Indian Association of Physics Teachers

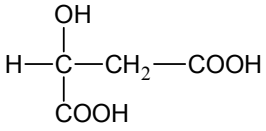
NATIONAL STANDARD EXAMINATION IN CHEMISTRY 2017-2018

SET-C324

Total time: 120 minutes **Marks: 240**

Only one out of four options is correct

1. Malic acid is a dicarboxylic acid present in apples and it has the following structure



(i) $H_2C{=}CH{-}COOH \xrightarrow[(iii)\ HCN/H_3O^+]{(i)\ HBr \\ (ii)\ KOH(aq.)}$

(ii) $H_2C(Br){-}CH_2{-}COOH \xrightarrow[(iii)\ HCN/H_3O^+]{(i)\ KOH(aq.) \\ (ii)\ PCC}$

(iii) $H_3C{-}CH_2{-}COOH \xrightarrow[(iv)\ HCN/H_3O^+]{(i)\ Red\ P/I_2 \\ (ii)\ NaOH(aq.) \\ (iii)\ [O]}$

(iv) $H_2C{=}CH{-}COOH \xrightarrow[(iii)\ HCN/H_3O^+]{(i)\ B_2H_6/H_2O_2 \\ (ii)\ [O]}$

(A) i and ii (B) ii
(C) ii and iii (D) i and iii

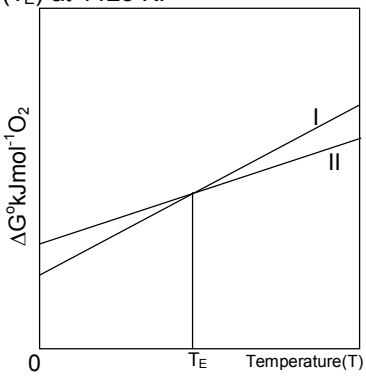
2. Which of the following cannot act as an oxidizing agent?
(A) S^{2-} (B) Br_2
(C) HSO_4^- (D) SO_3^{-2}

3. Ellingham diagrams are plots of ΔG^o vs temperature which have applications in metallurgy.

$2H_2 + O_2 = 2H_2O$ $\Delta G(J) = -247500 + 55.85T$ … (I)

$2CO + O_2 = 2CO_2$ $\Delta G(J) = -282400 + 86.81T$ … (II)

The Ellingham diagrams for the oxidation of H_2 (I) and CO(II) are given below. The two lines intersect (T_E) at 1125 K.



Which of the following is correct?

I. ΔG^o for reaction (i) is more negative at T < 1125 K
II. ΔG^o for the reduction of CO is more negative at T < 1125 K
III. H_2 is a better reducing agent at T > 1125 K
IV. H_2 is a better reducing agent at T < 1125 K

(A) I and II (B) I and III
(C) III only (D) I and IV

4. Hydrazine used in rocket fuels can be obtained by the reaction of ammonia and hydrogen peroxide according to the following equation

$2NH_3(g) + H_2O_2(\ell) \longrightarrow N_2H_4(\ell) + 2H_2O(\ell) \qquad \left(\Delta H^0_{reaction} = -241\,kJ/mol\right)$

If ΔH^0 (formation) of NH_3, H_2O_2 are – 46.1, - 187.8 and 285.8 kJ/mol respectively, ΔH^0 for the decomposition of hydrazine into N_2 and H_2 is

(A) 50.6 kJ/mol
(B) 241 kJ/mol
(C) - 50.6 kJ/mol
(D) 120.5 kJ/mol

5. Sn^{2+} compounds like SnO and $SnCl_2$ are well known reducing agents, while PbO_2 acts as an oxidizing agent. Which of the following statements support these reactivities?

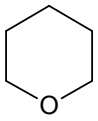
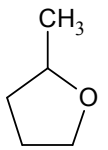
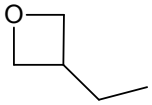
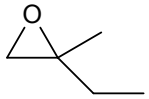
I. SnO is more stable than SnO_2
II. Sn^{4+} is more stable than Sn^{2+}
III. Pb^{4+} is more stable than Pb^{2+}
IV. Pb^{2+} is more stable than Pb^{4+}

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

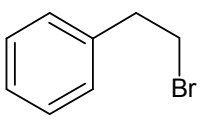
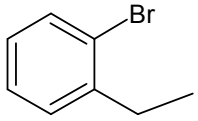
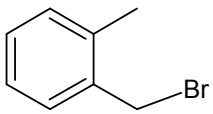
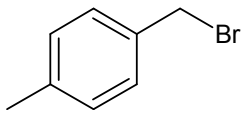
6. A fuel/oxidant system consisting of N,N-dimethylhydrazine $(CH_3)_2NNH_2$ and N_2O_4 (both liquids) is used in space vehicle propulsion. The liquid components are mixed stoichiometrically so that N_2, CO_2 and H_2O are the only products. If all gases are under the same reaction conditions, number of moles of gases produced from 1 mole of $(CH_3)_2NNH_2$ is

(A) 3
(B) 6
(C) 9
(D) 4.5

7. An ether (X) with molecular formula $C_5H_{10}O$ reacts with excess of hot aq. HI to give a product which on further reaction with hot NaOH in ethanol forms 1, 3 pentadiene. Structure of X is

(A) 
(B) 
(C) 
(D) 

8. Compound 'Y' with molecular formula C_8H_9Br gives a precipitate on heating with alcoholic $AgNO_3$. Oxidation of 'Y' gives product 'Z' ($C_6H_6O_4$) which gives an anhydride upon heating.
Compound 'Y' is

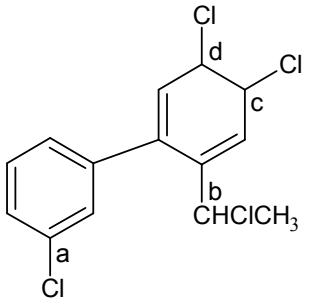
(A) 
(B) 
(C) 
(D) 

9. The observed effective magnetic moment of two octahedral complexes.
$K_4[Mn(CN)_6].3H_2O$ (X) and $K_4[Mn(SCN)_6]$ (Y) are 2.18 BM and 6.06 BM. Respectively. Which of the following is correct?

I. X is a low spin complex with two unpaired electrons
II. Y is a high spin complex with 5 unpaired electrons
III. X is a high spin complex with two unpaired electrons
IV. Y is a low spin complex with 5 unpaired electrons

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

10. The increasing reactivity of the sites (a – d) in the following compound in S_N1 reaction is



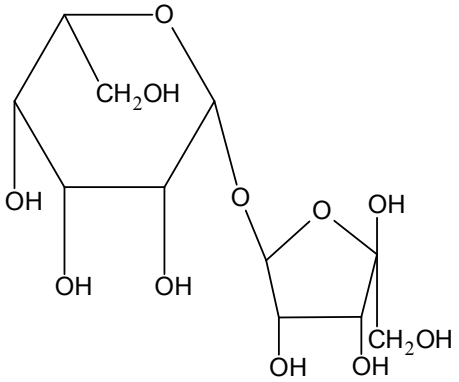
(A) d > b > c > a
(B) d > c > a > b
(C) d > c > b > a
(D) c > d > b > a

11. At constant T and P, 5.0 L of SO_2 are reacted with 3.0 L of O_2 according to the following equation

$$2SO_2(g) + O_2(g) \longrightarrow 2SO_3(g)$$

The volume of the reaction mixture at the completion of the reaction is
(A) 0.5 L
(B) 8.0 L
(C) 5.5 L
(D) 5 L

12. The following disaccharide is made up of



(A) D-aldose and D-ketose
(B) L-aldose and L-ketose
(C) L-aldose and D-ketose
(D) L-aldose and D-ketose

13. One mole of 4-nitrocatechol (4-nitro-1,2-dihydroxybenzene) on treatment with an excess of NaH followed by one mole of methyl iodide gives –
(A) 4-ntro-1,2-dimethoxybenzene
(B) 4-nitro-5-methyl-1,2-dimethoxybenzene
(C) 2-methoxy-5-nitrophenol
(D) 2-methoxy-4-nitrophenol

14. The colour changes of an indicator HIn in acid base titrations is given below

$$\underset{\text{Colour X}}{HIn(aq)} \rightleftharpoons \underset{\text{Colour Y}}{H^+(aq)} + In^-(aq)$$

Which of the following statements is correct?
(A) In a strong alkaline solution colour Y will be observed
(B) In a strongly acidic solution colour Y will be observed
(C) Concentration of In^- is higher than that of HIn at the equivalence point
(D) In a strong alkaline solution colour X is observed

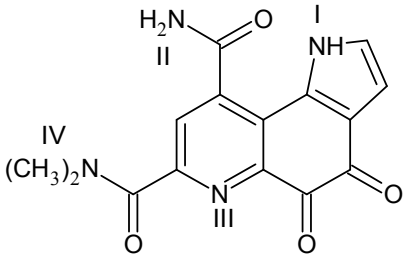
15. The table below gives the results of three titrations carried out with 0.200 M HCl to determine the molarity of a given NaOH solution using phenolphthalein as indicator. NaOH was taken in the burette and HCl was taken in a conical flask for the titrations.

Titration No	$V_{HCl(mL)}$	$V_{NaOHl(mL)}$	$V_{NaOH\ moldm^{-3}}$
I	21.4	19.3	0.222
II	18.6	16.8	0.221
III	22.2	21.1	0.210

The actual molarity of the prepared NaOH solution was 0.220 $moldm^{-3}$.
Which among the following could be the reason for the wrong value obtained in titration III?
(A) Number of drops of phenolphthalein added to the titration flask was more in this titration
(B) The concentration of HCl was wrongly used as 0.250 M for the calculation of M_{NaOH}
(C) A few drops of NaOH solution were spilled outside the titration flask during titration
(D) A few drops of the neutralized solution from titration II were left behind in the flask

16. The solution with pH value close to 1 is
(A) 10 mL of 0.1 M HCl + 90 mL of 0.1 M NaOH
(B) 55 mL of 0.1 M HCl + 45 mL of 0.1 M NaOH
(C) 75 mL of 0.2 M HCl + 25 mL of 0.2 M NaOH
(D) 75 mL of 0.2 M HCl + 25 mL of 0.1 M NaOH

17. The most basic nitrogen in the following compound is



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

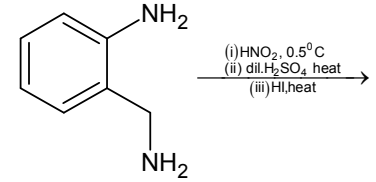
18. For the reaction $N_2 + 3H_2 \longrightarrow 2NH_3$, the rate expression is $-d[NH_3]/dt = k[H_2][N_2]$
The correct statement is
I. The reaction is not elementary
II. The reaction is of second order
III. $-d[H_2]/dt = -d[NH_3]/dt$

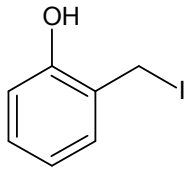
(A) II only (B) I and II
(C) II and III (D) I, II and III

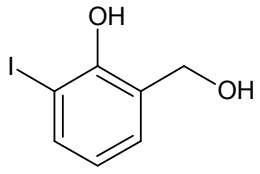
19. Which of the following is correct?
A liquid with
(A) low vapour pressure will have a low surface tension and high boiling point.
(B) high vapour pressure will have high intermolecular forces and high boiling point.
(C) low vapour pressure will have high surface tension and high boiling point.
(D) low vapour pressure will have low surface tension and low boiling point.

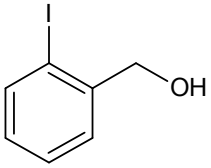
20. At 25°C, nitrogen exists as N_2 and phosphorous exists as P_4 because
(A) N_2 has valence electrons only in bonding and nonbonding orbitals, while P has valence electrons in both bonding and antibonding orbitals
(B) higher electronegativity ov N favours formation of multiple bonds
(C) bigger size of P does not favour multiple bonds
(D) P has preference to adapt structures with small bond angles.

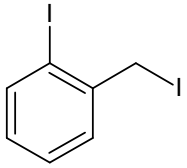
21. The product of the following reaction is



(A)


(B)


(C) 

(D) 

22. Three samples of 100 g of water (samples I, II and III), initially kept at 1 atm pressure and 298 K were given the following treatments.
Sample I was heated to 320 K and cooled to 298 K
Sample II was heated to 300K, cooled to 273 K and heated to 298 K
Sample III was heated to 373 K and cooled to 298 K
At the end of these processes, the internal energy of
(A) III is the highest
(B) II is the highest
(C) I and III are the same; II is lower than of I and III
(D) I, II and III are the same

23. For the reaction

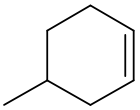
$$5Br^-(aq) + BrO_3^-(aq) + 6H^+(aq) \rightarrow 3Br_2(aq) + 3H_2O(\ell)$$

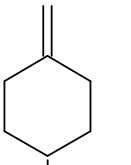
The rate expression was found to be $-d[BrO_3^-]/dt = k[Br^-][H^+]^2[BrO_3^-]$

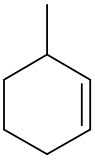
Which of the following statements is /are correct?
I. Doubling the initial concentration of all the reactants will increase the reaction rate by a factor of 8
II. Unit of rate constant of the reaction in a buffer solution is min^{-1}
III. Doubling the concentration of all the reactants at the same time will increase the reaction rate by a factor of 16
IV. Rate of conversion of BrO_3^- and rate of formation of Br^- are the same
(A) I and II (B) II and III
(C) II and IV (D) III only

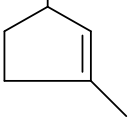
24. In the Lewis structure of ozone (O_3), the formal charge on the central oxygen atom is
(A) +1 (B) –1
(C) 0 (D) –2

25. Which of the following on treatment with hot concentrated acidified $KMnO_4$ will give 2-methylhexane-1,6-dioic acid as the only organic product?

(A) 

(B) 

(C) 

(D) 

26. Which of the following has the shortest bond length?
(A) O_2 (B) O_2^-
(C) O_2^+ (D) O_2^{2-}

27. Which of the following statement/s is/are correct about weak acids in aqueous solutions?
I. When pH = pKa of a monoprotic acid, 50% of the acid is ionized
II. If pH = pKa_2 of a diprotic acid, the average charge of all the ionized species is 0.5
III. When pH = pKa + 1, 10% of the acid is ionized
IV. When pH = 7, 50% of a monobasic acid is ionized
(A) I and IV (B) I, II and IV
(C) I, II and IV (D) I only

28. 'Iodine number' is the grams of iodine atoms (atomic mass = 127 g mol^{-1}) that can react completely with 100 g of a vegetable oil. Iodine monochloride (ICl) is a reagent used to determine iodine number. In an experiment, 25.00 cm^3 of 0.100 mol dm^{-3} ICl was added to 127 g of the oil. The unreacted ICl was found to be equivalent to 40.00 cm^3 of 0.10 mol dm^{-3} of $Na_2S_2O_3$.
The iodine number of the oil can be deduced as
(A) 127 (B) 100
(C) 200 (D) 50

29. When NiO is doped with a small quantity of Li_2O
(A) both cation and anion vacancies are generated
(B) Shottky defects are generated
(C) NiO becomes an n-type semiconductor
(D) NiO becomes a p-type semiconductor

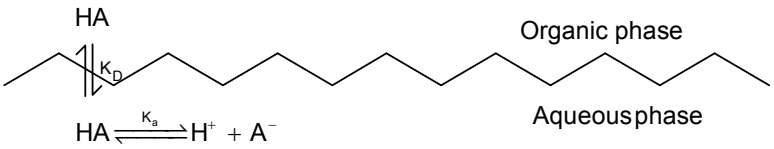
30. When sample of gas kept at 20°C and 4.0 atm is heated to 40°C at constant volume
(A) average speed of the gas molecules will decrease
(B) number of collisions between the gas molecules per second will remain the same
(C) average kinetic energy of the gas will increase
(D) pressure of the gas will become 8 atm

31. Addition of bromine to cis-3-hexene gives
(A) racemic dibromide (B) a mixture of diastereomeric dibromides
(C) optically active dibromide (D) meso dibromide

32. An organic compound "X" forms an orange-yellow precipitate with 2,4-DNP reagent. It does not react with aqueous $[Ag(NH_3)_2]NO_3$. X on reduction with $NaBH_4$ gives a secondary alcohol and on oxidation with nitric acid yields a dicarboxylic acid containing the same number of carbon atoms. On bromination, X gives a monobromo product. On the basis of these reactions, it can be concluded that X
I. contains aldehydic carbonyl group II. contains ketonic carbonyl group
III. contains ester carbonyl group IV. does not contain C = C bonds

(A) I only (B) III and IV
(C) III only (D) II and IV

33. The undissociated form of a weak organic acid HA can be extracted from the aqueous phase into an organic phase using a water-immiscible organic solvent according to the following scheme



Which of the following is/are correct for this extraction?
I. $[HA]_{org}/[HA]_{aq}$ depends on the pH of the aqueous phase
II. HA can be efficiently extracted from basic aqueous solutions
III. $[HA]_{org}/[HA]_{aq}$ depends on the initial concentration of HA
IV. $[HA]_{org}/[HA]_{aq} + [A^-]$ depends on the pH of the aqueous phase
(A) II and IV (B) IV only
(C) I only (D) III and IV

34. The correct order of reactivity in nucleophilic substitution reaction of the following compounds a, b and c would be

$CH_3CH_2CONH_2$ $CH_3CH_2COOCH_3$ CH_3CH_2COCl
(a) (b) (c)

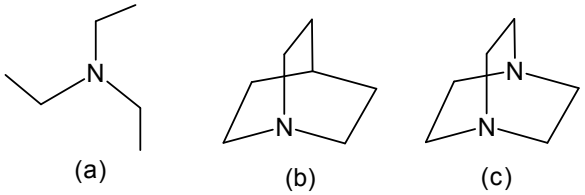
(A) a > c > b (B) a > b > c
(C) c > b > a (D) c > a > b

35. The complex ion that does not have d electrons in the metal atom is
(A) $[MnO_4]^-$ (B) $[Co(NH_3)_6]^{3+}$
(C) $[Fe(CN)_6]^{3-}$ (D) $Cr(H_2O)_6]^{3+}$

36. Radius of Ar atom is 145pm. The percentage volume occupied by an Ar atom at STP is
(A) 0.03 (B) 3.0
(C) 0.30 (D) 0.06

37. The reduction of O_2 to H_2O in acidic solution has a standard reduction potential of 1.23 V. If the pH of the acid solution is increased by one unit, half cell potential will
$O_2(g) + 4H^+(aq) + 4e^- \longrightarrow 2H_2O(\ell)$
(A) decrease by 59 mV (B) increase by 59 mV
(C) decrease by 236 mV (D) increase by 236 mV

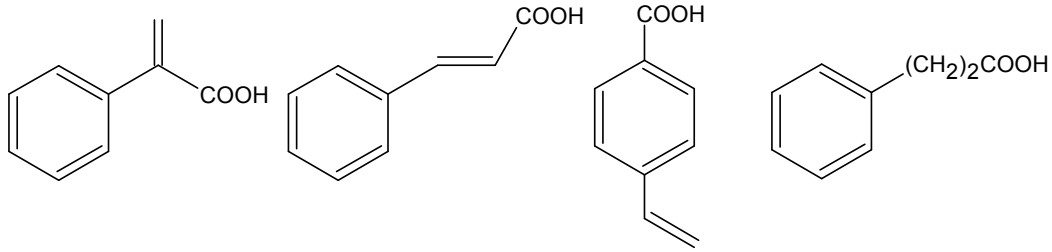
38. The order in which the compounds a, b and c react with CH_3I would be



(a) (b) (c)

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

39. An organic compound 'P' with molecular formula $C_9H_8O_2$ on oxidation gives benzoic acid as one of the products. The possible structure/s of 'P' is/are



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

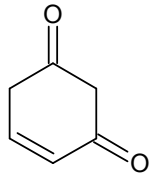
(A) I and III (B) II and IV
(C) I and II (D) II only

40. The energy of an electron in the ground state of H atom is –13.6 eV. The negative sign indicates that
(A) electrons are negatively changed
(B) H atom is more stable than a free electron
(C) energy of the electron in the H atom is lower than that of a free electron
(D) work must be done to make a H atom from a free electron and proton

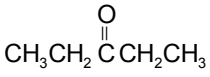
41. For the following spontaneous process
$H_2O_{(\ell)} \rightarrow H_2O_{(s)}$ at 268 K, which of the following is true?
(A) $\Delta S_{sys} < 0$ (B) $\Delta S_{sys} > 0$
(C) $\Delta S_{surr} < 0$ (D) $\Delta S_{sys} = -\Delta S_{surr}$

42. Lithium oxide (Li_2O; molar mass = 30 g mol^{-1}) is used in space shuttles to remove water vapour according to the following reaction
$Li_2O_{(s)} + H_2O(g) \rightarrow 2LiOH_{(s)}$
If 60 kg of water and 45 kg of Li_2O are present in a shuttle
I. water will be removed completely
II. Li_2O will be the limiting reagent
III. 100 kg of Li_2O will be required to completely remove the water present
IV. 27 kg of water will remain in the shuttle at the end of the reaction
(A) II only (B) II and IV
(C) III and IV (D) II, III

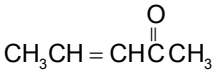
43. The order of enol content in the following molecules is



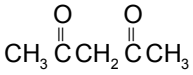
(a)



(b)



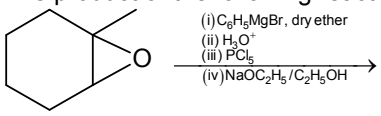
(c)



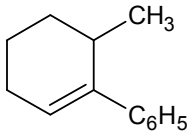
(d)

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

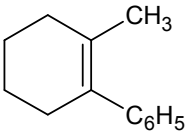
44. The product of the following reaction is



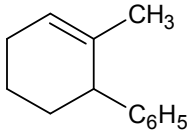
(A)



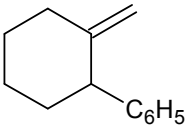
(B)



(C)

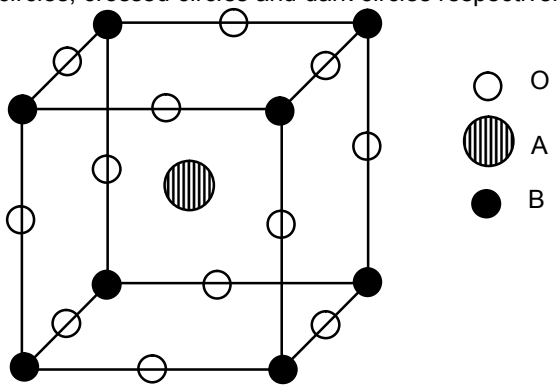


(D)



45. At constant volume, 6.0 mol of H_2 gas at 0^0 C and 100 kPa was heated to 250 kPa. The molar heat of H_2 at constant pressure (C_P) = 28.9 J mol^{-1}. (assume that the heat capacity values do not change with temperature). The final temperature of the H_2 gas and the change in entropy of the process are
(A) 273^0 C and 113 kJ mol^{-1} K^{-1}
(B) 410^0 C and 158.8 J mol^{-1} K^{-1}
(C) 682.5^0 C and 113 J mol^{-1} K^{-1}
(D) 682.5 K and 113 J mol^{-1} K^{-1}

46. The cubic unit cell of an oxide of metal A and B is as given below, in which oxygen, A and B are represented by open circles, crossed circles and dark circles respectively



The formula of the oxide can be deduced as
(A) AB_8O_{12}
(B) ABO
(C) ABO_6
(D) ABO_3

47. When a medal is electroplated with silver (Ag)
(A) the medal is the anode
(B) Ag metal is the cathode
(C) the solution contains Ag^+ ion
(D) the reaction at the anode is $Ag^+ + e^- \rightarrow Ag$

48. The energy of an electron in Bohr's orbit of hydrogen atom is –13.6 eV. The total electronic energy of a 'hypothetical' He atom in which there are no electron –electron repulsions is
(A) 27.2 eV
(B) –27.2 eV
(C) –108.8 eV
(D) 108.8 eV

49. Iodine is a solid and sublimes at ordinary temperatures. This is because of
(A) weak I-I bonds
(B) strong I-I bonds
(C) lone pair-bond pair repulsions
(D) weak van der Waals forces between I_2 molecules

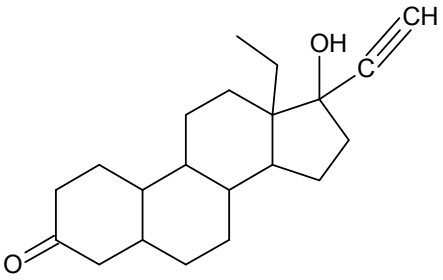
50. The equilibrium constants of the following isomerisation reaction at 400 K and 298 K are 2.07 and 3.42 respectively.

$$\text{cis}-\text{butene} \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} \text{trans}-\text{butene}$$

Which of the following is/are correct?
I. The reaction is exothermic
II. The reaction is endothermic
III. At 400 K 50 % of cis-butene and 50% of trans-butene are present at equilibrium
IV. Both at 298 K and 400 K, $k_1 = k_{-1}$
(A) I and IV
(B) II and IV
(C) I and III
(D) I only

51. Which of the following will not give a straight line plot for an ideal gas?
(A) V vs T
(B) T vs P
(C) V vs 1/P
(D) V vs 1/T

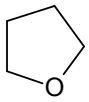
52. Levonorgestrel is a commonly used contraceptive. The number of chiral centers centers present in this molecule is

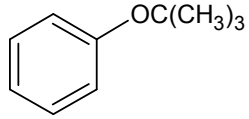


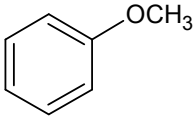
Levonorgestrel

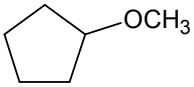
(A) 4
(B) 5
(C) 6
(D) 7

53. Which of the following *ethers cannot* be prepared by Williamson Synthesis?

(A) 

(B) 

(C) 

(D) 

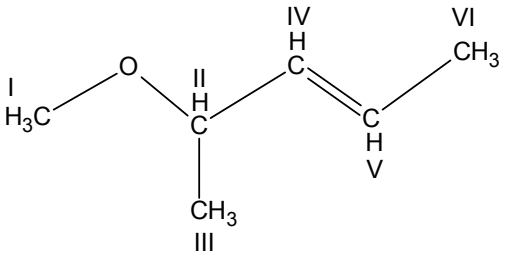
54. IUPAC name of the complex ion $\left[CrCl_2(ox)_2\right]^{3-}$ is
(A) dichlorodioxalatochromium (III)
(B) dioxalatodichrlorochromate (III)
(C) dichlorodioxalatochromate (III)
(D) bisoxalaeodichlorochromate (III)

55. Sodium azide (NaN_3) is used in the airbag of cars. This is a safety device which inflates on an impact according to the reaction $2NaN_3 \rightarrow 2Na + 3N_2$. An air bag of a particular car can be filled with 44.8 L of gas STP. The mass(g) of NaN_3 required to fill this airbag completely at 298 K and 1 atm. Pressure is
(A) 87
(B) 130
(C) 84
(D) 100

56. Which of the following mixtures of water and H_2SO_4 would have mass percentage of H_2SO_4 close to 30?
(A) 30 g H_2SO_4 + 100 g H_2O
(B) 1 mol of H_2SO_4 + 2 mol of H_2O
(C) 1 mol of H_2SO_4 + 200 g of H_2O
(D) 0.30 mol H_2SO_4 + 0.70 mol H_2O

57. In chlorides, the common oxidation states of aluminium and thallium are +3 and +1 respectively because
(A) Tl-Cl bond is ionic and Al-Cl bond is covalent
(B) 6s electrons of Tl are bound more strongly than the 3s electrons of Al
(C) Tl-Cl bond is stronger than Al-Cl bond
(D) 3s electrons of Al are bound strongly than the 6s electrons of Tl

58. In the given compound the order of ease with which hydrogen atom can be abstracted from carbons 1 to VI is



(A) II > VI > IV = V > I > III
(B) II > I > VI > III > IV = V
(C) II > I > III > VI > IV = V
(D) VI > II > I > III > IV = V

Use the table below to answer questions 19 and 20

Reaction	E_0/V
$Ag \rightarrow Ag^{+} + e^{-}$	– 0.80
$Cr^{3+} + 3e^{-} \rightarrow 3Cr$	– 0.74
$Zn^{2+} + 2e^{-} \rightarrow Zn$	– 0.76
$I_2(S) + 2e^{-} \rightarrow 2I^{-}$	0.54
$Co^{2+} + 2e^{-} \longrightarrow Co$	–0.28
$Ni^{2+} + 2e^{-} \rightarrow Ni$	–0.26

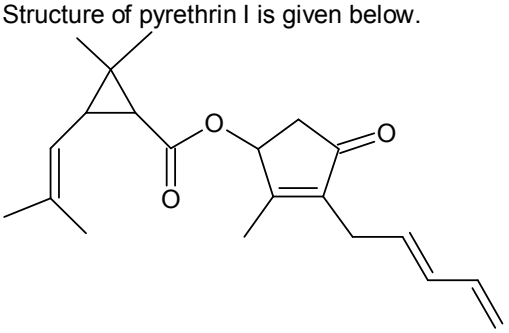
59. The best reducing agent among the following is
(A) Ag^{+}
(B) Zn^{2+}
(C) Cr^{3+}
(D) I^{-}

60. E^0 of the given cell is
$Ni\,|\,(Ni^{+2}, 1.0M)\,||\,(Co^{+2}, 1.0M)\,Co$
(A) +0.02 V
(B) –0.02 V
(C) –0.54 V
(D) + 0.54 V

61. Which of the flowing is *not* a pair of a Lewis acid and a Lewis base?
(A) $H^{+}, (C_2H_5)_2O$
(B) H_2O, $AlCl_3$
(C) Fe^{3+}, CO
(D) SiF_4, BF_3

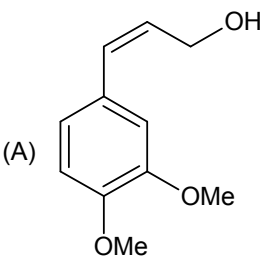
62. The type/s of isomerism that $Co(NH_3)_4Br_2Cl$ can exhibit is/are
(A) geometric and ionization
(B) ionization
(C) optical and ionization
(D) optical, ionization and geometric

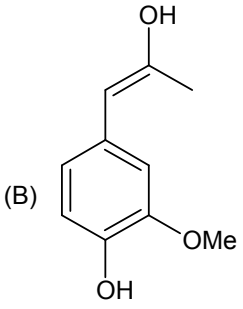
63. Pyrethrins are produced in chrysanthemum flowers and used as insecticides.
Structure of pyrethrin I is given below.

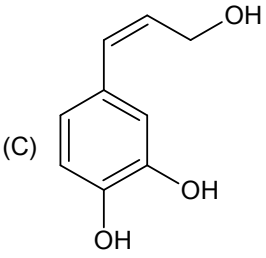


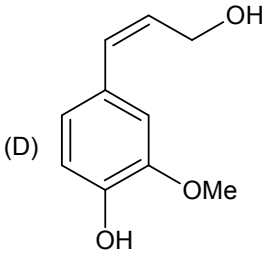
The volume of 0.05 mol dm^{-3} bromine water that would react with 500 mg sample of Pyrethrin I is
(A) 12.2 cm^3 (B) 122 dm^3
(C) 122 cm^3 (D) 1.31×10^3 cm^3

64. Coniferyl alcohol is isolated from pine trees. The following observations were made about this alcohol.
I. It forms methylated product with MeI in presence of base
II. One equivalent of coniferyl alcohol reacts with two equivalents of benzoyl chloride
III. Upon ozonolysis, coniferyl alcohol gives a product 'Y' (M.F $C_2H_4O_2$)
The structure of coniferyl alcohol would be

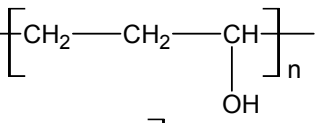
(A) 

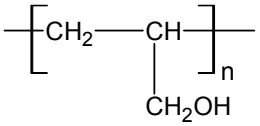
(B) 

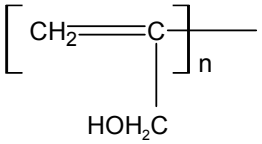
(C) 

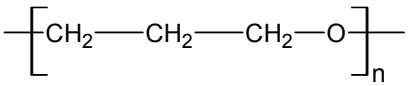
(D) 

65. Which of the following represents a polymer of prop-2-en-1-ol?

(A) 

(B) 

(C) 

(D) 

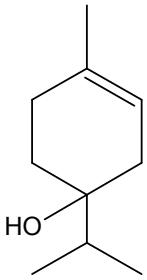
66. A 500 mL glass flask is filled at 298 K and 1 atm. Pressure with three diatomic gases X, Y and Z. The initial volume ratio of the gases before mixinig was 5 :3 :1. The density of the heaviest gas in the mixture is not more than 25 times that of the lightest gas. When the mixture was heated, vigorous reactions take place between X and Y and X and Z in which all the three gases were completely used up.
The gases X, Y, Z respectively are
(A) H_2, O_2, N_2 (B) H_2, O_2, Cl_2
(C) H_2, F_2, O_2 (D) O_2, H_2, F_2

67. The reaction X + Y $\rightarrow$ Z is first order with respect to X and second order with respect to Y. The initial rate of formation of Z = R $mol^{-}dm^3sec^{-1}$ when $[X]_0$ and $[Y]_0$ are 0.40 mol dm^{-3} and 0. mole dm^{-3} respectively. If $[X]_0$ is halved and $[Y]_0$ is doubled, the value of the initial rate would become
(A) 4R (B) R/4
(C) R (D) 2R

68. Which one of the following statements is not correct about glucose?
(molar mass of glucose = 180 g mol^{-1})
(A) An aqueous 0.25 M solution of glucose is prepared by dissolving 45 g of glucose in water to give 1000 cm^3 of solution
(B) 1.00 mmol glucose has a mass of 180 mg
(C) 90.0 g glucose contain 1.8×10^{22} atoms of carbon
(D) 100 cm^3 of a 0.10 M solution contains 18 g of glucose

69. The van der Waals equation for one mole of a real gas can be written as $(P + a/V^2)(V–b) = RT$. For the gases H_2, NH_3 and CH_4, the value of 'a' (bar L^{-2} mol^{-2}) are
0.2453, 4.170 and 2.253 respectively.
Which of the following can be inferred from the 'a' values?
(A) NH_3 can be most easily liquefied
(B) H_2 can be most easily liquefied
(C) value of 'a' for CH_4 is less than that of NH_3 because it has the lower molar mass
(D) intermolecular forces are the strongest in hydrogen

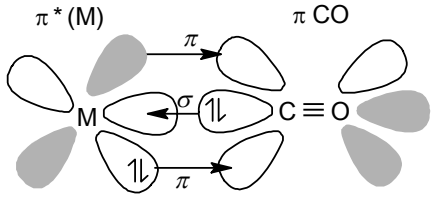
70. Terpinen-4-ol is an active ingredient in tea tree oil has the following structure

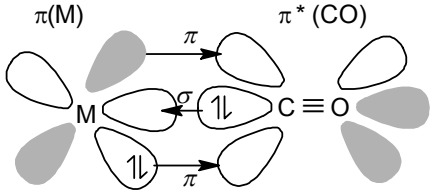


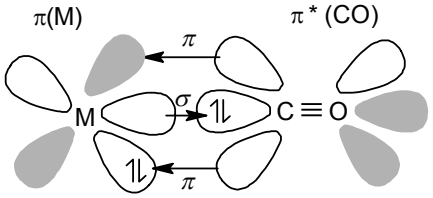
The correct observations for terpinen-4-ol is/are
I. It rotates the plane of plane polarized light
II. It reacts with Baeyers's reagent to form a triol
III. On reaction with NaBr and H_2SO_4, it gives form a diobromo compound
IV. On ozonolysis it gives a compound with molecular formula $C_{10}H_{18}O_3$
(A) I, II, III and IV (B) I, III and IV
(C) II and III (D) III and IV

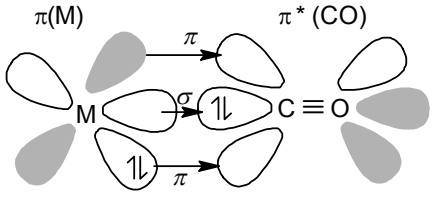
71. The correct order of the ability of the leaving groups is
(A) $OCOC_2H_5 > OC_2H_5 > OSO_2Et > OSO_2CF_3$
(B) $OC_2H_5 > OCOC_2H_5 > OSO_2CF_3 > OSO_2Me$
(C) $OSO_2CF_3 > OSO_2Me > OCOC_2H_5 > OC_2H_5$
(D) $OCOC_2H_5 > OSO_3CF_3 > OC_2H_5 > OSO_2Me$

72. Metal 'M' forms a carbonyl compound in which it is present in its lower valance state. Which of the following bonding is possible in this metal carbonyl ?

(A)


(B)


(C) 

(D) 

73. Acetic acid (CH_3COOH) is partially dimerised to $(CH_3COOH)_2$ in the vapour phase. At a total pressure of 0.200 atm, acetic acid is 92.0% dimerized at 298 K. The value of equilibrium constant of dimerisation under these condition is

(A) 57.5 (B) 9.7
(C) 97 (D) 194

74. Silanes are silicon hydrides of general formula Si_nH_{2n+2} and have several applications. From the data given below the bond dissociation enthalpy of Si – Si bond can be deduced as

ΔH of the reaction $2Si(s) + 3H_2(g) \longrightarrow Si_2H_6(g)$ is 80.3 kJ mol^{-1}

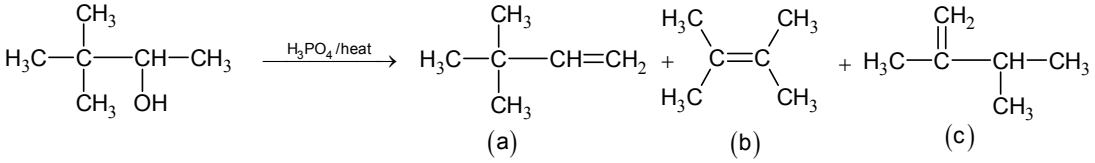
Bond dissociation enthalpy for H – H = 436 kJ/mol
Bond dissociation enthalpy for Si – H = 304 kJ/mol

$\Delta f_H[Si(g)] = 450$ kJ / mol

$\Delta f_H[Si_2H_6(g)] = 80.3$ kJ / mol

(A) - 304 kJ mol^{-1} (B) 384.3 kJ mol^{-1}
(C) 304 kJ mol^{-1} (D) - 384.3 kJ mol^{-1}

75. In the following reaction, three products a, b, c are obtained.



The approximates experimental yields of the three compounds were 64%, 33% and 3%. Which of the following is the correct with respect to yield and the corresponding product?

(A) (a) – 33%; (b) – 64%; (c) – 3% (B) (a) – 3%; (b) – 64%; (c) – 33%
(C) (a) – 3%; (b) – 33%; (c) – 64% (D) (a) – 33%; (b) – 64%; (c) – 3%

76. Which of the following represents the correct order of dipole moment?

(A) $NH_3 > NF_3 > H_2O$ (B) $NH_3 > H_2O > NF_3$
(C) $H_2O > NH_3 > NF_3$ (D) $H_2O > NF_3 > NH_3$

77. The best reaction sequence for the synthesis of 2-pentanone would be

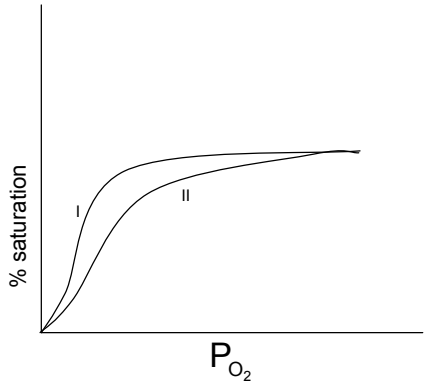
(A) $CH_3CH_2CH_2CHO \xrightarrow{CH_3MgI/ether} X \xrightarrow{H^+,H_2O}$

(B) $CH_3CH_2CH_2CN \xrightarrow{CH_3MgI/ether} X \xrightarrow{H^+,H_2O}$

(C) $CH_3CH_2CH_2CHO \xrightarrow{CH_3MgI/ether} X \xrightarrow{H^+,H_2O}$

(D) $CH_3CH_2CH_2MgI \xrightarrow{ether} X \xrightarrow{H^+,H_2O}$

78. Haemoglobin is a Fe containing protein responsible for oxygen transport in the blood. The curves given below indicate the percentage saturation of haemoglobin by O_2 as a function of partial pressure of O_2.



Which of the following statement/s is/are correct for the given curves?

I. In presence of CO_2, higher P_{O_2} is needed for a given percentage saturation

II. In presence of CO_2, lower P_{O_2} is needed for a given percentage saturation

III. The maximum percentage saturation is not affected by the presence of CO_2

IV. In the absence of CO_2, maximum saturation of haemoglobin occurs at lower P_{O_2}

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

79. An appropriate reagent for the conversion of 1-propanol to 1-propanal is
(A) acidified potassium dichromate
(B) alkaline potassium permanganate
(C) pyridinium chlorochromate
(D) acidified CrO_3

80. A student performed an experiment to determine the molecular formula of a given sample of hydrated copper (II) sulphate by weighing the sample before and after heating. The formula obtained experimentally was $CuSO_4.5H_2O$ while the actual formula of the given sample is $CuSO_4.5H_2O$. Which experimental error would account for the wrongly obtained result?
(A) During heating, some of the hydrated copper (II) sulphate was lost
(B) The hydrated sample was not heated long enough to remove all the water present
(C) Weight of the hydrated sample recorded was less than the actual weight taken
(D) The balance used in the study showed all weights consistently high by 0.10 g