Test Booklet Code & Serial No.
प्रश्नपत्रिका कोड व क्रमांक

A

Paper-II
CHEMICAL SCIENCE

Signature and Name of Invigilator

1. (Signature) .....

(Name) .....

2. (Signature) .....

(Name) .....

Seat No. | | | | | | |

(In figures as in Admit Card)

Seat No. .....

(In words)

OMR Sheet No. | | | | | | |

(To be filled by the Candidate)

APR - 33217

Time Allowed : 1¼ Hours] **[Maximum Marks : 100**

Number of Pages in this Booklet : **20**

Number of Questions in this Booklet : **50**

Instructions for the Candidates

1. Write your Seat No. and OMR Sheet No. in the space provided on the top of this page.
2. This paper consists of **50** objective type questions. Each question will carry *two* marks. *All* questions of Paper-II will be compulsory, covering entire syllabus (including all electives, without options).
3. At the commencement of examination, the question booklet will be given to the student. In the first 5 minutes, you are requested to open the booklet and compulsorily examine it as follows :
   (*i*) To have access to the Question Booklet, tear off the paper seal on the edge of this cover page. Do not accept a booklet without sticker-seal or open booklet.
   (*ii*) **Tally the number of pages and number of questions in the booklet with the information printed on the cover page. Faulty booklets due to missing pages/ questions or questions repeated or not in serial order or any other discrepancy should not be accepted and correct booklet should be obtained from the invigilator within the period of 5 minutes. Afterwards, neither the Question Booklet will be replaced nor any extra time will be given. The same may please be noted.**
   (*iii*) After this verification is over, the OMR Sheet Number should be entered on this Test Booklet.
4. Each question has four alternative responses marked (A), (B), (C) and (D). You have to darken the circle as indicated below on the correct response against each item.
   Example : where (C) is the correct response.

   (A) (B) ● (D)

5. Your responses to the items are to be indicated in the **OMR Sheet given inside the Booklet only.** If you mark at any place other than in the circle in the OMR Sheet, it will not be evaluated.
6. Read instructions given inside carefully.
7. Rough Work is to be done at the end of this booklet.
8. If you write your Name, Seat Number, Phone Number or put any mark on any part of the OMR Sheet, except for the space allotted for the relevant entries, which may disclose your identity, or use abusive language or employ any other unfair means, you will render yourself liable to disqualification.
9. You have to return original OMR Sheet to the invigilator at the end of the examination compulsorily and must not carry it with you outside the Examination Hall. You are, however, allowed to carry the Test Booklet and duplicate copy of OMR Sheet on conclusion of examination.
10. **Use only Blue/Black Ball point pen.**
11. **Use of any calculator or log table, etc., is prohibited.**
12. **There is no negative marking for incorrect answers.**

विद्यार्थ्यांसाठी महत्त्वाच्या सूचना

1. परिक्षार्थींनी आपला आसन क्रमांक या पृष्ठावरील वरच्या कोपऱ्यात लिहावा. तसेच आपणांस दिलेल्या उत्तरपत्रिकेचा क्रमांक त्याखाली लिहावा.
2. सदर प्रश्नपत्रिकेत **50** बहुपर्यायी प्रश्न आहेत. प्रत्येक प्रश्नास **दोन** गुण आहेत. या प्रश्नपत्रिकेतील **सर्व** प्रश्न सोडविणे अनिवार्य आहे. सदरचे प्रश्न हे या विषयाच्या संपूर्ण अभ्यासक्रमावर आधारित आहेत.
3. परीक्षा सुरू झाल्यावर विद्यार्थ्याला प्रश्नपत्रिका दिली जाईल. सुरुवातीच्या 5 मिनीटांमध्ये आपण सदर प्रश्नपत्रिका उघडून खालील बाबी अवश्य तपासून पहाव्यात.
   (*i*) प्रश्नपत्रिका उघडण्यासाठी प्रश्नपत्रिकेवर लावलेले सील उघडावे. सील नसलेली किंवा सील उघडलेली प्रश्नपत्रिका स्विकारू नये.
   (*ii*) **पहिल्या पृष्ठावर नमूद केल्याप्रमाणे प्रश्नपत्रिकेची एकूण पृष्ठे तसेच प्रश्नपत्रिकेतील एकूण प्रश्नांची संख्या पडताळून पहावी. पृष्ठे कमी असलेली/कमी प्रश्न असलेली/प्रश्नांचा चूकीचा क्रम असलेली किंवा इतर त्रुटी असलेली सदोष प्रश्नपत्रिका सुरुवातीच्या 5 मिनिटातच पर्यवेक्षकाला परत देऊन दुसरी प्रश्नपत्रिका मागवून घ्यावी. त्यानंतर प्रश्नपत्रिका बदलून मिळणार नाही तसेच वेळही वाढवून मिळणार नाही याची कृपया विद्यार्थ्यांनी नोंद घ्यावी.**
   (*iii*) वरीलप्रमाणे सर्व पडताळून पहिल्यानंतरच प्रश्नपत्रिकेवर ओ.एम.आर. उत्तरपत्रिकेचा नंबर लिहावा.
4. प्रत्येक प्रश्नासाठी (A), (B), (C) आणि (D) अशी चार विकल्प उत्तरे दिली आहेत. त्यातील योग्य उत्तराचा रकाना खाली दर्शविल्याप्रमाणे ठळकपणे काळा/निळा करावा.
   उदा. : जर (C) हे योग्य उत्तर असेल तर.

   (A) (B) ● (D)

5. या प्रश्नपत्रिकेतील प्रश्नांची उत्तरे **ओ.एम.आर. उत्तरपत्रिकेतच दर्शवावीत.** इतर ठिकाणी लिहीलेली उत्तरे तपासली जाणार नाहीत.
6. आत दिलेल्या सूचना काळजीपूर्वक वाचाव्यात.
7. प्रश्नपत्रिकेच्या शेवटी जोडलेल्या कोऱ्या पानावरच कच्चे काम करावे.
8. जर आपण ओ.एम.आर. वर नमूद केलेल्या ठिकाणा व्यतिरीक्त इतर कोठेही नाव, आसन क्रमांक, फोन नंबर किंवा ओळख पटेल अशी कोणतीही खूण केलेली आढळून आल्यास अथवा असभ्य भाषेचा वापर किंवा इतर गैरमार्गाचा अवलंब केल्यास विद्यार्थ्याला परीक्षेस अपात्र ठरविण्यात येईल.
9. परीक्षा संपल्यानंतर विद्यार्थ्याने मूळ ओ.एम.आर. उत्तरपत्रिका पर्यवेक्षकांकडे परत करणे आवश्यक आहे. तथापी, प्रश्नपत्रिका व ओ.एम.आर. उत्तरपत्रिकेची द्वितीय प्रत आपल्याबरोबर नेण्यास विद्यार्थ्यांना परवानगी आहे.
10. **फक्त निळ्या किंवा काळ्या बॉल पेनचाच वापर करावा.**
11. **कॅलक्युलेटर किंवा लॉग टेबल वापरण्यास परवानगी नाही.**
12. **चुकीच्या उत्तरासाठी गुण कपात केली जाणार नाही.**

Chemical Science
Paper II

Time Allowed : 75 Minutes] **[Maximum Marks : 100**

Note : This Paper contains **Fifty (50)** multiple choice questions. Each question carrying **Two (2)** marks. Attempt *All* questions.

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1. The number of metal-metal bonds in $[Mo_2Cl_8]^{4-}$ is :

   (A) 1 (B) 4

   (C) 3 (D) 2

2. The number of Cr—O bonds in $Cr_2(CH_3COO)_4.2H_2O$ is :

   (A) 8 (B) 10

   (C) 4 (D) 2

3. In reversed phase HPLC :

   (A) A hydrophilic stationary phase is combined with a Non-Polar mobile phase

   (B) A hydrophilic stationary phase is combined with a Polar mobile phase

   (C) A hydrophobic stationary phase is combined with a Non-Polar mobile phase

   (D) A hydrophobic stationary phase is combined with a Polar mobile phase

4. An analyst miscalculates the molecular weight of an analyst. This is an example of a ..... determinate error.

   (A) Methodic (B) Operative

   (C) Instrumental (D) Proportional

5. Which byproduct is obtained during the extraction of Pb from Galena in smelters ?

   (A) SO_3 (B) SO_4

   (C) SO_2 (D) S_3

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6. X-band EPR spectrum for $\left[Ni(H_2O)_6\right]^{2+}$ exhibit ..... lines.

(A) 5 (B) 2

(C) 7 (D) 0 (zero)

7. SF_4 molecule belongs to ..... point group.

(A) C_{2v} (B) C_{2h}

(C) C_{4h} (D) C_{4v}

8. The magnetic moment of lanthanide (III) ions are estimated by :

(A) $\mu_S = \sqrt{4S(S+1)}$ (B) $\mu_J = g\sqrt{J(J+1)}$

(C) $\mu_S = \sqrt{n(n+2)}$ (D) $\mu_{S+L} = \sqrt{4S(S+1)+L(L+1)}$

9. Tetrahedral complexes are always :

(A) high spin complexes (B) Low spin complexes

(C) Intermediate spin (D) High spin-low spin equilibria

10. Electric monopole interaction between nucleus and electrons at the nuclear site is known as ..... in Mössbauer spectroscopy.

(A) Isomer shift, δ (B) Quadrupole splitting, ΔE_q

(C) Magnetic splitting, ΔE_m (D) Mössbauer effect

11. According to IUPAC nomenclature the ligands O^{2-}, O_2^{2-} and Cl^- are named respectively as :

(A) Peroxido, oxido, chlorido (B) Oxido, peroxido, chlorido

(C) Oxido, peroxido, chloride (D) Oxido, superoxo, nitro

12. According to VSEPR theory, the shape of $[BF_4]^-$ ion is :

(A) Tetrahedral (B) Square planar

(C) Trigonal bipyramid (D) Octahedral

13. The number of electronic transitions observed in octahedral V(III) complexes are :

(A) Two (B) Three

(C) One (D) Four

14. The order of ionic radius for M^{+3} cations of group 13 is :

(A) Al < Ga < In < Tl (B) Al < Ga < Tl < In

(C) Al < In < Tl < Ga (D) Al < Tl < In < Ga

15. The hybridization in $[PtCl_4]^{2-}$ is :

(A) dsp^2 (B) dsp^3

(C) d^2sp^3 (D) sp^3

16. In spite of having trigonal bipyramid geometry, XeO_2F_2 and XeO_3F_2 contains ..... Π-bonds respectively.

(A) 2, 3 (B) 3, 2

(C) 2, 4 (D) 4, 2

17. The complexes $[Co(NH_3)_6]$ $[Cr(CN)_6]$ and $[Cr(NH_3)_6]$ $[Co(CN)_6]$ are examples of :

(A) Polymerization isomerism (B) Linkage isomerism

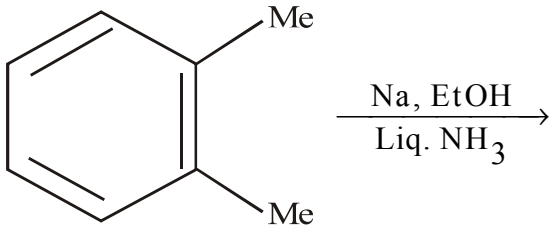
(C) Coordination isomerism (D) Ionization isomerism

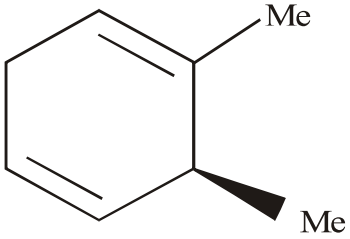
18. The laboratory analogues of ionophores are :

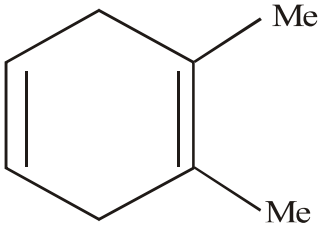
(A) Calixarenes (B) Cucurbituril

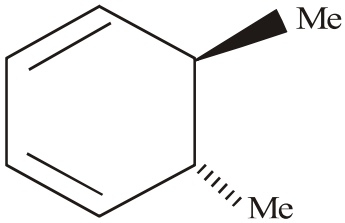
(C) Crown ethers (D) Cyclodextrin

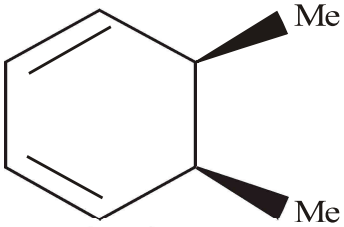
19. The major product formed in the following reaction is :



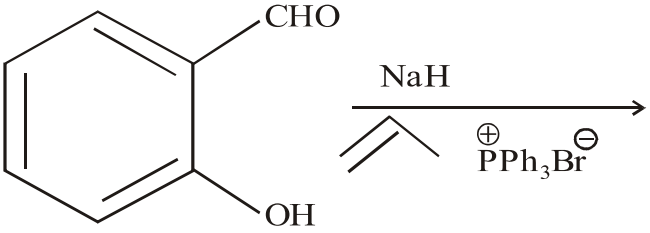
(A) 

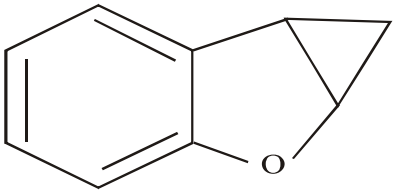
(B) 

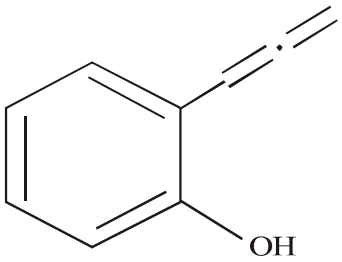
(C) 

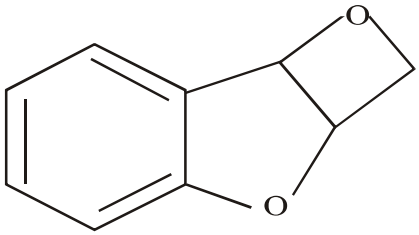
(D) 

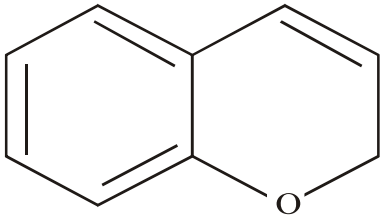
20. The major product formed in the following reaction is :



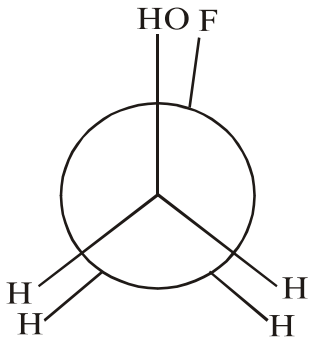
(A) 

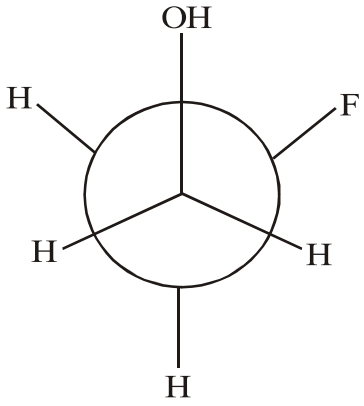
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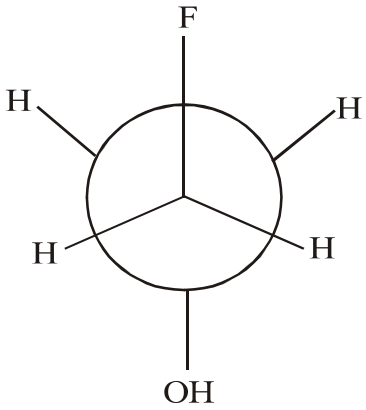
(C) 

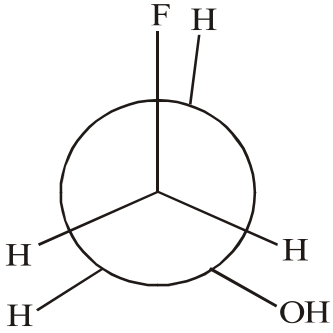
(D) 

21. The most stable conformation for $HOCH_2CH_2F$ is :

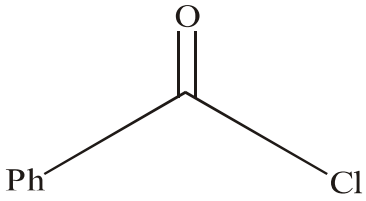
(A) 

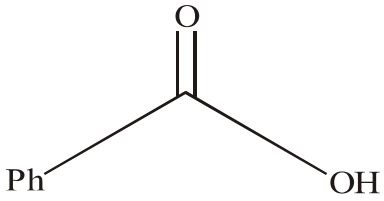
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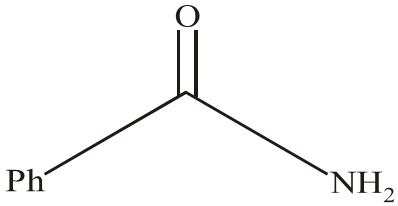
(C) 

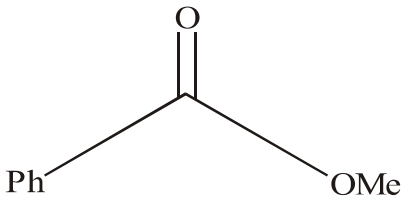
(D) 

22. Amongst the following, the compound that shows IR absorption band at 1815 cm^{-1} is :

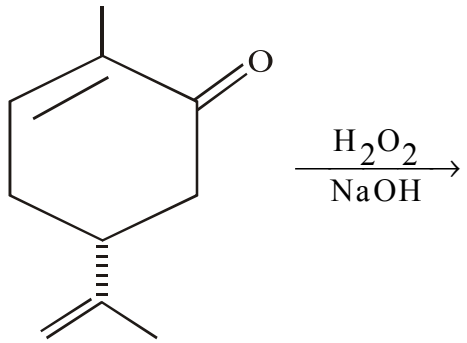
(A) 

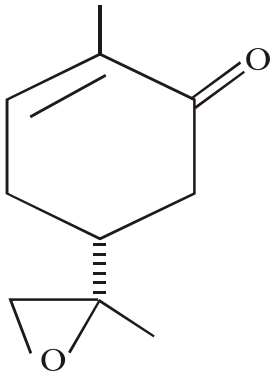
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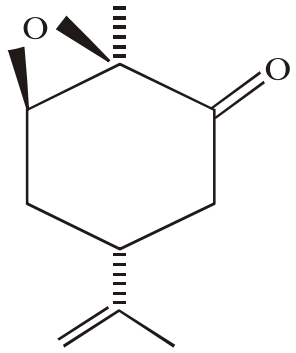
(C) 

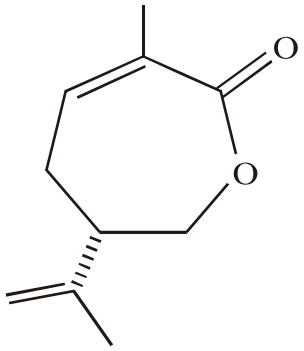
(D) 

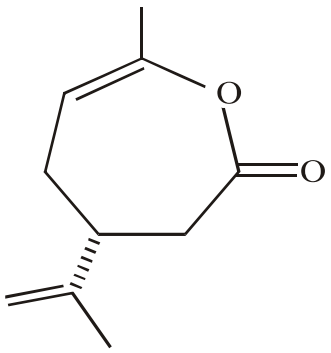
23. The major product formed in the following reaction is :



(A)


(B)


(C)


(D)


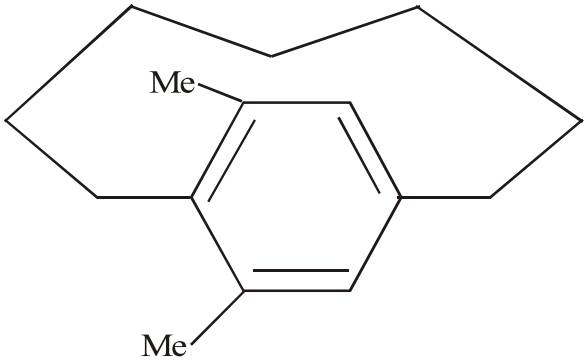
24. The *correct* order of basicity of the following species is :

$F_3CCO_2^{\ominus}$ (I) $Cl_3CCO_2^{\ominus}$ (II) $Br_3CCO_2^{\ominus}$ (III)

(A) I > III > II (B) II > I > III

(C) III > II > I (D) III > I > II

25. The symmetry present in the following molecule is :



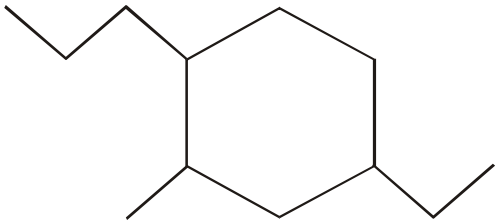
(A) Centre of symmetry

(B) C_2-axis of symmetry

(C) Plane of symmetry

(D) C_4-axis of symmetry

26. The *correct* IUPAC nomenclature of the following compound is :



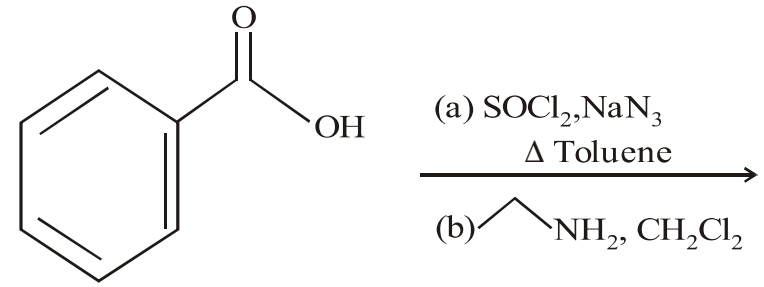
(A) 4-Ethyl-2-methyl-1-propylcyclohexane

(B) 1-Ethyl-3-methyl-4-propylcyclohexane

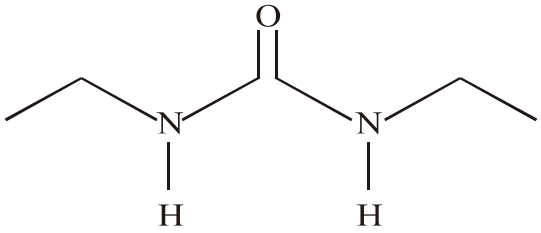
(C) 5-Ethyl-1-methyl-2-propylcyclohexane

(D) 3-Ethyl-1-methyl-6-propylcyclohexane

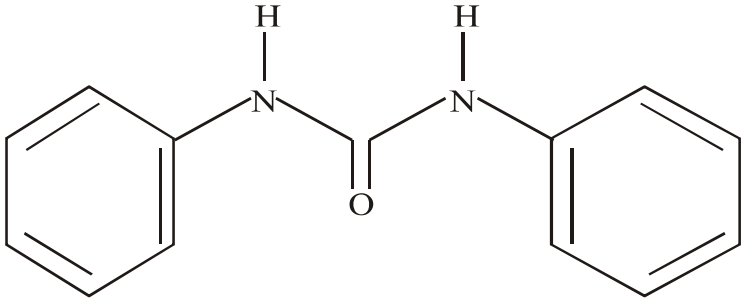
27. Major product of the following reaction is :



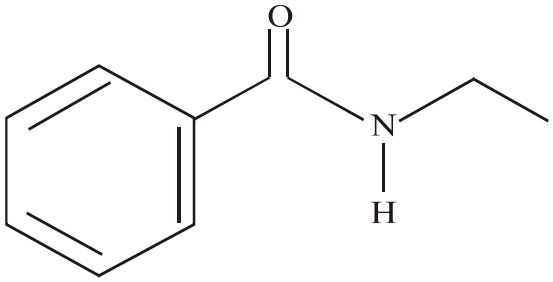
(A)



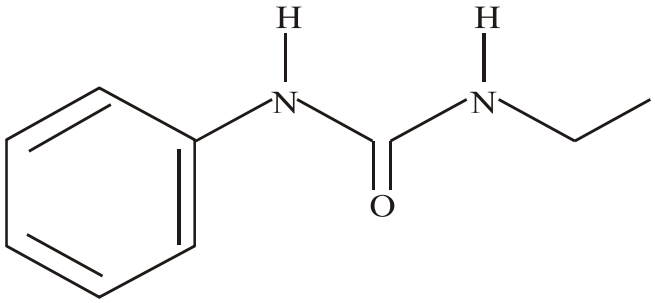
(B)



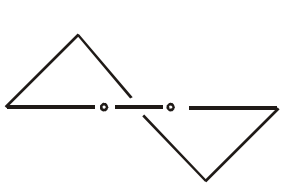
(C)



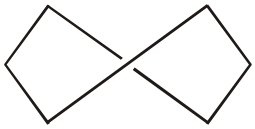
(D)



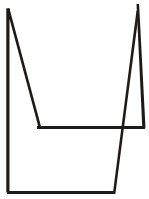
28. The *correct* order of stability for the following conformational structures of cyclohexane is :



(I)



(II)



(III)

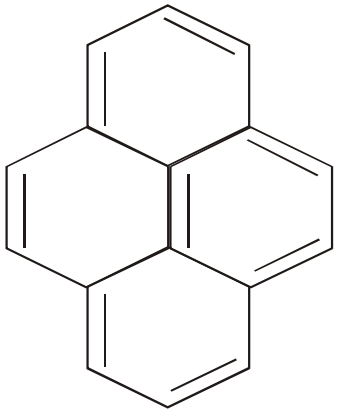
(A) III > I > II

(B) III > II > I

(C) II > III > I

(D) II > I > III

29. Total number of signals observed in the proton decoupled ^{13}C NMR spectrum of the following compound is :



(A) 4

(B) 5

(C) 8

(D) 16

30. Number of signals observed in the proton decoupled ^{13}C NMR spectrum of $(CH_3CH_2)_2\ C = CH—CH_3$ is :

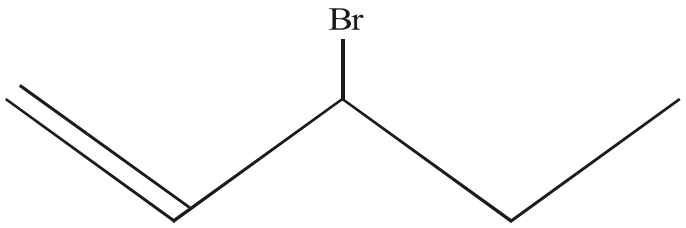
(A) 4

(B) 5

(C) 6

(D) 7

31. The *correct* IUPAC nomenclature of the following compound is :



(A) 3-Bromopent-4-ene

(B) 3-Bromopent-1-ene

(C) 1-Bromo-1-ethylprop-2-ene

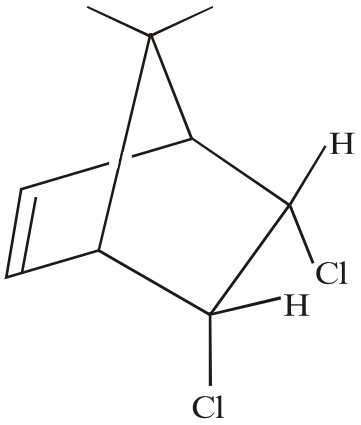
(D) Ethyl vinyl bromomethane

32. The coupling constant of a triplet is 7.0 Hz on 300 MHz NMR spectrometer. The coupling constant of this triplet on 600 MHz NMR spectrometer would be :

(A) 3.5 Hz (B) 6.0 Hz

(C) 7.0 Hz (D) 14.0 Hz

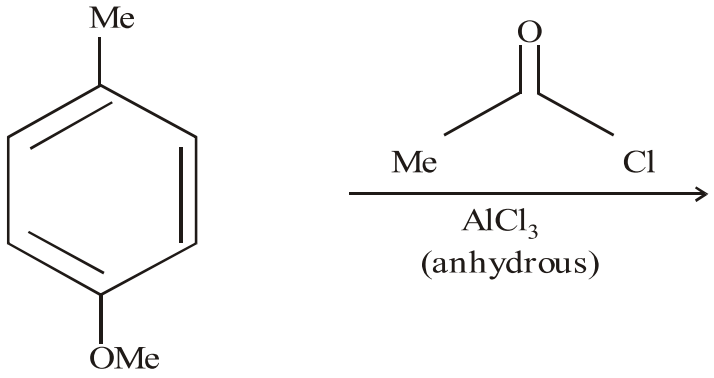
33. Number of signals observed in the ^{1}H NMR and proton decoupled ^{13}C NMR spectra for the following compound, respectively, are :



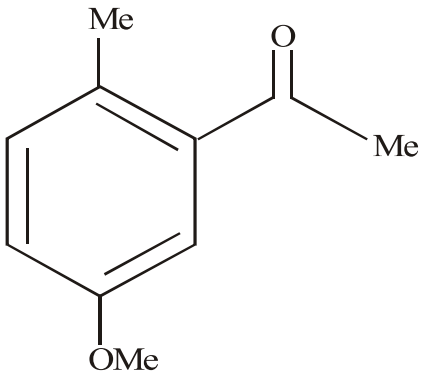
(A) 4, 5 (B) 5, 6

(C) 8, 6 (D) 5, 5

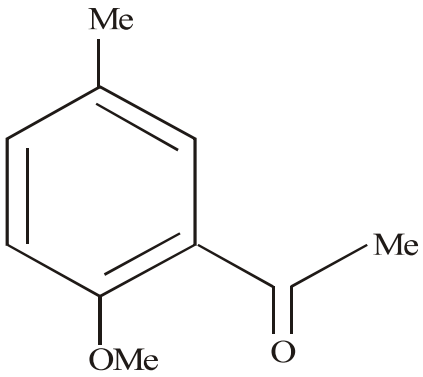
34. The major product formed in the following reaction is :



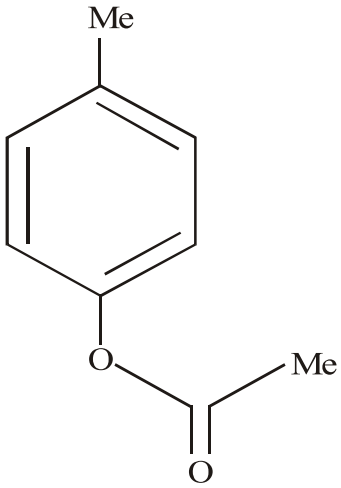
(A)



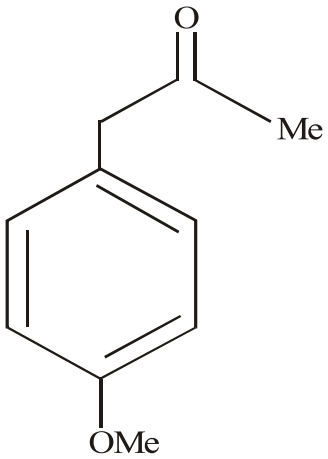
(B)



(C)



(D)



35. The redox reaction

$$2MnO_{4\,(aq)}^{-} + SO_{3\,(aq)}^{2-} + H_2O \longrightarrow 2MnO_{4\,(aq)}^{2-} + SO_{4\,(aq)}^{2-} + 2H^{+}_{(aq)}$$

in basic solution will be of the form :

(A) $2MnO_{4\,(aq)}^{-} + SO_{3\,(aq)}^{2-} \longrightarrow 2MnO_{4\,(aq)}^{2-} + SO_{4\,(aq)}^{2-} + H_2O_{(aq)}$

(B) $2MnO_{4\,(aq)}^{-} + SO_{3\,(aq)}^{2-} + 2OH^{-}_{(aq)} \longrightarrow 2MnO_{4\,(aq)}^{2-} + SO_{4\,(aq)}^{2-} + H_2O$

(C) $2MnO_{4\,(aq)}^{-} + SO_{3\,(aq)}^{2-} + 2OH^{-}_{(aq)} \longrightarrow 2MnO_{4\,(aq)}^{2-} + SO_{4\,(aq)}^{2-} + H_2O + 2OH^{-}_{(aq)}$

(D) $2MnO_{4\,(aq)}^{-} + SO_{3\,(aq)}^{2-} + H_2O \longrightarrow 2MnO_{4}^{2-} + SO_{4}^{2-} + 2H^{+}_{(aq)} + 2OH^{-}_{(aq)}$

36. Which of the following will increase the EMF of the given reaction ?

$$Cu_{(s)} + 2Ag^{+}_{(eq)} \rightleftharpoons Cu^{2+}_{(eq)} + 2Ag_{(s)}$$

(A) Increasing the area of the Cu electrode

(B) Increasing the area of the Ag electrode

(C) Increasing $[Cu^{2+}]_{aq}$

(D) Increasing $[Ag^{+}]_{aq}$

37. Which of the following is *not* a rodox reaction ?

(A) $Zn_{(s)} + 2H_2SO_{4(aq)} \longrightarrow ZnSO_{4(aq)} + 2H_2O_{(l)} + SO_{2(g)}$

(B) $2Mg_{(s)} + O_{2(g)} \longrightarrow 2MgO_{(s)}$

(C) $2AgNO_{3(aq)} + K_2CrO_{4(aq)} \longrightarrow Ag_2CrO_{4(aq)} + 2KNO_{3(aq)}$

(D) $Fe_2O_{3(s)} + 3CO_{(g)} \longrightarrow 2Fe_{(s)} + 3CO_2(g)$

38. In which of the following pairs of molecules the oxidation number of nitrogen is the same ?

(A) HNO_2 and HNO_3 (B) NO_2 and N_2O

(C) N_2O_5 and HNO_3 (D) HNO_3 and N_2O

39. When molten $CuCl_2$ is electrolysed using Pt electrodes, the reaction that occurs at the anode is :

(A) $Cu_{(s)} \longrightarrow Cu^{2+} + 2e^-$

(B) $2Cl^- \longrightarrow Cl_2(g) + 2e^-$

(C) $Cu^{2+} + 2e \longrightarrow Cu_{(s)}$

(D) $Cl_2 + 2e \longrightarrow 2Cl^-$

40. Based on the data given below, choose the *correct* option :

Br_2/Br^- = + 1.90 V

Ag^+/Ag = 0.80 V

Cu^{2+}/Cu = +0.34 V

I_2/I^- = +0.54 V

(A) Ca will oxidise Br^- (B) Ag will oxidise Cu^{2+}

(C) Cu will reduce Br_2 (D) Ag^+ will oxidise Cu

41. At 25°C, concentration of pure water is :

(A) 1.0 M (B) 55.5 M

(C) 18 M (D) 0.0 M

42. In a sample of pure water, which of the following is always ture at all conditions of temperature and pressure ?

(A) $[H_3O^+] = 1.0 \times 10^{-7}$ M

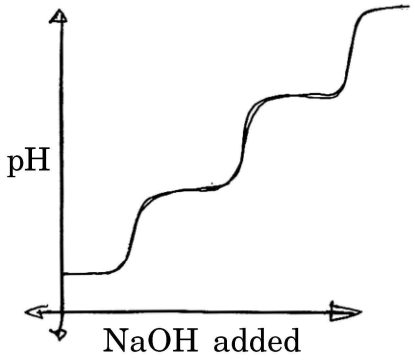
(B) $pK_w = 14.0$

(C) $[H_3O^+] = [OH^-]$

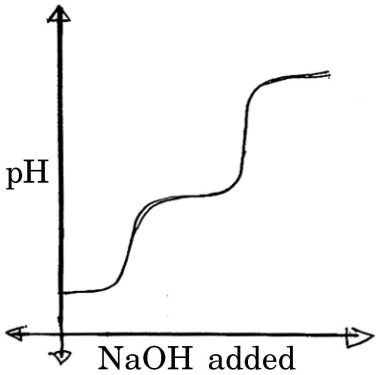
(D) $[H_3O^+] + [OH^-] = 1.0 \times 10^{-14}$

43. When completely protonated form of glycine is titrated with NaOH, which of the following represents the pH *Vs* conc. NaOH plot ? (Chemical formula of glycine is H_2NCH_2COOH).

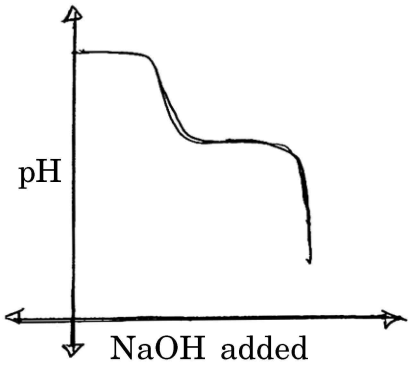
(A)



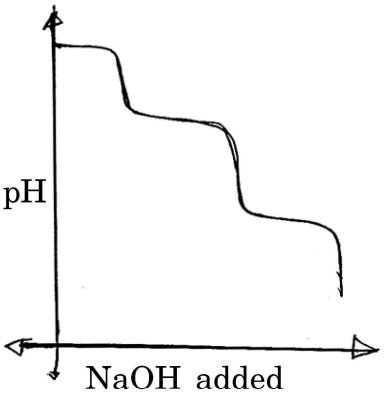
(B)



(C)



(D)



44. 50 mL of 0.1 M NaOH is mixed with an equal volume and equimolar solution of a monobasic acid whose K_a is 1.0×10^{-5}. The pH of the resulting solution is :

(A) 6.85 (B) 7.00

(C) 8.85 (D) 7.15

45. If the colour changes in an acid-base indicator ($pK_{indicator} = 7.2$) are as given below, which of the following is *correct* ?

$$HIn_{(aq)} \rightleftharpoons H^+_{(aq)} + In^-_{(aq)}$$

Yellow Pink

(A) In a strong alkaline solution pink colour will be observed

(B) In a strong acidic solution, pink colour is observed

(C) In a strong alkaline solution, yellow colour is observed

(D) At pH = 5.5, $[In^-]$ is more than [HIn]

46. Which of the following reactions will have $\Delta S^\circ > 0$?

(A) $S_{8(l)} \longrightarrow S_{8(s)}$

(B) $H_{2(g)} + O_{2(g)} \longrightarrow H_2O_{(l)}$

(C) $H_{2(g)} + 2Ag^+_{(aq)} \longrightarrow 2H^+_{(aq)} + 2Ag_{(s)}$

(D) $PCl_{5(g)} \longrightarrow PCl_{3(g)} + Cl_{2(g)}$

47. Which of the following does not have the dimensions of energy ?

(A) Pressure × area (B) Pressure × Volume

(C) Volt × Coloumb (D) Pressure × Volume

48. Among the following, the process that is exothermic is :

(A) Fusion (B) Evaporation

(C) Sublimation (D) Condensation

49. For the thermal decomposition of acetaldehyde, $CH_3CHO \longrightarrow CH_4 + CO$, the rate equation is found to be $\frac{d}{dt}[CH_4] = k[CH_3CHO]^{1.5}$. If v is the rate of this reaction when $p_{CH_3CHO} = p_1$, when $p_1 = 4p_1$, the :

(A) rate of the reaction will increase 4 times

(B) rate constant of the reaction will increase 4 times

(C) rate of the reaction will increase 8 times

(D) rate of the reaction will decrease 8 times

50. The heat capacity of an equimolar mixture of He and Ar be having as ideal gases would be :

(A) 6 R (B) 3/2 R

(C) 3 R (D) 2 R

ROUGH WORK