

Section 1 - M Sc - Chemistry or Applied Chemistry

1) The units of Molal Elevation constant (K_b) are

- A) $J K^{-1} mol^{-1}$
 - B) $J mol^{-1}$
 - C) $K kg mol^{-1}$
 - D) $K mol^{-1}$
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2) A surfactant makes micelles in water after reaching a certain concentration (10 mM) known as critical micelle concentration (CMC). What will be the effect on the CMC value if the water also contains 50 mM NaCl in it?

- A) It will increase
 - B) It will decrease
 - C) None of the above
 - D) It would remain the same
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3) If 30 ml of methyl alcohol ($\rho = 0.7980 \text{ gml}^{-1}$) is mixed with 70 ml of water ($\rho = 0.9984 \text{ gml}^{-1}$) at 25°C to give a solution of $\rho = 0.9575 \text{ gml}^{-1}$. The molal freezing constant of water is $1.86 \text{ mol}^{-1}\text{kg}$. The freezing point of solution will be

- A) -109.91°C
 - B) -79.91°C
 - C) -49.91°C
 - D) -19.91°C
-

4) What is the energy of a particle (of mass m) in a 1-dimensional box (of length a) in its second excited state ($n=3$).

- A) $4h^2/9ma^2$
- B) $9h^2/4ma^2$
- C) $9h^2/8ma^2$
- D) $4h^2/8ma^2$

5) How many constitutional and cis-trans stereoisomers are there of cycloalkanes with the formula C_5H_{10}

- A) 4
 - B) 7
 - C) 5
 - D) 6
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6) *trans*-dihydroxylation of alkenes can be achieved by

- A) By using all above three methods
 - B) OsO_4
 - C) Epoxidation followed by hydrolysis
 - D) $KMnO_4$
-

7) A radiation of $5000 \text{ \AA}$ lies in which part of the electromagnetic spectrum?

- A) IR
 - B) UV
 - C) Radio wave
 - D) Visible
-

8) The minerals having silicate chains are collectively called

- A) Olivine
 - B) Zircon
 - C) Pyroxenes
 - D) Natrolite
-

9) A cycloaddition reaction is favoured under which of the following conditions:

- A) EWG on diene and EDG on dienophile
- B) EDG on both diene and dienophile
- C) EWG on both diene and dienophile
- D) EWG group on dienophile and EDG on diene

10) A process is spontaneous at all temperatures when

- A) $\Delta H > 0$, and $\Delta S > 0$
 - B) $\Delta H < 0$, and $\Delta S > 0$
 - C) $\Delta H = 0$, and $\Delta S < 0$
 - D) $\Delta H < 0$, and $\Delta S < 0$
-

11) Be shows the diagonal relationship with

- A) Mg
 - B) B
 - C) Na
 - D) Al
-

12) HVZ reaction is used for:

- A) β -halogenation of carboxylic acids
 - B) α -halogenation of aldehydes
 - C) α -halogenation of carboxylic acids
 - D) β -halogenation of aldehydes
-

13) For two protons which are 2.438 kHz and 4.538 kHz downfield from the Reference compound on a 500 MHz ($B=11.74$ T) instrument, calculate the chemical shift difference between them in Hz on 300 MHz instrument.

- A) 1260 Hz
 - B) 4.2 Hz
 - C) 7 Hz
 - D) 2100 Hz
-

14) On dilution of a carboxylic acid, the OH stretching frequency

- A) Increases
 - B) Remain unaffected
 - C) None of the above
 - D) Decreases
-

15) Brass is an alloy of

- A) Cu, Al and Zn
 - B) Cu and Ni
 - C) Cu, Ni and Zn
 - D) Cu and Zn
-

16) Which of the given statements is true in respect of basicity of an acid?

- A) Basicity $\times$ atomic weight = Molecular weight
 - B) Basicity $\times$ Molecular weight = Equivalent weight
 - C) It is the number of replaceable H atoms in one molecule of an acid
 - D) It is the number of H atoms in one molecule of an acid
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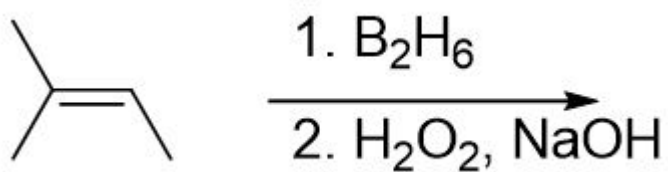
17) Give the type of hybridization in XeF_2

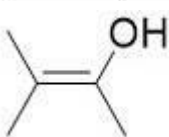
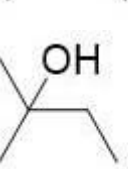
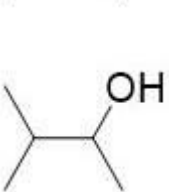
- A) sp^2
 - B) $\text{sp}^3 \text{d}^2$
 - C) $\text{sp}^3 \text{d}^1$
 - D) sp^3
-

18) The solution containing components A and B follows Raoult's law when

- A) A-B attractive force remains same as A-A and B-B
- B) A-B attractive force is less than A-A and B-B
- C) None of these
- D) A-B attractive force is greater than A-A and B-B

19) The major product of the following reaction sequence is



- A) 
- B) 
- C) 
- D) 

20) Carbonyl stretching frequency is the highest in the case of

- A) acids
B) anhydrides
C) aldehydes
D) amides

21) In the spectrochemical series, which ligand produces strong field?

- A) H_2O
B) CO
C) NH_3
D) Cl^-

22) The Purpose of an emulsifier is to

- A) Improve medication taste
 - B) Decrease surface area in a suspension
 - C) Stabilize the emulsion
 - D) Minimize the size of globules
-

23) MX_6 is a molecule with octahedral geometry. How many X – M – X bonds are at 180° ?

- A) Two
 - B) Four
 - C) Three
 - D) Six
-

24) In diborane, the two H-B-H angles are nearly:

- A) 95° and 120°
 - B) 180° and 120°
 - C) 95° and 150°
 - D) 60° and 120°
-

25) A spectroscopic transition of 9 GHz would amount to how much in cm^{-1} .

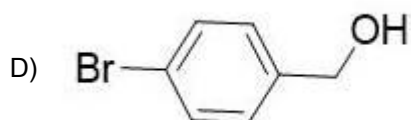
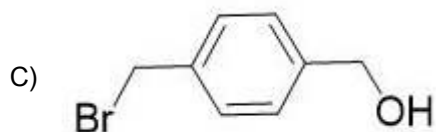
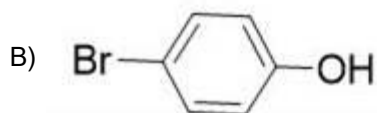
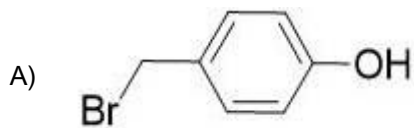
- A) 3.0 cm^{-1}
 - B) 0.3 cm^{-1}
 - C) 0.1 cm^{-1}
 - D) 1.0 cm^{-1}
-

26) Chose the correct expression for the Henderson-Hasselbach equation

- A) $\text{pH} = \text{pK}_a + \log_{10}([HA]/[A^-])$
- B) $\text{pH} = \text{pK}_a + \log_{10}([A^-]/[HA])$
- C) $\text{pK}_a = \text{pH} + \log_{10}([HA]/[A^-])$
- D) $\text{pK}_a = \text{pH} + \log_{10}([A^-]/[HA])$

27) Which of the following compounds is

- (i) insoluble in dil. NaOH solution
- (ii) On shaking with ethanolic silver nitrate gives precipitates



28) The triple point for carbon dioxide is

- A) None of the above
- B) depends only on temperature
- C) depends only on pressure
- D) depends on both temperature and pressure

29) What is the bond order in superoxide (O_2^-) ion?

- A) 2.5
- B) 2.0
- C) 1.5
- D) 1.0

30) Reaction of nitrobenzene with concentrated $\text{HNO}_3/\text{H}_2\text{SO}_4$ at 80-100 °C forms:

- A) 1,2,4-trinitrobenzene
 - B) 1,4-dinitrobenzene
 - C) 1,2-dinitrobenzene
 - D) 1,3-dinitrobenzene
-

31) Lysozyme belongs to the enzyme category of:

- A) hydrolases
 - B) isomerases
 - C) peptidases
 - D) transferases
-

32) The lines in the rotational spectrum become closer as we go from OC to OCN because

- A) The dipole moment increases.
 - B) The geometry changes.
 - C) The number of atoms increases.
 - D) All of the above.
-

33) For a probability distribution function

$$f(x) = (2\pi a^2)^{-1/2} e^{-x^2/2a^2} dx, \quad -\infty \rightarrow +\infty ?$$

What would be the expectation value of x within the limits

- A) 0
- B) $a/2$
- C) a^2
- D) a

34) The relative reactivity of benzene, aniline, toluene and nitrobenzene towards electrophilic substitution is in the order

- A) Aniline > benzene > toluene > nitrobenzene
 - B) Aniline > toluene > benzene > nitrobenzene
 - C) Nitrobenzene > benzene > toluene > aniline
 - D) Aniline > benzene > nitrobenzene > toluene
-

35) What are the most important intermolecular forces in H_2 ?

- A) Dispersion forces
 - B) Dipole-dipole interactions
 - C) Electronic interactions
 - D) Hydrogen bonding
-

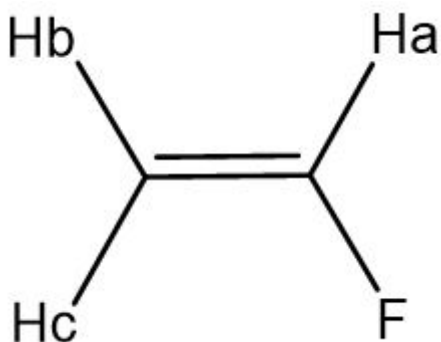
36) For the ground state energies of C-H and C-D bonds:

- A) C-H has higher energy than C-D
 - B) two have equal energies
 - C) none of the above is correct
 - D) C-D has higher energy than C-H
-

37) The size of colloidal particles is

- A) 1 nm-1000 nm
- B) More than 1000 nm
- C) None of above
- D) Less than 1nm

38) In the following compound, how many peaks are expected in the NMR spectrum of Fluorine nucleus? Given that $J_{H_a-F}=85$ Hz, $J_{H_b-F}=50$ Hz, and $J_{H_c-F}=20$ Hz.



- A) 6
 - B) 5
 - C) 8
 - D) 7
-

39) Overtone in IR is a result of

- A) Dipole moment of the molecule
 - B) None of the above
 - C) Moment of inertia
 - D) anharmonicity
-

40) The polymeric species $(SN)_n$ is a / an

- A) three dimensional conductor
 - B) two dimensional conductor
 - C) one dimensional conductor
 - D) insulator
-

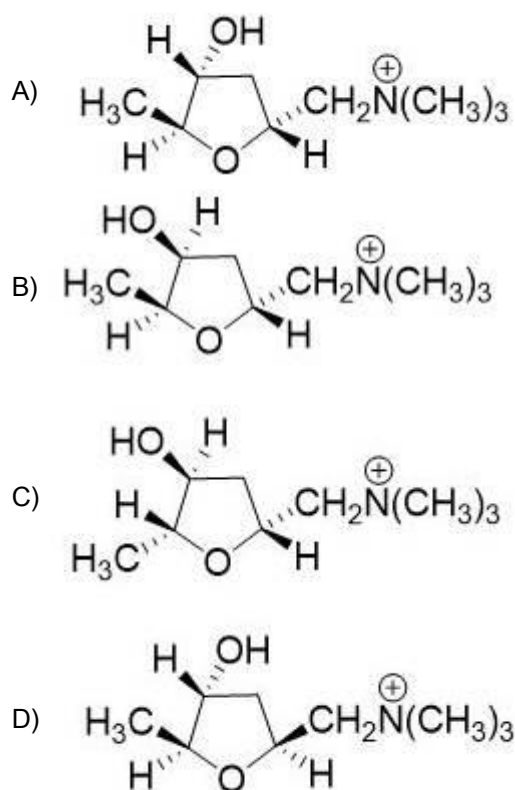
41) The increase in conjugation causes

- A) Bathochromic shift
 - B) Hyperchromic Shift
 - C) Hypochromic Shift
 - D) Hypsochromic Shift
-

42) The descending order of resonance stabilization energy of (i) naphthalene, (ii) benzene and (iii) furan is:

- A) (i) < (ii) < (iii)
 - B) (ii) < (iii) < (i)
 - C) (ii) > (i) > (iii)
 - D) (i) > (ii) > (iii)
-

43) Muscarine has the configuration 2S, 3R, 5S. The correct stereochemistry of muscarine is



44) The splitting pattern for ^{13}C NMR spectrum of CDCl_3 is:

- A) 3 lines of equal intensity
- B) 2 lines of equal intensity
- C) 4 lines of unequal intensity
- D) 4 lines of equal intensity

45) Which oxide is amphoteric?

- A) MgO
 - B) CaO
 - C) BaO
 - D) BeO
-

46) Reaction of a carbene over an alkene is a type of:

- A) electrocyclic reaction
 - B) cycloaddition reaction
 - C) substitution reaction
 - D) rearrangement reaction
-

47) Of the given anions, the strongest Bronsted base is:

- A) ClO_2^-
 - B) ClO_3^-
 - C) ClO^-
 - D) ClO_4^-
-

48) Which one of the following is correct:

- A) all of the above reduce nitro group
- B) Zn-HCl reduces nitro group
- C) Sn-HCl reduces nitro group
- D) H_2 over Pd-C reduces nitro group

49) For a Diatomic Molecule, the Vibrational quantum number and energy corresponding to Zero Point Energy are

- A) 1, 0
- B) $1, \frac{1}{2} h\nu$
- C) 2, $h\nu$
- D) $0, \frac{1}{2} h\nu$
-

50) Which of the ions have maximum hydration energy?

- A) Be^{2+}
- B) Sr^{2+}
- C) Ca^{2+}
- D) Mg^{2+}
-

51) Addition of bromine to cyclohexene gives one of the indicated products as the final product.

- A) 1,2-Dibromocyclohexane (Diaxial conformer)
- B) 1,1-Dibromocyclohexane
- C) 1,2-Dibromocyclohexane (Diequatorial conformer)
- D) 1,2-Dibromocyclohexane (Equatorial, axial conformer)
-

52) Bond energies for C-C, C-H, C=C, and H-H linkages are: 348, 413, 610, and 436 kJ per mole, respectively. The heat of hydrogenation of ethylene is

- A) 128 kJ
- B) 2698 kJ
- C) -128 kJ
- D) -2698 kJ
-

53) Which is used in the manufacture of safe matchsticks?

- A) Red Phosphorus
 - B) White phosphorus
 - C) Sulphur
 - D) Selenium
-

54) How many normal modes of vibration are possible for SO_2

- A) 3
 - B) 4
 - C) 1
 - D) 2
-

55) 2,4-DNP is commonly used for the detection of:

- A) amino group
 - B) aldehydic group
 - C) phenolic group
 - D) amidic group
-

56) Joule Thomson expansion is

- A) isothermal
 - B) isoenthalpic
 - C) isochoric
 - D) isobaric
-

57) Under which of the following reaction conditions, propene is converted into primary alcohol:

- A) $\text{H}_2\text{O}/\text{H}^+$
- B) KMnO_4
- C) $\text{Hg}(\text{OAc})_2\text{-H}_2\text{O}$, NaBH_4
- D) $\text{BH}_3\text{-H}_2\text{O}_2$

58) Which out of phenyl ethanoate and ethyl benzoate upon reaction with HNO_3 / H_2SO_4 / heat give p-substituted product as the major product?

- A) None of these
 - B) Phenyl ethanoate
 - C) Both of these
 - D) Ethyl benzoate
-

59) $d\pi-p\pi$ bonding is present in which molecule

- A) BO_3^{3-}
 - B) NO_3^-
 - C) CO_3^{2-}
 - D) SO_3^{2-}
-

60) The rate of evaporation of a liquid is faster at a higher temperature because

- A) The enthalpy of vaporization is zero
- B) None of the above
- C) The enthalpy of vaporization is exothermic
- D) The enthalpy of vaporization is endothermic

Answer Keys**Question Paper No: 60867_5**

1	C	31	A
2	B	32	C
3	D	33	A
4	C	34	B
5	D	35	A
6	C	36	A
7	D	37	A
8	C	38	C
9	D	39	D
10	B	40	C
11	D	41	A
12	C	42	D
13	A	43	D
14	A	44	A
15	D	45	D
16	C	46	B
17	C	47	C
18	A	48	A
19	D	49	D
20	B	50	A
21	B	51	C
22	C	52	A
23	C	53	A
24	A	54	A
25	B	55	B
26	B	56	B
27	C	57	D
28	D	58	B
29	C	59	D
30	D	60	D