WBPSC

Previous Year Paper

Industrial Chemist

27 Nov, 2021

IND/20

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE ASKED TO DO SO.

2020

TEST BOOKLET

Time allowed : $1\frac{1}{2}$ hours

Full marks : 100

Answer ***all*** the questions.

Questions are of equal value.

TEST BOOKLET SERIES

A

Serial No. 0557 ..... ***Roll No.:***

Signature of the Candidate:

INSTRUCTIONS

Candidates should read the following instructions carefully before answering the questions:

1. This booklet consists of 20 pages including this front page. Verify the Page Nos. and Test Booklet series on each page and bring at once to the Invigilator's notice any discrepancy.
2. Answers will have to be given in the Special Answer-Sheets supplied for the purpose.
3. Before you proceed to mark in the Answer-Sheet in response to various items in the Test Booklet, you have to fill in some particulars in the Answer-Sheet as per instructions sent to you in the Admit Card. ***Do not fold the Answer-Sheet as this will result in error in your marks.***
4. All questions are of multiple-choice answer-type. You will find ***four*** probable answers **(A)**, **(B)**, **(C)** and **(D)** against each question. Find out which of the four answers appears to you to be **correct or the best**. Now darken the circle corresponding to the letter of the selected answer in the Answer-Sheet with **Black Ball Point Pen** as per instructions printed on the reverse **of the Admit Card** and in the Answer-Sheet.
5. One and only one circle is to be fully blackened for answer. Any spot in any other circle (multiple circle) or in wrong circle will be considered as wrong answer.
6. ***There will be negative marking of $\frac{1}{3}$ mark for each wrong answer.***
7. There are blank pages at the end of this Booklet for Rough Work.
8. ***The Special Answer-Sheet should be handed over to the Invigilator before leaving the Examination Hall. You are permitted to take away the used Test Booklet after completion of the examination.***

1. The radio isotope, tritium $\left(H_1^3\right)$ has a half-life of 12·3 years. If the initial amount of tritium is 32 mg, how many milligrams of it would remain after 49·2 years?

(A) 4·0mg
(B) 8mg
(C) 1·0mg
(D) 2·0mg

2. Among the following compounds, the one having the lowest boiling point is

(A) $SnCl_4$
(B) $GeCl_4$
(C) $SiCl_4$
(D) CCl_4

3. The blue $CuSO_4$ solution decolourises on addition of excess KCN due to the formation of

(A) CuCN
(B) $Cu(CN)_2$
(C) $\left[Cu(CN)_4\right]^{3-}$
(D) $\left[Cu(CN)_4\right]^{2-}$

4. Which one of the following sets of quantum number is *not* allowed?

(A) $n = 3, l = 2, m_l = -1$
(B) $n = 4, l = 0, m_l = 0$
(C) $n = 3, l = 3, m_l = -3$
(D) $n = 5, l = 3, m_l = +2$

5. The correct increasing order of I_2O_5, Cl_2O_7 and P_4O_{10} to absorb water is

(A) $I_2O_5 > Cl_2O_7 > P_4O_{10}$
(B) $Cl_2O_7 > I_2O_5 > P_4O_{10}$
(C) $P_4O_{10} > Cl_2O_7 > I_2O_5$
(D) $P_4O_{10} > I_2O_5 > Cl_2O_7$

6. Which one of the following statements of $[PtCl_3(C_2H_4)]^-$ is incorrect?

(A) Given complex is known as Zeise's salt.
(B) All Pt–Cl bonds are equally strong.
(C) The C–C bond length of C_2H_4 moeity is lengthened with respect to C_2H_4(free).
(D) Substituted ethylene causes vary the M–C bond length.

7. Which of the following sequences of decreasing pK_a values is correct?

(A) Acetic acid > Benzoic acid > Formic acid > Salicylic acid
(B) Benzoic acid > Acetic acid > Formic acid > Salicylic acid
(C) Benzoic acid > Acetic acid > Salicylic acid > Formic acid
(D) Salicylic acid > Formic acid > Benzoic acid > Acetic acid

8. With increasing quantum number, the energy difference between adjacent levels of hydrogen atom

(A) increases.
(B) decreases.
(C) remains constant.
(D) first decreases then increases.

9. Which of the following metal cannot be extracted by carbon or self-reduction method?

(A) Cu
(B) Pb
(C) Zn
(D) Au

10. Identify the correct sequence of rates of reduction of carbonyl compounds by sodium borohydrite

(A) Cyclohexanone > Cyclobutanone > Acetone > Acetophenone

(B) Acetone > Cyclohexanone > Cyclobutanone > Acetophenone

(C) Cyclobutanone > Acetone > Cyclohexanone > Acetophenone

(D) Cyclobutanone > Cyclohexanone > Acetone > Acetophenone

11. A compound, molecular formula C_8H_8O shows the following ^{1}H-NMR signals – a 1H singlet, a 3H singlet, two 2H doublets in the aromatic region. Identify the compound.

(A) *p*-Methylbenzaldehyde

(B) *o*-Methylbenzaldehyde

(C) Acetophenone

(D) Phenylacetaldehyde

12. The correct order of C–O bond length among CO, CO_3^{2-} and CO_2 is

(A) $CO_2 < CO_3^{2-} < CO$

(B) $CO < CO_3^{2-} < CO_2$

(C) $CO_3^{2-} < CO_2 < CO$

(D) $CO < CO_2 < CO_3^{2-}$

13. A metal crystallizes in FCC lattice with unit cell length of 4.086 Å. The relative atomic mass of the metal is 107.88. The density of the substance is

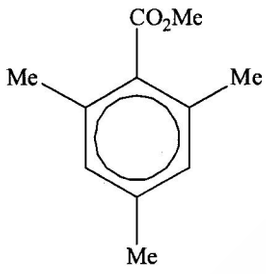
(A) 1.05 g cm^{-3}

(B) 10.5 g cm^{-3}

(C) 5.25 g cm^{-3}

(D) 2.625 g cm^{-3}

14. Hydrolysis of the methyl ester of mesitoic acid (I)



occurs by the

(A) $A_{AC}2$ mechanism with dilute H_2SO_4.

(B) $B_{AC}2$ mechanism with aqueous potassium hydroxide solution.

(C) $A_{AC}1$ mechanism by treatment with concentrated sulphuric acid, followed by addition of water.

(D) $A_{AL}1$ mechanism with dilute H_2SO_4.

15. The CFSE of the following d^3 metal ions (V^{2+}, Cr^{3+}, Mo^{3+}) decreases in the following order

(A) $V^{2+} > Mo^{3+} > Cr^{3+}$

(B) $Mo^{3+} > Cr^{3+} > V^{2+}$

(C) $Cr^{3+} > Mo^{3+} > V^{2+}$

(D) $Cr^{3+} > V^{2+} > Mo^{3+}$

16. Consider the following four xenon compounds : XeF_2, XeF_4, XeF_6 and XeO_3. The pair of compounds have non-zero dipole moment is

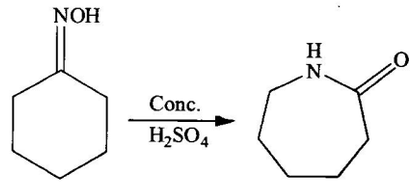
(A) XeF_4 and XeF_6

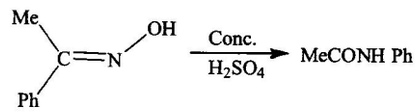
(B) XeF_2 and XeO_3

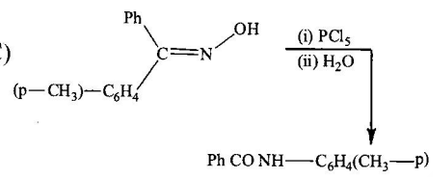
(C) XeF_2 and XeF_4

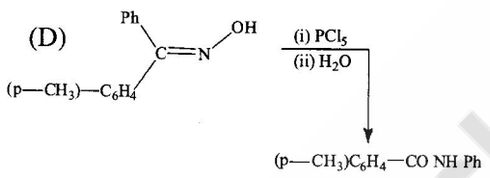
(D) XeO_3 and XeF_6

17. Bechmann rearrangements occur with high selectivity to give essentially one product. Which of the following shows the wrong product?

(A) 

(B) 

(C) 

(D) 

18. The intermolecular van-der Waals' potential is inversely to r^6. The corresponding force is proportional to

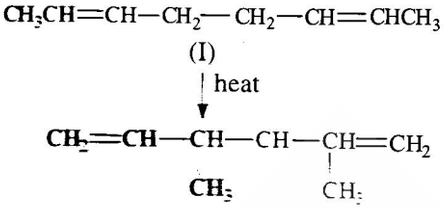
(A) $\frac{1}{r^5}$

(B) $\frac{1}{r^6}$

(C) $\frac{1}{r^7}$

(D) $\frac{1}{r^{12}}$

19. Cope rearrangement of 2, 6-octadienes (I) to 3, 4-dimethyl-1, 5-hexadienes (II) occur in a selective manner.



One of the following statements regarding selectivity of the process is incorrect. Identify the incorrect statement.

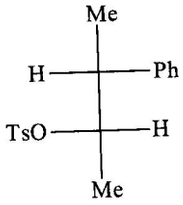
(A) E, E-diene (I) $\rightarrow$ 3, 4-anti-isomer (II)

(B) Z, Z-diene (I) $\rightarrow$ 3, 4-anti-isomer (II)

(C) E, Z-diene (I) $\rightarrow$ 3, 4-syn-isomer (II)

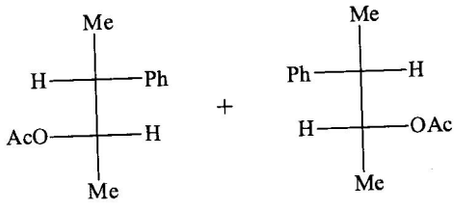
(D) Z, Z-diene (I) $\rightarrow$ 3, 4-syn-isomer (II)

20. Acetolysis of (+)–threo–3–phenyl–2–butyl tosylate (I)



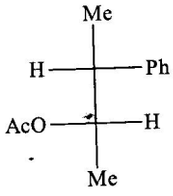
(I) gives

(A) Racemic threo–3–phenyl–2–butyl tosylate i.e.

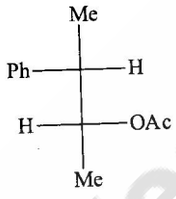


[i.e. in the proportion (1 : 1)]

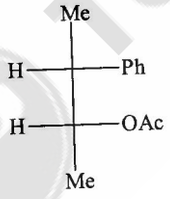
(B) Exclusively



(C) Exclusively



(D) Exclusively



21. Which of the following groups has the highest migrating aptitude in migration to a carbocation?

(A) $p-CH_3-C_6H_4$

(B) C_6H_5

(C) $p-NO_2-C_6H_4$

(D) $p-CH_3O\,C_6H_4$

22. A filter paper moistened with mercuric acetate solution turns red upon droping dilute solution of KI. The transition responsible for the red colour is

(A) $d-d$ transition

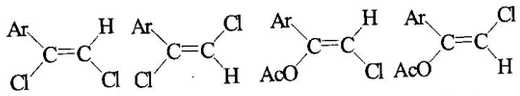
(B) $\sigma-\sigma^*$

(C) MLCT

(D) LMCT

23. The following reaction in acetic acid gives mixture of products. Identify the correct statement in options (A) to (D).

$$ArC \equiv CH + Cl_2 \rightarrow$$



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

(A) (I) + (II) + (III) + (IV)

(B) (I) + (II)

(C) (I) + (III)

(D) (II) + (IV)

26. Identify the correct sequence of increasing UV absorption maxima (λ_{max}) for the $\pi - \pi^*$ transition K-band.

(A) Nitrobenzene < *o*-NO_2-phenol < *p*-NO_2-phenol < *p*-NO_2-aniline

(B) *o*-nitrophenol < *p*-NO_2-phenol < aniline < nitrobenzene

(C) Nitrobenzene < *o*-NO_2-phenol < aniline < *p*-NO_2-phenol

(D) Nitrobenzene < aniline < *o*-nitrophenol < *p*-nitrophenol

27. For determination of surface tension of a wetting liquid by capillary rise method, the liquid rises in a capillary to a certain height. What will happen if the capillary is suddenly cut at a height of half the liquid column?

(A) The liquid will overflow.

(B) The liquid will rise till the end of the capillary.

(C) Liquid levels inside and outside the capillary will be the same.

(D) Level of the liquid column inside the capillary will depend on the liquid.

28. Which of the two ions from the list given below, have the geometry that is explained by the same hybridisation of orbitals,

$NH_2^-, NH_4^+, NO_2^-, SCN^-, NO_3^-$?

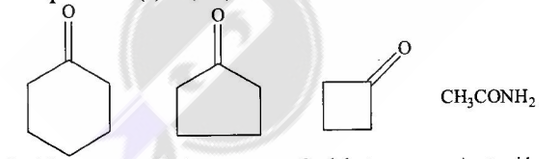
(A) NH_4^+ and NO_3^-

(B) SCN^- and NH_2^-

(C) NO_2^- and NH_2^-

(D) NO_2^- and NO_3^-

29. Identify the correct sequence of increasing infra-red frequencies of the carbonyl group in compounds (I) - (IV)



Cyclohexanone (I) | Cyclopentanone (II) | Cyclobutanone (III) | Acetamide (IV)

(A) (IV) < (III) < (II) < (I)

(B) (IV) < (III) < (I) < (II)

(C) (I) < (II) < (III) < (IV)

(D) (IV) < (I) < (II) < (III)

30. The wavelength (in Å) of an emission line obtained for Li^{2+} during an electronic transition from $n_2 = 2$ to $n_1 = 1$ is (R = Rydberg constant)

(A) $\frac{3R}{4}$

(B) $\frac{27R}{4}$

(C) $\frac{4}{3R}$

(D) $\frac{4}{27R}$

31. Indicate the correct series of decreasing nucleophilic reactivities.

(A) $HO^- > EtO^- > PhO^- > H_2O$

(B) $EtO^- > HO^- > H_2O > PhO^-$

(C) $HO^- > H_2O > EtO^- > PhO^-$

(D) $EtO^- > HO^- > PhO^- > H_2O$

32. Three gases CO_2, O_2 and Cl_2 are at the same temperature at 25°C. Which of the following relations for the average kinetic energy (E) is true?

(A) $E(CO_2) = E(O_2) = E(Cl_2)$

(B) $E(CO_2) > E(O_2) > E(Cl_2)$

(C) $E(CO_2) < E(O_2) < E(Cl_2)$

(D) $E(CO_2) > E(O_2) < E(Cl_2)$

33. $_{92}U^{235} + {}_0n^1 \rightarrow$ fission product + neutron + $3{\cdot}2 \times 10^{-11}$ J. The energy released, when 1g of $_{92}U^{235}$ finally undergoes fission, is

(A) $12{\cdot}75 \times 10^6$ KJ

(B) $18{\cdot}60 \times 10^9$ KJ

(C) $8{\cdot}21 \times 10^7$ KJ

(D) $6{\cdot}55 \times 10^6$ KJ

Please Turn Over

26. Identify the correct sequence of increasing UV absorption maxima (λ_{max}) for the π - π^* transition K-band.

(A) Nitrobenzene < o-NO_2-phenol < p-NO_2-phenol < p-NO_2-aniline

(B) o-nitrophenol < p-NO_2-phenol < aniline < nitrobenzene

(C) Nitrobenzene < o-NO_2-phenol < aniline < p-NO_2-phenol

(D) Nitrobenzene < aniline < o-nitrophenol < p-nitrophenol

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28. Which of the two ions from the list given below, have the geometry that is explained by the same hybridisation of orbitals,

$NH_2^-, NH_4^+, NO_2^-, SCN^-, NO_3^-$?

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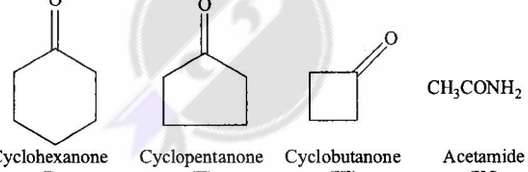

Cyclohexanone (I) Cyclopentanone (II) Cyclobutanone (III) CH_3CONH_2 Acetamide (IV)

(A) (IV) < (III) < (II) < (I)

(B) (IV) < (III) < (I) < (II)

(C) (I) < (II) < (III) < (IV)

(D) (IV) < (I) < (II) < (III)

30. The wavelength (in Å) of an emission line obtained for Li^{2+} during an electronic transition from $n_2 = 2$ to $n_1 = 1$ is (R = Rydberg constant)

(A) $\frac{3R}{4}$

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(C) $\frac{4}{3R}$

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31. Indicate the correct series of decreasing nucleophilic reactivities.

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(C) $E(CO_2) < E(O_2) < E(Cl_2)$

(D) $E(CO_2) > E(O_2) < E(Cl_2)$

33. $_{92}U^{235} + {}_0n^1 \rightarrow$ fission product + neutron + $3{\cdot}2 \times 10^{-11}$ J. The energy released, when 1g of $_{92}U^{235}$ finally undergoes fission, is

(A) $12{\cdot}75 \times 10^6$ KJ

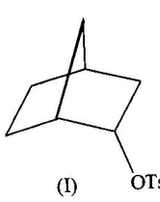
(B) $18{\cdot}60 \times 10^9$ KJ

(C) $8{\cdot}21 \times 10^7$ KJ

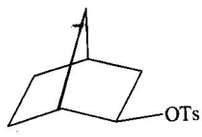
(D) $6{\cdot}55 \times 10^6$ KJ

Please Turn Over

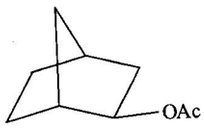
34. Acetolysis of norbornyl tosylates furnish norbornyl acetates of the following statements, one statement is incorrect. Identify the wrong statement.



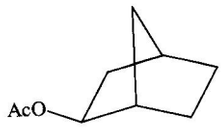
(I)



(II)



(III)



(IV)

(A) *Exo*-norbornyl tosylate (II) undergoes acetolysis several hundred times faster than *endo*-norbornyl tosylate (I)

(B) Acetolysis of (II) results in complete racemisation to a 1 : 1 mixture of (III) : (IV).

(C) Acetolysis (I) gives (III) exclusively.

(D) Nearly complete racemisation occurs on acetolysis of *endo*-norbornyl tosylate (I).

35. For ML_6-type complex, which of the following d-electron configuration will give maximum crystal field stabilisation energy?

(A) d^6 (high spin)

(B) d^4 (low spin)

(C) d^5 (low spin)

(D) d^7 (high spin)

36. S_N2 reactions at a chiral centre

$CHRR^1 - X + Nu^- \rightarrow CHRR^1 - Nu + X^-$

occur with

(A) complete inversion of configuration at the reaction centre.

(B) complete retention of configuration at the reaction centre.

(C) both retention and inversion of configuration with the former predominating.

(D) both retention and inversion of configuration with the latter predominating.

37. The species responsible for the superacidity of $SbF_5 - HSO_3F$ system is

(A) HSO_3F

(B) SbF_5

(C) HF

(D) $H_2SO_3F^+$

38. Identify the correct sequence of relative reactivity of nitration ($HNO_3 - CH_3NO_2$) of the following aromatic compounds.

(A) Benzene > Toluene > *p*-Xylene > Mesitylene

(B) *p*-Xylene > Toluene > Benzene > Mesitylene

(C) *p*-Xylene > Mesitylene > Toluene > Benzene

(D) Mesitylene > *p*-Xylene > Toluene > Benzene

39. Name the type of the structure of silicate in which one oxygen atom of $(SiO_4)^{4-}$ is shared.

(A) Sheet silicate

(B) Three dimensional silicate

(C) Linear chain silicate

(D) Pyrosilicate

40. The two electrons have the following sets of quantum numbers :

$$P = 3, 2, -2, +\frac{1}{2} \quad Q = 3, 0, 0, +\frac{1}{2}$$

Which of the following statements is true?

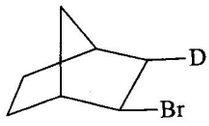
(A) P has greater energy than Q.

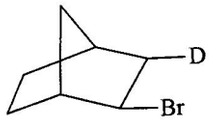
(B) P and Q represents same electron.

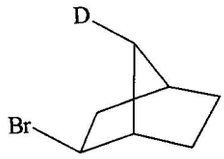
(C) P and Q have same energy.

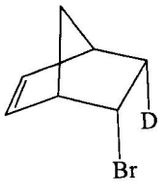
(D) P has lower energy than Q.

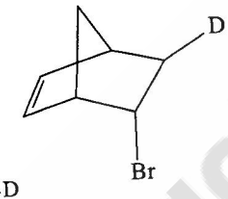
41. Identify the correct statement. Addition of D Br to norbornane gives

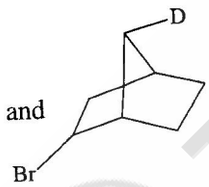
(A)  exclusively

(B) Mixture of 

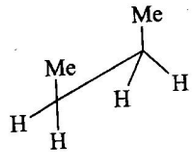
and 

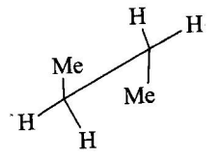
(C) 

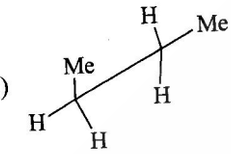
(D) Mixture of 

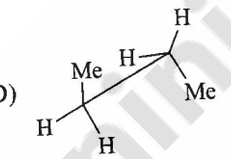
and 

42. Which of the following conformations of *x*-butane has the least energy?

(A) 

(B) 

(C) 

(D) 

43. Order of base strength against 2,4 — dinitrophenol in different solvent systems. Identify the wrong sequence.

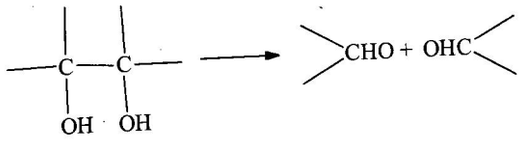
(A) $Bu_2NH > Bu_3N > BuNH_2$ in benzene

(B) $Bu_3N > Bu_2NH > BuNH_2$ in chlorobenzene

(C) $Bu_3N > BuNH_2 > Bu_2NH$ in chlorobenzene

(D) $Bu_2NH > BuNH_2 > Bu_3N$ in dibutyl ether

44. The cleavage reaction of vic-diols



is achieved by the following reagent(s) :

(A) Both HIO_4 and OsO_4

(B) HIO_4 but not OsO_4

(C) Aluminium isopropoxide

(D) NBS

45. Using 18-electron rule, the value of '*x*' in $Fe(CO)_x(\eta^5 - C_5H_5)(\eta^1 - C_5H_5)$ is

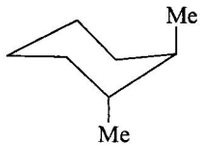
(A) 2

(B) 3

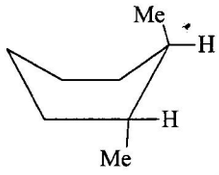
(C) 1

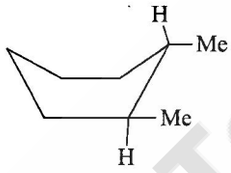
(D) 4

46. The lowest energy conformation of *trans*-1, 2 dimethyl cyclohexene is

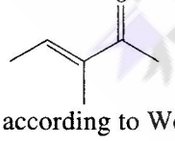
(A) 

(B) 

(C) 

(D) 

47. The calculated value of ultraviolet maximum absorption (λ_{max}) of



3-methyl-penten-3-en-2-one

according to Woodward's rule is

(A) 237 nm

(B) 215 nm

(C) 227 nm

(D) 245 nm

48. The final products in the reaction of BF_3 with water are

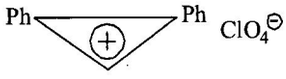
(A) $B(OH)_3$ and OF_2

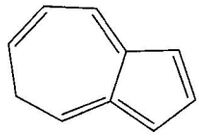
(B) H_3BO_3 and HBF_4

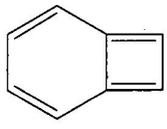
(C) B_2O_3 and HBF_4

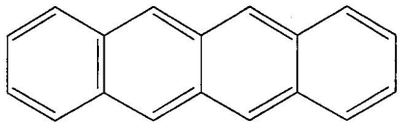
(D) $B(OH)_3$ and HF

49. Which of the following is not an aromatic compound?

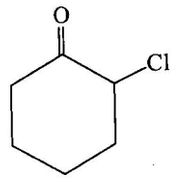
(A) 

(B) 

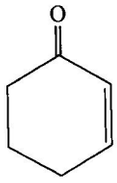
(C) 

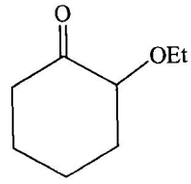
(D) 

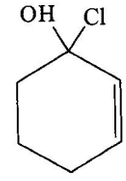
50. Reaction of (I) with $EtO^-/EtOH$ yields

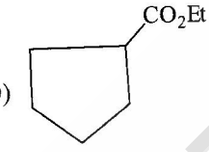


(I)

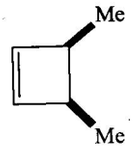
(A) 

(B) 

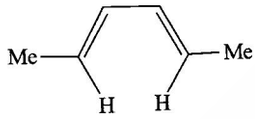
(C) 

(D) 

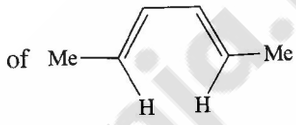
51. The thermal electrocyclic ring-opening of

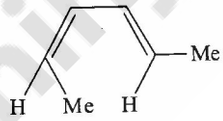


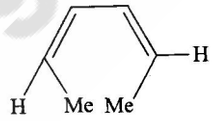
gives

(A) 

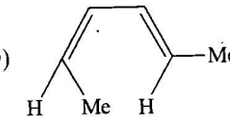
as the major product

(B) Approximately equal proportions of 

and 

(C) 

as the major product

(D) 

as the major product

52. The energy of second Bohr orbit of the H-atom is–328 KJ/mol, hence the energy of fourth Bohr orbit would be

(A) –41 KJ/mol

(B) –1312 KJ/mol

(C) –164 KJ/mol

(D) –82 KJ/mol

Please Turn Over

53. Which of the following compounds has the highest dipole moment?

(A) *p*-Nitroaniline

(B) Nitrobenzene

(C) *trans*-1, 2-dichloroethylene

(D) Aniline

54. Column chromatography is based on the principle of

(A) adsorption

(B) solubility

(C) thermal stability

(D) molecular size

55. Hydrolysis of $(CH_3)_2SiCl_2$ and CH_3SiCl_3 separately leads to

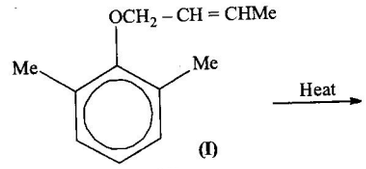
(A) linear chain and cross-linked silicones.

(B) cross-linked and linear chain silicones.

(C) linear chain silicones only.

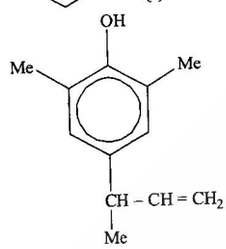
(D) cross-linked silicones only.

56. The major product of the Claisen rearrangement of the following compound(I) is

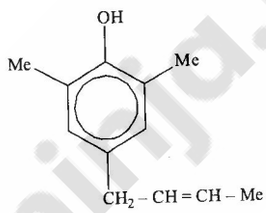


(I)

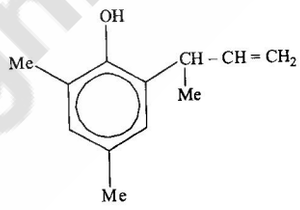
(A)



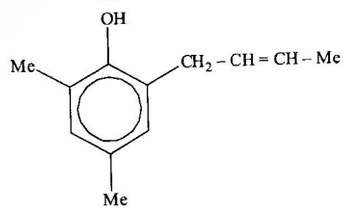
(B)



(C)



(D)



57. About 20 km above the earth, there is an ozone layer. Which one of the following statements about ozone and ozone layer is true?

(A) Ozone is a triatomic linear molecule.

(B) It is harmful as it stops useful radiation.

(C) It is beneficial to us as it stops UV-radiation.

(D) Conversion of ozone to oxygen is an endothermic reaction.

58. The oxide that has the inverse spinel structure is

(A) $FeCr_2O_4$

(B) $MnCr_2O_4$

(C) $CoAl_2O_4$

(D) Fe_2CoO_4

59. The ground state term for a free ion with $3d^7$ configuration is

(A) $^4F_{3/2}$

(B) $^4F_{9/2}$

(C) $^4F_{1/2}$

(D) $^4F_{5/2}$

60. Which one of the following is expected to exhibit optical isomerism? (en=ethylene diamine)

(A) $cis-[Pt(NH_3)_2Cl_2]$

(B) $trans-[Co(en)_2Cl_2]^+$

(C) $trans-[Pt(NH_3)_2Cl_2]$

(D) $cis-[Co(en)_2Cl_2]^+$

61. Polyanion formation is maximum in

(A) nitrogen

(B) oxygen

(C) sulphur

(D) boron

62. Among $[Ni(CO)_4]$, $[Ni(CN)_4]^{2-}$ and $[NiCl_4]^{2-}$ species, the hybridisation states of the Ni are, respectively

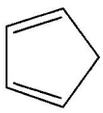
(A) sp^3, dsp^2, dsp^2

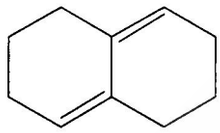
(B) sp^3, dsp^2, sp^3

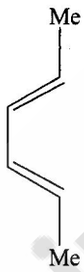
(C) sp^3, sp^3, dsp^2

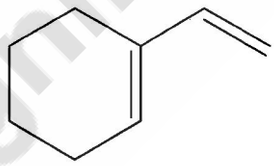
(D) dsp^2, sp^3, sp^3

63. Which of the following dienes does not undergo the thermal Diels-Alder reaction with a dienophile?

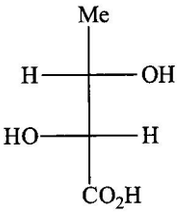
(A) 

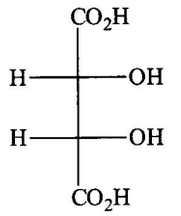
(B) 

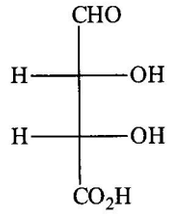
(C) 

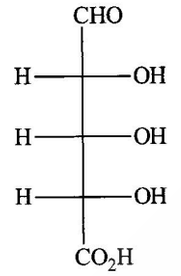
(D) 

64. Which of the following compounds is optically inactive?

(A) 

(B) 

(C) 

(D) 

65. Identify the correct sequence of relative rates in the following reaction series.

$$X - CH_2Cl + I^- \rightarrow X - CH_2 - I$$

$X = Pr^n$	$X = PhSO_2$	$X = MeCO$	$X = CO_2Et$
(I)	(II)	(III)	(IV)

(A) (III) > (IV) > (II) > (I)

(B) (IV) > (III) > (II) > (I)

(C) (III) > (IV) > (I) > (II)

(D) (I) > (II) > (IV) > (III)

66. Consider the statements regarding borazine as given below:

(I) It is isoelectronic with benzene.

(II) Each nitrogen receives more σ-electron density from neighbouring boron.

(III) It does not undergo addition reactions.

(IV) Nitrogen retains its basicity and boron its acidity.

Which of the following set is correct?

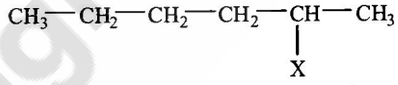
(A) (I), (II), (III)

(B) (II), (III), (IV)

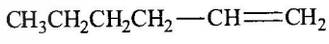
(C) (III), (IV)

(D) (I), (II), (IV)

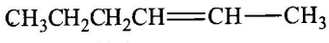
67. Base-indused E2 eliminations of



gives a mixture of 1-hexene(I) and two stereoisomesic 2-hexenes (IIa, IIh)



(I)



(IIa) *trans*

(IIh) *cis*

Identify the correct sequence of increasing (I) : (IIa, IIh) selectivity for different leaving groups $X^{\ominus}$, under different reaction conditions (i)–(iv).

(i) X = I; MeO^-/MeOH

(ii) X = I; Bu^tO^-/Bu^tOH

(iii) X = Cl; MeO^-/MeOH

(iv) X = Cl; Bu^tO/Bu^tOH

(A) (i) < (iii) < (ii) <(iv)

(B) (i) < (ii) < (iii) < (iv)

(C) (iii) < (iv) < (i) < (ii)

(D) (iv) < (iii) < (ii) < (i)

68. In the structure of $[B_4O_5(OH)_4]^{2-}$

(A) all four B-atoms are trigonal planar.

(B) one B-atom is tetrahedral and the other three are trigonal planar.

(C) three B-atoms are tetrahedral and one is trigonal planar.

(D) two B-atoms are tetrahedral and other two are trigonal planar.

69. Radial nodes present in 3*s* and 2*p* orbitals are respectively

(A) 0, 2

(B) 2, 0

(C) 2, 1

(D) 1, 2

70. The correct sequence of increasing chemical shifts in δ, ppm of the methyl group is

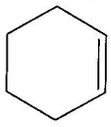
(A) $CH_3Cl < CH_3Ph < CH_3Br < CH_3I$

(B) $CH_3I < CH_3Br < CH_3Cl < CH_3F$

(C) $CH_3F < CH_3Br < CH_3I < CH_3Ph$

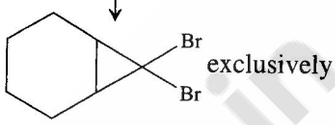
(D) $CH_3F < CH_3Cl < CH_3Br < CH_3I$

71. One of the following is incorrect. Identify the wrong one.



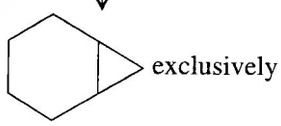
(I)

(A) (I) + $CHBr_3$ + t-BuOK

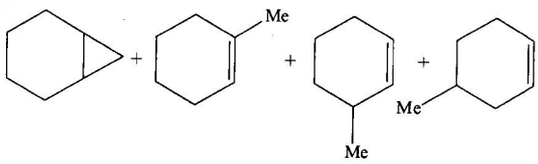


(B) (I) + Zn – Cu couple + CH_2I_2

(C) (I) + CH_2N_2 —hν→



(D) (I) + CH_2N_2 —hν→



(mixture of products)

72. The electronic spectrum of $[CrF_6]^{3-}$ shows three bands at 14900 cm^{-1}, 22400 cm^{-1} and 34800 cm^{-1}. The value of dq in this case is

(A) 1490 cm^{-1}

(B) 2240 cm^{-1}

(C) 3480 cm^{-1}

(D) 14900 cm^{-1}

Please Turn Over

73. The correct order of $\gamma_{NO}(cm^{-1})$ in the following compound is

(A) $NO^+ > NO > [NiCp(NO)] > [Cr(Cp)_2(NO)_4]$

(B) $[Cr(Cp)_2(NO)_4] > [NiCp(NO)] > NO^+ > NO$

(C) $NO^+ > [Cr(Cp)_2(NO)_4] > NO > [NiCp(NO)]$

(D) $[NiCp(NO)] > NO > [Cr(Cp)_2(NO)_4] > NO^+$

74. Which one of these order of acidity is false?

(A) HOI > HOBr > HOCl

(B) HI > HBr > HCl

(C) $HClO_4 > HClO_3 > HClO_2$

(D) $Cl_3C{\cdot}COOH > Cl_2CH{\cdot}COOH > ClCH_2{\cdot}COOH$

75. Which of the following sequences of increasing basicity of amines is correct?

(A) *m*-nitroaniline < *p*-nitroaniline < aniline < methylamine

(B) *p*-nitroaniline < *m*-nitroaniline < aniline < methylamine

(C) methylamine < aniline < *m*-nitroaniline < *p*-nitroaniline

(D) *m*-nitroaniline < aniline < *p*-nitroaniline < methylamine

76. IR spectrum of carbon dioxide molecule consists of

(A) one line

(B) two lines

(C) three lines

(D) four lines

77. For a second order reaction involving a single reactant the time needed for 75% conversion of the reactant is

(A) equal to the half life period.

(B) double the half life period.

(C) three times the half life period.

(D) four times the half life period.

78. X-ray diffraction study indicates sodium chloride and potassium chloride crystals are

(A) both SCC

(B) both FCC

(C) SCC and FCC respectively

(D) FCC and SCC respectively

79. Given that E° values of Ag^+/Ag, K^+/K, Mg^{2+}/Mg and Cr^{3+}/Cr are 0.80 V, –2.93 V, –2.37 V and –0.74 V, respectively. Which of the following orders regarding the reducing power of the metals is correct?

(A) Ag > Cr > Mg > K

(B) Ag < Cr < Mg < K

(C) Ag > Cr > K > Mg

(D) Cr > Ag > Mg > K

80. Most appropriate word associated with a micellar solution is

(A) homogeneous

(B) heterogeneous

(C) microheterogeneous

(D) None of the above

81. In a fluorescence spectrometer the source, sample and detector needs to be placed

(A) in a straight line

(B) making an angle 45 degree

(C) making an angle 60 degree

(D) making an angle 90 degree

82. What is the pH of a solution of 0.01M ammonium salt of phenyl acetic acid? Given, $K_a = 4.8 \times 10^{-5}$, $K_b = 1.8 \times 10^{-5}$

(A) 2.47

(B) 6.79

(C) 7.21

(D) 11.53

83. Formation of a micelle in water is

(A) an enthalpy driven process.

(B) an entropy driven process.

(C) indifferent to thermodynamics.

(D) None of the above

84. A dye solution containing 1 g per 100 mL transmitted 60% of the blue light in a cell 1 cm thick. The percentage of light that would be absorbed by a solution containing 2 g per 100 mL of the same solvent in the same cell is

(A) 34

(B) 36

(C) 66

(D) 64

85. For a first order reaction, the time taken to reduce initial concentration to a factor of ¼ is 10 min. The time required to reduce initial concentration to a factor of 1/16 will be

(A) 10 min

(B) 20 min

(C) 30 min

(D) 40 min

86. A FCC crystal has $d_{100}:d_{110}:d_{111}$ values

(A) 1 : 0.707 : 0.577

(B) 1 : 1.414 : 0.577

(C) 1 : 1.414 : 1.154

(D) 1 : 0.707 : 1.154

87. The bond distance of oxygen molecule can be experimentally determined from

(A) microwave spectroscopy

(B) IR spectroscopy

(C) Raman spectroscopy

(D) fluorescence spectroscopy

88. From Freundlich adsorption equation which of the following graphs would yield a straight line plot?

(A) x/m versus p

(B) log x/m versus p

(C) log x/m versus $log\ p$

(D) x/m versus $log\ p$

89. The wavelength associated with a 100 g ball moving with a velocity of 36 kilometre per hour is

(A) 6.626×10^{-30} m

(B) 6.626×10^{-34} m

(C) 6.626×10^{-36} m

(D) 6.626×10^{-40} m

90. Which of the following aqueous solutions is acidic?

(A) KCN solution

(B) $NaHCO_3$ solution

(C) NH_4Cl solution

(D) CH_3COONH_4 solution

91. Gold number is associated with

(A) gold nanoparticles

(B) colloids

(C) quality of gold metal

(D) quality of materials

92. For a reversible reaction at equilibrium at temperature T, which of the following is true?

(A) $T > \Delta H/\Delta S$

(B) $T < \Delta H/\Delta S$

(C) $T = \Delta H/\Delta S$

(D) $T = \Delta S/\Delta H$

93. The magnitude of viscous drag when a spherical ball of radius 1 cm moves steadily through a medium of viscosity coefficient 0.01 poise at 25° C with a terminal speed of 10 cm per second is

(A) 1.884 dyne

(B) 9.42 dyne

(C) 18.84 dyne

(D) 37. 68 dyne

94. Passage of electricity through a lyophobic colloid sol leads to

(A) only electrophoresis but not electroosmosis.

(B) only electroosmosis but not electrophoresis.

(C) both electrophoresis and electroosmosis.

(D) increase in the Brownian motion.

95. Which of the following reactions corresponds to the definition of enthalpy of formation of water at 298 K?

(A) $H_2(g) + ½\ O_2(g) \rightarrow H_2O(l)$

(B) $2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$

(C) $H_2(g) + ½\ O_2(l) \rightarrow H_2O(l)$

(D) $H_2(g) + ½\ O_2(s) \rightarrow H_2O(l)$

96. We experience solid naphthalene going directly to gaseous/vapour state. Find the correct statement from the following:

(A) Naphthalene does not have its liquid state in any situation.

(B) "All materials have three states, namely, solid, liquid and gas/vapour" is wrong.

(C) One can see liquid naphthalene at some lower pressure and higher temperature.

(D) One can see liquid naphthalene at some higher pressure and lower temperature.

97. An acid (HA) in aqueous medium at 25° C has $pK_a = 9.0$. Find the wrong statement among the following:

(A) Dissociation constant of HA at 25 °C is 1.0×10^{-9}.

(B) When HA behaves as an acid in water it produces H^+(hydrated) and A^-(hydrated).

(C) It will act as acid when pH of the aqueous solution will be < 9.0.

(D) It will act as acid when pH of the aqueous solution will be > 9.0.

98. The atomic number of the element next to S in the same group is

(A) 18

(B) 24

(C) 34

(D) 42

99. As we increase the solvent polarity the absorption maximum of n-π^* transition

(A) moves to higher energy.

(B) moves to lower energy.

(C) does not show any shift.

(D) moves to higher or lower energy depending on the fluorophore.

100. The ionic product of water

(A) increases with increase in temperature.

(B) decreases with increase in temperature.

(C) increases upto 4°C followed by decrease.

(D) remains constant with change in temperature.

सत्यमेव जयते

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No. 744 -PSC/Con(Q) Date: 01.12.2021

INDUSTRIAL CHEMIST																				
ADVT NO				11/2020				Date of Examination :						27-11-2021						
Q	A	B	C	D	Q	A	B	C	D	Q	A	B	C	D	Q	A	B	C	D	
1	D	C	C	D	26	A	D	D	C	51	D	C	B	C	76	B	C	B	C	
2	C	D	D	B	27	B	C	D	B	52	D	A	C	C	77	C	B	A	B	
3	C	A	A	B	28	D	D	C	C	53	A	B	A	D	78	D	C	B	C	
4	C	A	C	D	29	D	B	B	D	54	A	D	D	B	79	B	A	B	D	
5	C	D	A	D	30	D	A	A	B	55	A	C	C	A	80	C	C	C	C	
6	B	C	D	C	31	D	D	D	D	56	B	D	C	B	81	D	A	C	C	
7	A	B	C	C	32	A	A	A	D	57	C	A	B	B	82	B	D	C	A	
8	B	C	D	B	33	C	C	A	D	58	D	B	D	C	83	B	B	A	B	
9	D	A	B	B	34	C	D	D	D	59	B	B	C	D	84	D	D	B	B	
10	D	A	D	B	35	C	D	C	D	60	D	B	A	D	85	B	B	C	A	
11	A	D	A	A	36	A	A	D	D	61	C	B	B	D	86	D	C	C	D	
12	D	B	B	A	37	D	C	D	D	62	B	D	B	B	87	C	C	D	C	
13	B	D	C	A	38	D	A	A	B	63	B	C	B	B	88	C	D	C	C	
14	C	B	D	D	39	D	C	B	B	64	B	D	A	A	89	B	B	C	B	
15	B	C	A	D	40	A	A	B	C	65	C	A	D	A	90	C	B	D	A	
16	D	C	A	A	41	B	A	D	D	66	D	D	A	D	91	B	C	D	A	
17	D	A	A	A	42	B	B	D	D	67	A	A	B	A	92	C	B	B	D	
18	C	C	D	A	43	C	B	C	A	68	D	D	B	D	93	A	A	C	C	
19	D	D	D	D	44	A	B	C	B	69	B	B	C	A	94	C	D	C	B	
20	A	D	B	C	45	A	D	A	B	70	B	D	D	D	95	A	C	A	B	
21	D	D	D	C	46	B	A	D	B	71	C	C	B	A	96	C	B	A	B	
22	D	D	A	C	47	A	B	B	A	72	A	B	A	B	97	C	A	B	D	
23	A	D	B	C	48	B	A	C	A	73	A	D	B	C	98	C	C	B	C	
24	B	B	B	B	49	C	B	C	C	74	A	B	C	C	99	A	C	D	C	
25	C	C	D	C	50	D	C	D	C	75	B	A	A	B	100	A	C	C	C	

By Order of the Commission,
Dy. Secretary
Sd/- S. Chatterjee