PART–A

1. Fill the blank with the correct idiom/phrase
That boy from the town was a ____ in the sleepy village.
A) Dog out of herd
B) Sheep from the heap
C) Fish out of water
D) Bird from the flock

2. Choose the most appropriate pair of words from the options given below to complete the following sentence.
She could not ____the thought of ____the election to her bitter rival.
A) bear, loosing
B) bare, loosing
C) bear, losing
D) bare, losing

3. 'Advice' is _____.
A) A verb
B) A noun
C) An adjective
D) Both a verb and a noun

4. Choose the most appropriate phrase from the options given below to complete the following sentence.
The aircraft _____take off as soon as its flight plant was filed.
A) is allowed to
B) will be allowed to
C) was allowed to
D) has been allowed to

5. Select the most suitable synonym for the word SIMULATE.
A) Accumulate
B) Smile
C) Pretend
D) Gamble

6. Select the most suitable synonym for the word PANACEA.
A) Wonder
B) Elixir
C) Placebo
D) Honey

7. Select the most suitable antonym for the word CRUDE
A) Cruel
B) Sophisticated
C) Malevolent
D) Primeval

8. Select the most suitable antonym for the word HAPHAZARD.
A) Cumbersome
B) Concocted
C) Orderly
D) Zigzag

9. Select the pair which shows the same relationship as POLYMER : CELL
A) Coin : Money
B) Food : Wheat
C) Chain : Link
D) Fibre : Plastic

10. Choose the most appropriate preposition to complete the sentence:
He is a traitor _____ the country.
A) for
B) to
C) in
D) of

11. Which one of the following elements is essential for the formation of chlorophyll in green plants?
A) Calcium
B) Iron
C) Magnesium
D) Potassium

12. Which one of the following is a true fish as per the biological system of classification?
A) Silver flsh
B) Jelly fish
C) Cuttle fish
D) Flying fish

13. Bright light is found to emit from photographer's flashgun. This brightness is due to the presence of which one of the following noble gases?
A) Argon B) Xenon
C) Neon D) Helium

14. Which of the following National Parks of India are declared as World Heritage by UNESCO?
A) Keoladeo National Park B) Sundarbans National Park
C) Kaziranga National Park D) Ranthambore National Park

15. Cooking gas is a mixture of
A) Carbon monoxide and carbon dioxide B) Butane and propane
C) Carbon dioxide and oxygen D) Methane and ethylene

16. Find the odd man out:
A) 6V12 B) 2H4
C) 9F18 D) 3R6

17. For how many times, the hands of a clock are at right angles in a day ?
A) 24 B) 22
C) 44 D) 48

18. Find the missing term 97:89 :: 43: …?
A) 37 B) 31
C) 39 D) 41

19. The value of one US dollar is 65 Indian Rupees today, compared to 60 last year. The Indian Rupee has ____.
A) Depressed B) Depreciated
C) Appreciated D) Stabilized

20. 25 persons are in a room. 15 of them play hockey, 17 of them play football and 10 of them play both hockey and football. Then the number of persons playing neither hockey nor football is:
A) 2 B) 17
C) 13 D) 3

21. By selling an item for Rs. 198, Souvik made a loss of 12%. By how much should he have raised the price to make a profit of 8%?
A) Rs.25 B) Rs.55
C) Rs.44 D) Rs.45

22. A person who is the husband of my son's sister is my ___.
A) Nephew B) Son – in – Law
C) Son D) Brother

23. Ram and Ramesh appeared in an interview for two vacancies in the same department. The probabilities of Ram's selection is 1/6 and that of Ramesh is 1/8. What is probability that only one of them will be selected?
A) 47/48 B) 1/4 C) 13/48 D) 35/48

24. A is the father of B. C is the son of D. E is the brother of C while D is the sister of B. How is B related to E?
A) Uncle B) Aunt
C) Mother D) Either A or B

25. What will be next leap year after 2096?
A) 2100 B) 2101
C) 2104 D) 2108

PART–B

26. Which of the following is not a chelating agent?
    A) Pyridine
    B) en
    C) EDTA
    D) Oxalate

27. Theoretical magnetic moment for Eu^{3+} should be
    A) 0
    B) 1.83
    C) 6.9
    D) 4.9

28. Which statement is incorrect about CO ligands?
    A) A CO ligand can accept electrons into its π^* MO; this weakens the C–O bond.
    B) The IR spectrum of Fe(CO)5, absorptions assigned to the CO stretching modes are at higher wavenumber than that of free CO.
    C) CO ligands can adopt terminal, μ and μ3 bonding modes; the amount of back donation depends on the bonding mode.
    D) Fluxional behaviour is common in metal carbonyl compounds, and can be investigated by ^{13}C NMR spectroscopy

29. Which metal centre does not obey the 18-electron rule?
    A) Fe in $Fe(\eta^5\text{-}C_5H_4COMe)_2$
    B) Co in $Co_2(CO)_8$
    C) Ru in $[Ru(\eta^6\text{-}C_6Me_6)_2]^{2+}$
    D) V in $V(CO)_6$

30. Dimethylglyoxime (DMG) is used as a spot-test reagent for the confirmatory test of which cation?
    A) Pt^{4+}
    B) K^+
    C) Zn^{2+}
    D) Ni^{2+}

31. The electronic ground state of term for the chromium in $[Cr(CN)_6]^{4-}$ is:
    A) ^3H
    B) ^5D
    C) ^3F
    D) ^3G

32. The complex that is more likely to deviate from spin-only magnetic moment is:
    A) $[CrCl_6]^{4-}$
    B) $[Co(H_2O)_6]^{2+}$
    C) $KMnO_4$
    D) $[Ni(NH_3)_6]^{2+}$

33. The shape of BrF_3 should be:
    A) T-Shaped
    B) Pyramidal
    C) Trigonalbipyramidal
    D) See-Saw

34. The solubility product of AgCl = 1.56×10^{-10}. If the equal volumes of 50 µM $AgNO_3$ and 50 µM HCl are mixed together, which one of the following is correct?
    A) Precipitate of AgClwill be formed
    B) Precipitate of AgCl should not be formed
    C) No reaction will take place
    D) Solubility product of AgCl will change

35. Born-Lande equation is used for:
    A) To calculate enthalpy of sublimation
    B) To estimate theoretically the lattice energy
    C) Experimental determination of lattice energy
    D) To determine the nature of bond

36. The crystal field stabilization energy of $[Co(NH_3)_6]^{2+}$ should be (Δo is octahedral splitting energy and P is pairing energy):

A) $-1.8\ \Delta o + 3P$ B) $-0.8\ \Delta o + 1P$
C) $-0.8\ \Delta o$ D) $-1.8\ \Delta o + 2P$

37. Among the given boranes and heteroboranes, the "arachno" type is which one:

A) B_6H_{10} B) $[C_2B_9H_{11}]^{2-}$
C) $B_5H_8^-$ D) $GeC_2B_9H_{11}$

38. Which one is not a greenhouse gas:

A) O_2 B) CO_2
C) CH_4 D) O_3

39. Rutherford's experiment established that:

A) Inside the atom there are positive centres immersed in sea of electron
B) Nucleus contains proton, neutron and mesons
C) Most of the space in an atom is empty
D) All A), B) & C)

40. The correct electronic configuration and magnetic moment of Gd^{3+} is:

A) [Xe] $4f^7$ and 7.9 BM
B) [Xe] $4f^6$ and 8.9 BM
C) [Xe] $5f^7$ and 7.9 BM
D) [Xe] $4f^9$ and 11.9 BM

41. Which of the following correctly describes the trends in values of Pauling electronegativities (χP)?

A) F > Cl > Br > I B) F < Cl < Br = I
C) F = Cl < I > Br D) F > Cl = Br > I

42. Hypochlorous acid and perchloric acid are, respectively:

A) HOCl and $HClO_4$ B) HOCl and $HClO_3$
C) $HClO_2$ and $HClO_3$ D) $HClO_2$ and $HClO_4$

43. The relationship between dissociation energy of O_2, O_2^{2-} and O_2^- is:

A) $O_2 > O_2^- > O_2^{2-}$ B) $O_2 < O_2^- < O_2^{2-}$
C) $O_2 = O_2^- > O_2^{2-}$ D) $O_2 = O_2^{2-} > O_2^-$

44. Which of the following represent the typical non-metal and metal combination?

A) B, Al B) Al, Cu
C) Ga, Ni D) Al, Fe

45. Which of the following is most volatile?

A) CH_4 B) SnH_4
C) GeH_4 D) SiH_4

46. The correct way to mix an acid and water is:

A) Add slowly acid to the water
B) Pour the acid to water
C) Water should be drop by drop added to acid
D) Does not matter how they are mixed

47. The electron pairing energy will be lowest for:

A) Nickel B) Iron
C) Palladium D) Platinum

48. The intense purple colour of the $KMnO_4$ solutions is due to:
A) Spin allowed d-d transition
B) Laporte allowed d-d transition
C) Ligand-to-metal charge transfer transitions
D) Metal-to-ligand charge transfer transition

49. Which one is most reactive towards water?
A) Cl_2 B) F_2
C) Br_2 D) I_2

50. A stable oxidation state of +4 is shown by which of the following?
A) La B) Ce
C) Yb D) Sm

51. Which of the following gas will have the lowest rate of diffusion?
A) H_2 B) N_2
C) F_2 D) O_2

52. The compressibility factor (z) for an ideal gas is
A) Zero B) > 1
C) < 1 D) 1

53. The root mean square velocity of a certain gas at 27°C is x m sec^{-1}. Its root mean square velocity at 927°C is:
A) $x/2$ m sec^{-1} B) $2x$ m sec^{-1}
C) $3x$ m sec^{-1} D) $4x$ m sec^{-1}

54. For a liquid ΔH_{vap} = 9325 J mol^{-1}. The ΔS during boiling at 100°C at 1atm pressure is:
A) 15 J k^{-1} mol^{-1} B) 25J k^{-1} mol^{-1}
C) 46.63J k^{-1} mol^{-1} D) 93.25J k^{-1} mol^{-1}

55. Work done in a free expansion process is
A) Zero B) Minimum
C) Maximum D) Positive

56. At 27 C° the value of K_p *is* 10^{-5} for the equilibrium $CO_2 + H_2 \rightleftharpoons CO + H_2O$. The value of $\Delta G°$ is:
A) ~ 6.8 kJ B) ~12.5 kJ
C) ~ 28.7 kJ D) ~ 57.4 kJ

57. The relation between the equilibrium constants K_p & K_c **is** (terms carry their usual meaning)
A) $K_c = K_p\,(RT)^{\Delta n}$ B) $K_p = K_c\,(RT)^{\Delta n}$
C) $K_p = K_c\,(RT)^{-\Delta n}$ D) $K_c = K_p\,(RT)^{-\Delta n}$

58. The Maxwell's relationship derived from the equation, $dE = TdS - PdV$ is:
A) $\left(\frac{\partial T}{\partial V}\right)_S = -\left(\frac{\partial P}{\partial S}\right)_V$ B) $\left(\frac{\partial P}{\partial V}\right)_T = -\left(\frac{\partial T}{\partial S}\right)_P$
C) $\left(\frac{\partial V}{\partial T}\right)_P = -\left(\frac{\partial S}{\partial P}\right)_T$ D) None of these

59. A crystal with $a = b = c$ and $\alpha = \beta = \gamma \neq 90°$ is

A) Tetragonal B) Trigonal
C) Monoclinic D) Orthorhombic

60. The atomic packing fraction of simple cubic unit cell is

A) 0.52 B) 0.68
C) 0.72 D) 0.78

61. In cubic close packed (*ccp*) structure of a solid, the co-ordination number is:

A) 4 B) 6
C) 8 D) 12

62. The half-life of a first order reaction $A \rightarrow P$ is,

A) $[A]_0/k$ B) $1/(k[A]_0)$
C) $k/0.693$ D) $0.693/k$

63. The adsorption of a gas on a metal is govern by the Langmuir isotherm with equilibrium constant: $K = 0.40\ kPa^{-1}$. Calculate the fractional surface coverage at a pressure of 1 kPa.

A) 0.20 B) 0.40
C) 0.60 D) 0.80

64. If m and $\gamma_{\pm}$ are the molality and mean ionic activity coefficient of the electrolyte Na_2SO_4then the activity of the solution is:

A) $(\gamma\pm m)^3$ B) $2(\gamma\pm m)^3$
C) $3(\gamma\pm m)^3$ D) $4(\gamma\pm m)^3$

65. The number of component for KCl-NaCl-H_2O and KCl-NaBr-H_2O systems are,

A) 1 and 2 B) 3 and 3
C) 3 and 4 D) 4 and 5

66. The molar ionic conductance at infinite dilution of lithium halide (LiX) is found to be 89.2×10^{-4} S m^2 mol^{-1}. If the molar ionic conductance of the Li^+ is 38.7×10^{-4} S m^2 mol^{-1} then the molar ionic conductance of the halide ion is:

A) 25.25×10^{-4} S m^2 mol^{-1} B) 50.5×10^{-4} S m^2 mol^{-1}
C) 63.95×10^{-4} S m^2 mol^{-1} D) 127.9×10^{-4} S m^2 mol^{-1}

67. The molar conductance of solution of an electrolyte is measured in

A) ohm cm mol^{-1} B) ohm^{-1} $cm^{-1}mol^{-1}$
C) ohm $cm^{-1}mol^{-1}$ D) ohm^{-1} cm^2mol^{-1}

68. The formula used for the determination of surface tension (γ) by capillary rise method is (termscarry their usual meaning),

A) $2\gamma = hr\rho g$ B) $\gamma = 2hr\rho g$
C) $2\gamma = hr^2\rho g$ D) $2\gamma = \pi r\rho\cos\theta$

69. The probability that a particle in a 1D box of length L is found to between 0 and $L/2$ is:

A) 0.40 B) 0.50
C) 0.60 D) 0.80

70. Which of the following wavefunctions is well behaved function?

A) $\tan(x^2)$ B) x^2
C) $\exp(x^2)$ D) $\exp(-x^2)$

71. For the hydrogen atom, which of the following statement is correct:

A) 3*s* has the lowest energy B) 3*p* has the lowest energy
C) 3*d* has the lowest energy D) They all have the same energy

72. The number of photons emitted by a 100W yellow lamp in 1 sec is (wavelength of yellow light is 560 nm and posits 100% efficiency)

A) 1.4×10^{20} B) 2.8×10^{20}
C) 5.6×10^{20} D) 8.8×10^{20}

73. Bond length of O_2 molecule can be obtained from,

A) Pure rotational spectra
B) Infra-red spectra
C) Rotational Raman spectra
D) NMR spectra

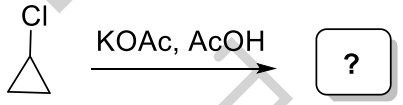
74. How many vibrational degrees of freedom of CO_2 molecule can be detected by IR-spectra?

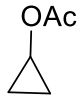
A) 1 B) 2
C) 3 D) 4

75. Which molecule will not show IR spectra?

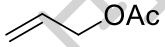
A) CO_2
B) CH_3Cl
C) N_2
D) HCl

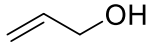
76. The major product in the transformation shown below is:



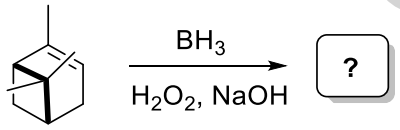
A) 

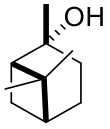
B) 

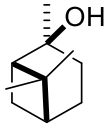
C) 

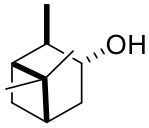
D) 

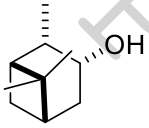
77. The major product in the transformation shown below is:



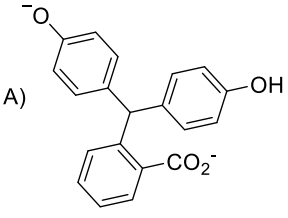
A) 

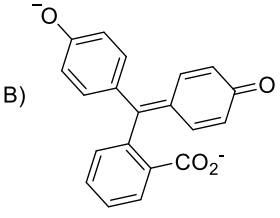
B) 

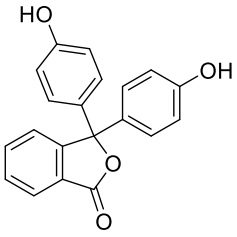
C) 

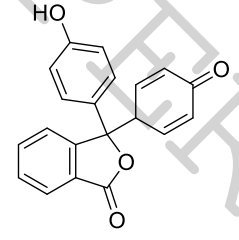
D) 

78. The pink colour of phenolphthalein in alkaline medium is due to the formation of:

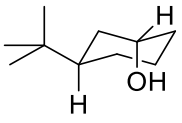
A) 

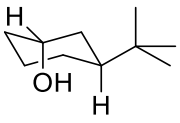
B) 

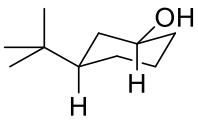
C) 

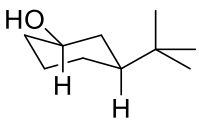
D) 

79. The most stable conformation of (1*S*,3*S*)-3-(*tert*-butyl)cyclohexane-1-ol is represented by:

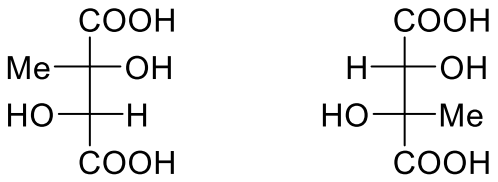
A) 

B) 

C) 

D) 

80. The two compounds **P** and **Q** shown below are:

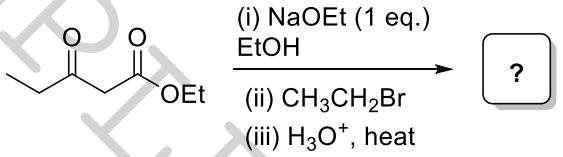


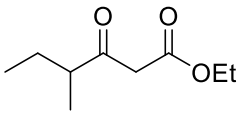
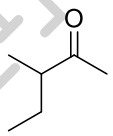
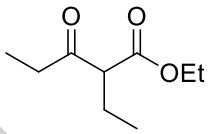
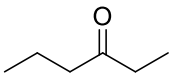
A) Enantiomers
B) Diastereomers
C) Epimers
D) Identical

81. Chemically, Vitamin B_1 is:

A) Thiamine
B) Riboflavin
C) Niacin
D) Cyanocobalamin

82. The major product in the transformation shown below is:

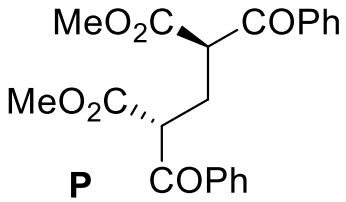


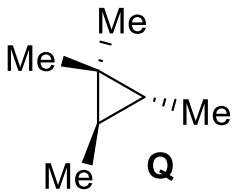
A) 
B) 
C) 
D) 

83. Which of the following is a blood-pressure lowering drug?

A) Chlorpheniramine
B) Methyldopa
C) Ethambutol
D) Metronidazole

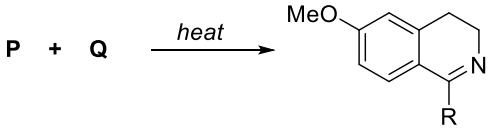
84. Among the two compounds shown below:

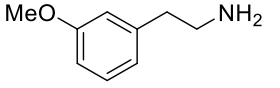
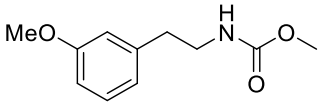
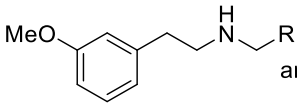
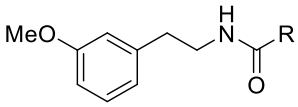

P


Q

A) P is meso and Q is optically active
B) Q is meso and P is optically active
C) Both P and Q are meso
D) Both P and Q are optically active

85. In the reaction shown below, P and **Q**respectively are correctly represented by the pair:

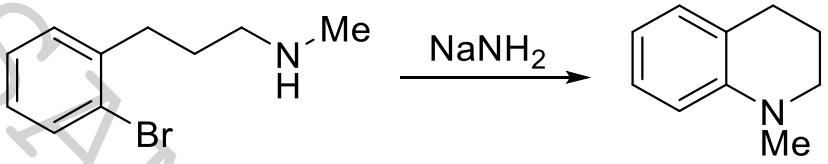


A)  and RCHO
B)  and RCHO
C)  and $POCl_3$
D)  and $POCl_3$

86. Birch reduction of benzoic acidproduces:

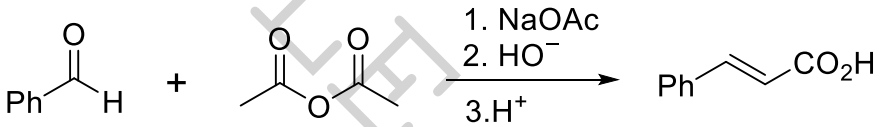
A) Cyclohexa-1,4-diene-1-carboxylic acid
B) Cyclohexa-1,5-diene-1-carboxylic acid
C) Cyclohexa-2,4-diene-1-carboxylic acid
D) Cyclohexa-2,5-diene-1-carboxylic acid

87. The reactive intermediate involved in the reaction given below is:



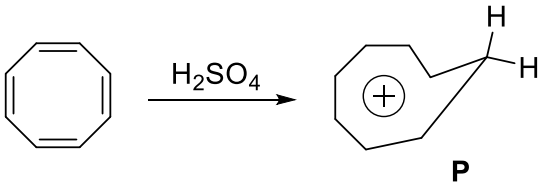
A) A free radical
B) An aryne
C) A carbocation
D) A carbanion

88. The reaction shown below is known as:



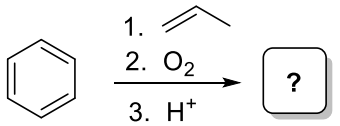
A) Claisen condensation
B) Perkin condensation
C) Dieckmann condensation
D) Benzoin condensation

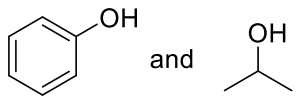
89. In the reaction shown below, the product P can be classified as a/an:

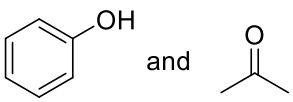


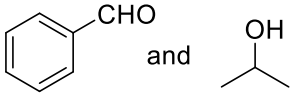
A) Pseudoaromatic compound
B) Antiaromatic compound
C) Homoaromatic compound
D) Nonaromatic compound

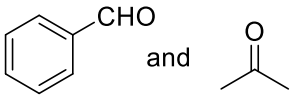
90. The correct combination of P and Q in the reaction given below is represented by:



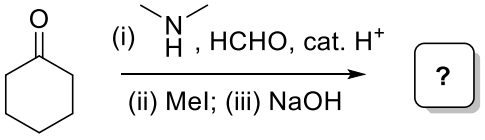
A) 

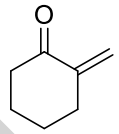
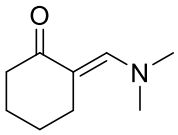
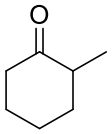
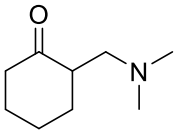
B) 

C) 

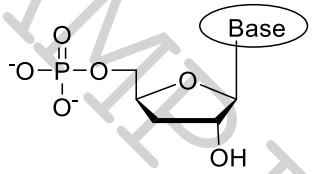
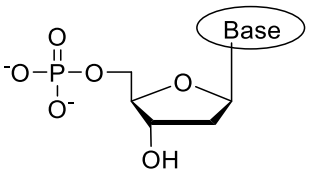
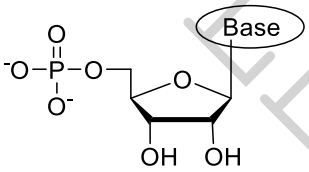
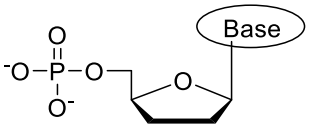
D) 

91. The major product in the transformation shown below is:



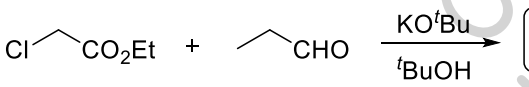
A) 
B) 
C) 
D) 

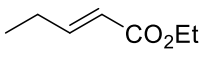
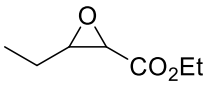
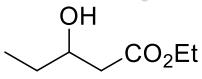
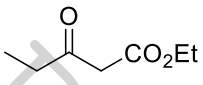
92. The chemical structural unit that serves as a platform of RNA is correctly represented by:

A) 
B) 
C) 
D) 

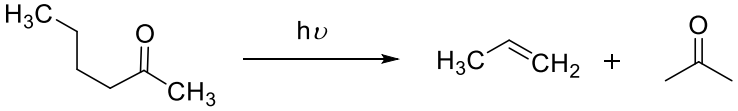
93. Among the following, the amino acid which is most basic in nature is:
A) Leucine
B) Asparagine
C) Tyrosine
D) Arginine

94. The major product in the transformation shown below is:



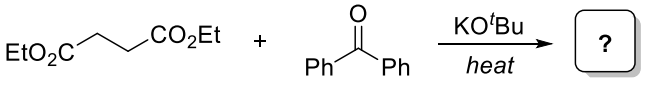
A) 
B) 
C) 
D) 

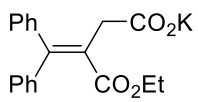
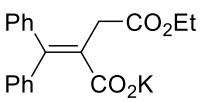
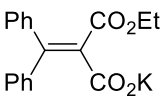
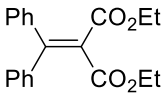
95. The reaction shown below is an example of:



A) Paterno-Buchi reaction
B) Norrish type-I process
C) McLafferty rearrangement
D) Norrish type-II process

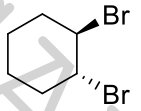
96. The major product in the transformation shown below is:

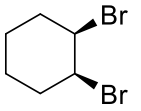


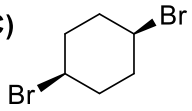
A) 
B) 
C) 
D) 

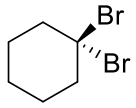
97. The Knoevenagel condensation is correctly represented by the substrate combination of:
    A) Benzaldehyde and acetophenone
    B) Benzaldehyde and diethyl malonate
    C) Benzoyl chloride and acetophenone
    D) Benzoyl chloride and diethyl malonate

98. Among the following dibromocyclohexanes, the one that reacts fastest with sodium iodide to give cyclohexane is:

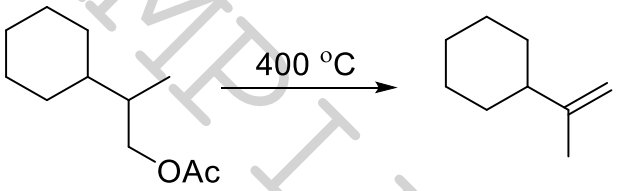
A) 

B) 

C) 

D) 

99. The elimination reaction given below follows:



    A) E1 mechanism
    B) E2 mechanism
    C) E1cB mechanism
    D) Ei mechanism

100. Maltose and Trehalose are disaccharides formed from two units of glucose. If maltose is a reducing and trehalose is a non-reducing sugar, the position of the O-glycosidic bond is correctly represented as:
    A) C_1-C_4 in maltose and C_1-C_1 in trehalose
    B) C_1-C_1 in maltose and C_1-C_4 in trehalose
    C) C_4-C_4 in maltose and C_1-C_1 in trehalose
    D) C_1-C_1 in maltose and C_4-C_4 in trehalose