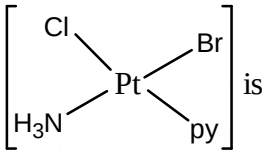
58. Match the silicate minerals (column I) with their compositions (column II) and order of hardness (column III)

I		II		III	
P.	talc	U	$KAl_3Si_3O_{10}(OH)_2$	X	high
Q.	muscovite	V	$Mg_3Si_4O_{10}(OH)_2$	Y	low
R.	margarite	W	$CaAl_4Si_2O_{10}(OH)_2$	Z	intermediate

(a) P, V, Y – Q, U, Z – R, W, X (b) P, U, X – Q, V, Z – R, W, Y
(c) P, W, X – Q, V, Y – R, U, Z (d) P, V, Z – Q, U, Y – R, W, X

59. The structure of $P_4N_4Cl_8$ is puckered whereas that of $P_4N_4F_8$ is planar because
(a) F is more electronegative than Cl
(b) F is smaller in size than that of Cl
(c) F is more polarizable than Cl
(d) Extent of π-electron delocalization is more in $P_4N_4Cl_6$ than in $P_4N_4F_6$.

60. The correct order of addition of NH_3, pyridine (py) and Br^- to $[PtCl_4]^{2-}$ to obtain



is

(a) py, Br^- and NH_3 (b) Br^-, py and NH_3 (c) NH_3 py and Br^- (d) NH_3, Br^- and py

61. $[Ru(C_2H_5)Cl(PPh_3)_3]$ is stable only under a pressure of ethene because
(a) it is a 16-electron complex (b) it forms an 18-electron adduct with ethene
(c) one of the decomposition products is ethene (d) it prevents α–elimination of ethene

62. The ground state term symbols for p^3 and d^3 electronic configuration respectively, are
(a) ^4S and ^4F (b) ^4D and ^4F (c) ^1D and ^4F (d) ^4S and ^2G

63. The "styx" code for diborane is
(a) 2020 (b) 2200 (c) 2002 (d) 0220

64. $\left[CoCl(NH_3)_5\right]^{3+} + \left[Cr(H_2O)_6\right]^{2+} \rightarrow \left[Co(H_2O)(NH_3)_5\right]^{2-} + \left[CrCl(H_2O)_5\right]^{3+}$

The correct statement regarding the above reaction is that
(a) it follows outer-sphere mechanism
(b) it follows inner-sphere mechanism with NH_3 acting as the bridging ligand.
(c) it follows inner-sphere mechanism with Cl^- acting as the bridging ligand
(d) it is not an electron-transfer reaction.

65. The pecentage transmittance of a transition metal complex at 360 nm and at 25°C is 25% for a 6×10^{-4} mol L^{-1} solution in a 1 cm cell. The molar adsorption coefficient in the unit of L mol^{-1} cm^{-1} is:

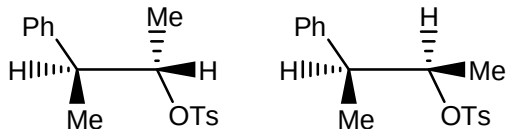
(a) $\sim 1.0\times10^{-3}$ (b) $\sim 1.0\times10^{3}$ (c) $\sim 2.0\times10^{3}$ (d) $\sim 1.0\times10^{4}$

66. The bond order of the metal-metal bonds in $[Re_2Cl_8]^{2-}$, $[Re_2Cl_6(P(C_2H_5)_3)_2]$ and $[Re_2Cl_4P(C_2H_5Ph_2)_4]$ respectively are
(a) 4, 4 and 3 (b) 3, 4 and 4 (c) 4, 2 and 3 (d) 2, 3 and 4

Dynamic Chemistry Point

Q. 67–73 Contains a Statement (S) with a Reason (R) and an Assertion (A). for each question, choose the correct answer from the following four choices.

(a) Both R and A are correct (b) both R and A are wrong
(c) R is correct but A is wrong (d) R is wrong but A is correct



67. **Statement :** solvolysis of tosylates (I) and (II) shown above, in acetic acid yield the corresponding acetates.
Reason : Due to neighbouring group participation of the bridge phenonium ion, achiral intermediatesare formed in both cases of (I) and (II).
Assertion : Tosylate (I) gives an acetate with retention of configuration and tosylate (II) gives a recemic mixture of acetates.

68. **Statement :** Cyclopentadiene can potentially undergo Diels-Alder reaction $(4\pi + 2\pi)$ and $2\pi + 2\pi$ cycloaddition reactions with ketenes. However, it reacts to give stereospecifically only one product.
Reason : Due to sp hybridisation of the ketene carbon $2\pi_s + 2\pi_a$ cycloaddition is feasible and thermally this reaction is symmetry allowed.
Assertion : Ketenes undergo only $2\pi + 2\pi$ cycloaddition reaction with 1, 3-dienes.

69. **Statement :** 1.3-Dichloroallene is optically active and the enantiomers are resolvable.
Reason : Optical activity is due to the presence of a chiral center in the molecule.
Assertion : The enantiomers are resolvable because interconversion of enantiomers is possible only if there is a free rotation about C=C bonds, which is absent.

70. **Statement :** At 273 K, the fugacities (in atm) of N_2 are 97.03 and 1839 at the experimental pressures (atm) of 100 and 1000, respectively.
Reason : At 1000 atm, the system is above the critical temperature and pressure.
Assertion : The contribution of the repulsive forces is more dominant at 1000 atm.

71. **Statement :** for the equilibrium,

$$Ag_2CO_3(s) \rightleftarrows Ag_2O(s) + CO_2(g)$$

A plot of ln K_p vs 1/T gives a linear relationship with a positive slope.
Reason : The reaction is exothermic.
Assertion : The free energy change for the reaction is more negative at higher temperatures.

72. **Statement :** The potential for the cell,

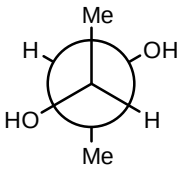
$$Pt\left|H_2(g, 1atm)\right|HCl(m)\left|AgCl(s)\right|Ag(s)$$

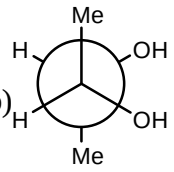
decreases as the concentration of HCl is increased.
Reason : The mean ionic activity coefficient decreases with increase in HCl concentration.
Assertion : In a plot of E vs [HCl], the intercept at the potential axis is equal to the standard reduction potential of the hydrogen electrode.

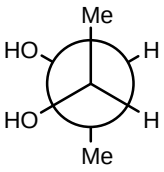
Dynamic Chemistry Point

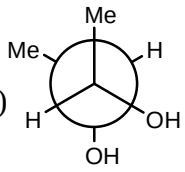
73. **Statement :** Oxygen is preferred to air for welding metals using acetylene gas.
Reason : With air, metal nitrides are formed resulting in poor welding.
Assertion : With air, inert nitrogen dissipates the heat of combustion and hence, the maximum temperature attained is less than that with oxygen.

74. Among the following, the Newmann projections of meso-2, 3-butanediol are

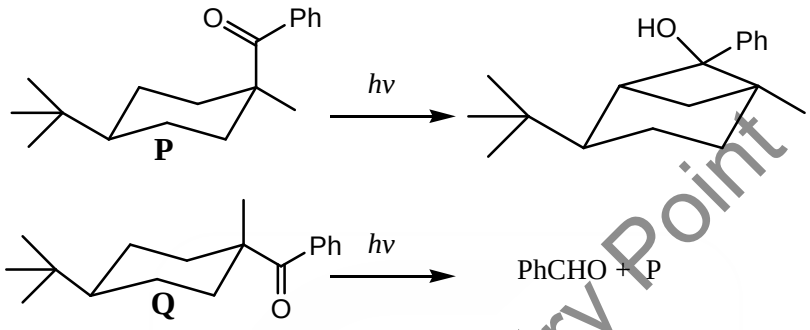
(a) 

(b) 

(c) 

(d) 

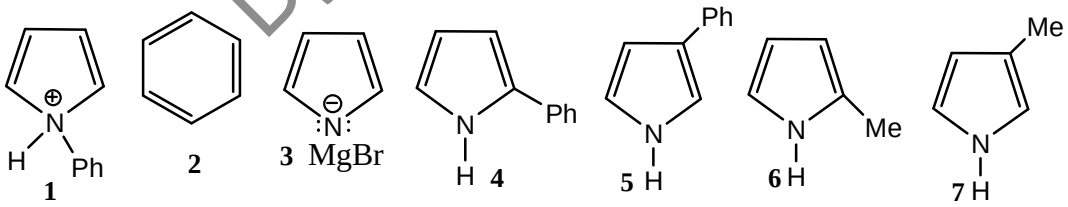
75. The correct description of the following two reactions is that



(a) Both P and Q undergo α-cleavage reaction
(b) P undergoes only Norrish type II reaction whereas Q undergoes only Norrish type I reaction.
(c) Q gives P by photochemical chair to chair interconversion of the cyclohexane Ring
(d) Both P and Q undergo Norrish type I reaction, but only Q gives S through this mechanism.

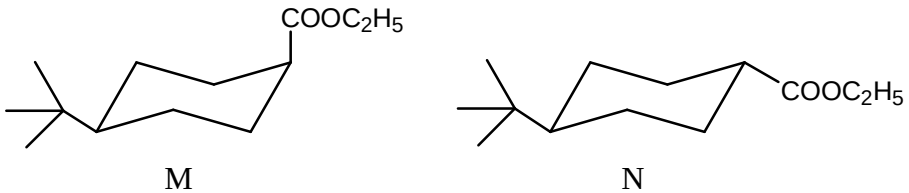
76. A 10.0 g mixture of n-butane and 2-butene was treated with bromine in CCl_4 and it consumed 8.0 g of bromine (Atomic wt. = 80). Another 10.0 g of the same mixture was hydrogenated to get n-butane only. The weight of 2-butene in the original mixture and the gain in the weight of the mixture after hydrogenation, respectively are
(a) 2.8 g and 0.1 g (b) 5.6 g and 0.4 g (c) 7.2 g and 0.8 g (d) 8.0 g and 1.0 g

77. Pyrrole + PhMgBr → E + F
E + MeCl → G + H
F + MeCl → no reaction without a catalyst.



The structure of products E–H, respectively are
(a) 3, 2, 6, 7 (b) 4, 5, 6, 1 (c) 3,4, 5, 2 (d) 3, 2, 4, 5

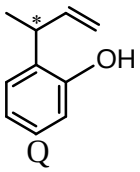
78. Regarding the saponification of M and N shown below, the correct statement is that



Dynamic Chemistry Point

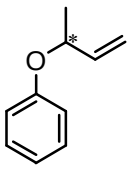
(a) M reacts faster than N because the transition state is less crowded for M than for N.
(b) M reacts slower than N because the transition state is more crowded for M than for N.
(c) N and M react at the same rate because of formation of tetrahedral intermediate in both cases.
(d) N reacts slower than M because of its greater thermodynamics stability.

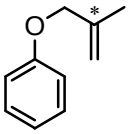
79. Reactant P labelled with "C (labelled carbon marked with a star) rearranged to product Q on heating

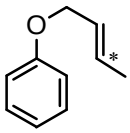


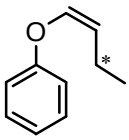
Q

The structure of reactant P is

(a) 

(b) 

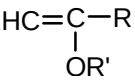
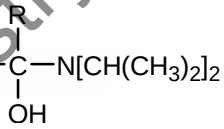
(c) 

(d) 

80. $RCH_2COR + R'X \xrightarrow{[(CH_3)_2CH]_2NLi} P + Q$

In the above reaction, X is a halogen and the products P and Q are

(I) $R'N[CH(CH_3)_2]_2$ (II) $RCH(R')COR$

(III)  (IV) 

(a) I and II (b) II and III (c) III and IV (d) I and IV

81. Among the halobenzenes, the one that undergoes electrophilic aromatic substitution most readily and the reason for its higher reactivity are

(a) fluorobenzene; the benzenonium ion intermediate is stablished by 2p (F), 2p (C) overlap which is most efficient
(b) chlorobenzene; very high electron affinity of chlorine considerably lowers the energy of activation of the reaction
(c) bromobenzene; high polarising power of the halogen atom helps in effective stabilisation of the benzenonium ion intermediate
(d) iodobenzene; iodine atom has the lowest electronegativity and hence electron density of the phenyl ring is least disturbed

82. Among the carboxylic acids shown below, the ones that exhibit stereoisomerism an also form, on heating, cyclic anhydrides are

(I) $HOOCCH(CH_3)CH_2CH_2COOH$

(II) $HOOCCH(i-C_3H_7)COOH$

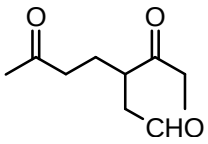
(III) $HOOCCH(C_2H_5)CH_2COOH$

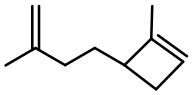
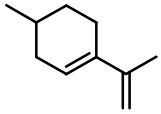
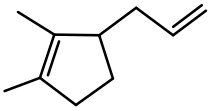
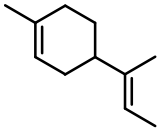
(IV) $HOOCC(CH_3)(C_2H_3)COOH$

(a) (I) and (II) (b) (I) and (III) (c) (II) and (III) (d) (II) and (IV)

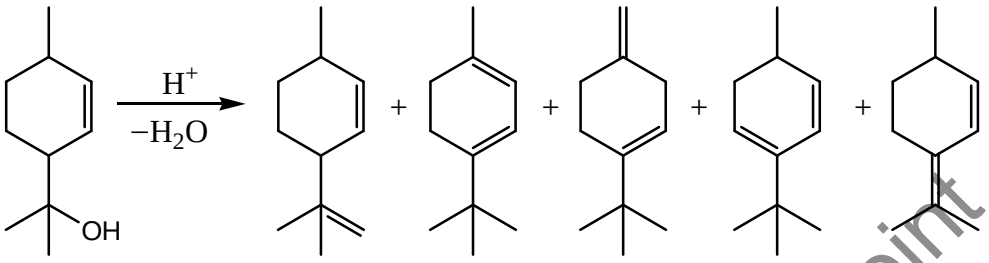
Dynamic Chemistry Point

83. The reactants that lead to products (X) and (Y) on ozonolysis are



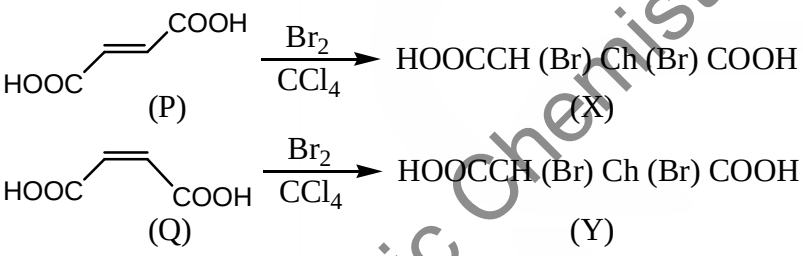
(I)  (II)  (III)  (IV) 

(a) (I) and (IV) (b) (I) and (III) (c) (II) and (III) (d) (II) and (IV)

84. 

On the basis of Woodward-Fieser rules, the dienes that have λ_{max} values in the range 268-273 nm are

(a) P and Q (b) P and R (c) Q and R (d) Q and S

85. 

The correct statements with respect to the above pair of reactions are that

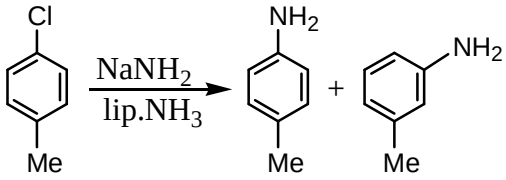
(I) the reactions are stereospecific

(II) (X) is erythro and (Y) is threo isomer

(III) (X) is threo and (Y) is erythro isomer

(IV) each of (P) and (Q) gives a mixture of (X) and (Y)

(a) (I) and (II) (b) (I) and (III) (b) (I) and (IV) (d) (II) and (IV)

86. 

The above reaction is an example of

(a) nucleophilic substitution of addition-elimination mechanism

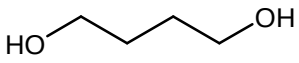
(b) electrophilic substitution by addition-elimination mechanism

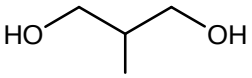
(c) radical substitution reaction

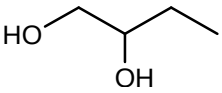
(d) nucleophilic substitution involving benzyne intermediate

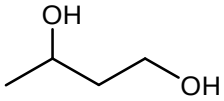
Dynamic Chemistry Point

87. Diols (I-IV) which react with CrO_3 in aqueous H_2SO_4 and yield products that readii undergo decarboxylation on heating, are

(I) 

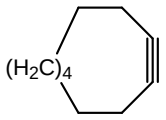
(II) 

(III) 

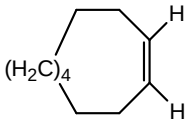
(IV) 

(a) (I) and (II) (b) (II) and (III) (c) (II) and (IV) (d) (I) and (IV)

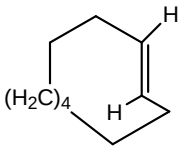
88. Reactant P gives products Q and/or R.



P



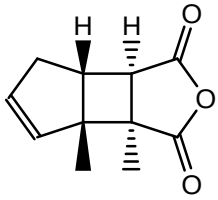
Q

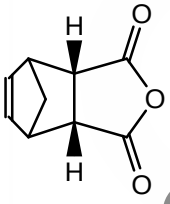


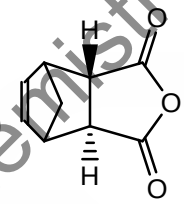
R

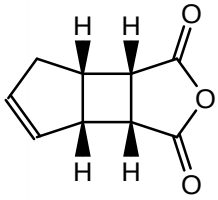
The possible reagents are: (I) 2Na/liq. NH_3 , (II) H_2/Pd/$CaCO_3$ (quinoline), (III) 2H_2/Pd/C.
The correct statement with respect to the conversion is:
(a) Q is obtained on treatment with reagent (I) (b) R and Q are obtained on treatment with reagent (III)
(c) R is obtained on treatment with reagent (I) (d) R is obtained on treatment with reagent (II).

89. The product obtained in the thermal reaction of cyclopentadiene with maleic anhydride is

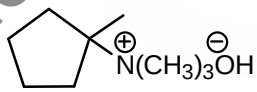
(a) 

(b) 

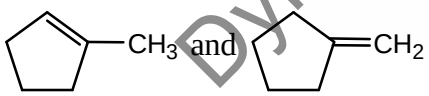
(c) 

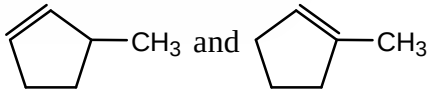
(d) 

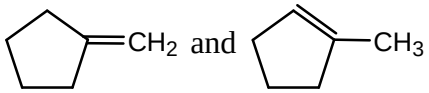
90. Two alkenes, X(91% yield) and Y(9% yield) are formed when the following is heated.

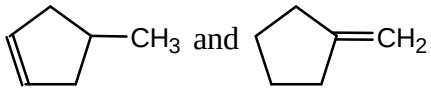


The structures of X and Y, respectively are

(a) 

(b) 

(c) 

(d) 

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