4) Mn^{2+}

For the reaction, $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$ Attainment of equillibrium is predicted correctly by :

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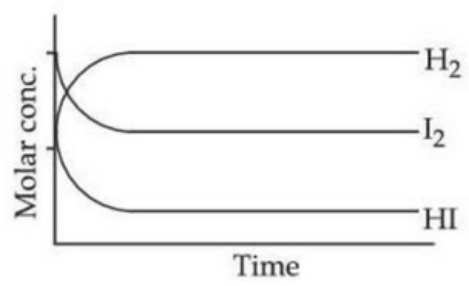
JEE Main 2025 January

(1)



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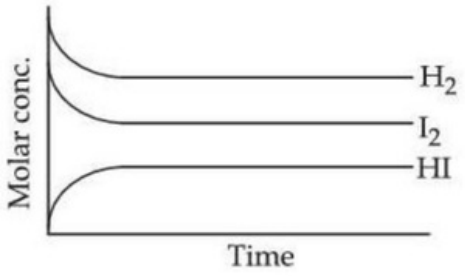

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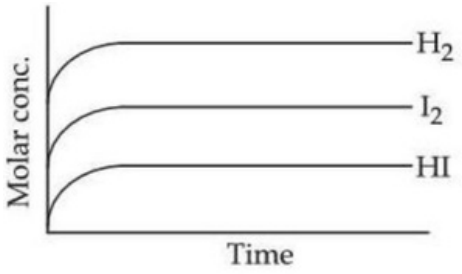
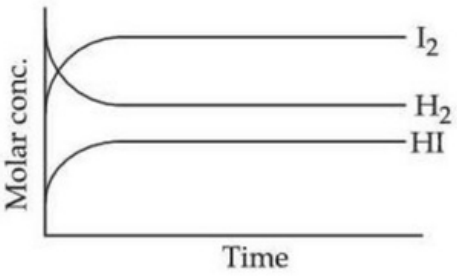


(4)



Q59. Find the compound ' A ' from the following reaction sequences. A $\xrightarrow{\text{aqua-regia}}$ B $\xrightarrow[\text{(2) AcOH}]{\text{(1) KNO2 I NH4OH}}$ yellowppt

(1) CoS
(2) ZnS
(3) NiS
(4) MnS

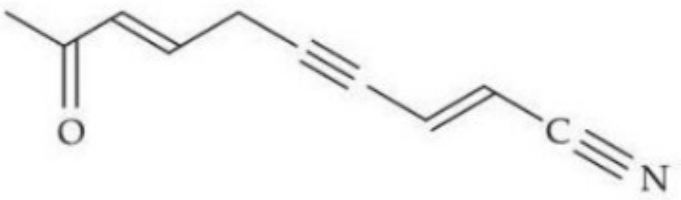
Q60. The elemental composition of a compound is 54.2%C,9.2%H and 36.6%O. If the molar mass of the compound is 132 g mol−1, the molecular formula of the compound is : [Given : The relative atomic mass of C:H:O=12:1:16]

(1) C4H9O3
(2) C6H12O6
(3) C4H8O2
(4) C6H12O3

Q61. The conditions and consequence that favours the $t_{2g}^4 e_g^2$ configuration in a metal complex are

(1)weak field ligand, low spin complex
(2)weak field ligand, high spin complex
(3)strong field ligand, high spin complex
(4)strong field ligand, low spin complex

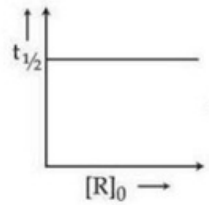
In the given structure, number of sp and sp2 hybridized carbon atoms present respectively are :

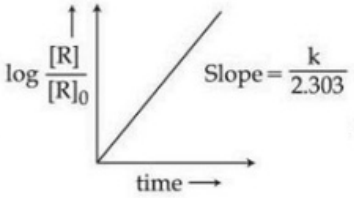


(1)4 and 5
(2)3 and 5
(3)3 and 6
(4)4 and 6

2 025 (24 Jan Shift 2)
JEE Main 2025 January

Q63.

Statement (I) :  is valid for first order reaction.

Statement (II) :  is valid for first order reaction.

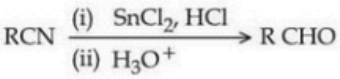
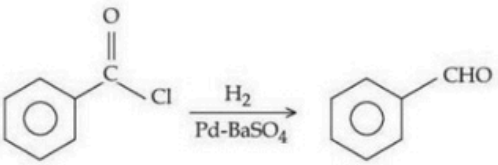
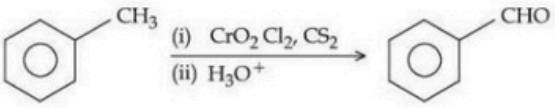
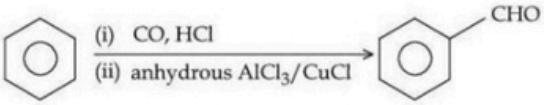
Given below are two statements :

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 false but Statement II is true

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

Q64. Match **List - I** with **List - II.**

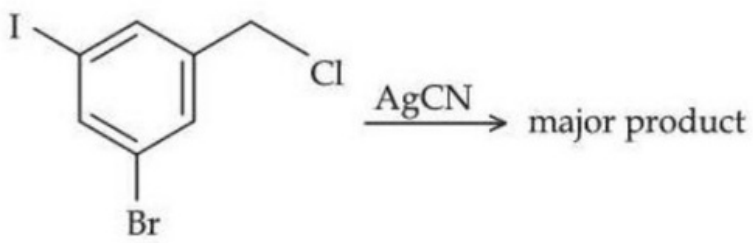
List - I		**List - II**
(A)		(I) Etard reaction
(B)		(II) Gatterman-Koch reaction
(C)		(III) Rosenmund reduction
(D)		(IV) Stephen reaction

Choose the correct answer from the options given below :

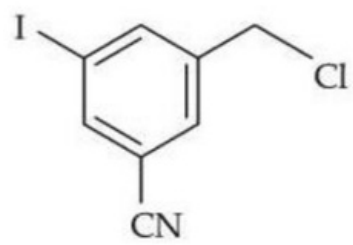
(1)(A)-(III), (B)-(IV), (C)-(II), (D)-(I) (3) (2)(A)-(I), (B)-(III), (C)-(II), (D)-(IV) (4)

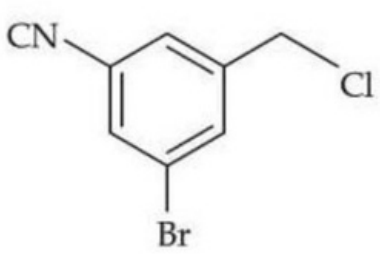
(A)-(III), (B)-(IV), (C)-(I), (D)-(II) (A)-(IV), (B)-(III), (C)-(I), (D)-(II)

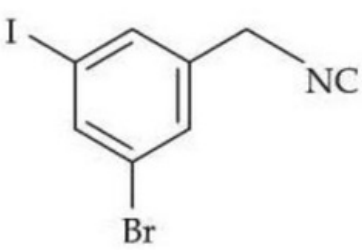
Q65. The structure of the major product formed in the following reaction is :

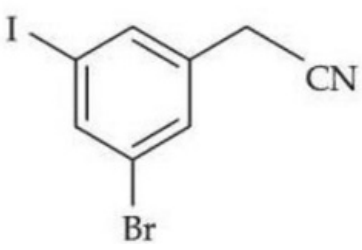


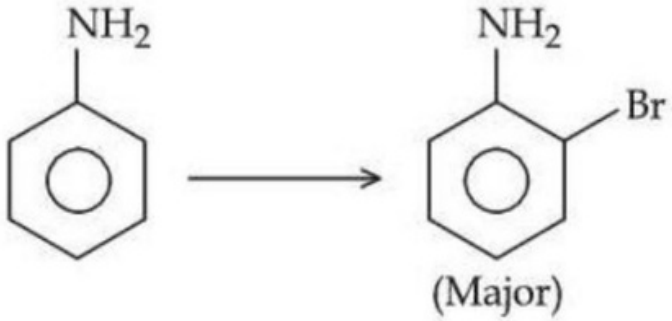
2 025 (24 Jan Shift 2)
JEE Main 2025 January

(1) 

(2) 

(3) 

(4) 



For reaction

The correct order of set of reagents for the above conversion is :

(1) Br2 | FeBr3,H2O(Δ),NaOH

(2) H2SO4,Ac2O,Br2,H2O(Δ),NaOH

(3) Ac2O,Br2,H2O(Δ),NaOH

(4) Ac2O,H2SO4,Br2,NaOH

The successive 5 ionisation energies of an element are 800,2427,3658,25024 and 32824 kJ/mol, respectively. By using the above values predict the group in which the above element is present :

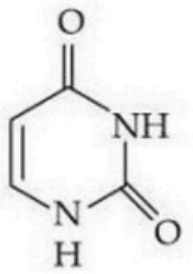
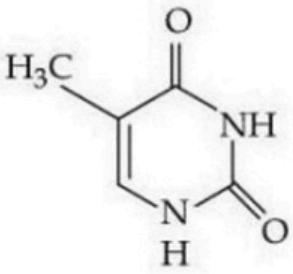
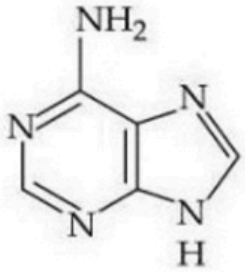
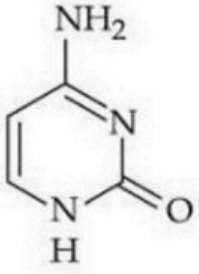
(1)Group 13

(2)Group 14

(3)Group 2

(4)Group 4

Q68. Match **List - I** with **List - II**.

List - I		**List - II**
(A) Adenine	(I)	
(B) Cytosine	(II)	
(C) Thymine	(III)	
(D) Uracil	(IV)	

Choose the correct answer from the options given below :

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

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

Q69. Which of the following mixing of 1 M base and 1 M acid leads to the largest increase in temperature?

(1)30 mLCH3COOH and 30 mL NaOH

(2)$45mLCH3COOHand25mLNaOH$

(3)30 mL HCl and 30 mL NaOH

(4)50 mL HCl and 20 mL NaOH

2 025 (24 Jan Shift 2)
JEE Main 2025 January

Q70. $S(g) + \frac{3}{2}O_2(g) \rightarrow SO_3(g) + 2x\,kcal$

$SO_2(g) + \frac{1}{2}O_2(g) \rightarrow SO_3(g) + y\,kcal$

The heat of formation of $SO_2(g)$ is given by :

(1) $x + y$ kcal

(2) $y - 2x$ kcal

(3) $2x - y$ kcal

(4) $2x + y$ kcal

Q71. In Carius method of estimation of halogen, 0.25 g of an organic compound gave 0.15 g of silver bromide (AgBr). The percentage of Bromine in the organic compound is ..... $\times 10^{-1}$% (Nearest integer). (Given : Molar mass of Ag is 108 and Br is 80 g mol^{-1})

Q72. The observed and normal molar masses of compound MX2 are 65.6 and 164 respectively. The percent degree of ionisation of MX2 is ..... %. (Nearest integer)

Q73. Consider a complex reaction taking place in three steps with rate constants $k1$,$k2$ and $k3$ respectively. The overall rate constant is given by the expression $k = \sqrt{k}\frac{1}{k}3$. If the activation energies of the three steps are 60,30 and 10 kJ mol^{-1} respectively, then the overall energy of activation in kJmol^{-1} is ..... . (Nearest integer)

The possible number of stereoisomers for 5-phenylpent-4-en-2-ol is .....

The hydrocarbon (X) with molar mass 80 g mol^{-1} and 90% carbon has ..... degree of unsaturation.

2025 (24 Jan Shift 2)

JEE Main 2025 January

1. (3)	2. (3)	3. (2)	4. (1)	5. (1)	6. (3)	7. (1)	8. (2)
9. (2)	10. (3)	11. (1)	12. (1)	13. (3)	14. (4)	15. (3)	16. (3)
17. (55)	18. (4)	19. (2)	20. (1)	21. (1)	22. (1)	23. (4)	24. (2)
25. (4)	26. (3)	27. (4)	28. (2)	29. (3)	30. (5)	31. (36)	32. (43)
33. (1)	34. (2)	35. (4)	36. (4)	37. (2)	38. (2)	39. (3)	40. (4)
41. (20)	42. (4)	43. (2)	44. (2)	45. (3)	46. (2)	47. (255)	48. (75)
49. 57	50. 58	51. (1)	52. 60	53. 61	54. 62	55. 63	56. 64
65. 73	66. 74	59. (1)	68.	69.	70.	71.	72.
		67. (1)					
		75. (3)					