1.   The increasing order of electron affinity values among the elements C, N, O & F is
   A) $N < C < O < F$ B) $C < N < O < F$
      C) $N < O < C < F$ D) $C < O < N < F$
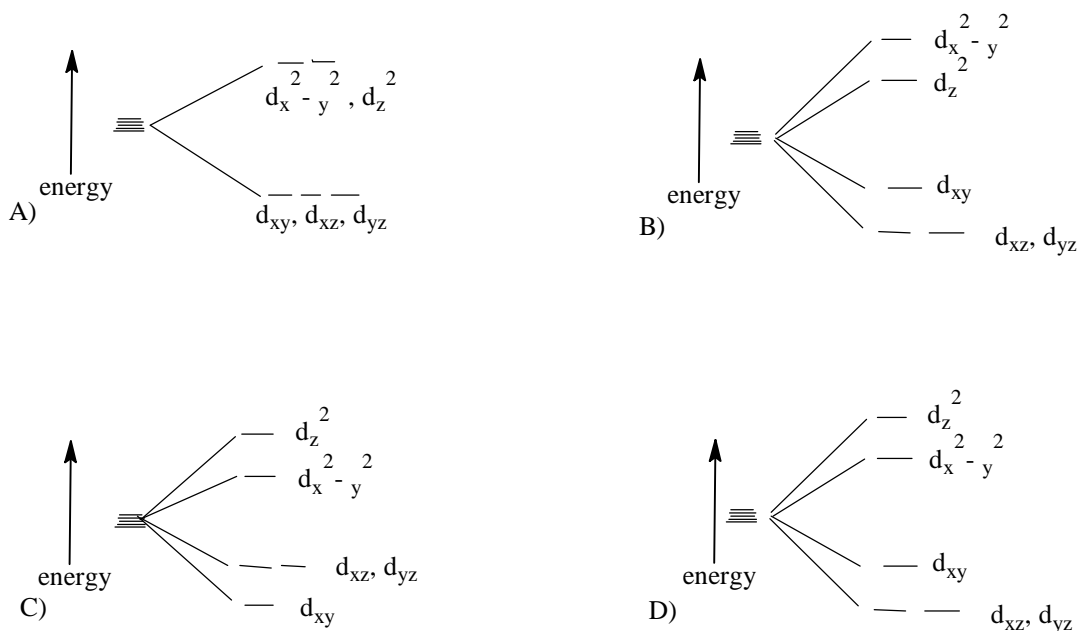
2.   Match the shapes of the following molecules:

Molecules		**Shape**	
a)	BF_3	i)	square pyramid
b)	BrF_5	ii)	triangular planar
c)	PCl_5	iii)	tetrahedral
d)	XeO_4	iv)	trigonal bipyramid
		v)	regular pentagon

      A)   a-ii, b- v, c- i, d- iv   B)   a-iii, b- iv, c- i , d- ii
      C)   a-ii, b- i, c- iv, d- iii   D)   a-ii, b- v, c- i , d- iii

3.   Among the following inter halogen ions which are having linear structure?

      $ClF_2^-, ClF_2^+, IF_2^-, BrF_{2,}^+ ICl_2^-$
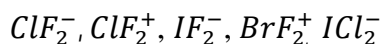
      A) ClF_2^+, IF_2^-, BrF_2^+ B) $ClF_2^-, IF_2^-, ICl_{2,}^-$
      C) $ClF_2^+, IF_2^-, ICl_{2,}^-$ D)   All of these

4.   Which among the following boranes has arachno butterfly structure?
      A) B_5H_9 B) $B_6H_6^{2-}$ C) $B_{10}H_{14}$ D) B_4H_{10}

5.   Among the first transition series, which metals show maximum number of oxidation states?
      A)   V, Cr   B)   Cr, Mn   C)   Fe, Co   D)   Mn, Co

6.   Which among the following ions have a structure with two tetrahedra joined by sharing an oxygen atom at one vertex?
      A) $Cr_2O_7^{2-}$ B) $[Mo_2O_6SO_4]^{4-}$ C) $[Mo_6O_{19}]^{2-}$ D) $[Ta_6O_{19}]^{2-}$

7.   Given below are two statements
      Statement I: Zr and Hf occur together in nature and their separation is difficult
      Statement II: They have similar size due to lanthanide contraction
      Identify the correct choice from the following

      A)   Statement I is correct and statement II is the correct explanation of statement I
      B)   Statement I is correct and statement II is not the correct explanation of statement I
      C)   Statement I is correct and statement II is incorrect
      D)   Statement I is incorrect and statement II is incorrect

8. Which among the following is not a super heavy element?

A) $_{105}Db$ B) $_{106}Sg$ C) $_{102}No$ D) $_{104}Rf$

9. The number of isomers possible for the complex $[CoCl_2(NH_3)_2(PPh_3)_2]^+$ is
    A) 3 B) 4 C) 5 D) 6

10. Which among the following is the splitting pattern of d-orbitals in square planar complexes?

A)

$d_x{}^2{}_-{}_y{}^2, d_z{}^2$

energy

d_{xy}, d_{xz}, d_{yz}

B)

$d_x{}^2{}_-{}_y{}^2$

$d_z{}^2$

energy

d_{xy}

d_{xz}, d_{yz}

C)

$d_z{}^2$

$d_x{}^2{}_-{}_y{}^2$

energy

d_{xz}, d_{yz}

d_{xy}

D)

$d_z{}^2$

$d_x{}^2{}_-{}_y{}^2$

energy

d_{xy}

d_{xz}, d_{yz}

11. The colour of $MnO_4{}^-$ ion is due to
    A) d-d transition
    B) f-d transition
    C) Metal to ligand charge transfer
    D) Ligand to metal charge transfer

12. The magnetic moments of $[Fe(H_2O)_6]^{2+}$ and $[Fe(CN)_6]^{3-}$ are respectively

A) 1.73 μ_B, 4.9 μ_B B) 3.87 μ_B, 1.73 μ_B
C) 4.9 μ_B, 1.73 μ_B D) 4.9 μ_B, 0

13. The number of metal – metal bonds and bridging CO ligands in $Co_2(CO)_8$ are respectively
    A) 1, 2 B) 2, 1 C) 0, 3 D) 2, 2

2

14. Match the hapticity of organic ligands in the following organometallic compounds

Organometallic compound		**Hapticity**	
a.	$Fe(C_5H_5)_2$	i.	4
b.	$Cr(C_6H_6)_2$	ii.	5
c.	$(C_4H_4)Fe(CO)_3$	iii.	6
d.	$U(C_8H_8)_2$	iv.	7
		v.	8

A) a- ii, b – i, c-iii, d- v   B) a- ii, b – iii, c-i, d- v
C) a- ii, b – iv, c-iii, d- v   D) a- iv, b – ii, c-iii, d- i

15. The catalyst used in the homogeneous hydrogenation of olefins is
A) Ni   B) $Co_2(CO)_8$ C) $[Rh(CO)_2I_2]^-$ D) $[Rh(PPh_3)_3Cl]$

16. The organometallic compound used in the preparation of Ziegler-Natta catalyst is
A) $Al(C_2H_5)_3$ B) $Fe(C_5H_5)_2$
C) $Rh(CO)H(PPh_3)_3$ D) $[Ru(BINAP)Br_2]$

17. The metal ion which plays the crucial role in transferring information from gene by enabling the protein to recognise and bind to precise sequences of DNA base pairs is
A) Ca^{2+} B) Mg^{2+} C) Zn^{2+} D) K^+

18. The enzyme that catalyse the reduction of O_2 to water without incorporation of O atoms is
A) Cytochrome c peroxidise   B) Cytochrome c oxidase
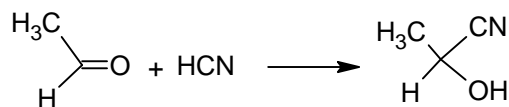C) Carboxypeptidase   D) Carbonic anhydrase

19. In oxyhaemoglobin, iron is in
A) High spin Fe(II)   B) High spin Fe(III)
C) Low spin Fe(II)   D) Low spin Fe(III)

20. Carboplatin, a platinum complex, is used as
A) Anti-cancer drug   B) Anti-arthritis drug
C) Anti-malarial   D) Anti-histamine

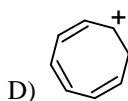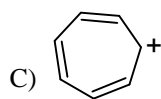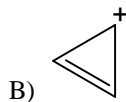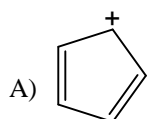21. Which among the following effects is facilitating the following reaction?

A) Inductive effect   B) Electromeric effect
C) Mesomeric effect   D) Hyper conjugative effect

22. The increasing order of stability of the following free radicals is

   i) $CH_3^{\cdot}$ ii) $CF_3^{\cdot}$ iii) $CH_2F^{\cdot}$ iv) $CHF_2^{\cdot}$

   A)   i < iii < iv < ii   B)   i < ii < iii < iv
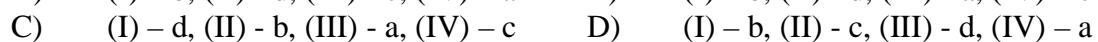   C)   i < iii < ii < iv   D)   ii < i < iii < iv

23. Which among the following ion is homo aromatic?

   A)

   B)

   C)

   D)

24. Match the following reactions with the correct intermediates
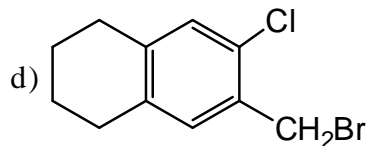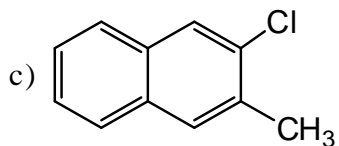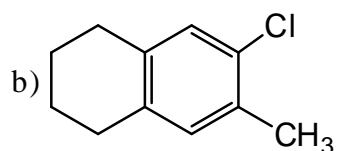
   Reaction   **Intermediate**

   (I)   dil. H_2SO_4 a)   carbene

   (II)   aq. KOH   b)   carbocation

   (III)   hv   c)   free radical

   (IV) $H_2C{=}CH(CH_2)_4Br$ $\xrightarrow[\text{AIBN}]{(TMS)_3SiH}$ —CH_3 d)   carbanion

   A)   (I) – b, (II) - d, (III) - c, (IV) – a   B)   (I) – b, (II) - d, (III) - a, (IV) – c
   C)   (I) – d, (II) - b, (III) - a, (IV) – c   D)   (I) – b, (II) - c, (III) - d, (IV) – a

25. The major product formed in the following reaction is

+ NBS $\xrightarrow{CH_2Cl_2}$

A)

B)

C)

D)
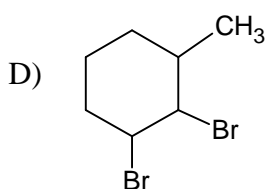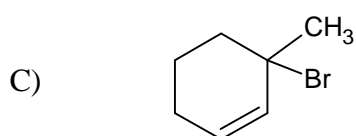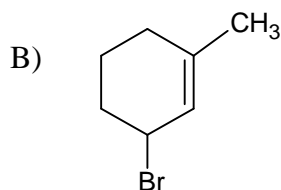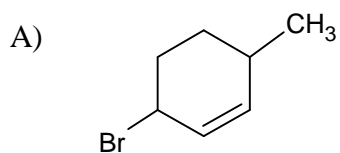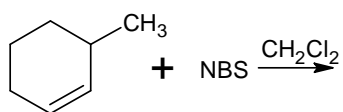
26. Product of the reaction

 $\xrightarrow{LiAlH_4}$

a)

b)

c)

d)

5
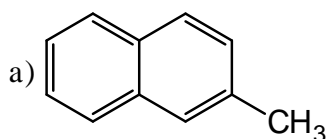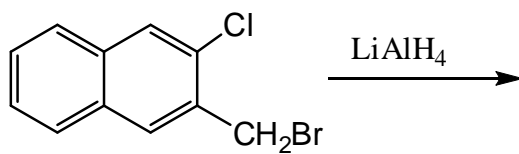
27. The major product of the reaction

A)

B)

C)

D)
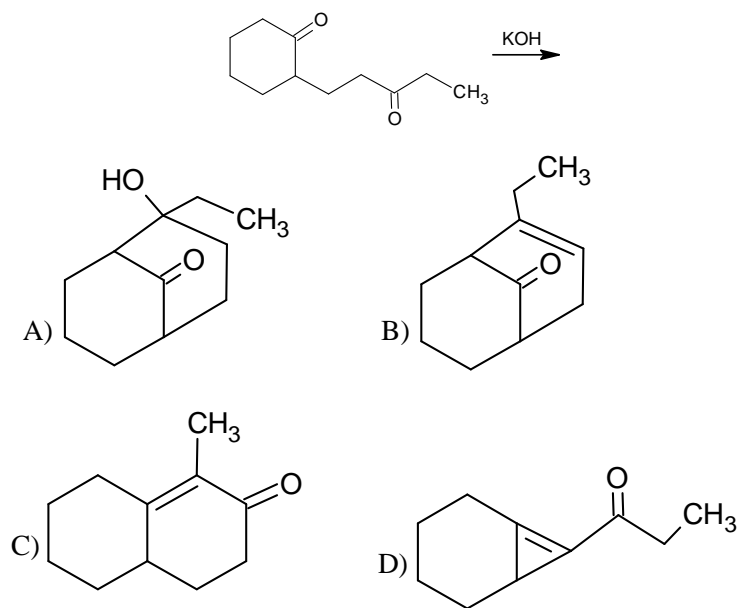
28. Match the following reactions with the respective names

Reaction   **Name**

(I)   Phenol + CHCl$_3$/ NaOH → salicylaldehyde sodium salt   a) Ullmann reaction

(II)   Phenyl acetate + BF$_3$ → 2-hydroxyacetophenone + 4-hydroxyacetophenone   b) Reimer–Tieman reaction

(III) Bromobenzene + Cu$^+$ → biphenyl   c) Perkin reaction

(IV)   Benzaldehyde + acetic anhydride / NaOAc → cinnamic acid   d) Fries rearrangement
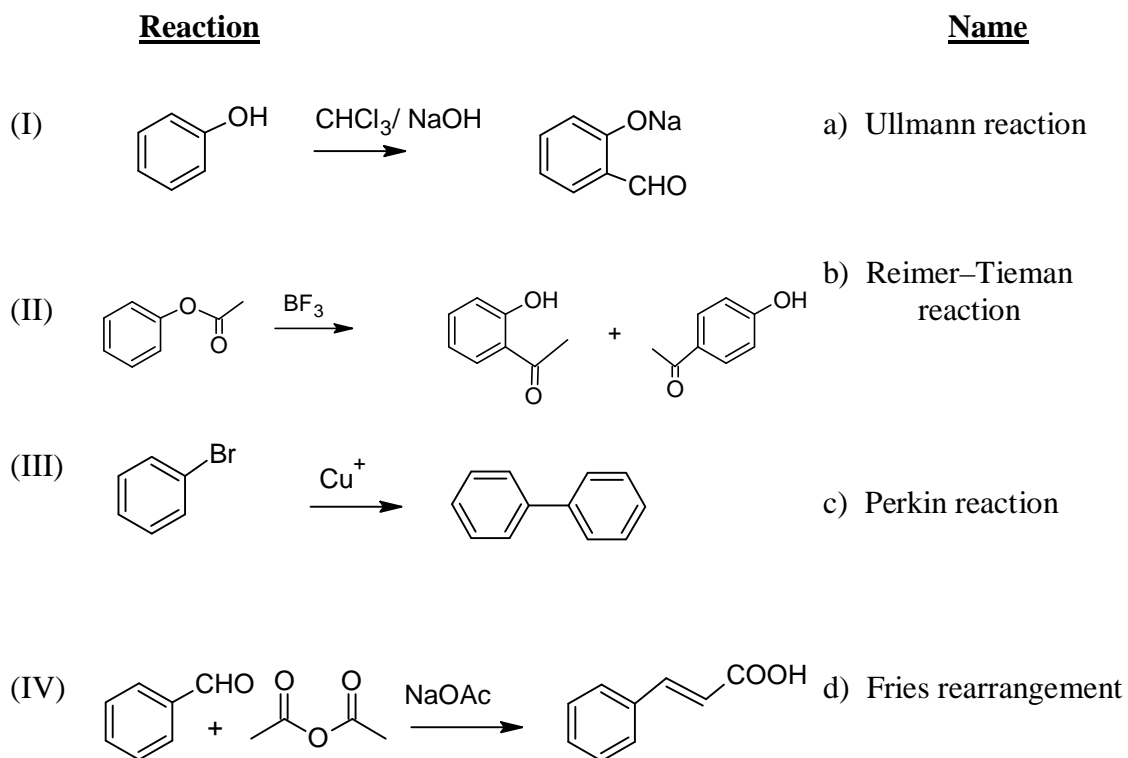
A)   (I) – b, (II) - d, (III) - c, (IV) – a   B)   (I) – b, (II) - d, (III) - a, (IV) – c
C)   (I) – d, (II) - b, (III) - a, (IV) – c   D)   (I) – b, (II) - c, (III) - d, (IV) – a

29. Which among the following structures is/are of (R)-glyceraldehyde?

CHO
H—OH
CH₂OH
(I)

CH₂OH
H‴—CHO
HO
(II)

CHO
HOH₂C‴—OH
H
(III)

HO   H
HOH₂C—CHO
(IV)
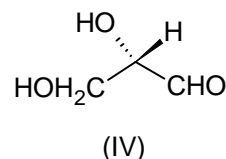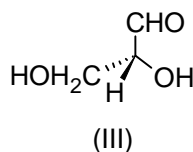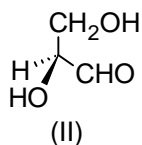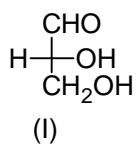
A)   (I) only
B)   (II) and (III) only
C)   (I) and (III) only
D)   (IV) only

30. The IUPAC name of the following compound is

CHO Cl   OH

A)   (2Z, 4R,6R)- 4-Chloro-6-hydroxy-2-metthylhept-2-enal
B)   (2E, 4S,6R)- 4-Chloro-6-hydroxy-2-metthylhept-2-enal
C)   (2E, 4R,6S)- 4-Chloro-6-hydroxy-2-metthylhept-2-enal
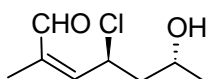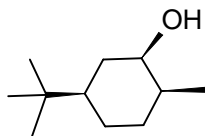D)   (2Z, 4S,6R)- 4-Chloro-6-hydroxy-2-metthylhept-2-enal

31. The most stable conformation of the following molecule is

OH

A)   t-butyl and methyl equatorial, hydroxyl group axial
B)   t-butyl and hydroxyl group axial, methyl equatorial
C)   All equatorial
D)   t-butyl axial, methyl and hydroxyl group equatorial

32. Which among the following statements is correct regarding the reaction?

O
DIBALH
→

OH
(I)

+

OH
(II)
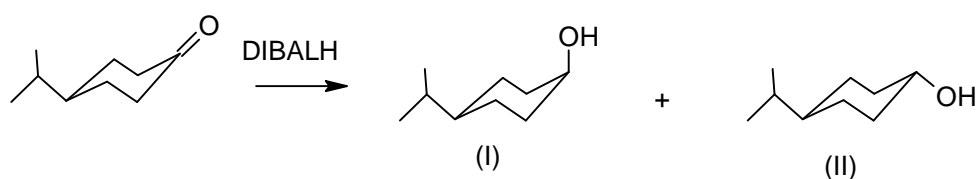
A)   It is a stereospecific reaction and only (I) is formed
B)   It is a stereospecific reaction and only (II) is formed
C)   It is a stereoselective reaction and (I) is the major product
D)   It is a stereoselective reaction and (II) is the major product

33. The following photochemical reaction proceeds through

O H

H
hv
→

O
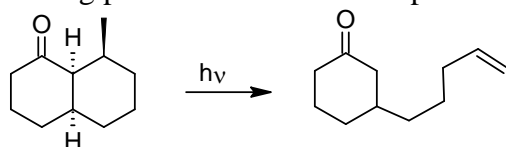
A)   Paterno- Buchi reaction   B)   Norrish Type I reaction
C)   Norrish Type II reaction   D)   Barton reaction

34. The major products X and Y formed in the following photochemical reactions are

A) (X) =   (Y) =   B) (X) = (Y) =

C) (X) =   (Y) =   D) (X) = (Y) =
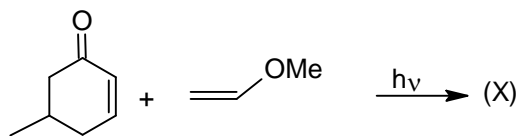
35. The correct statement for the following reaction is

(X)   (Y)
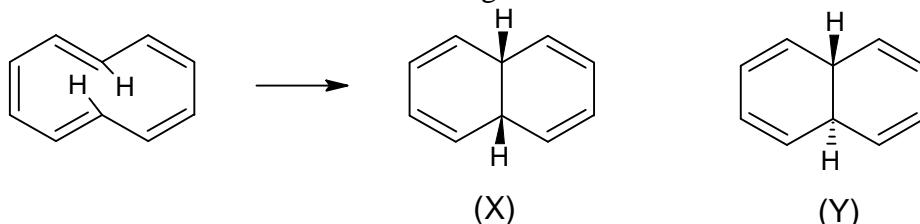
A)   X is formed by thermal conrotatory & Y by photochemical disrotatory ring closure
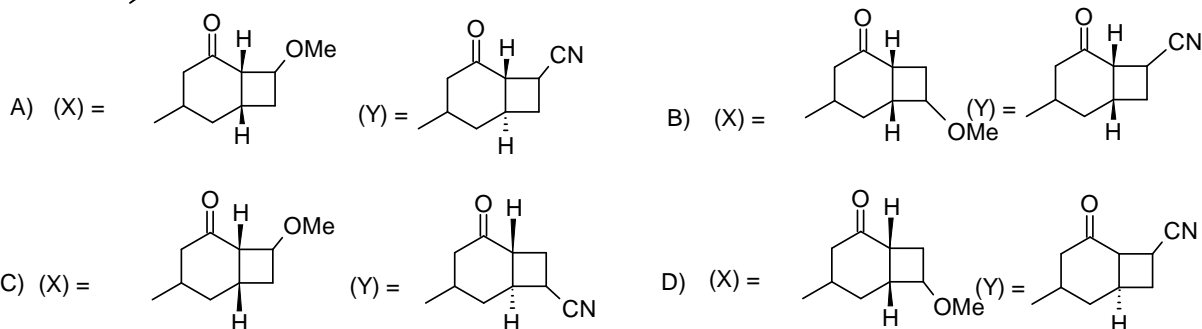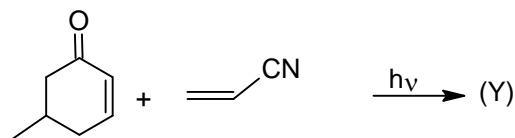B)   X is formed by photochemical conrotatory & Y by thermal disrotatory ring closure
C)   X is formed by thermal disrotatory & Y by photochemical conrotatory ring closure
D)   Both X and Y are formed by photochemical disrotatory ring closure.

36. The correct statements regarding the reaction
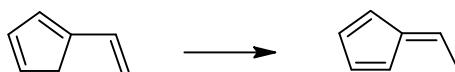
I.   It is a [1,7]H shift
II.   It is a [1,5]H shift
III.   It occurs by thermal antarafacial H shift
IV.   It occurs by photochemical suprafacial H shift

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

8
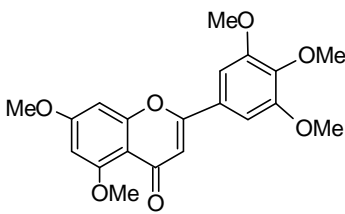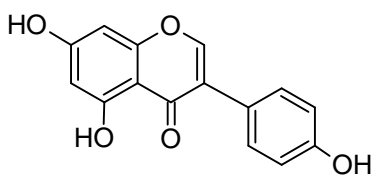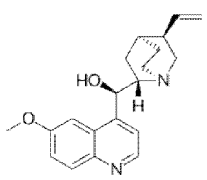
37. The structure of alpha pinene is

A)

B)

C)

D)
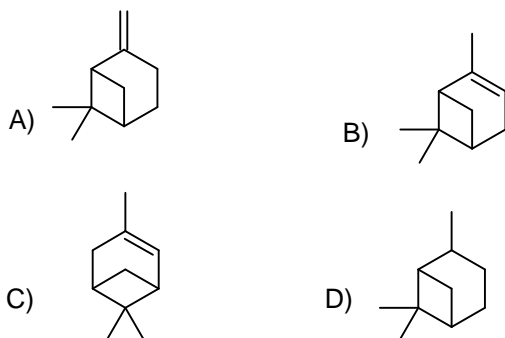
38. Match the following Structures in column I with the type of compounds in column II

Column I	Column II
a)	i) lipid
b)	ii) alkaloid
c)	iii) flavone
d)	iv) Isoflavone

A)   a - ii, b – iii, c – iv, d – i   B)   a - ii, b – iv, c – i, d – iii
C)   a - iv, b – iii, c – i, d – ii   D)   a - iii, b – iv, c – ii, d – i

39. The cofactor which is responsible for transfer of CO_2 in carboxylase enzymes is
A)   Vitamin B_{12} B)   Vitamin C   C)   Biotin   D)   Vitamin E

40. Which among the following is the wrong statement regarding the base pairs in nucleic acids?
A)   Adenine is paired by thymine in DNA
B)   Cytosine is paired by guanine in RNA
C)   Guanine is paired by cytosine in DNA
D)   Thymine is paired by adenine in RNA

41. The miller indices of a plane parallel to the crystallographic 'a' and 'b' axes and cuts the c–axis at unit distance is
A) 100 B) 110 C) 001 D) 010

42. CsCl has an interpenetrating simple cubic lattice. The co-ordination number of Cs^+ and Cl^- ions are respectively
A) 8 and 8 B) 6 and 6 C) 4 and 4 D) 8 and 4

43. The type of liquid crystals used to measure skin temperature is
A) Nematic B) Cholesteric C) Smectic D) Lyotropic

44. Which among the following is incorrect regarding thermal conductivity of a gas?
A) Thermal conductivity is directly proportional to its average velocity
B) Thermal conductivity is directly proportional to molar concentration
C) Thermal conductivity is directly proportional to heat capacity (Cv)
D) Thermal conductivity is inversely proportional to mean free path

45. Which among the following are correct for a spontaneous process?
I) $dS_{U,V} > 0$ **II)** $dU_{S,V} < 0$ **III)** $dS_{H,P} > 0$ **IV)** $dH_{S,P} > 0$ **V)** $dG_{T,P} < 0$

A) I and III only B) I, II, III and V only
C) I, II, III and IV only D) All of these

46. Match the following relations in column I with column II

Column I	Column II
a) $\left(\frac{\partial T}{\partial P}\right)_S = \left(\frac{\partial V}{\partial S}\right)_P$	i) Joule Thomson coefficient
b) $\left(\frac{\partial}{\partial T}\frac{\Delta G}{T}\right)_P = -\frac{\Delta H}{T^2}$	ii) Maxwell relation
c) $\left(\frac{\partial T}{\partial P}\right)_H = \mu$	iii) Duhem- Margules equation
d) $\left(\frac{dlnP_A}{dlnX_A}\right)_{T,P} = \left(\frac{dlnP_B}{dlnX_B}\right)_{T,P}$	iv) Gibbs-Helmholtz equation

A) a – ii, b – iv, c – i, d – iii B) a – ii, b – i, c – iv, d – iii
C) a – i, b – ii, c – iv, d – iii D) a – iv, b – i, c – ii, d – iii

47. The number of components (c) and phases (p) present when calcium carbonate is heated in a closed container are
A) c = 2, p = 2 B) c = 3, p = 2 C) c = 2, p = 3 D) c = 1, p = 3

48. The expression for pressure in terms of canonical partition function $Q = \frac{q^N}{N!}$ is
A) $-kTlnQ - kT(1- lnN_A)$ B) $kT\left(\frac{\partial lnQ}{\partial V}\right)_T$

C) $kT^2\left(\frac{\partial lnQ}{\partial T}\right)_{P,N}$ D) $kT^2\left(\frac{\partial lnQ}{\partial T}\right)_{V,N}$

49. Thermal decomposition of compound A is a first order reaction. If 75% of A is decomposed in 50 min, how long will it take for 94% of the compound to decompose?
A) 90 min   B) 75 min   C) 125 min   D) 100 min

50. The ionic strength of 0.2 molal $FeCl_3$ solution is
A) 0.6   B) 0.8   C) 1.0   D) 1.2

51. The first successful explanation of unimolecular reactions was given by the Scientist
A) Arrhenius   B) Eyring   C) Lindmann   D) Gottingen

52. The temperature dependence of the rate constant of a second-order reaction is given by
$\log k = -3140/T + 11$
The Arrhenius parameters 'A' and 'E_a' for the reaction are respectively

A) $1 \times 10^{11} s^{-1}$, 60 kJmol^{-1}

B) $1 \times 10^{11} s^{-1}$, - 60 kJmol^{-1}

C) $2 \times 10^{11} s^{-1}$, 26 kJmol^{-1}

D) $e^{11} s^{-1}$, -26 kJmol^{-1}

53. Match the following equations in Column I with the respective names in Column II

Column I

a) $\Delta_{solv}G^{\circ} = \frac{z_i^2 e^2 N_A}{8\pi\epsilon_0 r_1}\left(1 - \frac{1}{\epsilon_r}\right)$

b) $\log\gamma_{\pm} = -|z_+z_-|AI^{\frac{1}{2}}$

c) $\Lambda = \Lambda_0 - (A + B\Lambda_0)\sqrt{c}$

Column II

i) Debye- Huckel limiting law

ii) Onsager equation

iii) Born equation

A) a - ii, b – i, c - iii   B) a – iii, b – ii, c – i
C) a – iii, b – i, c – ii   D) a – i, b – iii, c – ii

54. The Nernst equation $E = E^{\circ} - \frac{RT}{nF}\ln Q$ indicates that the equilibrium constant K will be equal to Q when
A) $E = E^{\circ}$ B) $\frac{RT}{nF} = 1$ C) $E^{\circ} = 1$ D) E = zero

55. The values of emf of the following three galvanic cells
I. Zn | Zn^{2+}(a = 1) || Cu^{2+} (a = 1) | Cu
II. Zn | Zn^{2+}(a = 0.1) || Cu^{2+} (a = 1) | Cu
III. Zn | Zn^{2+}(a = 1) || Cu^{2+} (a = 0.1) | Cu
are represented by E_1, E_2, and E_3. Then which of the following statement is true?

A) $E_1 > E_2 > E_3$ B) $E_3 > E_2 > E_1$ C) $E_3 > E_1 > E_2$ D) $E_2 > E_1 > E_3$

56. The enthalpy of formation and free energy of formation of water at 298K are -285 kJ mol^{-1} and 237 kJ mol^{-1} respectively. The efficiency of hydrogen-oxygen fuel cell is
   A)   93%   B)   83%   C)   100%   D)   60%

57. Which of the following statements is true?
   A)   When n =1, BET isotherm reduces to Freundlich isotherm
   B)   When n =1, BET isotherm reduces to Langmuir isotherm
   C)   When n = 2, BET isotherm reduces to Langmuir isotherm
   D)   When n = 2, BET isotherm reduces to Freundlich isotherm

58. Which of the following represents a gel?
   A)   Solid dispersed in liquid   B)   Solid dispersed in gas
   C)   Liquid dispersed in solid   D)   Liquid dispersed in liquid

59. Emission of a second electron after high energy radiation has expelled an electron, is called
   A)   ESCA   B)   Auger effect   C)   SEM   D)   PES

60. Which among the following statements is **not** true?
   A)   Enzymes are essentially proteins responsible for reactions in living organism
   B)   The catalyst changes the rates of both forward and backward reactions
   C)   A catalyst lowers the free energy of activation of the reaction
   D)   A catalyst alters the value of equilibrium constant of the reaction

61. Which of the following is an eigen function of the operator $\hat{P}_x$?
   A) e^{ikx} B) xe^{ikx} C) $x^2 + 2x$ D) e^{ikx^2}

62. The energy of a particle in a 3D cubic box of side length L is $14\ h^2/8mL^2$. The degeneracy of the state is
   A)   4   B)   2   C)   6   D)   3

63. The ground term symbol of V^{2+} is
   A) $^4F_{\frac{3}{2}}$ B) $^4D_{\frac{3}{2}}$ C) $^4F_{\frac{9}{2}}$ D) $^4D_{\frac{1}{2}}$

64. According to variation principle, the energy E evaluated using a trial wave function will be related to the ground state energy
   A) $E \leq E_0$ B) $E = E_0$ C) $E \geq E_0$ D) $E \neq E_0$

65. Which among the following statements regarding CO are correct?

   I.   In CO the HOMO is σ which is largely non bonding and is located on C atom.
   II.   In CO the HOMO is π which is largely non- bonding and is located on C atom.
   III.   In CO the LUMO is doubly degenerate anti bonding π.
   IV.   In CO the negative end of the dipole is on the carbon atom even though it is less electro negative.

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

66. Match the following:

Column I-Hybridization		Column II - molecules	
a)	sp^3	i)	SF_4
b)	dsp^2	ii)	XeF_4
c)	sp^3d	iii)	$[Ni(CN_4)]^{2-}$
d)	sp^3d^2	iv)	XeO_3

A) a – iv, b – iii, c – i, d – ii   B) a – ii, b – iii, c – iv, d – i

C) a – iii, b – iv, c – i, d – ii   D) a – iv, b – i, c – ii, d – iii

67. The third Hermite polynomial is

A) 1   B) $4\xi^2$ C) 2ξ D) $4\xi^2$-2

68. According to Huckel MO treatment the six π-MO energies of benzene are given by $\alpha \pm 2\beta$ and $\alpha \pm \beta$ twice. The delocalization energy of benzene is

A) -2β B) 2β C) β D) 4β

69. The point group of 1, 3, 5- tribromobenzene is

A) C_{3V} B) C_{3h} C) D_{3d} D) D_{3h}

70. Molecules falling in which of the point groups possess a permanent dipole moment

A) C_n, C_s, C_{nv} B) C_{nv}, C_s, C_i C) C_s, C_{nh}, C_{nv} D) C, C_s, D_{nh}

71. Which among the following statements is /are correct

I. The number of irreducible representations is equal to the number of classes of symmetry operations in a point group.

II. In a given representation characters of all matrices belonging to operations in the same class are identical.

III. The irreducible representations contained in any point group are always of one dimension.

IV. All point groups contain a totally symmetric one dimensional irreducible representation.

A) I only   B) I and IV only

C) I, II and IV only   D) I and III only

72. The product of $\sigma_{xy} \times \sigma_{xz}$ is equal to

A) σ_{yz} B) $C_{2(x)}$ C) $C_{2(y)}$ D) $C_{2(z)}$

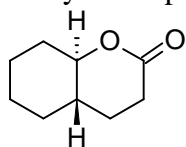73. Which among the following molecules is/are both microwave and IR inactive?
CO_2, H_2, HCl, CH_4, SF_6

A) H_2, CH_4 & SF_6 B) CO_2, H_2

C) H_2, HCl   D) H_2

74. The first four vibrational levels of HI molecule are respectively 1145 cm^{-1}, 3375 cm^{-1}, 5526 cm^{-1} and 7597 cm^{-1}. The fundamental and first overtone will appear respectively at:

A) 2290 cm^{-1} and 4381 cm^{-1} B) 3375 cm^{-1} and 7597 cm^{-1}

C) 2230 cm^{-1} and 4381 cm^{-1} D) 2230 cm^{-1}and 6452 cm^{-1}

75. g-value of odd electron species is determined by
    A) Rotational spectra   B) Raman spectra
    C) NMR spectra   D) ESR spectra

76. Fine structure in ESR spectra is observed due to
    A) Interaction of electron spin with nuclear spin
    B) Electron spin - spin coupling in species having more than one electron
    C) Nuclear spin – spin coupling
    D) Both A and C

77. In the IR spectrum, carbonyl absorption band for the following compound appears at

    A) 1810 cm^{-1} B) 1770 cm^{-1} C) 1730 cm^{-1} D) 1690 cm^{-1}

78. Which among the following molecules show maximum value for λ_{max} in UV region

    A)

    B)

    C)

    D)
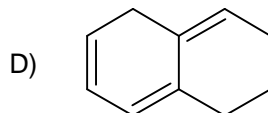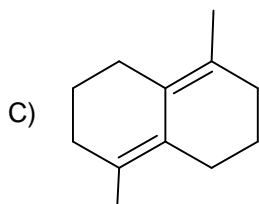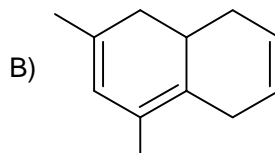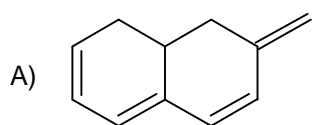
79. The number of ^{13}C NMR signals obtained in the following three compounds are:

    a

    b

    c
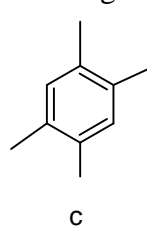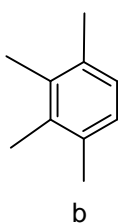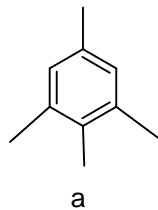
    A) a – 3, b – 5, c – 4   B) a – 5, b – 4, c – 3
    C) a – 7, b – 5, c – 4   D) a – 7, b – 5, c – 3

80. The recoil energy of a nucleus of mass m emitting a gamma ray of energy $E\gamma$ is given by

    A) $R = \dfrac{E_\gamma^2}{2mc^2}$ B) $R = \dfrac{E_\gamma}{2mc^2}$ C) $R = \dfrac{E_\gamma^2}{2mc}$ D) $R = \dfrac{E_\gamma}{2mc}$

81. Which among the following is false with respect to instrument errors?
   A) They may arise due to the use of glassware at a temperature that differs significantly from the calibration temperature.
   B) They may emerge as the voltage of a battery-operated power supply of an instrument decreases with use.
   C) The non-ideal chemical or physical behaviour of the reagents and reactions on which an analysis is based often introduces these errors.
   D) Pipettes and volumetric flasks may deliver volumes slightly different from those indicated by their graduations.

82. If the area beneath a Gaussian curve for a population is 68.3%, it corresponds to area within
   A) one standard deviation ($\pm\sigma$) deviation of the mean μ.
   B) two standard deviation ($\pm2\sigma$) deviation of the mean μ.
   C) three standard deviation ($\pm3\sigma$) deviation of the mean μ.
   D) five standard deviation ($\pm5\sigma$) deviation of the mean μ.

83. Which among the following is not used as a metal ion indicator?
   A) Calmagite   B) Eriochrome black T
   C) Murexide   D) Bromothymol blue

84. Which among the following is/are incorrect to get precipitates in gravimetric analysis?
   I. Precipitation is to be carried out in hot solutions.
   II. Precipitation is to be done in concentrated solutions by adding the reagent slowly.
   III. Large excess of reagent should be added for complete precipitation of the species.
   IV. Masking agents are needed to prevent unwanted ions from getting precipitated.

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

85. The distribution coefficient of an alkaloid between chloroform and water is 20.0. If a 100 mL solution containing 1g of alkaloid was extracted with two successive 50 mL quantities of chloroform, the amount of alkaloid remaining unextracted is:
   A) 0.0083 g   B) 0.0166 g   C) 0.05 g   D) 0.00083 g

86. The effectiveness of a column in chromatographic separation is measured by
   A) Plate height   B) length of the column
   C) Number of theoretical plates D) retention time

87. Solubility product of $CaSO_4$, $CaCO_3$, $Ca(OH)_2$ and $CaCl_2$ are respectively 2.4×10^{-5}, 4.5×10^{-9}, 6.5×10^{-6} and 1.57×10^{-3}. Which reagent would you chose to estimate Ca^{2+} from its aqueous solution gravimetrically?
   A) Sodium sulphate solution   B) Sodium carbonate solution
   C) Sodium hydroxide solution   D) Sodium chloride solution

88. DNA sequencing is usually done by
   A) HPLC   B) GC- MS
   C) Gel – electrophoresis   D) Ion exchange chromatography

89. When a monochromatic beam of light of wavelength 630 nm is passed through a sample solution in cell 1cm thick the transmittance is 50%. If the same beam passes through the sample solution in a cell of 2 cm thickness, the intensity of transmitted light will be:
A) 0.0   B) 0.25   C) 0.3   D) 0.5

90. Which among the following factors affect phosphorimetric analysis?
A) Dissolved oxygen   B) Temperature
C) pH   D) All the above

91. Which among the following is/are true with respect to flame atomic emission spectroscopy?
I. A high concentration of calcium in a sample can produce a band emission from $Ca(OH)_2$ causing blank interference
II. The presence of phosphate in a sample will not alter the atomic concentration of calcium and will not influence the volatilization of the sample
III. Ionisation suppressants containing elements such as potassium or caesium can eliminate ionization interference
A) I, II and III only   B) I and III only
C) I and II only   D) I only

92. Scattering radiation by colloidal particles is used in which of the spectroscopic analytical method
A) AAS   B) Turbidimetry C) Nephelometry D) Both B and C

93. A glass electrode can be used to measure the pH value of solutions having pH values in the range
A) 0 to 14   B) -1 to 12   C) 0 to 12   D) – 1 to 14

94. The electrochemical technique in which a controlled current, usually a constant current, is caused to flow between two electrodes; the potential of one electrode, is monitored as a function of time with respect to a suitable reference electrode, is known as
A) Cyclic voltammetry   B) Amperometry
C) Electrogravimetry   D) Chronopotentiometry

95. Which among the following curves represent the conductometric precipitation titration of $AgNO_3$ solution against NaCl solution?
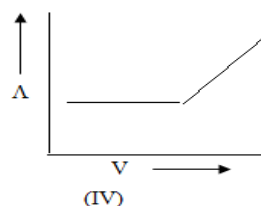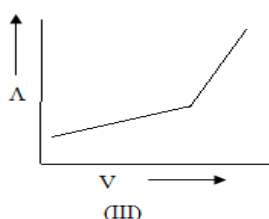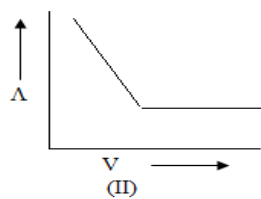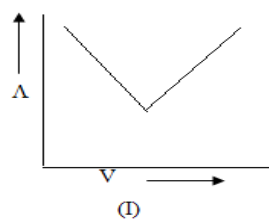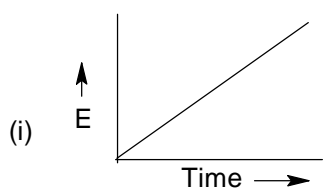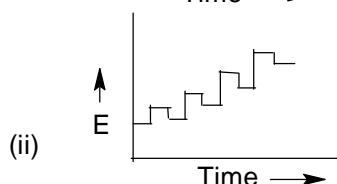

A) I   B) II   C) III   D) IV

96.   Match the following graphs with the corresponding type of voltammetry:
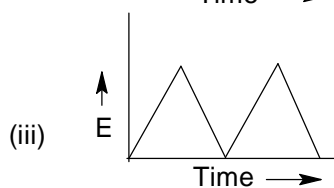
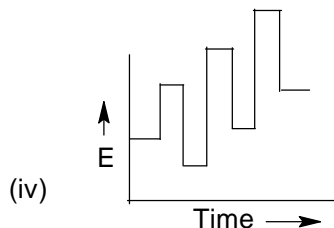| Column I-Wave forms	Column II-Type of Voltammetry
(i)	a) cyclic voltammetry
(ii)	b) Square wave voltammetry
(iii)	c) Differential pulse polarography
(iv)	d) polarography

A)   (i)–d, (ii)–c, (iii)–a, (iv)– b   B)   (i) – b, (ii) – c, (iii) – d, (iv) – a
C)   (i)–d, (ii) - a, (iii)–c, (iv) –b   D)   (i) – d, (ii) – c, (iii) – b, (iv) – a

97.   In thermometric titrations, during each portion of the titrant added, the property measured is
 A)   Free energy   B)   Enthalpy   C)   Temperature   D)   Heat change

98.   Glass transition temperature of a substance can be determined by
A)   TG   B)   DTA   C)   DSC   D)   All the above

99.   In neutron activation analysis the induced radioactivity of the sample is monitored by measuring
A) α – emission   B) β –emission
C)   positron emission   D) γ – emission

100.   Match the following radiation quantities and units:

Column I	Column II
a) rem	(i) 3.7×10^{10} dps
b) sievert	(ii) 100 erg/g
c) curie	(iii) 1dps
d) becquerel	(iv) 1J/kg

A)   a – ii, b – iii, c – i, d – iv   B)   a – ii, b – iv, c – i, d – iii
C)   a – iii, b – ii, c – i, d – iv   D)   a – iv, b – iii, c – ii, d – i

101. Which among the following reactions is least atom economic in nature?
    A) Wittig Reaction
    B) Diels–Alder Reaction
    C) Photo Fries Rearrangement
    D) Claisen Rearrangement

102. Which of the following one is not an ozone layer depleting substance?
    A) Freon
    B) Teflon
    C) Methyl bromide
    D) Carbon tetrachloride

103. Which is true with respect to a Phase Transfer Catalyst (PTC)?
    A) A PTC has an appropriate hydrophilic/lipophilic balance to enable it to have compatibility with water/organic phases, which is the most common system encountered.
    B) PTC catalysed reactions are often very slow, one reason being that anions in the organic phase have very high water molecules associated, making them highly reactive through increase inactivation energy.
    C) Since the organic layer is mixed with the water-soluble contaminants, it cannot be simply decanted off and thus product separation is often difficult, resulting in large amount of waste.
    D) Because of higher activation energy, the reactions using PTC can be run only at higher temperatures, which may increase by-product formation.

104. Nitrile hydratase is a biocatalyst used in
    A) the enantioselective reduction of ketones
    B) anaerobic glycerol metabolism
    C) thiamine metabolism
    D) the industrial production of acrylamide from acrylonitrile

105. The characterization of nanomaterials are done by
    A) Scanning tunnelling microscopy
    B) Atomic force microscopy
    C) Scanning probe microscopy
    D) All the above

106. The most common stabilizing material used for gold nanoparticles is
    A) Long chain thio alcohols
    B) Fatty acids
    C) Nitro alkanes
    D) None of the above

107. Quantum cascade (QC) lasers are constructed from which of the following materials
    I) GaAs, **II**) AlAs **III**) ZnS **IV**) InAs

    A) I and III only
    B) III only
    C) I, II and IV only
    D) All of these

108. In class I inorganic-organic nanocomposite materials the type of bond between organic and inorganic phases is/are:
    A) Ionic
    B) Covalent
    C) Weak electrostatic interactions
    D) All the above

109. The main reaction cycle of ozone formation in the middle atmosphere is called
    A)   Calvin cycle   B)   Chapman cycle
    C)   Schonbein cycle   D)   Rowland cycle

110. Catalytic converters used for the control of car exhaust emissions are made up of
    A)   silica and magnesium oxide   B)   platinum, palladium and rhodium
    C)   lead tetra ethyl   D)   manganese pentacarbonyl dimer

111. The amount of oxygen needed (i.e., demanded) by aerobic biological organisms to break down organic material present in a given water sample at certain temperature over a specific time period is known as
    A)   BOD   B)   COD   C)   DO   D)   Both A and B

112. As the acidity of soil increases the fertility of soil decreases due to
    A)   Deficiency of potassium   B)   Deficiency of calcium
    C)   Aluminium excess   D)   All the above

113. Which of the following polymers involve cross linkages?
    A)   Bakelite   B)   Vulcanized rubber
    C)   Nylon 6   D)   Both A and B

114. Match the following polymerisation methods with the respective examples:
    Type of polymerization   **Example**

    a) Radical addition   i) polyacrylonitrile
            polymerization
    b) Cationic addition   ii) polythene
            polymerization
    c) Anionic addition   iii) Nylon 66
            polymerization
    d) Condensation   iv) butyl rubber
            polymerization

    A)   a – ii, b – iii, c – i, d – iv   B)   a – ii, b – iv, c – i, d – iii
    C)   a – iii, b – i, c – iv, d – ii   D)   a – iv, b – iii, c – ii, d – i

115. The electrical conductance of polyacetylene can be increased by doping it with
    A) $SrCl_2$ B)   Iodine   C)   Copper oxide   D)   Zinc oxide

116. Ziegler – Natta catalytic polymerization of propene gives polypropene with stereochemistry
    A)   Isotactic   B)   Syndiotactic   C)   Atactic   D)   Both B and C

117. Paraquat poisoning causes:

    A)   Renal failure   B)   Cardiac failure
    C)   Respiratory failure   D)   Multiple organ failure

118. The correct structure of paracetamol is:

A)

B)

C)

D)
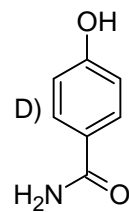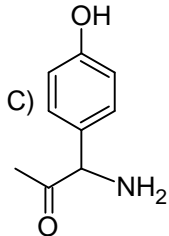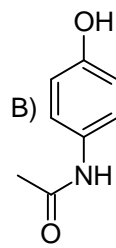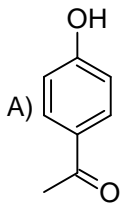
119. The source of arsenic contamination in water is:
   A) Industrial waste   B) Fertilizers
   C) Phosphate rocks   D) All of the above

120. The sedative drug which is a urea derivative is
   A) Morphine   B) Equanil   C) Phenobarbital   D) Heroin

_____