CSIR UGC – NET JRF: Model Test

Chemical Science

❖ Question Paper

Section-A

Q.1 A sphere of radius 4 cm is carved from a homogeneous sphere of radius 8 cm and mass 160 g. The mass of the smaller sphere is

(a) 80 g (b) 60 g (c) 40 g (d) 20 g

Q.2 Two boys, A and B are at two diametrically opposite points on a circle. At one instant, the two start running on the circle; A anticlockwise with constant speed v and B clockwise with constant speed 2v. In 2 minutes, they pass each other for the first time. How much later will they pass each other for the second time

(a) 1 minute (b) 2 minutes (c) 3 minutes (d) 4 minutes

Q.3 There are k baskets and n balls. The balls are put into the baskets randomly. If $k < n$,

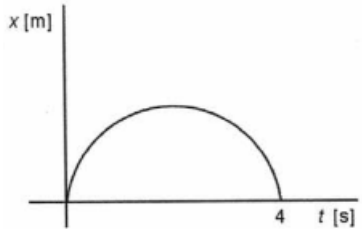
(a) There is no empty basket.

(b) There are exactly (n – k) baskets with at least one ball.

(c) There is at least one basket with two or more balls.

(d) There are (n – k) baskets with exactly two balls.

Q.4 An ant is crawling along the x-axis such that the graph of its position on the x-axis versus time is a semi-circle (see figure). The total distance covered in the 4 s is

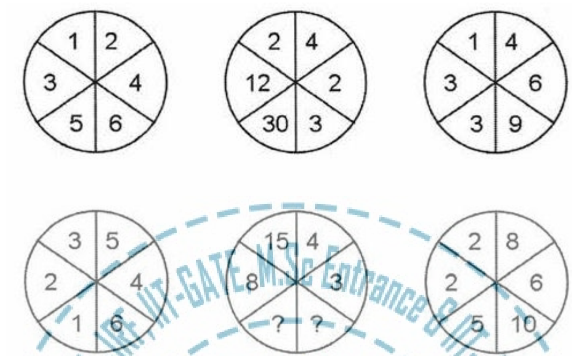


(a) 4 m (b) 2 m (c) 2πm (d) 4πm

Q.5 In a bag containing only blue, red and green marbles, all but 15 are blue, all but 13 are red and all but 12 are green. How many are red?

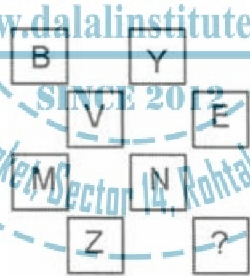
(a) 13 (b) 7 (c) 25 (d) 20

Q.6 Find the missing numbers in the bottom middle circle. (Clue: left halves of the central circles relate to the left circles and the right halves to the right circles)



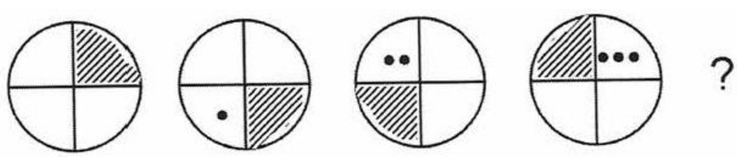
(a) 10, 20 (b) 15, 15 (c) 21, 2 (b) 6, 2

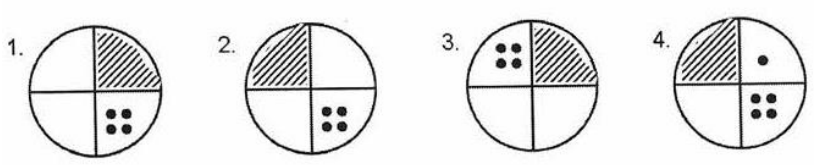
Q.7 Identify the missing letter.



(a) W (b) A (c) X (d) B

Q.8 Identify the figure that comes next in the sequence.





Q.9 A person buys a shirt with marked price Rs.300/- at 20% discount. In order to make a profit of 20% the person should sell the shirt for

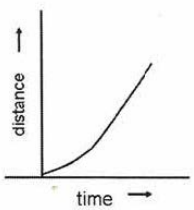
(a) Rs.288/- (b) Rs.300/- (c) Rs.240/- (d) Rs.360/-

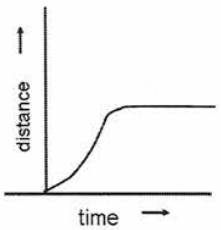
Q.10 A uniform cylindrical container is half filled with water. The height of the cylinder is twice its diameter. The cylinder is gradually tilted until the water touches the brim. At this instant, the container is inclined at

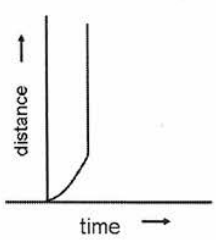
(a) 30° to vertical (b) 45° to vertical (c) 60° to vertical (d) 75° to vertical

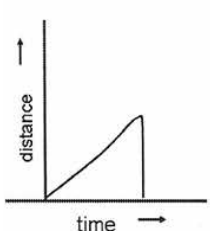
Q.11 A car is moving along a straight road. The graph below shows how the speed varies with time.

Which of the following graphs represents the distance covered by the car with time?

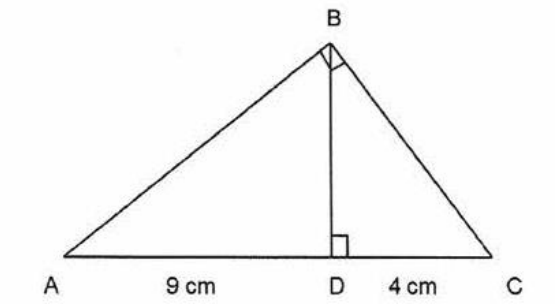
(a)


(b)


(c)


(d)


Q.12 In triangle ABC, shown in the figure, AB is perpendicular to BC. Further, BD is perpendicular to AC. If AD = 9 cm and DC = 4 cm, the length BD is



(a) 6cm (b) 6.5 cm (c) 36/13 cm (d) 13/36 cm

Q.13 A box of sticks of equal lengths is provided. The minimum number sticks needed to build a frame to enclose a 3-dimensional volume is

(a) 6 (b) 12 (c) 3 (d) 8

Q.14 5 kg of adulterated rice has 2% stones in it and the rest is rice. Half of the stone content was removed. Now the percentage of stone content in it is

(a) 0.99% (b) 1% (c) 1.1% (d) 1.01%

Q.15 A coin is tossed six times. The probability that heads will occur at least once is

(a) 63/64 (b) 1/3 (c) 1/64 (d) 3/2

Q.16 Two parameters TC and TF are related as shown in the table. Find the value of TF corresponding to a TC of 75.

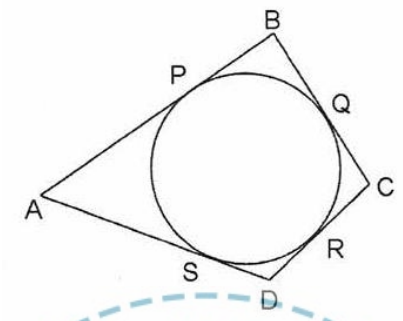
TC	0	25	50	75	100
TF	32	77	122	?	212

(a) 167 (b) 162 (c) 150 (d) 200

Q.17 Several identical cubes are arranged in a close-packed single layer. If the area of the layer is A and the volume of the layer is V, then the number of cubes in the collection is

(a) V/A. (b) A^3/V^2. (c) V^2/A^3 (d) A/V.

Q.18 Circle PQR is inscribed in a quadrilateral ABCD. The circle touches side AD at point S. AP = 8 cm, QC = 3 cm and DC = 6 cm. The length of side AD is



(a) 9 cm (b) 10 cm (c) 11 cm (d) 12 cm

Q.19 The distribution of wages in a population is shown below for 2 years.

The average wage(s)

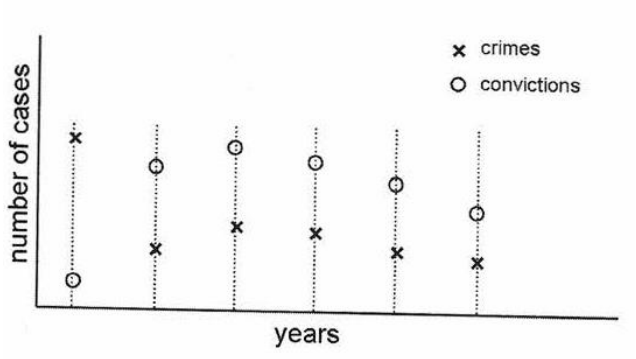
(a) in 1999 is greater than that in 2000.

(b) in 1999 is less than that in 2000.

(c) in the two years are equal, but the variances are unequal.

(d) In the two years are unequal, but the variances are equal.

Q.20 The graph below shows crime rates and convictions for 5 years in a certain society.



Which of the following is correct?

(a) The cause of convictions being on the rise is better law enforcement.

(b) Falling crime rates have slowly reduced the conviction rates also.

(c) There are fewer convictions because crime rate has fallen.

(d) The graph must be wrong.

Section-B

Q.21 $[CoCl_4]^{2-}$ shows a deep blue colour because of

(a) Metal to ligand charge transfer transition.

(b) Ligand to metal charge transfer transition.

(c) Spin allowed and Laporte forbidden d-d transition.

(d) Spin allowed and Laporte allowed d-d transition.

Q22 The violet colour of iodine vapour is due to

(a) $n \rightarrow n*$ transition

(c) $\pi \rightarrow \pi*$ transition

(c) $n \rightarrow \sigma*$ transition

(d) $\sigma \rightarrow \pi*$ transition

Q.23 Choose the correct statement among the following

(a) Diamond has lower thermal and electrical conductivities compared to graphite.

(b) Diamond has similar thermal and electrical conductivities compared to graphite.

(c) Diamond has higher thermal conductivity but lower electrical conductivity compared to graphite

(d) Diamond has the same thermal but lower electrical conductivity compared to graphite.

Q.24 Which of the following is a nido-borane?

(a) B_4H_{10} (b) B_5H_9 (c) $[B_6H_6]^{2-}$ (d) B_5H_{11}

Q.25 Among the three types of orbital s, p, d, and f,

(a) Both p and f orbitals have centre of symmetry (b) Both p and d orbitals have centre of symmetry

(c) Only d orbitals have centre of symmetry (d) f orbitals alone have centre of symmetry

Q.26 The absorbance of solution having 20% transmittance is

(a) 0.301 (b) 0.699 (c) 1.301 (d) 1.699

Q.27 The active site of enzyme nitrogenase contains

(a) Mo (b) Mn (c) Fe (d) Cu

Q.28 Which one of the following is a free radical?

(a) CO (b) CN^- (c) NO (d) CS

Q.29 Choose the 16 e^- complex from the following:

(a) $Ni(CO)_4$ (b) $Rh(PPh_3)_3Cl$ (c) $Fe(CO)_5$ (d) $(\eta^6\text{-}C_6H_6)_2Cr$

Q.30 The species having metal-metal bond is:

(a) $Mn_2(CO)_{10}$ (b) $Al_2(CH_3)_6$ (c) $V_2(CO)_{12}$ (d) $Al_2(OPr^i)_{12}$

Q.31 The only molecule having bridging oxygen is

(a) Phosphorus trioxide (b) Phosphorus pentoxide

(c) Cyclic tetraphosphate (d) Pyrophosphate

Q.32 The coordination number of phosphorus in $[PMo_{12}O_{40}]^{3-}$ is

(a) 2 (b) 4 (c) 5 (d) 6

Q.33 Using phenolphthalein as the indicator, which of the following titration is possible:

(a) Acetic acid with pyridine (b) Oxalic acid with sodium hydroxide

(c) Hydrochloric acid with aniline (d) Sulphuric acid with aqueous ammonia

Q.34 Which of the following species is ESR-active?

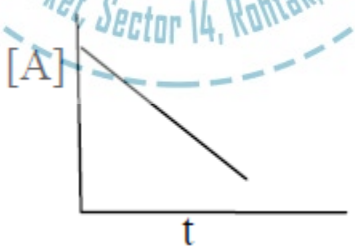
(a) $VOSO_4$ (b) $K_2Cr_2O_7$ (c) $KMnO_4$ (d) $[Co(NH_3)_6]Cl_3$

Q.35 Large deviation from Trouton's rule is observed for systems which are

(a) Having more ordered structure (b) Having more disordered structure

(c) Having low melting points (d) Having low boiling points

Q.36 The concentration of a reactant decreases linearly with time. What is the order of the reaction?



(a) 1st order (b) Fractional order (c) 2nd order (d) Zero order

Q.37 The point group symmetry of the molecule cis–ML_4X_2 is

(a) C_{4v} (b) D_{4h} (c) C_{2h} (d) C_{2v}

Q.38 The number of rotational degrees of freedom of CO_2 is

(a) One (b) Two (c) Three (d) Four

Q.39 The magnitude of the nuclear spin angular momentum of a nuclei is $\sqrt{15/2\hbar}$ units. The value of I is

(a) 5/2 (b) ½ (c) 1 (d) 3/2

Q.40 Which of the following transitions in the electronic spectrum of a homonuclear diatomic molecule is forbidden

(a) $\Sigma^+_u \rightarrow \Sigma^+_g$ (b) $\Sigma_g^+ \rightarrow \Pi_u^+$ (c) $\Sigma_u^+ \rightarrow \Pi_g^+$ (d) $\Sigma_g^+ \rightarrow \Delta_u$

Q.41 The diffraction pattern of a cubic solid has an intense 110 Bragg reflection, but the 100 and 111 Bragg reflections are absent. The structure of the solid is

(a) Body-centered cubic (b) Primitive cubic

(c) Face-centered cubic (d) Edge-centered cubic

Q.42 The logarithmic conductivity of a crystalline solid shows a linear variation with inverse temperature (1/T). The band gap may be obtained from

(a) Slope of the plot. (b) Intercept on the conductivity axis.

(c) Intercept on the temperature axis. (d) Inverse slope.

Q.43 The molar masses of monodisperse and polydisperse polymers obey respectively the conditions: ($\bar{M}_n$ = Number average molecular weight and $\bar{M}_w$ = Weight average molecular weight).

(a) $\bar{M}_n > \bar{M}_w \; and \; \bar{M}_n < \bar{M}_w$ (b) $\bar{M}_n = \bar{M}_w \; and \; \bar{M}_n < \bar{M}_w$

(c) $\bar{M}_n < \bar{M}_w \; and \; \bar{M}_n < \bar{M}_w$ (d) $\bar{M}_n = \bar{M}_w \; and \; \bar{M}_n = \bar{M}_w$

Q.44 The spatial part of hydrogen molecular wave function in the simplest molecular orbital theory is given by σ_g^2 where σ_g is a normalized linear combination of two hydrogen 1s orbitals. Which of the following is true about the above wave function?

(a) It contains only covalent terms.
(b) It includes only a small amount of ionic terms.
(c) It contains only ionic terms.
(d) It over estimates the ionic terms.

Q.45 A $2p_z$ orbital of hydrogen atom is an eigenfunction of

(a) H only (b) H and L^2 only (c) H, L^2 and L_z only (d) H, L^2, L_z and L_x

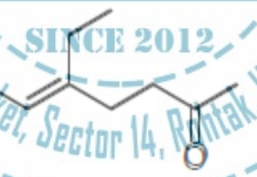
Q.46 By a reversible process, we mean one that always

(a) Takes infinite time for completion
(b) Satisfies ΔS (universe) = 0
(c) Satisfies $\Delta G = 0$
(d) Gives the minimum work

Q.47 A hydrogenic 3p orbital has the following form of the radial wavefunction (α_i = constant):

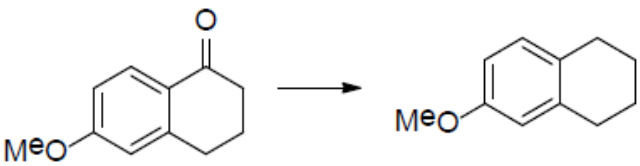
(a) $r(\alpha_1 - r)e^{-\alpha_2 r}$
(b) $re^{-\alpha_3 r}$
(c) $r(\alpha_4 - r)(\alpha_5 - r)e^{-\alpha_6 r}$
(d) $r^3 e^{-\alpha_3 r}$

Q.48 IUPAC name for the compound given below is



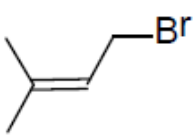
(a) *E*-5-ethylhept-5-en-2-one
(b) Z-5-ethylhept-5-en-2-one
(c) E-3-ethylhept-2-en-6-one
(d) *Z*-3-ethylhept-2-en-6-one

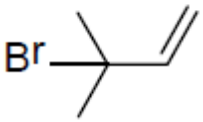
Q.49 The most suitable reagent for the following transformation is

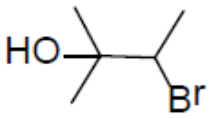


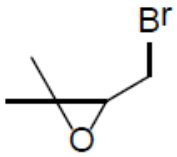
(a) $NaBH_4$ (b) B_2H_6 (c) Zn-Hg/ HCl (d) NH_2NH_2/ HCl

Q.50 The major product formed in the reaction of 2-methyl but-3-en-2-ol with HBr is

(a) 

(b) 

(c) 

(d) 

Q.51 Among dimethylcyclobutanes, which one can exhibit optical activity?

(a) cis-1,2-dimethylcyclobutane (b) trans-1,2-dimethylcyclobutane

(c) cis-1,3-dimethylcyclobutane (d) trans-1,3-dimethylcyclobutane

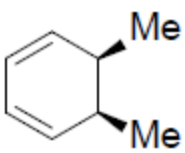
Q.52 The monomer of biopolymer DNA is a

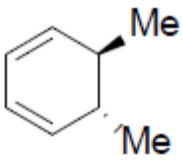
(a) Nucleotide (b) Amino acid (c) Disaccharide (d) Fatty acid

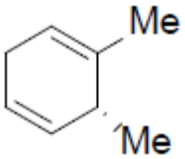
Q.53 The order of chemical shifts (δ value) in the ^{1}H NMR spectrum of crotonaldehyde is

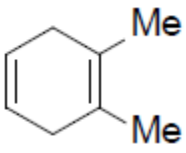
(a) Olefinic>CHO>Me (b) CHO>Me>olefinic (c) CHO>Olefinic>Me (d) Olefinic>Me>CHO

Q.54 The product formed in the reaction given below is

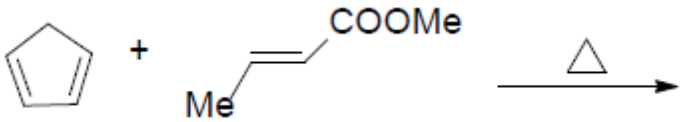
(a) 

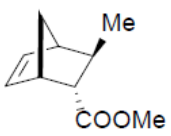
(b) 

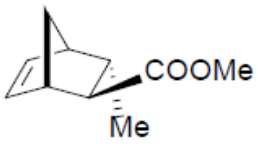
(c) 

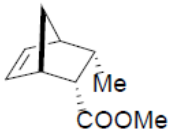
(d) 

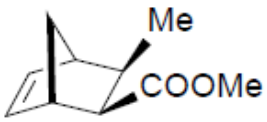
Q.55 The major product formed in the reaction given below is



(a) 

(b) 

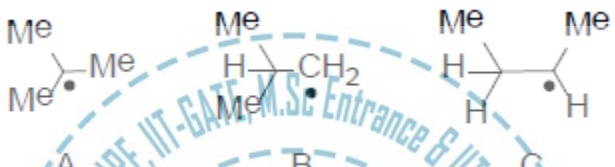
(c) 

(d) 

Q.56 The conversion of excited singlet state (S_1) of a molecule to triplet state (T_1) is known as

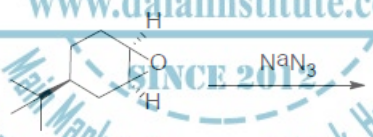
(a) Fluorescence (b) Phosphorescence (c) Intersystem crossing (d) Internal conversion

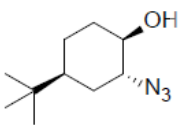
Q.57 The decreasing order of stability of the free radicals A, B and C is

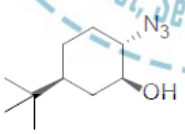


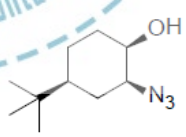
(a) A > B > C (b) C > A > B (c) B > A > C (d) A > C > B

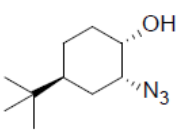
Q.58 The major product formed in the reaction given below:



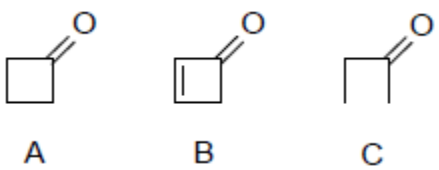
(a) 

(b) 

(c) 

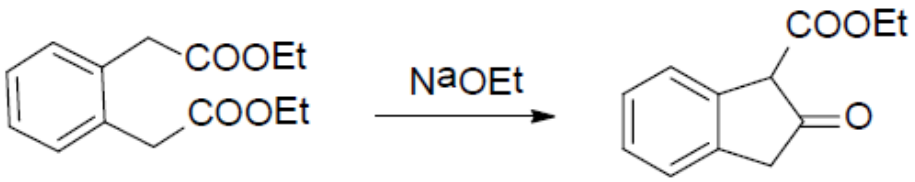
(d) 

Q.59 The rates of keto-enol tautomerism in the ketones A-C, given below are in the order



(a) A > B > C (b) A > C > B (c) C > A > B (d) C > B > A

Q.60 The reaction given below is an example of



(a) Aldol condensation (b) Knoevenagel condensation

(c) Dieckmann condensation (d) Acyloin condensation

Section-C

Q.61 The covalent radii vary gradually in the Periodic Table. From the orders given below for such radii, the correct ones are

(a) Ce > Lu, (b)Co > Ti, (c) Sr > Ca, (d)I > Se

(a) (a) and (b) only (b) (a) and (c) only (c) (a), (c) and (d) only (d) (b), (c) and (d) only

Q.62 The pair of gaseous molecules/ions having tetrahedral structure is

(a) $SnCl_4$, PH_4^+ (b) $SnCl_4$, XeF_4 (c) ICl_4^-, PH_4^+ (d) $SnCl_4$, ICl_4^-

Q.63 Consider the following:

Volumetric method for Ag(I)	Indicator used
(a). Fajan method	Chromate
(b). Mohr's method	Fluorescein
(c). Vohlard method	ferric salt

The method and indicator matches correctly in

(a) (a) and (b) only (b) 2. (b) and (c) only (c) (c) only (d) (b)only

Q.64 An unknown lead solution has diffusion current of 1.0 μA. To a 10 ml of this solution 0.5 ml of 0.04 M lead solution is added. The diffusion current of the spiked solution is 1.50 μA. The concentration of the unknown lead solution is

(a) 0.0020 M (b) 0.0050 M (c) 0.0035 M (d) 0.0010 M

Q.65 The ^{32}Pradio isotope, used in leukemia therapy, has $t_{1/2}$=14.26 days. What % of ^{32}P remains after 35 days?

(a) 30% (b) 8% (c) 81.7% (d) 18.3%

Q.66 On a 30 cm column, the t_R of A and B respectively are16.40 and 17.63 minutes. The t_0 of the column is 1.30 minutes. The peak width at base lines for A and B are 1.11 and 1.21 minutes respectively. The column resolution R_S is

(a) 1.06 (b) 1.23 (c) 2.12 (d) 2.23

Q.67 Which one of the following pairs of electronic configurations of high-spin transition metal ions (3d) in an octahedral field undergoes a substantial John-Teller distortion:

(a) d^3, d^9 (b) d^4, d^9 (c) d^5, d^9 (d) d^6, d^9

Q.68 Which one of the following pairs consists of a good oxidizing and a good reducing agent respectively:

(a) Ce(IV), Ln(III) (b) Ln(III), Eu(II) (c) Ce(IV), Eu(II) (d) Ln(III), Ce(III)

Q.69 Which one of the pairs of following statements about reduction of $[CoCl(NH_3)_5]^{2+}$ By Cr(II) is correct:

(A). Reactant $[CoCl(NH_3)_5]^{2+}$ has non-labile coordination sphere

(B). Reaction proceeds by outer-sphere mechanism

(C). Reactant $[CoCl(NH_3)_5]^{2+}$has labile coordination sphere

(D). Reaction proceeds by inner-sphere mechanism

(a) (A) and (B) (b) (A) and (D) (c) (C) and (B) (d) (C) and (D)

Q.70 Hemocyanin contains

(a) A dinuclear copper core and binds dioxygen in the cuprous state.

(b) A dinuclear copper core and binds dioxygen in the cupric state.

(c) A mononuclear copper core and binds dioxygen in the cuprous state.

(d) A mononuclear copper core and binds dioxygen in the cupric state.

Q.71 The ^{31}PNMR spectrum of $PF_4N(CH_3)_2$ at room temperature and low temperature (173K) respectively shows (assume that N and H do not couple):

(a) Triplet and quintet

(b) Quintet and triplet

(c) Quintet and triplet of triplets

(d) Triplet and triplet of triplets

Q.72 The number of hyperfine lines in the EPR spectrum of a one electron reduced product of $[Co_3(CO)_9Se]$(I=7/2 for Co nucleus) is:

(a) 8 (b) 15 (c) 22 (d) 1

Q.73 The highest oxidation state of a metal in the following compounds is :

$(\eta^6\text{-}C_6H_6)_2Cr$, $Mn(CO)_5Cl$, $Na_2[Fe(CO)_4]$,$K[Mn(CO)_5]$and $K[Mo(CO)_5Br]$

(a) 1 (b) 2 (c) –1 (d) –2

Q.74 The maximum number of valence electrons of a metal in these complexes are: $Mn_2(CO)_{10}$, $(\eta^5\text{-}C_5H_5)Mo(CO)_3Cl$, $(\eta^5\text{-}C_5H_5)_2Ni$, and $(\eta^5\text{-}C_5H_5)_2TiCl_2$

(a) 16 (b) 18 (c) 20 (d) 22

Q.75 Olefin hydrogenation using Wilkinson's catalyst initiates with:

(a) Olefin addition to $Rh(PPh_3)_2Cl$.

(b) Olefin addition to $Rh(PPh_3)_3Cl$.

(c) A phosphine dissociation from $Rh(PPh_3)_3Cl$.

(d) A phosphine addition to $Rh(PPh_3)_2Cl$.

Q.76 Although Fe(III) is a better Lewis acid compared to Zn(II), most hydrolytic Enzymes contain Zn(II) at the active site because

(a) Fe(III) is a redox active ion.

(b) Fe(III) has less abundance compared to Zn(II).

(c) Fe(III) generally makes octahedral complexes while Zn(II) makes tetrahedral complexes.

(d) Zn(II) makes kinetically labile complexes.

Q.77 Considering the two complexes (A) $[Ni(H_2O)_6]^{2+}$and (B)$[Ni(NH_3)_6]^{2+}$, the right statement is

(a) Complex (A) is diamagnetic and complex (B) is paramagnetic.

(b) Complex (A) is paramagnetic and complex (B)is diamagnetic.

(c) Both are paramagnetic.

(d) Both are diamagnetic.

Q.78 Unlike d-d transitions, the f-f transitions

(a) Do not change much with change in ligand.

(b) Change significantly with change in ligand.

(c) Appear at low energies i.e., at the near-IR region.

(d) Appear as broad bands.

Q.79 Strongest super acid among the following is a

(a) Solution of HNO_3 in H_2SO_4 (b) Solution of $HClO_4$ in H_2SO_4

(c) Solution of SbF_5 in HF (d) Solution of $SbCl_5$ in HCl

Q.80 Consider the following statements regarding borazine:

A. It is isoelectronic with benzene.

B. Each nitrogen receives more σ-electron density from neighboring boron than it gives away as a π-donor.

C. It does not undergo addition reactions.

D. Nitrogen retains its basicity and boron its acidity.

The true statements among the above are

(a) A, C and D (b) A, B and D (c) A and C only (d) B, C, and D

Q.81 For a diffusion-controlled bimolecular reaction, the rate constant (k_D) is proportional to (T = temperature; η = coefficient of viscosity of medium).

(a) ηT (b) $1/\eta T$ (c) $\frac{T}{\sqrt{\eta}}$ (d) T/η

Q.82 Consider the unimolecular reaction

A(g) → products

For which the following remarks were made.

A. The reaction is second order at low pressure and becomes first order at high pressure.

B. The reaction is first order at low pressure and becomes second order at high pressure.

C. The reaction is zero order.

Which of these is/are correct?

(a) A and B (b) B and C (c) Only C (d) Only A

Q.83 A random distribution of errors obeys the Gaussian form $\sqrt{A/\pi}\exp[-Ax^2]$. The mean and standard deviation of this distribution obeys

(a) $\langle x\rangle = 0$ and $\sigma_x = \sqrt{2A}$ (b) $\langle x\rangle \neq 0$ and $\sigma_x = 1/\sqrt{2A}$

(c) $\langle x\rangle = 0$ and $\sigma_x = \sqrt{A}$ (d) $\langle x\rangle = 0$ and $\sigma_x \neq A$

Q.84 The function $\sin^{-1}x$ is not an acceptable wave function because

(a) It is not differentiable (b) Its first derivative is not continuous

(c) It does not cover the entire space (d) It is not a single-valued function

Q.85 The first-order correction to energy for the ground state of a particle-in-a-box due to a perturbation λx would be

(a) λL/2 (b) λL (c) 2λL (d) 2

Q.86 Characters of a few symmetry operations are given below. Identify the character of the irreducible representation A'_{2g}

	E	C_n	C_2	i	σ_h
1.	1	1	1	–1	–1
2.	1	1	–1	1	1
3.	1	–1	–1	1	1
4.	1	1	–1	–1	1

Q.87 The character of the irreducible representation A_1 in C_{3v} point group is given below

	E	$2C_3$	$3\sigma_v$
A_1	1	1	1

Identify one irreducible representation orthogonal to A1 among the following.

	E	$2C_3$	$3\sigma_v$
Γ_1	1	-1	1
Γ_2	2	-1	0
Γ_3	2	0	-1
Γ_4	1	-1	-1

(a) Γ_1 (b) Γ_2 (c) Γ_3 (d) Γ_4

Q.88 The energy levels of cyclopropene are $\alpha + 2\beta$, $\alpha - \beta$, and $\alpha - \beta$. The delocalization energy in $C3H3^-$ is

(a) 2β (b) 0 (c) β (d) 3β

Q.89 The rotational constant (B) of $H^{35}Cl$, $H^{37}Cl$ and $D^{35}Cl$ follow the order

(a) $H^{35}Cl > D^{35}Cl > H^{37}Cl$ (b) $H^{35}Cl > H^{37}C\ l > D^{35}Cl$

(c) $D^{35}Cl > H^{35}Cl > H^{37}Cl$ (d) $H^{37}Cl > H^{35}Cl > D^{35}Cl$

Q.90 In a crystal, atom A is at the corners of the unit cell, B is at the centre of the cell and the oxygen atoms are at the face-centred positions. What is the formula per unit cell?

(a) A_8BO_6 (b) ABO_6 (c) A_8BO_3 (d) ABO_3

Q.91 On mixing 100 mL of 0.1 M CH_3COOH and 50 mL of 0.1 M NaOH, the pH of the solution will be

(a) $pk_a+0.301$ (b) pk_a (c) $pk_a–0.301$ (d) $pk_a+0.477$

Q.92 Using the fundamental equation dA= –SdT – PdV, the Maxwell relation is

(a) $\left(\frac{\partial S}{\partial P}\right)_T = \left(\frac{\partial V}{\partial S}\right)_V$ (b) $\left(\frac{\partial S}{\partial V}\right)_T = \left(\frac{\partial P}{\partial T}\right)_V$ (c) $\left(\frac{\partial T}{\partial V}\right)_T = \left(\frac{\partial P}{\partial S}\right)_T$ (d) $\left(\frac{\partial S}{\partial V}\right)_T = \left(\frac{\partial P}{\partial T}\right)_V$

Q.93 The relationship between mean ionic activity coefficient for $Ca_3(PO_4)_2$ and its ions is given by

(a) $\gamma_\pm = \gamma_+^3\gamma_-^2$ (b) $\gamma_\pm = \gamma_+^2\gamma_-^3$ (c) $\gamma_\pm^5 = \gamma_+^3\gamma_-^2$ (d) $\gamma_\pm^5 = \gamma_+^2\gamma_-^3$

Q.94 Assuming that C−H and C−X bond lengths in

are nearly equal, the molar residual entropy at 0 K is

(a) 0 (b) Rln2 (c) Rln3 (d) Rln6

Q.95 The contributions to the molar entropy by translational (tr), rotational (rot), vibrational (vib) and electronic (ele) degrees of freedom is in order

(a) tr > rot > vib > ele (b) rot > vib > tr > ele (c) ele > vib > rot > tr (d) vib > rot > tr > ele

Q.96 A binary mixture of A_2 and B_2 will show negative deviation from Raoult's law when

(a) A−A and B−B interactions are stronger than A−B.

(b) A−A and B−B interactions are weaker than A−B.

(c) Both A−A and B−B interactions are equal to A−B.

(d) Either A−A or B−B interactions is equal to A−B.

Q.97 In the presence of external magnetic field the transition $^3D_1 \rightarrow {}^3P_1$ splits into

(a) 3 (b) 5 (c) 7 (d) 9

Q.98 Ionic equivalent conductance value for Ca^{2+} is 0.0119 (S m^2mol^{-1}) and for Cl^- is 0.0076 (Sm^2mol^{-1}). The correct expected molar conductivity at infinite dilution for $CaCl_2$ is

(a) 0.0195 S m^2mol^{-1} (b) 0.0271 S m^2mol^{-1} (c) 0.0542 S m^2mol^{-1} (d) 0.01355 S m^2mol^{-1}

Q.99 The term symbol for the ground state configuration of NO is

(a) $^2\prod_u$ (b) $^2\prod_g$ (c) $^1\prod_u$ (d) $^1\prod_g$

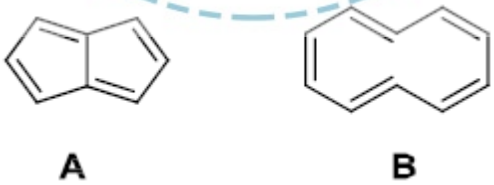
Q.100 The kinetic chain length (ν) is a measure of chain propagation. If the rates of consumption are denoted by R_c and rates of production by R_p; M and $M^\bullet$ denote the monomer and the active center, respectively. The correct definition of ν is

(a) $R_c(M)/ R_p(M^\bullet)$ (b) $R_p(M^\bullet) / R_c(M)$ (c) $R_c(M^\bullet) / R_p(M)$ (d) $R_c(M)/ R_c(M^\bullet)$

Q.101 4-tert-Butylcyclohexanoneon reduction gives two isomeric alcohols which are

(a) Enantiomers (b) Diastereomers (c) Rotamers (d) Homomers

Q.102 For the following compounds A and B the correct statement is



A B

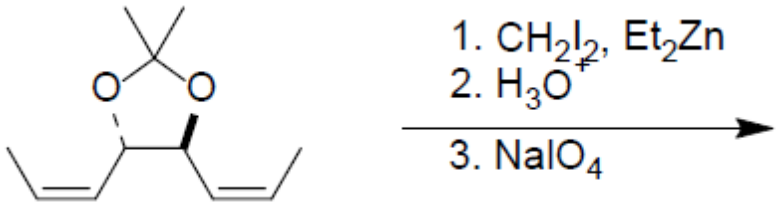
(a) A is aromatic and B is antiaromatic.

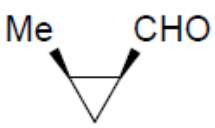
(b) A is antiaromatic and B is non-aromatic.

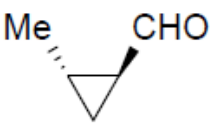
(c) A and B are both aromatic.

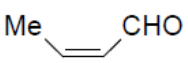
(d) A and B are both non-aromatic

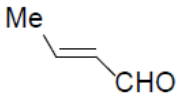
Q.103 Identify the product formed in the following transformations



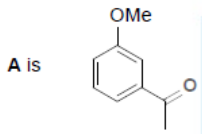
(a) 

(b) 

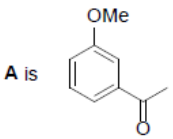
(c) 

(d) 

Q.104 Identify the product A and B in the following reaction sequence

(a) 

(b)

(c) 

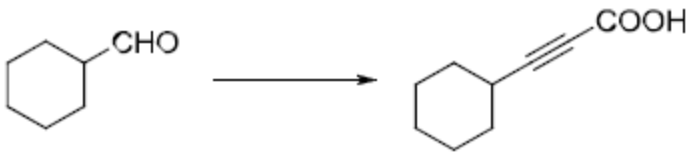
(d)

Q.105 Match the following:

A. Conversion of 1,7-octadiene to cyclohexene	(i) Wacker Oxidation
B. Conversion of bromobenzene to ethylcinnamate	(ii) Mc Murry Coupling
C. Conversion of 1-hexene to 2-hexanone	(iii) Heck reaction
	(iv) Olefin Metathesis

(a) A: iv; B: ii; C: iii (b) A: ii; B: iv; C: i (c) A: iv; B: iii; C: i (d) A: i; B: iii; C: iv

Q.106 Reagents that can be used in the following conversion are



(a) i) $Ph_3P{=}CH_2$, ii) HCN, iii) H_3O+

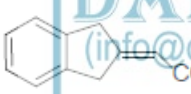
(b) i) $HS(CH_2)_2SH$, ii) n-BuLi, iii) $BrCH_2COOH$

(c) i) EtMgI, ii) $KMnO_4$

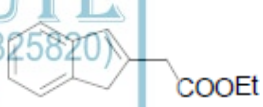
(d) i) Ph_3P,CBr_4, ii) n-BuLi, iii) CO_2

Q.107 In the following reaction, the structure of the major product is

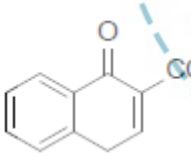
(a)



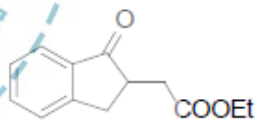
(b)



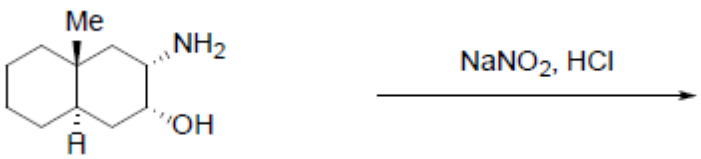
(c)



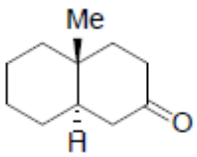
(d)



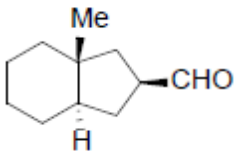
Q.108 The following reaction, the structure of the major product is



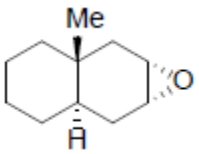
(a)



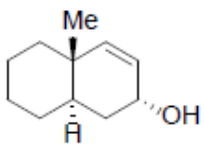
(b)



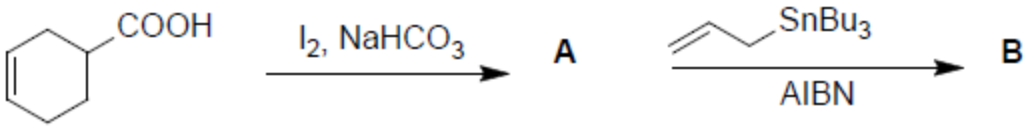
(c)

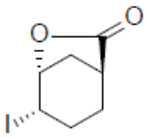
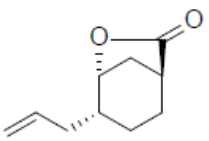


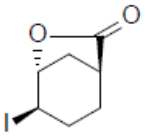
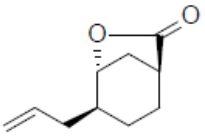
(d)

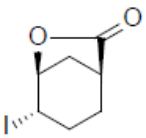
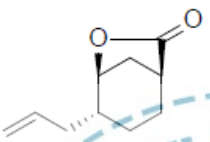


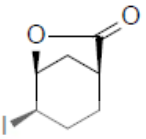
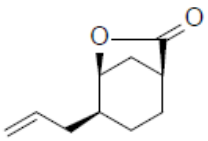
Q.109 Identify the products A and B in the following reaction sequence.



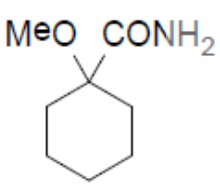
(a) A is  B is 

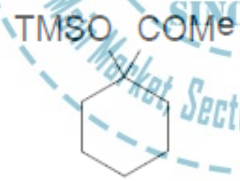
(b) A is  B is 

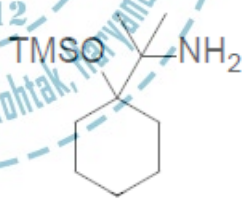
(c) A is  B is 

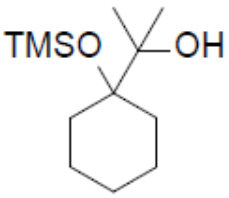
(d) A is  B is 

Q.110 Major product formed in the following reaction is

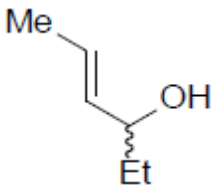
(a) 

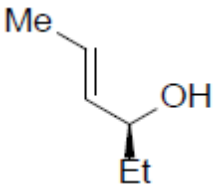
(b) 

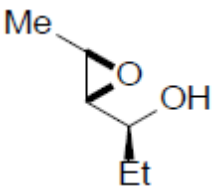
(c) 

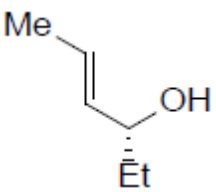
(d) 

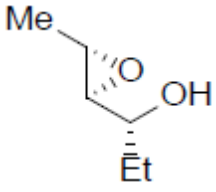
Q.111 Product of Sharpless kinetic resolution of the following alcohol with (–)-diethyl tartrate is



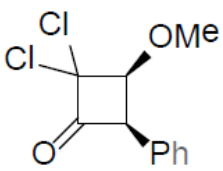
(a) 

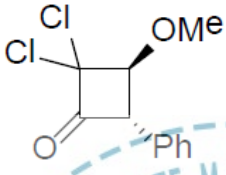
(b) 

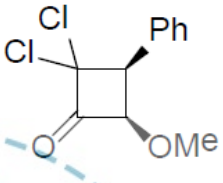
(c) 

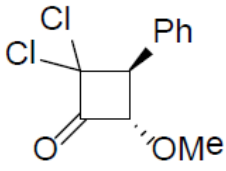
(d) 

Q.112 Select the product of the reaction of (Z)-(2-methoxyvinyl) benzene with dichloroacetylo chloride in presence of triethyl amine

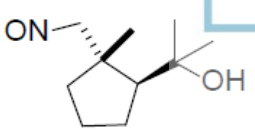
(a) 

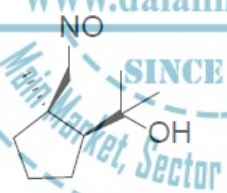
(b) 

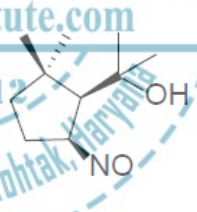
(c) 

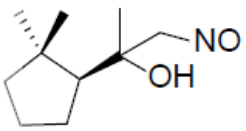
(d) 

Q.113 Identify the product formed in the following reaction

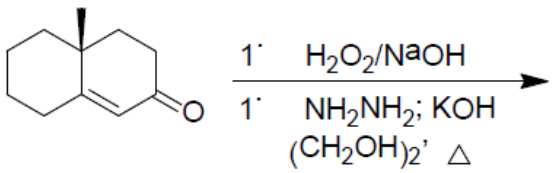
(a) 

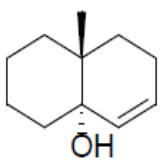
(b) 

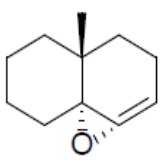
(c) 

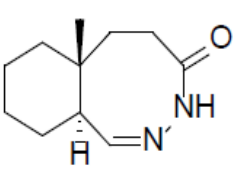
(d) 

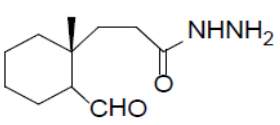
Q.114 The compound formed in the following reaction sequence is



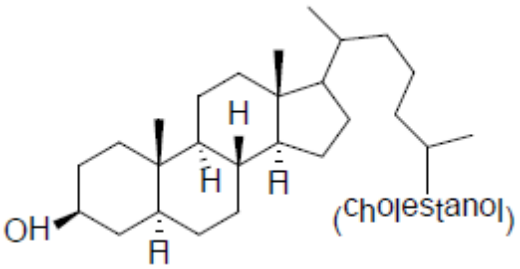
(a) 

(b) 

(c) 

(d) 

Q.115 Cholestanol on oxidation with chromium trioxide in acetic acid/pyridine gives a dicarboxylic acid, which on pyrolysis in the presence of a catalytic amount of barium hydroxide gives compound A as the major product. The structure of A is



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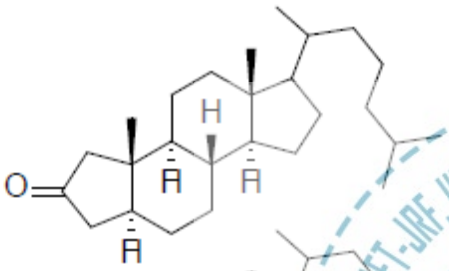

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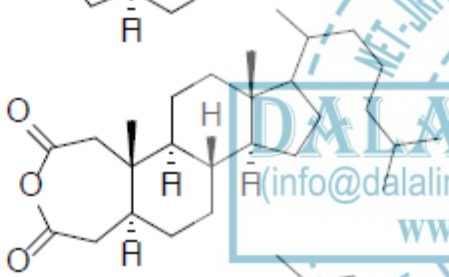
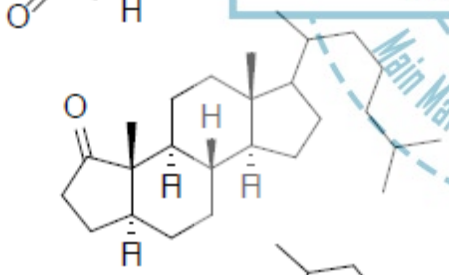
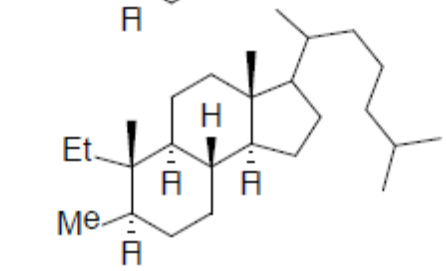


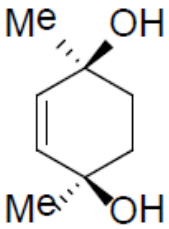
3.

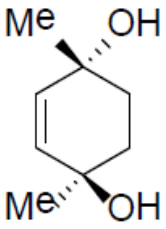


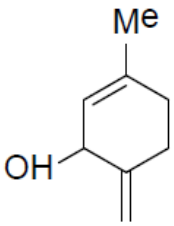
4.

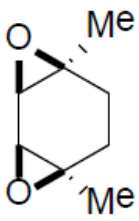


Q.116 Photolysis of 1, 4-dimethyl-1, 3-cyclohexadiene in presence of excess oxygen and catalytic amount of Rose Bengal followed by reduction with H_2/Pt provides

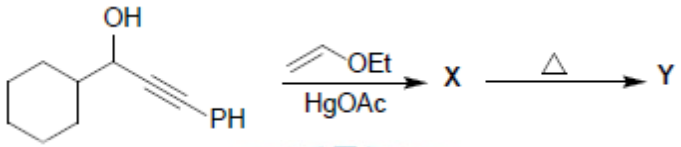
(a) 

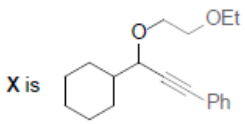
(b) 

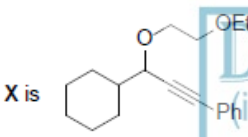
(c) 

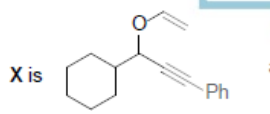
(d) 

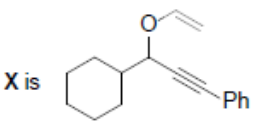
Q.117 In the following reaction sequence, the correct structures of the major products X and Y are



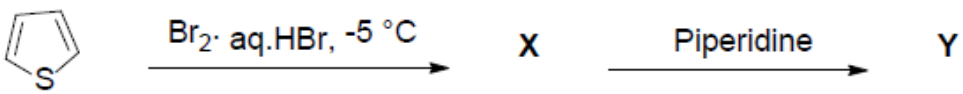
(a) 

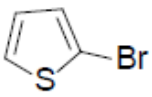
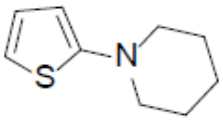
(b) 

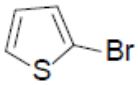
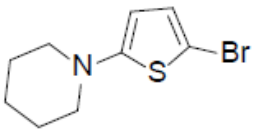
(c) 

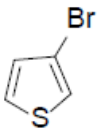
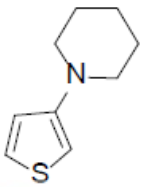
(d) 

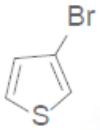
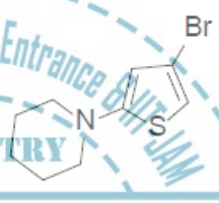
Q.118 Structure of the X and Yin the reaction sequence of thiophene given below are



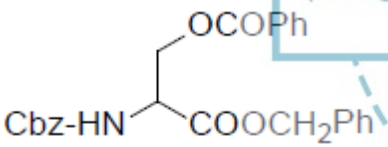
(a) **X is**  and **Y is** 

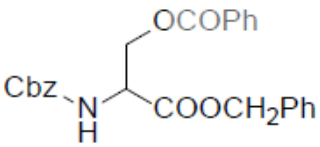
(b) **X is**  and **Y is** 

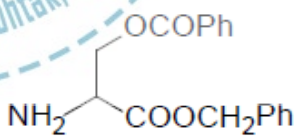
(c) **X is**  and **Y is** 

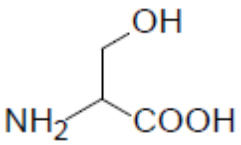
(d) **X is**  and **Y is** 

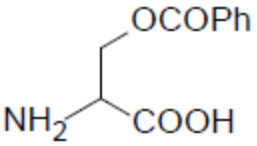
Q.119 Identify the product of hydrogenation (H_2, Pd/C) of the protected amino acid given below



(a) 

(b) 

(c) 

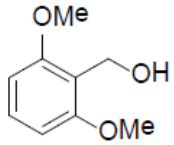
(d) 

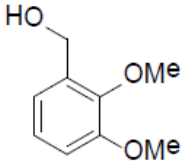
Q.120 In the proton NMR spectrum, an organic compound exhibited the following spectral data

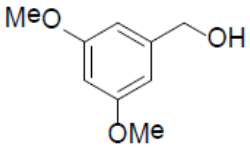
δ 7.2 (1H, dd, J=8and 1.5 Hz), 6.8 (1H, d, J =1.5 Hz), 6.7 (1H, d, J=8Hz),

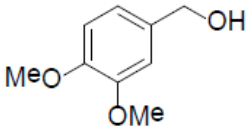
4.9 (2H, s), 3.9 (3H, s), 3.85 (3H, s), 3.5 (1H, br s, exchangeable with D_2O)

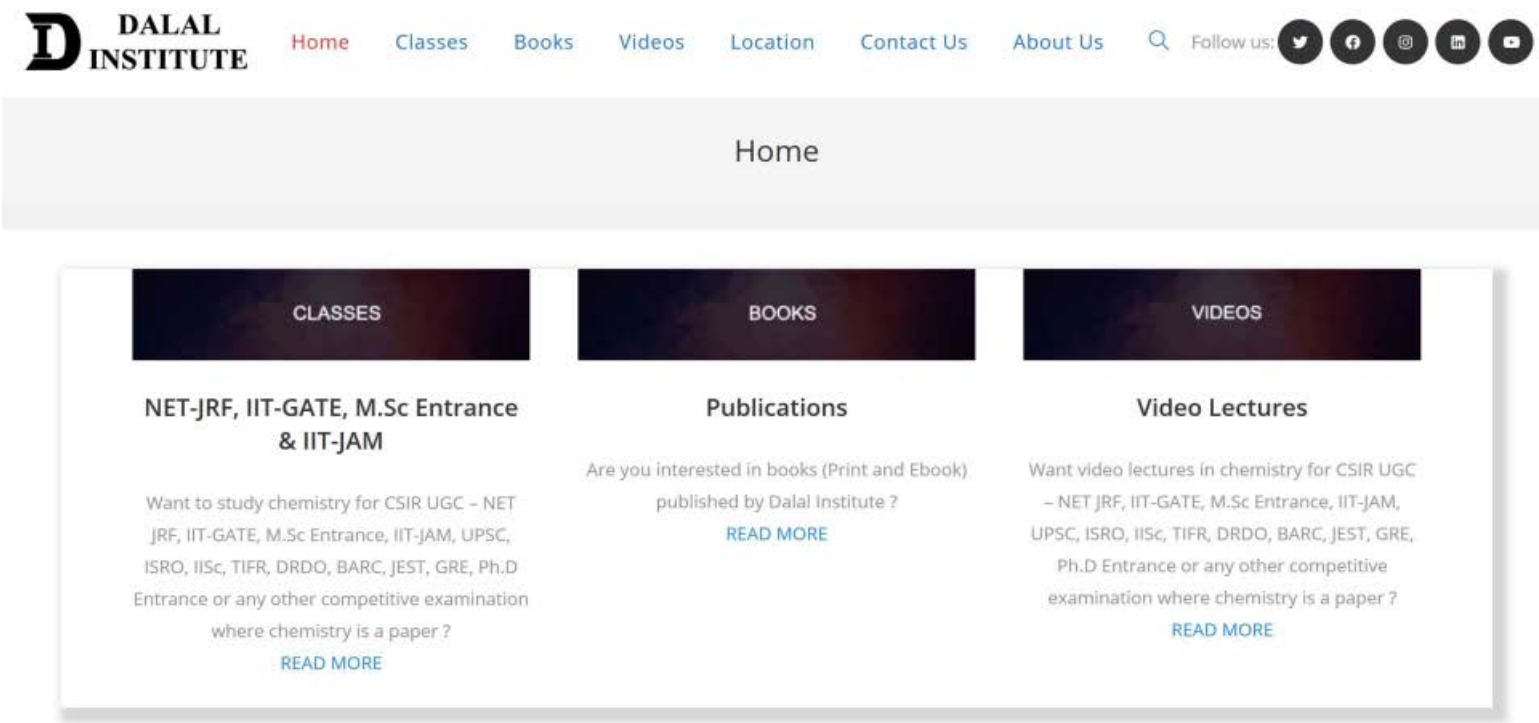
The compound among the choices given below is

(a) 

(b) 

(c) 

(d) 



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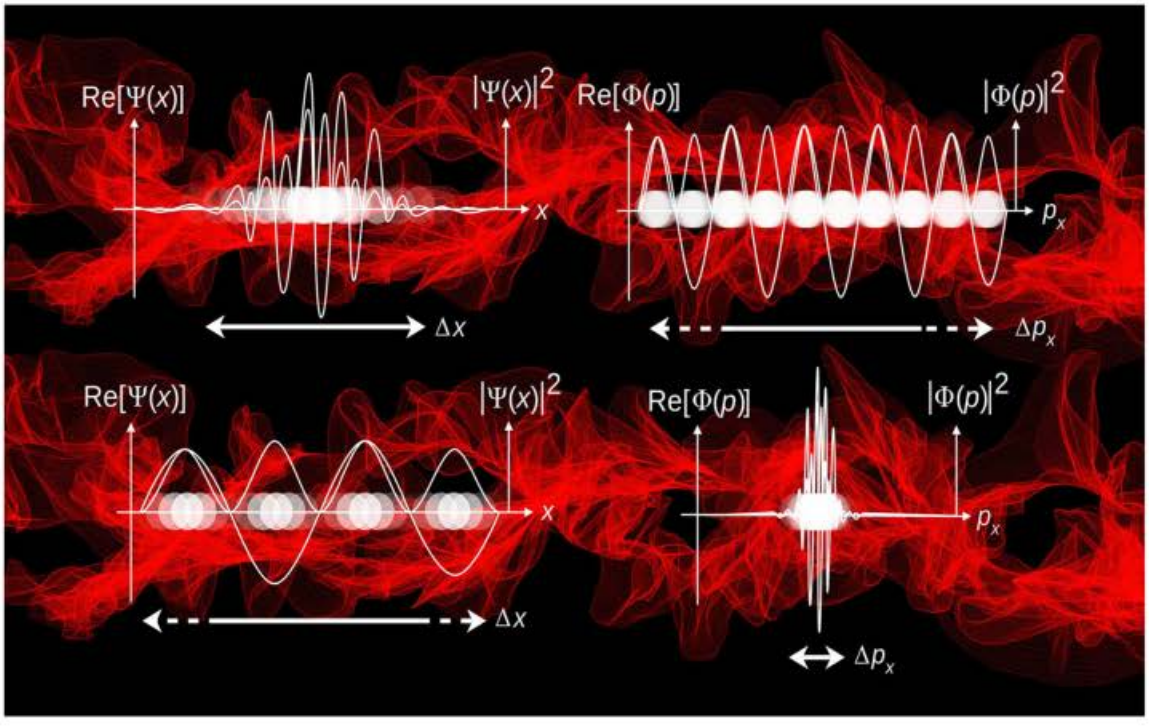

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