DU M.SC. ENTRANCE CHEMISTRY 2015

1. $4H_3AsO_3 + 3Na[BH_4] \rightarrow ..... + H_3BO_3 + NaOH$

(a) $As(OH)_3$ (b) Na_3AsO_4 (c) AsH_3 (d) As_2O_3

2. Of the following nuclides, the one most likely to be radioactive is

(a) ${}^{14}_{6}C$ (b) ${}^{14}_{6}N$ (c) ${}^{31}_{15}P$ (d) ${}^{66}_{30}Zn$

3. Arrange the following metal-carbonyl complexes in the increasing order of the carbonyl stretching frequency :

$[Fe(CO)_4]^{2-}$, $[Mn(CO)_6]^{+}$ and $[Cr(CO)_6]$

(a) $[Mn(CO)_6]^{+} [Cr(CO)_6] < [Fe(CO)_4]^{2-}$

(b) $[Fe(CO)_4]^{2-} < [Cr(CO)_6] < [Mn(CO)_6]^{+}$

(c) $[Cr(CO)_6] < [Mn(CO)_6]^{+} < [Fe(CO)_4]^{2-}$

(d) $[Fe(CO)_4]^{2-} < [Mn(CO)_6]^{+} < [Cr(CO)_6]$

4. The self-indicating silica gel (impregnated with cobalt chloride) turns pink on absorbing moisture and become blue on heating. The pink and blue colours are respectively due to

(a) Co^{2+} and Co^{3+} (b) $[Co(H_2O)_6]^{2+}$ and Co_2CO_3

(c) $[Co(H_2O_6)]^{2+}$ and $[CoCl_4]^{2-}$ (d) $[Co(H_2O_6)]^{2+}$ and $[Co(H_2O_6)]^{3+}$

5. Which one of the following molecules doesn't obey the $18e^-$ rule

(a) $[Mn(CO)_6]^{+}$ (b) $[Fe(CO)_5]$ (c) $[Cr(CO)_5]^{2-}$ (d) $[Mn(CO)_4Cl_2]^{2-}$

6. The calculated magnetic moment (B.M) of Eu^{3+} system will be

(a) 0 (b) 3.42 (c) 7.91 (d) 3.61

7. The acidic strength of the following oxo-acid is in order

(a) HOF < HOCl < HOBr < HOI (b) HOCl < HOF < HOBr < HOI

(c) HOI < HOBr < HOCl < HOF (d) HOI < HOBr < HOF < HOCl

8. Identify the correct IUPAC nomenclature for the given complex : $\left[Pt(py)_4\right]\left[Pt(Cl_4)\right]$

(a) Tetrapyridineplatinum (II) tetrachloroplatinate (II)

(b) Tetrachloroplatinate (II) Tetrapyridineplatinum (II)

(c) Tetrachloro-tetrapyridine bis platinum (II)

(d) Platinum (II) tetrapyridinyl platinum (II) tetrachlorate

9. A solution containing 2.675 g of $CoCl_2.6NH_3$ (molecular weight = 267.5) is passed through a cation exchanger. The chloride ions obtained is solutions were treated with excess of $AgNO_3$ to give 4.78 g of AgCl. (molecular weight = 143.5). The formula of the complex formed is

(a) $\left[CoCl_2(NH)_3)_4\right]Cl$ (b) $\left[CoCl_3(NH)_3)_3\right]$

(c) $\left[Co(NH)_3)_6\right]Cl_3$ (d) $\left[CoCl(NH)_3)_5\right]Cl_2$

10. The empirical formula of Layered silicate structures in clays is :

(a) SiO_4^{4-} (b) $Si_2O_5^{2-}$ (c) $Si_2O_7^{6-}$ (d) $(SiO_3)_n^{2n-}$

11. Predict the extrinsic semiconducting properties of WO_3 and CdO

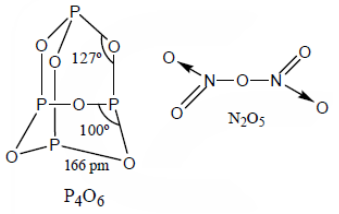
(a) Both p-type semiconductor

(b) Both n-type semiconductor

(c) WO_3 is n-type and CdO is insulator

(d) WO_3 is n-type and CdO is p-type semiconductor

12. N_2O_5 have open structure, whereas P_4O_6 has closed cage structure as shown in figure , the formation of open structure in N_2O_5 is due to



(a) d_p – pp mixing (b) dp-dp mixing (c) pp-pp mixing (d) None of these

13. When XeF_6 reacts will silica or glass, it gives a colourless liquid of the following composition

(a) $SiXeO_2F_6$ (b) XeO_3 (c) XeO_4F_2 (d) $XeOF_4$

14. Waker's process uses the catalyst :

(a) $\left[PdCl_4\right]^{2-}$ (b) $\left[Rh(CO)_2I_2\right]^-$

(c) $\left[Pt(C_2H_4)Cl_3\right]^-$ (d) $Cp_2TiCl_2 - Al(C_2H_5)_3$

15. Metal function needed in photosynthesis and respiration are :

(a) Zn, Ga and Ca (b) Zn, Mg and Ca

(c) Al, Ga and In (d) Mn, Fe, Co and Cu

16. Term symbols for d^2 configuration are ^3F, ^3P, ^1D, ^1S, ^1G and the ground state term is

(a) $^3F_4$ (b) $^3F_2$ (c) $^1G_4$ (d) $^3P_0$

17. How many vibrational modes are present in NH_3 ?

(a) 4 (b) 6 (c) 5 (d) 12

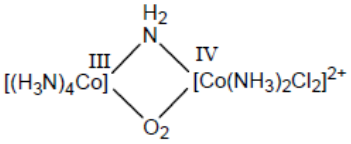
18. The charge/size ratio of a cation determines it's polarizing power. Which one of the following sequences represents the increasing order of the polarizing power of cationic species : $K^+, Ca^{2+}, Mg^{2+}, Be^{2+}$

(a) $K^+ < Ca^{2+} < Mg^{2+} < Be^{2+}$ (b) $Ca^{2+} < Be^{2+} < Mg^{2+} < K^+$

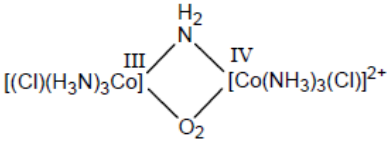
(c) $Be^{2+} < Mg^{2+} < Ca^{2+} < K^+$ (d) $Mg^{2+} < Ca^{2+} < Be^{2+} < K^+$

19. The poly-nuclear complexes (I) and (II) shown below are

Polynuclear complex (I)



Polynuclear complex (II)



(a) Ionization isomer (b) Stereoisomer

(c) Coordination position isomer (d) Coordination isomer

20. Capacity of anion exchanger resin decrease with

(a) decrease in pH (b) increase in pH

(c) at $pH = 7$ (d) Not affected by pH

21. Bromination of toluene gives

(a) Only 3-bromotoluene as product

(b) Only 4-bromotoluene as product

(c) Mixture of 2-bromotoluene and 4-bromotoluene as products

(d) Mixture of 3-bromotoluene and 4-bromotoluene as products

22. SN^{-1} reaction on optically active substrate mainly gives

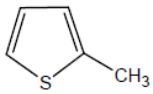
(a) Racemic product (b) Inversion of configuration

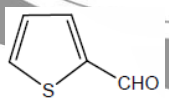
(c) Retention of configuration (d) No product

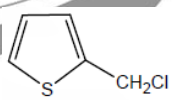
23. The electrophilic aromatic substitution proceeds thorough

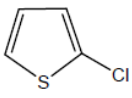
(a) Free radical (b) Sigma complex (c) benzyne (d) carbene

24. Thiophene reacts with HCHO in presence of aqueous HCl to give

(a) 

(b) 

(c) 

(d) 

25. Aldose and ketose are differentiated by

(a) Tollen's reagents (b) Fehling's solution

(c) Br_2 water (d) HIO_4

26. Rearrange the following in the order of acid strength

(I) Benzoic acid (II) 4-methoxybenzoic acid

(III) 2-methoxybenzoic acid

(a) I < II < III (b) III < I < II (c) II < I < III (d) III < II < I

27. Which one of the following reactions will not result in formation of anisole

(a) Phenol + dimethyl sulfate in presence of base

(b) Sodium phenoxide treated with methyl iodide

(c) Reaction of diazomethane with phenol

(d) Reaction of methyl magnesium iodide with phenol

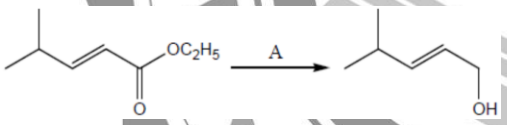
28. 2-phenylethanol may be prepared by the reaction of phenyl magnesium bromide with

(a) HCHO (b) CH_3CHO (c) CH_3COCH_3 (d) 

29. 2-Acetoxy benzoic acid is known as

(a) Aspirin (b) Paracetamol (c) Ibuprofen (d) Wintergreen oil

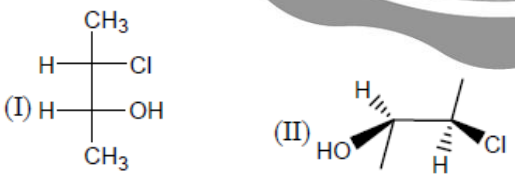
30. For the following reaction



Reagent A is

(a) $LiAlH_4$ (b) $NaBH_4$ (c) KBH_4 (d) Borane

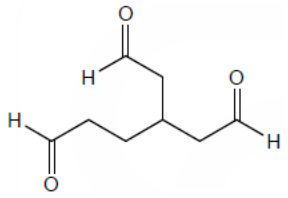
31. Correct relation between compound I and II is



(a) I and II are identical (b) I and II are diastereomer

(c) I and II are enantiomer (d) I and II are meso compounds

32. The correct IUPAC name of the below given compound is



(a) (4-formylmethyl)-hexane-1, 6-dial (b) (3-formylethyl)-pentane-1, 5-dial (c) (2-formylethyl)-pentane-1, 5-dial (d) (3-formylmethyl)-hexane-1, 6-dial

33. The number of signals observed in $^{1}H-NMR$ of 1, 3-dibromobenzene

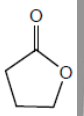
(a) 3 (b) 4 (c) 2 (d) 6

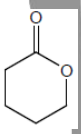
34. The fisher projection of meso-tartaric acid represents :

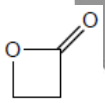
(a) Skew from (b) Staggered form (c) Eclipsed form (d) Gauche form

35. Match the compounds (List I) with correct IR frequency of C-O stretching (list II)

List-I **List-II**

(P)  (i) 1840 cm^{-1}

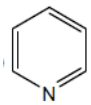
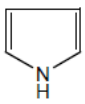
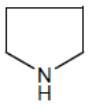
(Q)  (ii) 1740 cm^{-1}

(R)  (iii) 1770 cm^{-1}

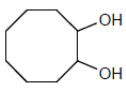
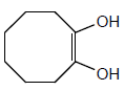
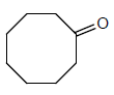
(a) (P)-(i), (Q)-(ii), (R)-(iii) (b) (P)-(i), (Q)-(iii), (R)-(ii)

(c) (P)-(iii), (Q)-(ii), (R)-(i) (d) (R)-(i), (Q)-(ii), (P)-(iii)

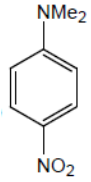
36. Among the following compounds, the most basic compound is

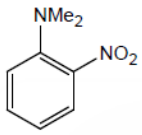
(a)  (b)  (c)  (d) 

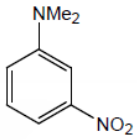
37. The reaction of cyclooctyne with $HgSO_4$ in the presence of aqueous H_2SO_4 gives

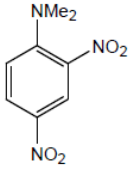
(a)  (b)  (c)  (d) 

38. The major product formed on nitration of N, n-dimethylaniline with conc. $H_2SO_4 - HNO_3$ mixture is

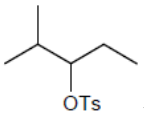
(a) 

(b) 

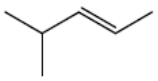
(c) 

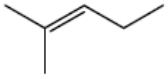
(d) 

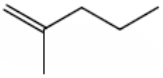
39. The major product obtained upon treatment of compound X with H_2SO_4 at 80°C

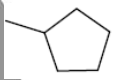


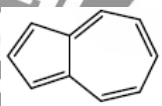
is

(a) 

(b) 

(c) 

(d) 



40. The compound is

(a) anti-aromatic and has no dipole moment

(b) non-aromatic and has high dipole moment

(c) aromatic and has high dipole moment

(d) aromatic and has less dipole moment

41. Match List I with List II and select the correct answer

List I	List II
(A) Critical temperature	1. $\frac{a}{Rb}$
(B) Boyle temperature	2. $\frac{2a}{a/Rb}$
(C) Inversion temperature	3. $\frac{T}{T_C}$
(D) Reduced temperature	4. $\frac{8a}{27\,Rb}$

	A	B	C	D		A	B	C	D
(a)	2	1	4	3	(b)	4	3	2	1
(c)	2	3	4	1	(d)	4	1	2	3

42. Which has the maximum value of mean free path?

(a) CO_2 (b) H_2 (c) O_2 (d) N_2

43. As the supercooled water freezes spontaneously, its temperature rises to $0°C$, ΔH for the spontaneous process is equal to $H_2O(l)\text{ at } -10°C \rightarrow H_2O(l)\text{ at } 0°C$

(a) enthalpy of fusion (b) enthalpy of vaporization

(c) enthalpy of sublimation (d) Zero

44. 60 g of urea is dissolved in 1100 g solution. To keep $\Delta T / K_f$ as 1 mol/kg, water separated in the form of ice is

(a) 40 g (b) 60 g (c) 100 g (d) 200 g

45. Relative decrease in vapour pressure of an aqueous NaCl is 0.167. No. of moles of NaCl present is 180 g of H_2O is

(a) 2 mol (b) 1 mol (c) 3 mol (d) 4 mol

46. Elevation in boiling point of an aqueous urea solution is $0.52°$ $\left(K_b = 0.52 \quad mol^{-1}kg\right)$. Hence mole fraction of urea in this solution is

(a) 0.982 (b) 0.0567 (c) 0.943 (d) 0.018

47. Following are the values of E_a and ΔH for three reactions carried out at the same temperature

(I) $E_a = 20kJ\ mol^{-1}, \Delta H = -60kJ\ mol^{-1}$

(II) $E_a = 10kJ\ mol^{-1}, \Delta H = -20kJ\ mol^{-1}$

(III) $E_a = 20kJ\ mol^{-1}, \Delta H = +15kJ\ mol^{-1}$

If all the three reactions have same frequency factor then factor then fastest reactions are

	Fastest	Slowest
(a)	I	II

(b) II III

(c) II III

(d) cannot be predicted

48. For reaction $2A + B \rightarrow$ product, rate law is $-\frac{d[A]}{dt} = k[A]$. At a time when $t = \frac{1}{k}$, concentration of the reactant is : (C_0 = initial concentration)

(a) $\frac{C_0}{e}$ (b) $\frac{1}{C_0}$ (c) $\frac{C_0}{e^2}$ (d) $\frac{e}{C_0}$

49. Acid hydrolysis of ester is first-order reaction and rate constant is given by

$$k = \frac{2.303}{t}\log\frac{V_\infty - V_0}{V_\infty - V_0}$$

Where V_0, V_t and V_∞ are the volumes of standard NaOH to neutralize acid present at a given time; if ester is 50% hydrolysed then :

(a) $V_\infty = V_t$ (b) $V_\infty = (V_t - V_0)$ (c) $V_\infty = 2V_t - V_0$ (d) $V_\infty = 2V_t + V_0$

50. Temperature of 1 mol of gas is increased by $1°$ at constant pressure. Work done :

(a) R (b) 2R (c) R/2 (d) 3R

51. K_{sp} of $Mg(OH)_2$ is 1.8×10^{-11} t $30°C$. Its molar solubility is ..... at $pH = 12$

(a) 1.8×10^{-11} M (b) 1.8×10^{-9} M (c) 1.34×10^{-54} M (d) 1.8×10^{-7} M

52. For the half cell $Cl^- / Pt(Cl_2)$, the value of $(E - E^0)$:

(a) increases as $[Cl^-]$ increases (b) decreases as $[Cl^-]$ increases

(c) remains constant as $[Cl^-]$ increases (d) cannot be predicated

53. If E_0 is the zero point energy of a harmonic oscillator of frequency v and h is the planck's constant than its energy in the $n = 2$ state will be

(a) $(E_0 + hv)$ (b) $2E_0$ (c) $4E_0$ (d) $(E_0 + 2hv)$

54. The molecules which are IR-inactive but raman active is :

(a) N_2 (b) HCl (c) SO_2 (d) Protein

55. A thermos bottle containing coffee is vigorously shaken and there by the temp of the coffee rises. Regard the coffee as system

(a) $Q=0;W=-ve\ \Delta U\text{ is}+ve$ (b) $Q=0;W=+ve;\ \Delta U\text{ is}+ve$

(c) $Q=0;W=-ve\ \Delta U\text{ is}-ve$ (d) $Q=0;W=+ve;\ \Delta U\text{ is}-ve$

56. Conjugate base of H_2 is

(a) H^+ (b) H_3^+ (c) H^- (d) H_3^-

57. Lithium selenide can be described as a closest - packed array of selenide ions with lithium ions in all the tetrahedral holes. Formula of lithium selenide is

(a) Li_2Se (b) Li_2Se_3 (c) $LiSe_2$ (d) Li_3Se

58. The pK_a of an amino acid is 9.15. At what pH amino acid is 5% dissociated?

(a) 9.15 (b) 4.85 (c) 9.44 (d) 7.87

59. For the equilibrium $NH_2COONH_4(s) \rightleftharpoons 2NH_3(g)+CO_2(g)$

$\rho CO_2 = 1$ atm at $100°C$. Hence equilibrium constant is :

(a) $1\ atm^3$ (b) $2\ atm^3$ (c) $4\ atm^3$ (d) $3\ atm^3$

60. For the following equilibrium $NH_2CO_2NH_4(s) \rightleftharpoons 2NH_3(g)+CO_2(g)$

K_p is found to be 0.5 at 500 K. Hence the partial of NH_3 and CO_2 are respectively

(a) 2.0 and 1.0 (b) 1.0 and 2.0 (c) 1.0 and 0.5 atm (d) 0.5 and 1.0 atm