Test Booklet Code &No.
प्रश्नपत्रिका कोड व क्र.

A

Paper-II
CHEMICAL SCIENCE

Signature and Name of Invigilator

Seat No. ☐☐☐☐☐☐

1. (Signature) ....

(In figures as in Admit Card)

(Name) ....

2. (Signature) ....

Seat No. ....

(In words)

(Name) ....

OMR Sheet No. ☐☐☐☐☐☐

MAY - 33216

(To be filled by the Candidate)

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	विद्यार्थ्यांसाठी महत्त्वाच्या सूचना
1. Write your Seat No. and OMR Sheet No. in the space provided on the top of this page.	1. परिक्षार्थींनी आपला आसन क्रमांक या पृष्ठावरील वरच्या कोप-यात लिहावा. तसेच आपणांस दिलेल्या उत्तरपत्रिकेचा क्रमांक त्याखाली लिहावा.
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).	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. 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 :	3. परीक्षा सुरू झाल्यावर विद्यार्थ्याला प्रश्नपत्रिका दिली जाईल. सुरुवातीच्या 5 मिनिटांमध्ये आपण सदर प्रश्नपत्रिका उघडून खालील बाबी अवश्य तपासून पहाव्यात.
(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.	(i) प्रश्नपत्रिका उघडण्यासाठी प्रश्नपत्रिकेवर लावलेले सील उघडावे. सील नसलेली किंवा सील उघडलेली प्रश्नपत्रिका स्विकारू नये.
(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.**	(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) After this verification is over, the OMR Sheet Number should be entered on this Test Booklet.	(iii) वरीलप्रमाणे सर्व पडताळून पहिल्यानंतरच प्रश्नपत्रिकेवर ओ.एम.आर. उत्तरपत्रिकेचा नंबर लिहावा.
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. Ⓐ Ⓑ ● Ⓓ	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. Ⓐ Ⓑ ● Ⓓ
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.	5. या प्रश्नपत्रिकेतील प्रश्नांची उत्तरे **ओ.एम.आर. उत्तरपत्रिकेतच दर्शवावीत.** इतर ठिकाणी लिहीलेली उत्तरे तपासली जाणार नाहीत.
6. Read instructions given inside carefully.	6. आत दिलेल्या सूचना काळजीपूर्वक वाचाव्यात.
7. Rough Work is to be done at the end of this booklet.	7. प्रश्नपत्रिकेच्या शेवटी जोडलेल्या को-या पानावरच कच्चे काम करावे.
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.	8. जर आपण ओ.एम.आर. वर नमूद केलेल्या ठिकाणा व्यतिरिक्त 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. 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.	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. **Use only Blue/Black Ball point pen.**	10. **फक्त निळ्या किंवा काळ्या बॉल पेनाचा वापर करावा.**
11. **Use of any calculator or log table, etc., is prohibited.**	11. कॅलक्युलेटर किंवा लॉग टेबल वापरण्यास परवानगी नाही.
12. **There is no negative marking for incorrect answers.**	12. चुकीच्या उत्तरासाठी गुण कपात केली जाणार नाही.

ROUGH WORK

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.

---

1. The value of $\left(\dfrac{\partial C_v}{\partial V}\right)_T$ for an ideal gas is :

    (A) $\dfrac{R}{V}$ (B) $\dfrac{V}{P}$

    (C) Zero   (D) $\dfrac{V}{R}$

2. 1 mole of MnO_4^{2-} in neutral aqueous medium get disproportionate to :

    (A) $\dfrac{2}{3}$ mol of MnO_4^- and $\dfrac{1}{3}$ mol of MnO_2

    (B) $\dfrac{1}{3}$ mol of MnO_4^- and $\dfrac{2}{3}$ mol of MnO_2

    (C) $\dfrac{1}{3}$ mol of Mn_2O_7 and $\dfrac{2}{3}$ mol of MnO_2

    (D) $\dfrac{2}{3}$ mol of Mn_2O_7 and $\dfrac{1}{3}$ mol of MnO_2

3. A diatomic gas is heated at constant pressure. If 20 J of heat is given to the gas what is the change in internal energy of the gas ?

    (A) 4 J   (B) 8 J

    (C) 3 Kcal   (D) 6 J

4. Which of the following species contains an element in an oxidation state that is not a whole number ?

(A) VO_4^{3-}

(B) Mn_2O_3

(C) $S_4O_6^{2-}$

(D) $Cr_2O_7^{2-}$
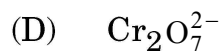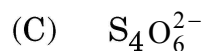
5. For a second order reaction a graph of $\dfrac{1}{(a-x)}$ *Vs* time is shown :
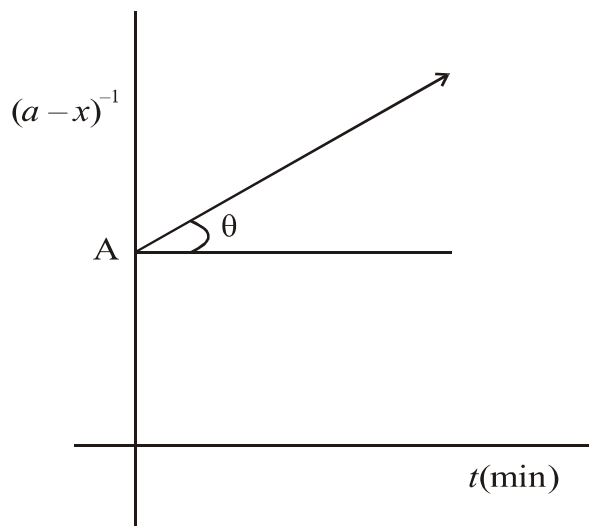
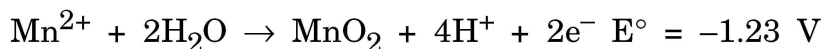If $\theta = \tan^{-1}(0.5)$ and OA = 2.1 cm^{-1}, then the half-life for this reaction is :

(A)   1.386 min

(B)   4 min

(C)   16 min

(D)   2 min

6. Consider the following half cell reactions ?

    $Mn^{2+} + 2H_2O \rightarrow MnO_2 + 4H^+ + 2e^-$ $E° = -1.23$ V

    $MnO_4^- + 4H^+ + 3e^- \rightarrow MnO_2 + 2H_2O$ $E° = +1.70$ V

    Based on this information, select the *correct* statement.

    (A) Mn^{2+} cannot react with MnO_4^- in acidic solution

    (B) A stable $Mn(MnO_4)_2$ complex forms

    (C) MnO_2 disproportionate to Mn^{2+} and MnO_4^{2-}

    (D) Mn^{2+} react with MNO_4^- in acidic solution to form MnO_2

7. The species in which the central atom uses sp^2 hybrid orbitals in its bonding is :

    (A) PH_3 (B) NH_3

    (C) BCl_3 (D) SbH_3

8. The oxidation number of oxygen in O_2^{2-} ion is :

    (A) 0   (B) -2

    (C) -4 (D) -1

9. Which of the following represents the *correct* rank order for second ionization energies ?

    (A) F > O > N > C   (B) C > N > O > F

    (C) O > F > N > C   (D) O > N > F > C

10. Which of the following *does not* acts as Lewis acid ?

    (A) BF_3 (B) $SnCl_4$

    (C) CCl_4 (D) SF_4

11. The hydrogenic orbital having two radial nodes and one angular node in their appropriate representations is :

    (A) $3d$ (B) $4f$

    (C) $5d$ (D) $5p$

12. Which of the following curves corresponds to the titration of weak base (analyte) with strong acid (titrant) ?

    (A)   (B)

    (C)   (D)
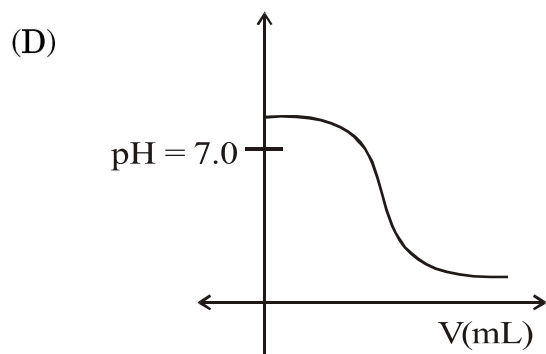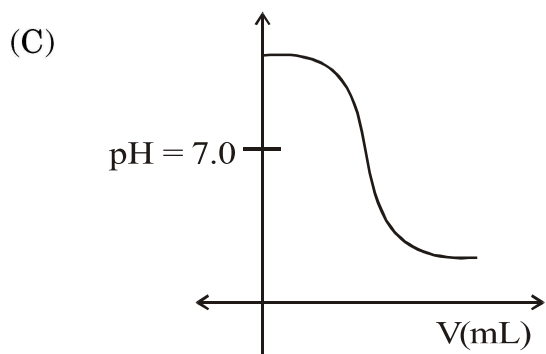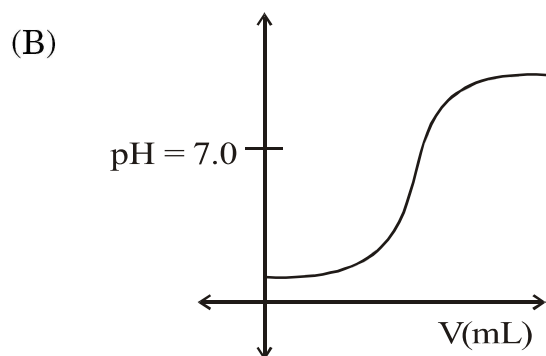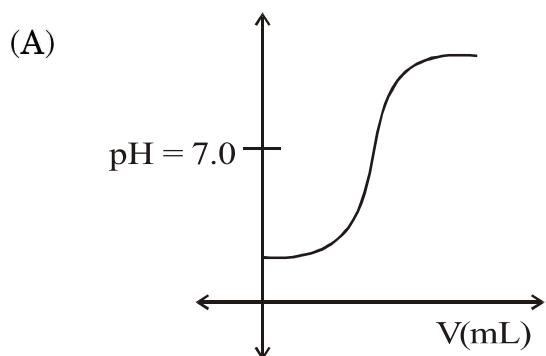
13. Which of the following species has bond order 3 ?

    (A)   CN   (B)   NO

    (C)   BN   (D) CN^-

14. Which of the following is *not* a buffer solution ?

    (A) 0.8 M H_2S + 0.8M KHS

    (B) 2M $C_6H_5NH_2$ + 2M $C_6H_5NH_3^+Br^-$

    (C) 3M H_2CO_3 + 3M $KHCO_3$

    (D) 0.05 M $KClO_4$ + 0.05 M $HClO_4$

15. The hydrogenic orbital with its (unnormalized) spherical harmonic part being $\sin^2 \theta \sin^2 \phi$ represents which of the following orbital ?

    (A) $d_{x^2 - y^2}$ (B) d_{z^2}

    (C) d_{yz} (D) d_{xy}

16. pH of 0.1 M solutions of the following salts increases in the order :

    (A) NaCl < NH_4Cl < NaCN < HCl

    (B) HCl < NH_4Cl < NaCl < NaCN

    (C) NaCN < NH_4Cl < NaCl < HCl

    (D) HCl < NaCl < NaCN < NH_4Cl

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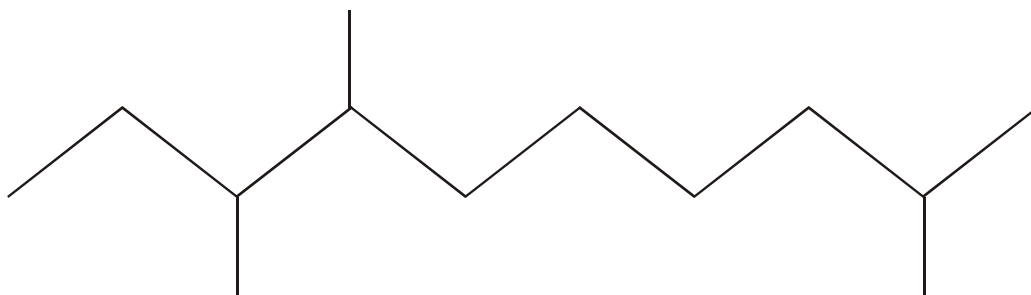

    (A) 3, 4, 9-trimethyl decane

    (B) 2, 7, 8-trimethyl decane

    (C) isotetradecane

    (D) 7-methyl-2-(1-methylpropyl) octane

18. (2R, 3S)-D-threose on oxidation with nitric acid gives tartaric acid. The *correct* stereo-chemical structure of the product in this reaction is :

(A)

(B)

(C)

(D)
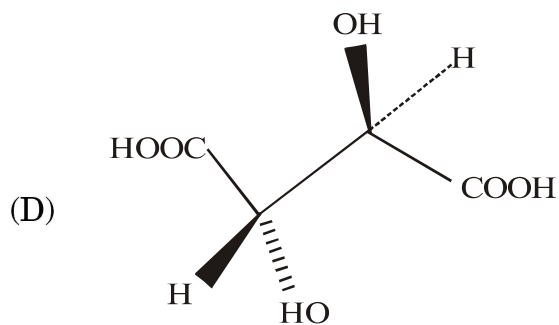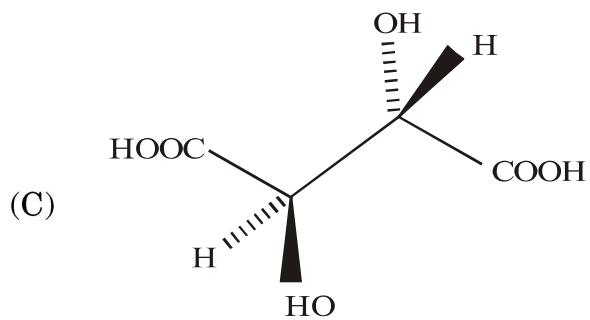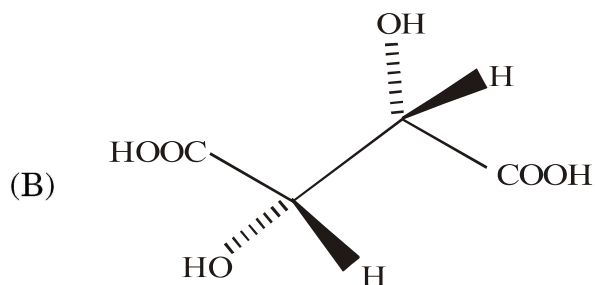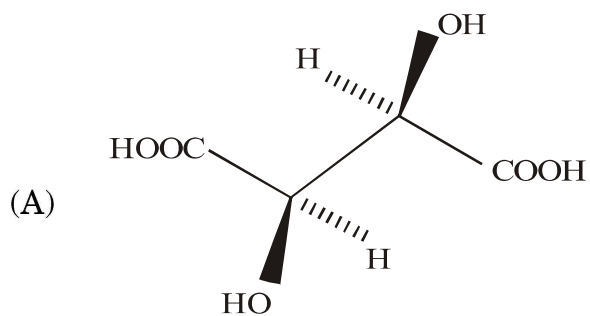
19. The most *correct* statement with reference to 1, 2-dibromocyclohexane is :
   (A) Its diaxial form is more stable than diequatorial form due to favorable steric arrangement of bromine atoms
   (B) Its diaxial form is less stable than the diequatorial form
   (C) Its diaxial form is more stable than diequatorial form due to favorable arrangement of dipoles
   (D) Its diequatorial form is less stable than the diaxial form

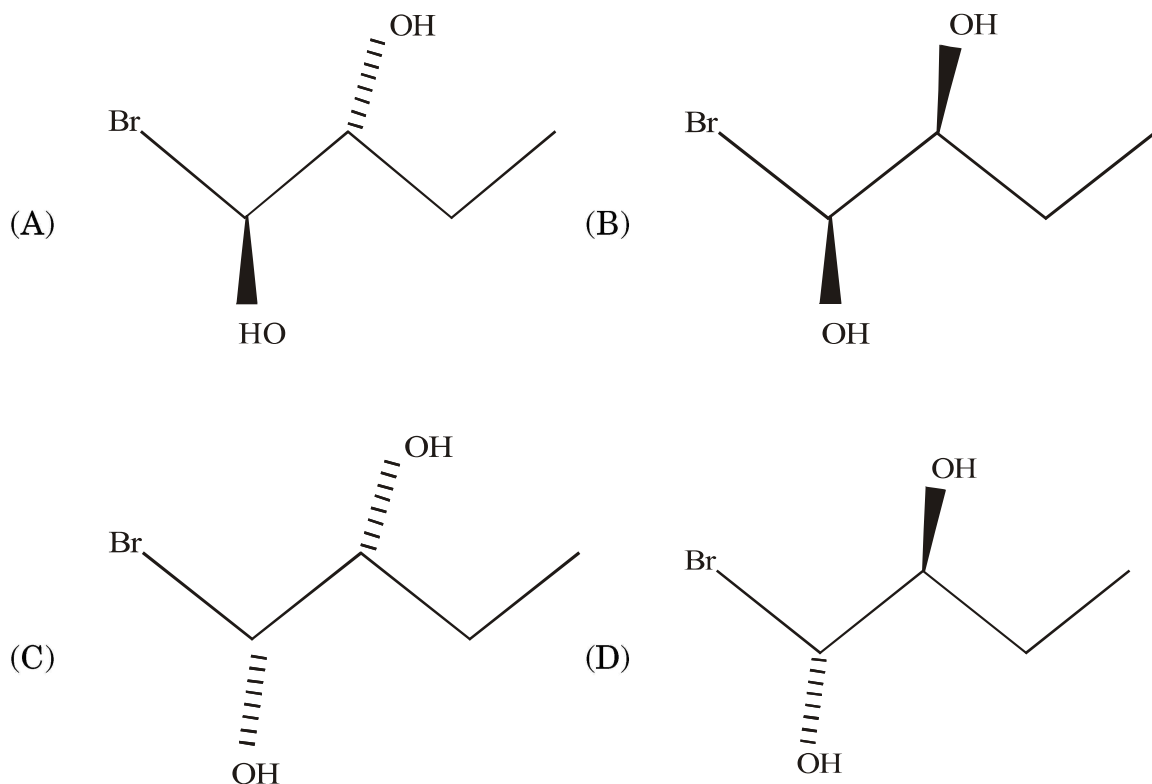20. Which of the Fischer projection correctly represents the following compound ?

[P.T.O.
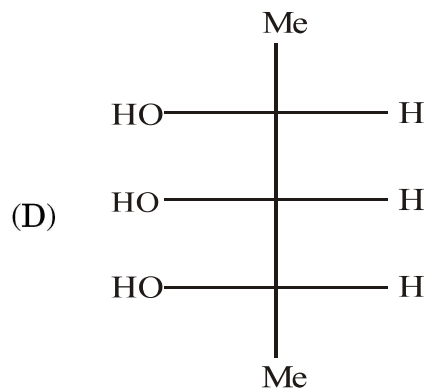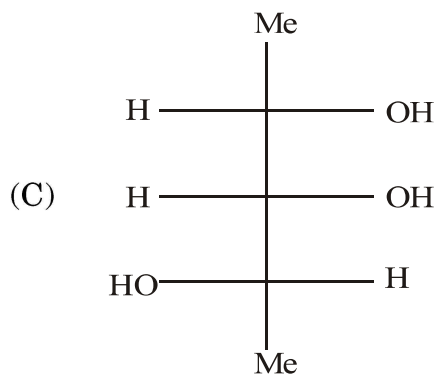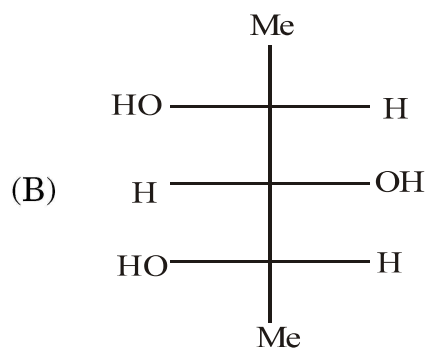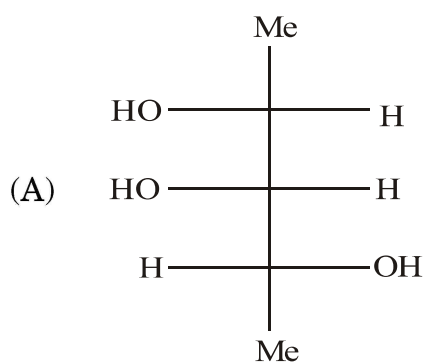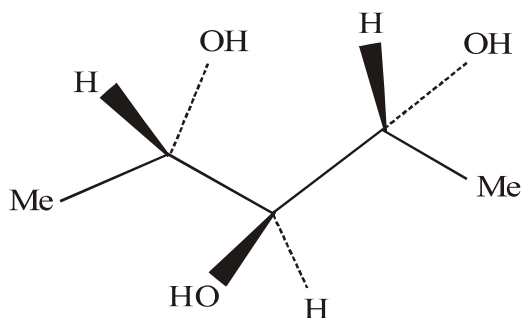
21. Hexa-2, 3, 4-triene shows :

   (A)   Cis-trans isomerism   (B)   Atropisomerism

   (C)   Polymorphism   (D)   Metamorphism

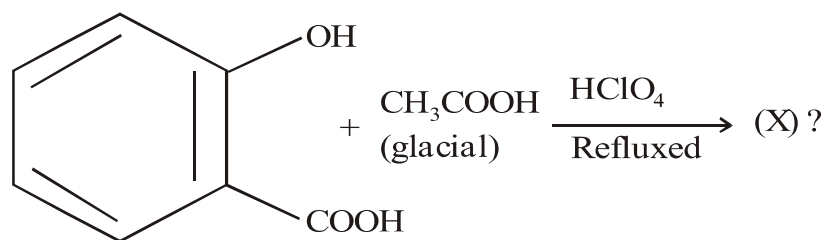22. The number of diastereomers present in pentan-2, 3, 4-triol are :

   (A)   Three   (B)   Two

   (C)   Four   (D)   One

23. The *correct* structure of (1R, 2R)-1-bromobutane-1, 2-diol is represented by :
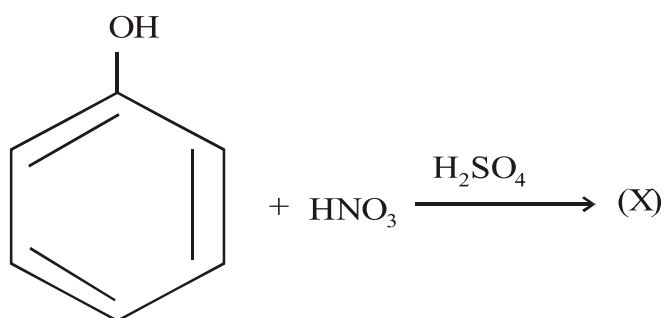
(A)

(B)

(C)

(D)

24. The product(X) of the following reaction is :

(A)   X = Oil of Winter Green   (B)   X = Oil of Winter Red

(C)   X = Oil of Summer Green   (D)   X = Oil of Summer Red

25. Predict the product(X) of the following reaction :


(A)   X = partial nitration to give 2-nitrophenol only

(B)   X = partial nitration to give 4-nitrophenol only

(C)   X = maximum nitration to give 2, 4-dinitrophenol

(D)   X = complete nitration to give picric acid

26. Ethoxide anion is a strong base and hence can act as :

   (A) good nucleophile in nucleophilic substitution reactions with alkyl halide

   (B) good electrophile in electrophilic substitution reactions with phenyl halide

   (C) good nucleophile in nucleophilic substitution reaction with phenyl halide

   (D) good nucleophile in nucleophilic substitution reactions with vinyl halide

27. (4+2) π type cycloaddition reaction occurs between alkene and other species is (X)

$+ (x) \xrightarrow{h\nu}$ Cyclic Ring of Six Members Carbon Skeleton
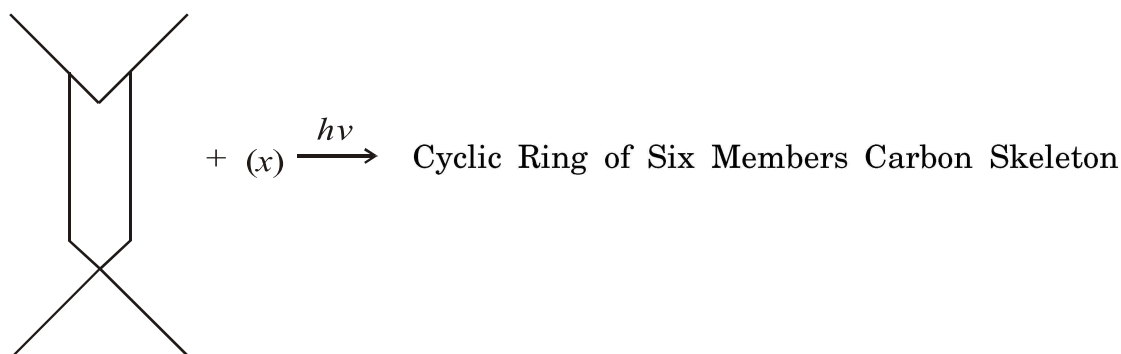
   (A) $(x) = 1, 3$ butadiene

   (B) $(x) = 1, 2$ butadiene

   (C) $(x) =$ Acetylene with structure $(CH_3—C≡C—CH_3)$

   (D) $(x) =$ Ketene with structure $[(CH_3)_2—C=C=O]$

28. The acid sensitive aldehydes and ketones reacts to give alkanes only under :

   (A) Catalytic Reduction   (B) Birch Reduction

   (C) MPV Reduction   (D) Wolf-Kishner Reduction

29. Picric acid formation from phenol is carried out in two steps, first sulphonation of phenol and second step is nitration of intermediate. This is done :

    (A)   To avoid formation of explosive material

    (B)   To avoid decomposition of picric acid

    (C)   To avoid problems arise due to reversibility

    (D)   To avoid oxidative degradation of phenol under direct nitration procedure

30. Gammaxene, a known pesticide has the following one of the structure :
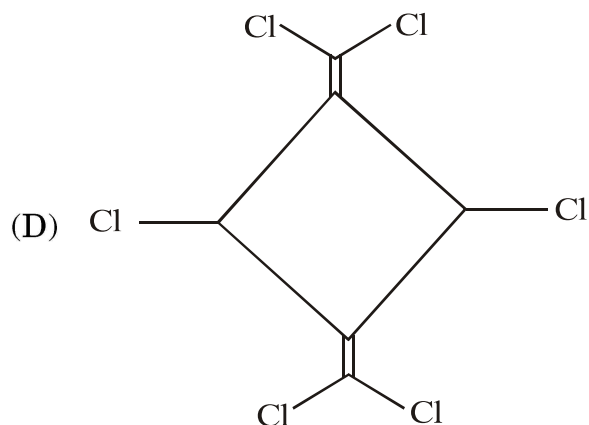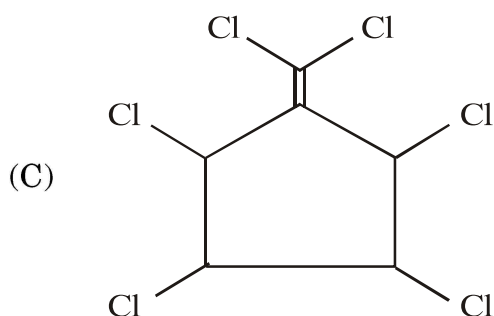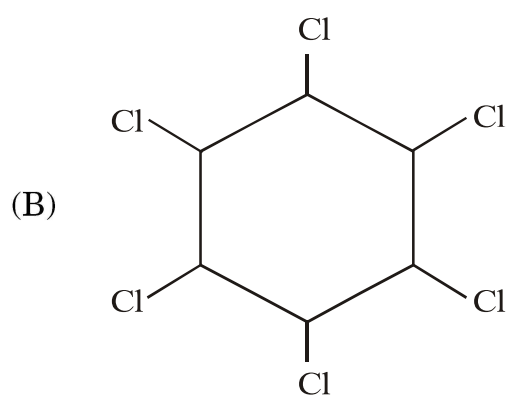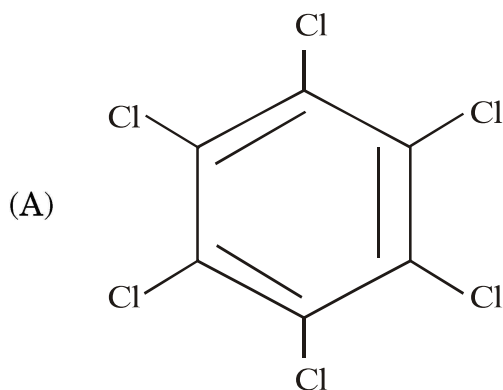
31. Oppenauer oxidation is a method for selective oxidation of secondary alcohols to ketones and this reaction process is opposite to :

(A) Meerwein-Pondroff-Verley reduction

(B) Wolf-Kishner reduction

(C) Birch reduction

(D) Clemmensen reduction

32. A solution of sodium metal in liquid ammonia generates $[Na(NH_3)_x]^+.e^-$ which gives intense blue colour, this species is called as :

(A) The ammonium-electron pair   (B) The free electron

(C) The hydrated electron   (D) The solvated electron

33. Which metal is extracted from ore bauxite ?

(A) Tungsten   (B) Arsenic

(C) Aluminum   (D) Gold

34. A solution of sodium in liquid ammonia is strongly reducing due to the

    presence of :

    (A) Sodium atom   (B) Sodium hydride

    (C) Sodium amide   (D) Solvated electrons

35. Which are metals having the largest atomic radii within their period (row)

    of the periodic table ?

    (A) Alkali metals   (B) Alkaline earth metals

    (C) Rare earth metals   (D) Transition metals

36. The acidic character of the oxides of C and S increases in the order :

    (A) $CO_2 < SO_2 < SO_3$ (B) $SO_2 < CO_2 < SO_3$

    (C) $SO_3 < SO_2 < CO_2$ (D) $SO_3 < CO_2 < SO_2$

37. Which of the following structure is most expected for molecule $XeOF_4$?

(A)   Tetrahedral   (B)   Square pyramidal

(C)   Trigonal bipyramidal   (D)   Octahedral

38. The number of bridging carbonyl group in $Mn_2(CO)_{10}$, $Os_2(CO)_9$ and

$Fe_2(CO)_9$ is respectively :

(A)   1, 2 and 3   (B)   0, 1 and 2

(C)   0, 1 and 3   (D)   1, 2 and 3

39. The difference between the energy of d_{xy} and $d_{x^2-y^2}$ orbitals in the

complexes with tetrahedral geometry is :

(A)   0 Dq   (B)   4 Dq

(C)   6 Dq   (D)   10 Dq

40. The total number of isomers formed by $[Co(NH_3)_4(NO_2)_2]$ is :

(A)   2   (B)   3

(C)   4   (D)   6

41. Carborundum is one of the form of :

   (A) Al_2O_3 (B)   SiC

   (C) CaC_2 (D) Al_4C_3

42. In XeF_4, Xe atom involves hybridization :

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

   (C) sp^3d^2 (D) sp^3d^3
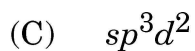
43. Dinuclear metal carbanyl containing only one bridging carbonyl group is :

   (A) $Mn_2(CO)_{10}$ (B) $Fe_2(CO)_9$

   (C) $Co_2(CO)_8$ (D) $Ru_2(CO)_9$
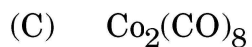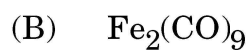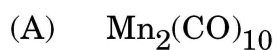
44. Which one of the following is paramagnetic ?

   (A) $Fe(CO)_5$ (B) $Cr(CO)_6$

   (C) $Ni(CO)_4$ (D) $V(CO)_6$
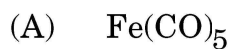
45. A metal ion with $S = \dfrac{1}{2}$ and $I = \dfrac{7}{2}$ has isotropic ESR. How many hyperfine lines are expected to be observed in its ESR spectrum ?

   (A) 7   (B) 8

   (C) 14   (D) 15

46. A particular method for determination of iron yields results that are low by 0.6 mg. What will be the percent relative error due to this source if the weight of iron in the sample is 25 mg ?

   (A) +2.4%   (B) −2.4%

   (C) −1.2%   (D) +1.2%

47. A certain instrumental technique has a standard deviation of 0.2%. How many replicate measurements are necessary if the standard error of the mean is to be 0.01% ?

   (A) 4.0×10^2 (B) 2.0×10^2

   (C) 2.0×10^4 (D) 4.0×10^3

48. The calibration curve for the chromatographic determination of isooctane in a hydrocarbon mixture was described as :

$$Y = 2.09 \ C + 0.26$$

where C is in mole percent. A peak area of 2.65 was obtained for a given sample of hydrocarbon. What is the mole percent of isooctane in the given sample ?

(A)   0.144

(B)   1.144

(C)   2.144

(D)   0.149

49. The following results were obtained in the replicate determination of lead content in environment sample :

0.752, 0.756, 0.752, 0.751 and 0.760.

The mean value and standard deviation of this observation are 0.754 ppm and 0.004 ppm Pb. What is the coefficient of variation ?

(A)   0.45%

(B)   0.53%

(C)   0.82%

(D)   0.55%

50. The standard deviation in a method for the determination of substance x in a given sample has been found to be 0.03 ppm. How many measurements should be made if the 95% confidence level (z = 1.96) is to be ± 0.017 ?

(A)   12

(B)   10

(C)   13

(D)   9

ROUGH WORK