Q1. Let $\vec{A}=\left(\hat{i}+\hat{j}\right)$ and $\vec{B}=\left(2\hat{i}-\hat{j}\right)$. The magnitude of a coplanar vector $\vec{C}$ such that $\vec{A}.\vec{C}=\vec{B}.\vec{C}=\vec{A}.\vec{B}$ is given by:

(1) $\sqrt{\frac{9}{12}}$ (2) $\sqrt{\frac{20}{9}}$

(3) $\sqrt{\frac{5}{9}}$ (4) $\sqrt{\frac{10}{9}}$

Q2. The percentage errors in quantities P, Q, R and S are 0.5%, 1%, 3% and 1.5% respectively in the measurement of a physical quantity A$=\frac{P^3Q^2}{\sqrt{R}S}$. The maximum percentage error in the value of A will be:

(1) 6.5 $\%$ (2) 7.5 $\%$

(3) 6.0 $\%$ (4) 8.5 $\%$

Q3. A body of mass m starts moving from rest along $x-$axis so that its velocity varies as $v=a\sqrt{s}$ where a is a constant and s is the distance covered by the body. The total work done by all the forces acting on the body in the first t second after the start of the motion is

(1) $8\ ma^4t^2$ (2) $\frac{1}{4}\ ma^4t^2$

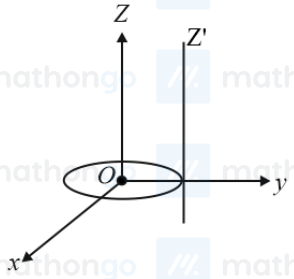
(3) $4\ ma^4t^2$ (4) $\frac{1}{8}ma^4t^2$

Q4. Two particles of the same mass m are moving in circular orbits because of force, given by $F\left(r\right)=-\frac{16}{r}-r^3$. The first particle is at a distance $r=1$, and the second, at $r=4$. The best estimate for the ratio of kinetic energies of the first and the second particle is closest to

(1) $3\ \times10^{-3}$ (2) $6\ \times10^2$

(3) $6\ \times10^{-2}$ (4) 10^{-2}

Q5. A thin circular disk is in the xy plane as shown in the figure. The ratio of its moment of inertia about z and $z\prime$ axes will be:



(1) 1 : 4 (2) 1 : 5

(3) 1 : 3 (4) 1 : 2

Q6. The relative uncertainty in the period of a satellite orbiting around the earth is 10^{-2} . If the relative uncertainty in the radius of the orbit is negligible, the relative uncertainty in the mass of the earth is:

(1) $2\ \times\ 10^{-2}$ (2) $6\ \times\ 10^{-2}$

(3) $3\ \times\ 10^{-2}$ (4) 10^{-2}

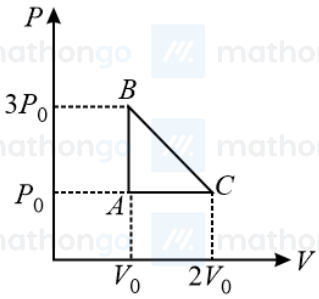
Q7. Suppose that the angular velocity of rotation of the Earth is increased. Then, as a consequence,

(1) weight of the object, everywhere on the earth, will decrease.
(2) weight of the object, everywhere on the earth, will increase.
(3) except at poles, weight of the object on the earth, will decrease.
(4) there will be no change in weight anywhere on the earth.

Q8. A small soap bubble of radius 4cm is trapped inside another bubble of radius 6cm without any contact. Let P_2 be the pressure inside the inner bubble and P_0, the pressure outside the outer bubble. Radius of another bubble with pressure difference $P_2 - P_0$ between its inside and outside would be:

(1) 2.4 cm
(2) 12 cm
(3) 4.8 cm
(4) 6 cm

Q9. One mole of an ideal monatomic gas is taken along the path $ABCA$ as shown in the PV diagram. The maximum temperature attained by the gas along the path BC is given by:



(1) $\frac{25}{4}\frac{P_0V_0}{R}$
(2) $\frac{5}{8}\frac{P_0V_0}{R}$
(3) $\frac{25}{8}\frac{P_0V_0}{R}$
(4) $\frac{25}{16}\frac{P_0V_0}{R}$

Q10. Two moles of helium are mixed with n moles of hydrogen. If $\frac{C_p}{C_v} = \frac{3}{2}$ for the mixture then the value of n is,

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

Q11. An oscillator of mass M is at rest in its equilibrium position in a potential, $V = \frac{1}{2}k(x-X)^2$. A particle of mass m comes from the right with speed u and collides completely inelastic with M and sticks to it. This process repeats every time the oscillator crosses its equilibrium position. The amplitude of oscillations after 13 collisions is: $(M = 10,\ m = 5,\ u = 1,\ k = 1)$

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

Q12. A particle executes simple harmonic motion and it is located at $x = a,\ b$ and c at time $t_0,\ 2t_0$ and $3t_0$ respectively. The frequency of the oscillation is:

(1) $\frac{1}{2\pi t_0}\cos^{-1}\left(\frac{a+c}{2b}\right)$
(2) $\frac{1}{2\pi t_0}\cos^{-1}\left(\frac{a+2b}{3c}\right)$
(3) $\frac{1}{2\pi t_0}\cos^{-1}\left(\frac{a+b}{2c}\right)$
(4) $\frac{1}{2\pi t_0}\cos^{-1}\left(\frac{2a+3c}{b}\right)$

Q13. The end correction of a resonance column is 1 cm. If the shortest length resonating with the tuning fork is 10 cm, the next resonating length should be

(1) 32 cm
(2) 40 cm
(3) 28 cm
(4) 36 cm

Q14. Two sitar strings, A and B playing the note 'Dha' are slightly out of tune and produce beats of frequency 5 Hz . The tension of the string B is slightly increased and the beat frequency is found to decrease by 3 Hz. If the frequency of A is 425 Hz. The original frequency of B is

(1) 428 Hz (2) 430 Hz

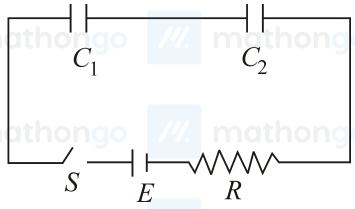
(3) 422 Hz (4) 420 Hz

Q15. Two identical conducting spheres A and B carry an equal charges. They are separated by a distance much larger than their diameters, and the force between them is F. A third identical conducting sphere, C, is uncharged. Sphere C is first touched to A, then to B, and then removed. As a result, the force between A and B would be equal to:

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

(3) $\frac{3F}{8}$ (4) F

Q16. In the following circuit the switch $S$is closed at $t = 0$. The charge on the capacitor C_1 as a function of time will be given by $\left(C_{eq} = \frac{C_1C_2}{C_1+C_2}\right)$



(1) $C_1E\left[1-\exp\left(-\frac{tR}{C_1}\right)\right]$ (2) $C_{eq}E\exp\left[-\frac{t}{RC_{eq}}\right]$

(3) $C_{eq}E\left[1-\exp\left(-\frac{t}{RC_{eq}}\right)\right]$ (4) $C_2E\left[1-\exp\left(-\frac{t}{RC_2}\right)\right]$

Q17. A heating element has a resistance of $100\ \Omega$ at room temperature. When it is connected to a supply of 220 V, a steady current of 2 A passes in it and temperature is $500\ ^o$C more than the room temperature. The temperature coefficient of resistance of the heating element is

(1) $5\times10^{-4}\ ^o\text{C}^{-1}$ (2) $2\times10^{-4}\ ^o\text{C}^{-1}$

(3) $1\times10^{-4}\ ^o\text{C}^{-1}$ (4) $0.5\times10^{-4}\ ^o\text{C}^{-1}$

Q18. A galvanometer with its coil resistance $25\ \Omega$ requires a current of 1 mA for its full deflection. In order to construct an ammeter to read up to a current of 2 A the approximate value of the shunt resistance should be:

(1) $1.25\times10^{-2}\ \Omega$ (2) $2.5\times10^{-3}\ \Omega$

(3) $2.5\times10^{-2}\ \Omega$ (4) $1.25\times10^{-3}\ \Omega$

Q19. In a circuit for finding the resistance of a galvanometer by half deflection method, a 6 V battery and a high resistance of $11\ \text{k}\Omega$ are used. The figure of merit of the galvanometer is $60\ \mu\text{A}$ division^{-1}. In the absence of shunt resistance, the galvanometer produces a deflection of $\theta = 9$ divisions when current flows in the circuit. The value of the shunt resistance that can cause the deflection of $\frac{\theta}{2}$, is closest to:

(1) $550\ \Omega$ (2) $220\ \Omega$

(3) $55\ \Omega$ (4) $110\ \Omega$

Q20. A charge q is spread uniformly over an insulated loop of radius r. If it is rotated with an angular velocity ω with respect to normal axis then magnetic moment of the loop is:

(1) $\frac{3}{2}\ q\omega r^2$ (2) $\frac{1}{2}\ q\omega r^2$
(3) $q\omega r^2$ (4) $\frac{4}{3}\ q\omega r^2$

Q21. A coil of cross-sectional area A having n turns is placed in a uniform magnetic field B. When it is rotated with an angular velocity ω, the maximum e.m.f. induced in the coil will be:
(1) $\frac{3}{2}nBA\omega$ (2) $3nBA\omega$
(3) $nBA\omega$ (4) $\frac{1}{2}nBA\omega$

Q22. A power transmission line feeds input power at 2300 V to a step-down transformer with its primary windings having 4000 turns giving the output power at 230 V. If the current in the primary coil of the transformer is 5 A and its efficiency is 90 %, the output current would be:
(1) 45 A (2) 50 A
(3) 20 A (4) 25 A

Q23. A plane electromagnetic wave of wavelength λ has an intensity I. It is propagating along the positive $Y-$ direction. The allowed expressions for the electric and magnetic fields are given by:
(1) $\overrightarrow{E}=\sqrt{\frac{2\,I}{\varepsilon_0 c}}\,\cos\left[\frac{2\pi}{\lambda}(y-ct)\right]\widehat{\mathrm{k}}$, $\overrightarrow{B}=+\frac{1}{c}E\hat{\mathrm{i}}$
(2) $\overrightarrow{E}=\sqrt{\frac{I}{\varepsilon_0 c}}\,\cos\left[\frac{2\pi}{\lambda}(y-ct)\right]\widehat{\mathrm{k}}$, $\overrightarrow{B}=+\frac{1}{c}E\hat{\mathrm{i}}$
(3) $\overrightarrow{E}=\sqrt{\frac{2\,I}{\varepsilon_0 c}}\,\cos\left[\frac{2\pi}{\lambda}(y+ct)\right]\widehat{\mathrm{k}}$, $\overrightarrow{B}=+\frac{1}{c}E\hat{\mathrm{i}}$
(4) $\overrightarrow{E}=\sqrt{\frac{I}{\varepsilon_0 c}}\,\cos\left[\frac{2\pi}{\lambda}(y-ct)\right]\hat{\mathrm{i}}$, $\overrightarrow{B}=+\frac{1}{c}E\widehat{\mathrm{k}}$

Q24. A ray of light is incident at an angle of 60° on one face of a prism of angle 30°. The emergent ray of light makes an angle of 30° with incident ray. The angle made by the emergent ray with second face of prism will be:
(1) 0° (2) 90°
(3) 30° (4) 45°

Q25. Unpolarized light of intensity I is incident on a system of two polarizers, A followed by B. The intensity of emergent light is $\frac{I}{2}$. If a third the polarizer C is placed between A and B the intensity of emergent light is reduced to $\frac{I}{3}$. The angle between the polarizers A and C is θ , then
(1) $\cos\theta=\left(\frac{2}{3}\right)^{\frac{1}{4}}$ (2) $\cos\theta=\left(\frac{1}{3}\right)^{\frac{1}{4}}$
(3) $\cos\theta=\left(\frac{1}{3}\right)^{\frac{1}{2}}$ (4) $\cos\theta=\left(\frac{2}{3}\right)^{\frac{1}{2}}$

Q26. The de-Broglie wavelength (λ_B) associated with the electron orbiting in the second excited state of hydrogen atom is related to that in the ground state (λ_G) by:
(1) $\lambda_B=\ 3\lambda_G$ (2) $\lambda_B=2\lambda_G$
(3) $\lambda_B=\lambda_{\frac{G}{3}}$ (4) $\lambda_B=\lambda_{\frac{G}{2}}$

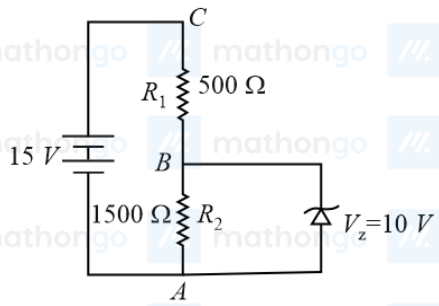
Q27. Both the nucleus and the atom of some element are in their respective first excited states. They get de-excited by emitting photons of wavelengths $\lambda_N,\ \lambda_A$ respectively. The ratio $\frac{\lambda_N}{\lambda_A}$ is closest to:
(1) 10^{-1} (2) 10^{-6}
(3) 10 (4) 10^{-10}

Q28. At some instant, a radioactive sample S_1 having an activity 5μCi has twice the number of nuclei as another sample S_2 which has an activity of 10μCi. The half lives of S_1 and S_2 are :

(1) 4 : 1 (2) 1 : 4

(3) 1 : 2 (4) 2 : 1

Q29. In the given circuit the current through zener diode is:



(1) 3.3 mA (2) 2.5 mA

(3) 5.5 mA (4) 6.7 mA

Q30. A carrier wave of peak voltage 14 V is used for transmitting a message signal. The peak voltage of the modulating signal given to achieve a modulation index of 80% will be:

(1) 22 .4 V (2) 7 V

(3) 11 .2 V (4) 28 V

Q31. An unknown chlorohydrocarbon has 3.55 % of chlorine. If each molecule of the hydrocarbon has one chlorine atom only; chlorine atoms present in 1 g of chlorohydrocarbon are :(Atomic wt. of Cl = 35 .5 u; Avogadro constant = 6 .023 $\times 10^{23}$ mol^{-1})

(1) 6.023×10^{9} (2) 6.023×10^{23}

(3) 6.023×10^{21} (4) 6.023×10^{20}

Q32. Which of the following statements is false?

(1) Splitting of spectral lines in electrical field is called Stark effect

(2) Frequency of emitted radiation from a black body goes from a higher wavelength to lower wavelength as the temperature increases

(3) Photon has momentum as well as wavelength

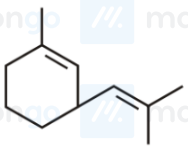
(4) Rydberg constant has unit of energy

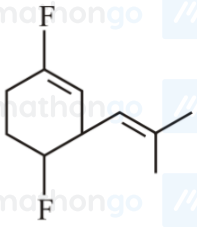
Q33. Which of the following conversions involves change in both shape and hybridisation?

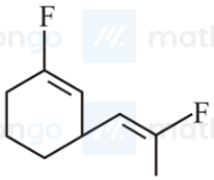
(1) $H_2O \rightarrow H_3O^+$ (2) $BF_3 \rightarrow BF_4^-$

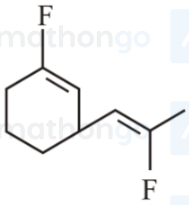
(3) $CH_4 \rightarrow C_2H_6$ (4) $NH_3 \rightarrow NH_4^+$

Q34. The most polar compound among the following is:

(1) 

(2) 

(3) 

(4) 

Q35. The incorrect geometry is represented by:

(1) NF_3 - trigonal planar (2) BF_3 - trigonal planar

(3) AsF_5 - trigonal bipyramidal (4) H_2O - bent

Q36. Assuming ideal gas behavior, the ratio of density of ammonia to that of hydrogen chloride at same temperature and pressure is: (Atomic weight of Cl is 35.5 u)

(1) 1.46 (2) 1.64

(3) 0.46 (4) 0.64

Q37. At 320 K, a gas A_2 is 20 % dissociated to $A(g)$. The standard Gibbs free energy change at 320 K and 1 atm in $J\ mol^{-1}$ is approximately:

$\left(\mathrm{R}\ =\ 8\ .314\ \ \mathrm{JK}^{-1}\ \ \mathrm{mol}^{-1}\ ;\ln 2\ =\ 0\ .693\ ;\ln 3\ =\ 1\ .098\right)$

(1) 1844 (2) 2068

(3) 4281 (4) 4763

Q38. For which of the following processes, ΔS is negative?

(1) $\mathrm{C\ (diamond)} \rightarrow \mathrm{C\ (graphite)}$ (2) $\mathrm{N_2(g, 1\,atm)} \rightarrow \mathrm{N_2(g,\ 5\ atm)}$

(3) $\mathrm{N_2(g,\ 273K)} \rightarrow \mathrm{N_2(g,\ 300K)}$ (4) $\mathrm{H_2(g)} \rightarrow \mathrm{2H(g)}$

Q39. For standardizing NaOH solution, which of the following is used as a primary standard?

(1) Sodium tetra borate (2) Ferrous Ammonium sulphate

(3) Oxalic acid (4) Dil. HCl

Q40. The gas phase reaction $2\,\mathrm{NO_2(g)}\ \rightarrow\ \mathrm{N_2O_4\ (g)}$ is an exothermic reaction. The decomposition of $\mathrm{N_2O_4}$, in equilibrium mixture of $\mathrm{NO_2\ (g)\ and\ N_2O_4\ (g)}$ can be increased by:

(1) Addition of an inert gas at constant pressure (2) Lowering the temperature

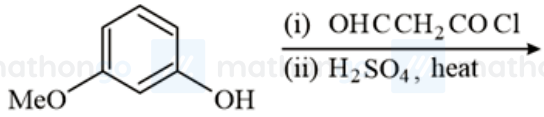
(3) Increasing the pressure (4) Addition of an inert gas at constant volume

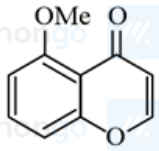
Q41. A group 13 element $'\mathrm{X}'$ reacts with chlorine gas to produce a compound $\mathrm{XCl_3}$. $\mathrm{XCl_3}$ is electron deficient and easily reacts with $\mathrm{NH_3}$ to form $\mathrm{Cl_3\,X \leftarrow NH_3}$ adduct; however, $\mathrm{XCl_3}$ does not dimerize. X is:

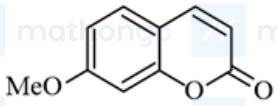
(1) B (2) Al

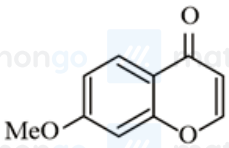
(3) In (4) Ga

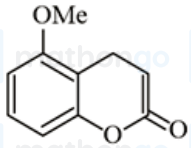
Q42. The major product of the following reaction is:



(1) 

(2) 

(3) 

(4) 

Q43. The mass of a non-volatile, non-electrolyte solute (molar mass $=$ 50 g mol^{-1}) needed to be dissolved in 114 g octane to reduce its vapour pressure by 75 %, is:

(1) 37.5 g (2) 75 g

(3) 150 g (4) 50 g

Q44. When 9.65 ampere current was passed for 1.0 hour into nitrobenzene in acidic medium, the amount of p-aminophenol produced is:

(1) 109.0 g (2) 98.1 g

(3) 9.81 g (4) 10.9 g

Q45. If 50 % of a reaction occurs in 100 second and 75 % of the reaction occurs in 200 second, the order of this reaction is:

(1) 2 (2) 3

(3) Zero (4) 1

Q46. Which one of the following is not a property of physical adsorption?

(1) Higher the pressure, more the adsorption (2) Greater the surface area, more the adsorption

(3) Lower the temperature, more the adsorption (4) Unilayer adsorption occurs

Q47. In the extraction of copper from its sulphide ore, metal is finally obtained by the oxidation of cuprous sulphide with:

(1) SO_2 (2) Fe_2O_3

(3) Cu_2O (4) CO

Q48. Among the oxides of nitrogen:
N_2O_3, N_2O_4 and N_2O_5; the molecule(s) having nitrogen - nitrogen bond is/are:

(1) N_2O_3 and N_2O_4 (2) N_2O_4 and N_2O_5

(3) N_2O_3 and N_2O_5 (4) Only N_2O_5

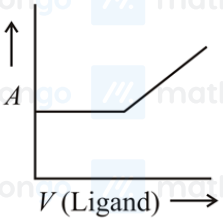
Q49. When XO_2 is fused with an alkali metal hydroxide in presence of an oxidizing agent such as KNO_3; a dark green product is formed which disproportionate in acidic solution to afford a dark purple solution. X is:

(1) Mn (2) Cr
(3) V (4) Ti

Q50. The **incorrect** statement is:

(1) Cu^{2+} ion gives chocolate coloured precipitate with potassium ferrocyanide solution
(2) Cu^{2+} and Ni^{2+} ions give black precipitate with H_2S in presence of HCl solution
(3) Ferric ion gives blood red colour with potassium thiocyanate
(4) Cu^{2+} salts give red coloured borax bead test in reducing flame

Q51. In a complexometric titration of metal ion with ligand M (Metal ion) $+ L$(Ligand) $\rightarrow C$ (Complex) end point is estimated spectrophotometrically (through light absorption). If 'M' and 'C' do not absorb light and only 'L' absorbs then the titration plot between absorbed light (A) versus volume of ligand 'L' (V) would look like:

(1)


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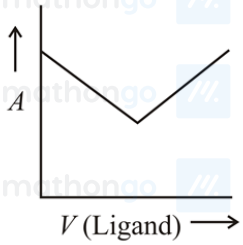

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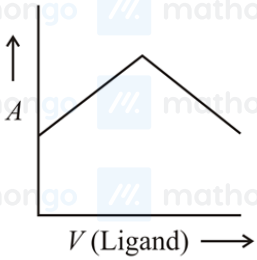

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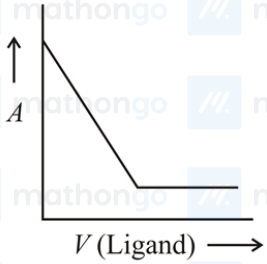


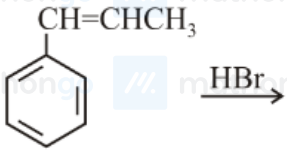
Q52. In Wilkinson's catalyst, the hybridization of central metal ion and its shape are respectively:

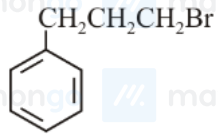
(1) sp^3d, trigonal bipyramidal (2) d^2sp^3, octahedral
(3) dsp^2, square planar (4) sp^3, tetrahedral

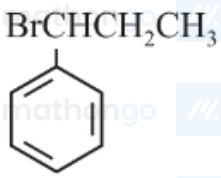
Q53. Which of the following complexes will show geometrical isomerism?

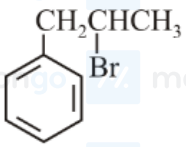
(1) Potassium tris(oxalato)chromate(III)
(2) Pentaaquachlorochromium(II)chloride
(3) Aquachlorobis(ethylenediamine)cobalt(II)chloride
(4) Potassiumamminetrichloroplatinate(II)

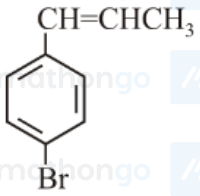
Q54. The major product of the following reaction is:



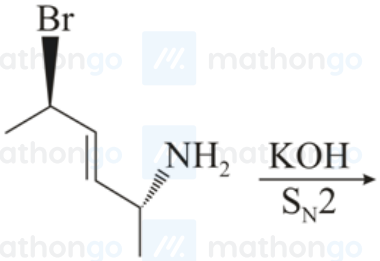
(1) 

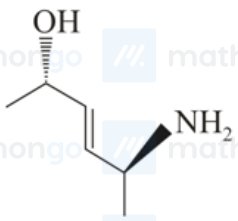
(2) 

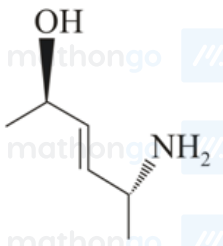
(3) 

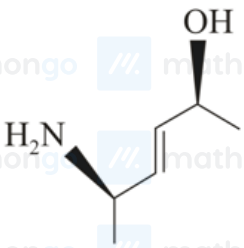
(4) 

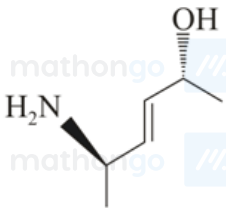
Q55. The major product of the following reaction is:



(1) 

(2) 

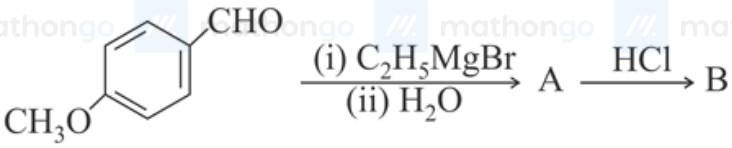
(3) 

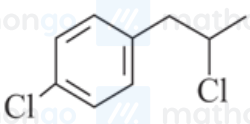
(4) 

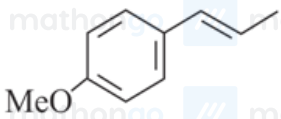
Q56. Which of the following compounds will most readily be dehydrated to give alkene under acidic condition?

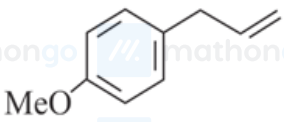
(1) 4 - Hydroxypentan - 2-one
(2) 3- Hydroxypentan-2-one
(3) 1-Pentanol
(4) 2-Hydroxycyclopentanone

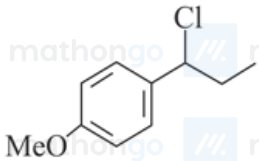
Q57. The major product B formed in the following reaction sequence is:



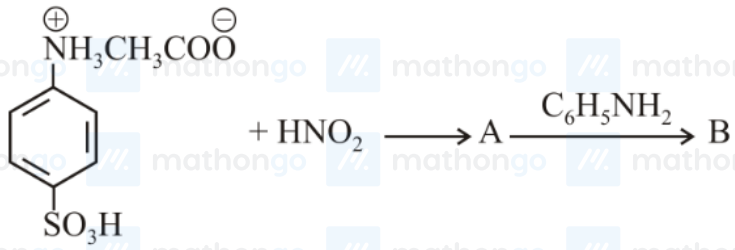
(1) 

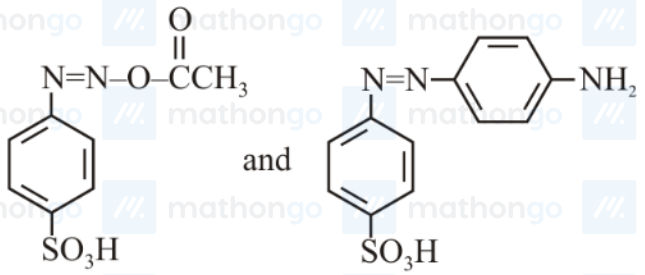
(2) 

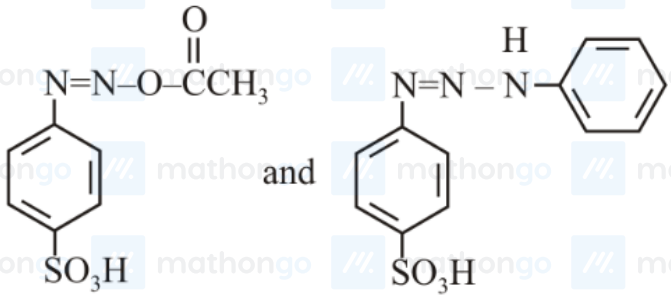
(3) 

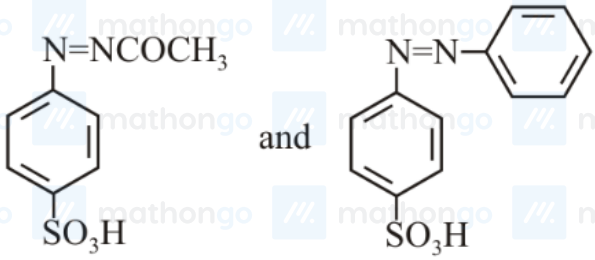
(4) 

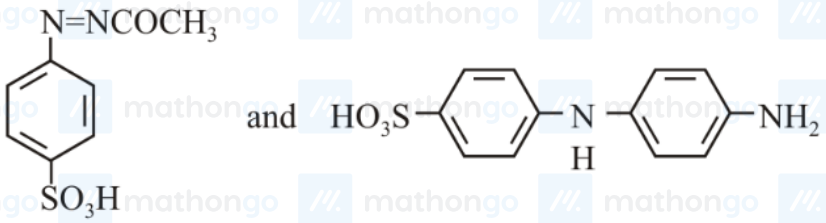
Q58. Products A and B formed in the following reactions are respectively:



(1) 

(2) 

(3) 

(4) 

Q59. The correct match between items of List-I and List-II is:

List –I	List - II
(A) Phenelzine	(P) Pyrimidine
(B) Chloroxylenol	(Q) Furan
(C) Uracil	(R) Hydrazine
(D) Ranitidine	(S) Phenol

(1) (A) – (S), (B) – (R), (C) – (Q), (D) – (P)
(2) (A) – (R), (B) – (S), (C) – (P), (D) – (Q)
(3) (A) – (R), (B) – (S), (C) – (Q), (D) – (P)
(4) (A) – (S), (B) – (R), (C) – (P), (D) – (Q)

Q60. Among the following, the incorrect statement is

(1) cellulose and amylose has $1,4-$glycosidic linkage.
(2) lactose contains $\beta-\mathrm{D}-$galactose and $\beta-\mathrm{D}-$glucose.
(3) maltose and lactose has $1,4-$glycosidic linkage.
(4) sucrose and amylose has $1,2-$glycosidic linkage.

Q61. Let p, q and r be real numbers $(p \neq q, r \neq 0)$, such that the roots of the equation $\frac{1}{x+p}+\frac{1}{x+q}=\frac{1}{r}$ are equal in magnitude but opposite in sign, then the sum of squares of these roots is equal to
(1) p^2+q^2 (2) $\frac{p^2+q^2}{2}$
(3) $2\left(p^2+q^2\right)$ (4) $p^2+q^2+r^2$

Q62. If an angle A of a ΔABC satisfies $5\cos A+3=0$, then the roots of the quadratic equation $9x^2+27x+20=0$ are
(1) $\sec A,\ \cot A$ (2) $\sec A,\ \tan A$
(3) $\tan A,\ \cos A$ (4) $\sin A,\ \sec A$

Q63. The least positive integer n for which $\left(\frac{1+i\sqrt{3}}{1-i\sqrt{3}}\right)^n=1$ is
(1) 2 (2) 5
(3) 6 (4) 3

Q64. The number of numbers between $2,000$ and $5,000$ that can be formed with the digits $0,\ 1,\ 2,\ 3,\ 4$ (repetition of digits is not allowed) and are multiple of 3 is
(1) 36 (2) 30
(3) 24 (4) 48

Q65. Let $\frac{1}{x_1},\ \frac{1}{x_2}, \ldots, \frac{1}{x_n}\left(x_i \neq 0 \text{ for } i=1,\ 2, \ldots,\ n\right)$ be in A.P. such that $x_1=4$ and $x_{21}=20$. If n is the least positive integer for which $x_n>50$, then $\sum_{i=1}^{n}\left(\frac{1}{x_i}\right)$ is equal to
(1) 3 (2) $\frac{1}{8}$
(3) $\frac{13}{4}$ (4) $\frac{13}{8}$

Q66. The sum of the first 20 terms of the series $1+\frac{3}{2}+\frac{7}{4}+\frac{15}{8}+\frac{31}{16}+\ldots$ is
(1) $39+\frac{1}{2^{19}}$ (2) $38+\frac{1}{2^{20}}$
(3) $38+\frac{1}{2^{19}}$ (4) $39+\frac{1}{2^{20}}$

Q67. The coefficient of x^2 in the expansion of the product $\left(2-x^2\right)\left\{\left(1+2x+3x^2\right)^6+\left(1-4x^2\right)^6\right\}$ is
(1) 107 (2) 108
(3) 155 (4) 106

Q68. The locus of the point of intersection of the lines $\sqrt{2}x-y+4\sqrt{2}k=0$ and $\sqrt{2}kx+ky-4\sqrt{2}=0$ (k is any non-zero real parameter) is
(1) an ellipse whose eccentricity is $\frac{1}{\sqrt{3}}$
(2) a hyperbola whose eccentricity is $\sqrt{3}$
(3) a hyperbola with length of its transverse axis $8\sqrt{2}$
(4) an ellipse with length of its major axis $8\sqrt{2}$

Q69. If a circle C, whose radius is 3, touches externally the circle $x^2+y^2+2x-4y-4=0$ at the point $(2,2)$, then the length of the intercept cut by this circle C on the x-axis is equal to

(1) $2\sqrt{3}$ (2) $\sqrt{5}$

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

Q70. Let P be a point on the parabola $x^2=4y$. If the distance of P from the center of the circle $x^2+y^2+6x+8=0$ is minimum, then the equation of the tangent to the parabola at P is

(1) $x+y+1=0$ (2) $x+4y-2=0$

(3) $x+2y=0$ (4) $x-y+3=0$

Q71. If the length of the latus rectum of an ellipse is 4 units and the distance between a focus and its nearest vertex on the major axis is $\frac{3}{2}$ units, then its eccentricity is

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

(3) $\frac{1}{9}$ (4) $\frac{1}{3}$

Q72. $\lim\limits_{x\to 0}\frac{(27+x)^{\frac{1}{3}}-3}{9-(27+x)^{\frac{2}{3}}}$ equals

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

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

Q73. If $p\to(\sim p\vee\sim q)$ is false, then the truth values of p and q are, respectively

(1) $F,\ F$ (2) $T,\ T$

(3) $F,\ T$ (4) $T,\ F$

Q74. The mean and the standard deviation $(\mathrm{S.D.})$ of five observations are 9 and 0, respectively. If one of the observation is increased such that the mean of the new set of five observations becomes 10, then their S. D. is

(1) 0 (2) 2

(3) 4 (4) 1

Q75. A man on the top of a vertical tower observes a car moving at a uniform speed towards the tower on a horizontal road. If it takes 18 min for the angle of depression of the car to change from 30° to 45°, then the time taken (in min) by the car to reach the foot of the tower is

(1) $\frac{9}{2}\left(\sqrt{3}-1\right)$ (2) $18\left(1+\sqrt{3}\right)$

(3) $18\left(\sqrt{3}-1\right)$ (4) $9\left(1+\sqrt{3}\right)$

Q76. Let N denote the set of all natural numbers. Define two binary relations on N as $R_1=\{(x,y)\in N\times N: 2x+y=10\}$ and $R_2=\{(x,y)\in N\times N: x+2y=10\}$. Then

(1) both R_1 and R_2 are transitive relations (2) range of R_2 is $\{1,2,3,4\}$

(3) range of R_1 is $\{2,4,8\}$ (4) both R_1 and R_2 are symmetric relations

Q77. Let $A=\begin{bmatrix}1&0&0\\1&1&0\\1&1&1\end{bmatrix}$ and $B=A^{20}$. Then the sum of the elements of the first column of B is

(1) 210 (2) 211

(3) 251 (4) 231

Q78. The number of values of k for which the system of linear equations $(k+2)x+10y=k$ & $kx+(k+3)y=k-1$ has no solution is

(1) 1 (2) 2

(3) 3 (4) 4

Q79. If the function f defined as $f(x)=\frac{1}{x}-\frac{k-1}{e^{2x}-1},\ x\neq 0$ is continuous at $x=0$, then ordered pair $(k, f(0))$ is equal to

(1) $(2,1)$ (2) $(3,1)$

(3) $(3,2)$ (4) $\left(\frac{1}{3},2\right)$

Q80. If $x=\sqrt{2^{\text{cosec}^{-1}t}}$ and $y=\sqrt{2^{\sec^{-1}t}},\ (|t|\geq 1)$, then $\frac{dy}{dx}$ is equal to

(1) $\frac{y}{x}$ (2) $-\frac{y}{x}$

(3) $-\frac{x}{y}$ (4) $\frac{x}{y}$

Q81. Let M and m be respectively the absolute maximum and the absolute minimum values of the function, $f(x)=2x^3-9x^2+12x+5$ in the interval $[0,3]$. Then $M-m$ is equal to

(1) 9 (2) 4

(3) 1 (4) 5

Q82. If $\int\frac{\tan x}{1+\tan x+\tan^2 x}dx=x-\frac{K}{\sqrt{A}}\tan^{-1}\left(\frac{K\tan x+1}{\sqrt{A}}\right)+C$, ($C$ is a constant of integration), then the ordered pair (K,A) is equal to

(1) $(2,1)$ (2) $(2,3)$

(3) $(-2,1)$ (4) $(-2,3)$

Q83. If $f(x)=\int_0^x t(\sin x-\sin t)dt$, then

(1) $f'''(x)-f''(x)=\cos x-2x\sin x$ (2) $f'''(x)+f''(x)-f'(x)=\cos x$

(3) $f'''(x)+f''(x)=\sin x$ (4) $f'''(x)+f'(x)=\cos x-2x\sin x$

Q84. If the area of the region bounded by the curves, $y=x^2,\ y=\frac{1}{x}$ and the lines $y=0$ and $x=t(t>1)$ is 1 sq. unit, then t is equal to

(1) $e^{\frac{2}{3}}$ (2) $e^{\frac{3}{2}}$

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

Q85. The differential equation representing the family of ellipses having foci either on the x-axis or on the y-axis, center at the origin and passing through the point $(0,3)$ is

(1) $xyy'-y^2+9=0$ (2) $xyy''+x(y')^2-yy'=0$

(3) $xyy'+y^2-9=0$ (4) $x+yy''=0$

Q86. Let $\vec{a}=\hat{i}+\hat{j}+\hat{k}$, $\vec{c}=\hat{j}-\hat{k}$ and a vector $\vec{b}$ be such that $\vec{a}\times\vec{b}=\vec{c}$ and $\vec{a}\cdot\vec{b}=3$. Then $\left|\vec{b}\right|$ equals

(1) $\frac{11}{3}$ (2) $\frac{11}{\sqrt{3}}$

(3) $\sqrt{\frac{11}{3}}$ (4) $\frac{\sqrt{11}}{3}$

Q87. The sum of the intercepts on the coordinate axes of the plane passing through the point $(-2,-2,2)$ and containing the line joining the points $(1,-1,2)$ and $(1,1,1)$ is

(1) 4 (2) 12
(3) -8 (4) -4

Q88. If the angle between the lines $\frac{x}{2}=\frac{y}{2}=\frac{z}{1}$ and $\frac{5-x}{-2}=\frac{7y-14}{P}=\frac{z-3}{4}$ is $\cos^{-1}\left(\frac{2}{3}\right)$, then P is equal to

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

Q89. Two different families A and B are blessed with equal number of children. There are 3 tickets to be distributed amongst the children of these families so that no child gets more than one ticket. If the probability that all the tickets go to the children of the family B is $\frac{1}{12}$, then the number of children in each family is

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

Q90. Let $A,\ B$ and C be three events, which are pair-wise independent and $\overline{E}$ denotes the complement of an event E. If $P(A\cap B\cap C)=0$ and $P(C)>0$, then $P\left[\left(\overline{A}\cap\overline{B}\right)\middle|C\right]$ is equal to

(1) $P\left(\overline{A}\right)-P(B)$ (2) $P\left(\overline{A}\right)-P\left(\overline{B}\right)$
(3) $P\left(\overline{A}\right)+P\left(\overline{B}\right)$ (4) $P(A)+P\left(\overline{B}\right)$

ANSWER KEYS

1. (3)	**2.** (1)	**3.** (4)	**4.** (3)	**5.** (3)	**6.** (1)	**7.** (3)	**8.** (1)
9. (3)	**10.** (3)	**11.** (2)	**12.** (1)	**13.** (1)	**14.** (4)	**15.** (3)	**16.** (3)
17. (2)	**18.** (1)	**19.** (4)	**20.** (2)	**21.** (3)	**22.** (1)	**23.** (1)	**24.** (2)
25. (1)	**26.** (1)	**27.** (2)	**28.** (1)	**29.** (1)	**30.** (3)	**31.** (4)	**32.** (4)
33. (2)	**34.** (3)	**35.** (1)	**36.** (3)	**37.** (4)	**38.** (2)	**39.** (3)	**40.** (1)
41. (1)	**42.** (2)	**43.** (3)	**44.** (3)	**45.** (4)	**46.** (4)	**47.** (3)	**48.** (1)
49. (1)	**50.** (2)	**51.** (1)	**52.** (3)	**53.** (3)	**54.** (2)	**55.** (3)	**56.** (1)
57. (4)	**58.** (1)	**59.** (2)	**60.** (4)	**61.** (1)	**62.** (2)	**63.** (4)	**64.** (1)
65. (3)	**66.** (3)	**67.** (4)	**68.** (3)	**69.** (4)	**70.** (1)	**71.** (4)	**72.** (1)
73. (2)	**74.** (2)	**75.** (4)	**76.** (2)	**77.** (4)	**78.** (1)	**79.** (2)	**80.** (2)
81. (1)	**82.** (2)	**83.** (4)	**84.** (1)	**85.** (1)	**86.** (3)	**87.** (4)	**88.** (2)
89. (2)	**90.** (1)						