Test Paper : **III**

Test Subject : **CHEMICAL SCIENCE**

Test Subject Code : **K-2714**

Test Booklet Serial No. : _____

OMR Sheet No. : _____

Roll No. | | | | | | | | |
(Figures as per admission card)

Name & Signature of Invigilator/s

Signature : _____ Signature : _____

Name : _____ Name : _____

Paper : III

Subject : CHEMICAL SCIENCE

Time : 2 Hours 30 Minutes Maximum Marks : 150

Number of Pages in this Booklet : **16** Number of Questions in this Booklet : **75**

ಅಭ್ಯರ್ಥಿಗಳಿಗೆ ಸೂಚನೆಗಳು

1. ಈ ಪುಟದ ಮೇಲ್ತುದಿಯಲ್ಲಿ ಒದಗಿಸಿದ ಸ್ಥಳದಲ್ಲಿ ನಿಮ್ಮ ರೋಲ್ ನಂಬರನ್ನು ಬರೆಯಿರಿ.
2. ಈ ಪತ್ರಿಕೆಯು ಬಹು ಆಯ್ಕೆ ವಿಧದ ಎಪ್ಪತ್ತೈದು ಪ್ರಶ್ನೆಗಳನ್ನು ಒಳಗೊಂಡಿದೆ.
3. ಪರೀಕ್ಷೆಯ ಪ್ರಾರಂಭದಲ್ಲಿ, ಪ್ರಶ್ನೆಪುಸ್ತಿಕೆಯನ್ನು ನಿಮಗೆನೀಡಲಾಗುವುದು. ಮೊದಲ5 ನಿಮಿಷಗಳಲ್ಲಿ ನೀವು ಪುಸ್ತಿಕೆಯನ್ನು ತೆರೆಯಲು ಮತ್ತು ಕೆಳಗಿನಂತೆ ಕಡ್ಡಾಯವಾಗಿ ಪರೀಕ್ಷಿಸಲು ಕೋರಲಾಗಿದೆ.
   (i) ಪ್ರಶ್ನೆಪುಸ್ತಿಕೆಗೆ ಪ್ರವೇಶಾವಕಾಶ ಪಡೆಯಲು, ಈ ಹೊದಿಕೆ ಪುಟದ ಅಂಚಿನ ಮೇಲಿರುವ ಪೇಪರ್ ಸೀಲನ್ನು ಹರಿಯಿರಿ. ಸ್ಟಿಕ್ಕರ್ ಸೀಲ್ ಇಲ್ಲದ ಪ್ರಶ್ನೆಪುಸ್ತಿಕೆ ಸ್ವೀಕರಿಸಬೇಡಿ. ತೆರೆದ ಪುಸ್ತಿಕೆಯನ್ನು ಸ್ವೀಕರಿಸಬೇಡಿ.
   (ii) **ಪುಸ್ತಿಕೆಯಲ್ಲಿನ ಪ್ರಶ್ನೆಗಳ ಸಂಖ್ಯೆ ಮತ್ತು ಪುಟಗಳ ಸಂಖ್ಯೆಯನ್ನು ಮುಖಪುಟದ ಮೇಲೆ ಮುದ್ರಿಸಿದ ಮಾಹಿತಿಯೊಂದಿಗೆ ತಾಳೆ ನೋಡಿರಿ. ಪುಟಗಳು/ ಪ್ರಶ್ನೆಗಳು ಕಾಣೆಯಾದ, ಅಥವಾ ದ್ವಿಪ್ರತಿ ಅಥವಾ ಅನುಕ್ರಮವಾಗಿಲ್ಲದ ಅಥವಾ ಇತರ ಯಾವುದೇ ವ್ಯತ್ಯಾಸದ ದೋಷಪೂರಿತ ಪುಸ್ತಿಕೆಯನ್ನು ಕೂಡಲೆ5 ನಿಮಿಷದ ಅವಧಿ ಒಳಗೆ, ಸಂವೀಕ್ಷಕರಿಂದ ಸರಿ ಇರುವ ಪುಸ್ತಿಕೆಗೆ ಬದಲಾಯಿಸಿಕೊಳ್ಳಬೇಕು. ಆ ಬಳಿಕ ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆಯನ್ನು ಬದಲಾಯಿಸಲಾಗುವುದಿಲ್ಲ, ಯಾವುದೇ ಹೆಚ್ಚು ಸಮಯವನ್ನೂ ಕೊಡಲಾಗುವುದಿಲ್ಲ.**
4. ಪ್ರತಿಯೊಂದು ಪ್ರಶ್ನೆಗೂ (A), (B), (C) ಮತ್ತು (D) ಎಂದು ಗುರುತಿಸಿದ ನಾಲ್ಕು ಪರ್ಯಾಯ ಉತ್ತರಗಳಿವೆ. ನೀವು ಪ್ರಶ್ನೆಯ ಎದುರು ಸರಿಯಾದ ಉತ್ತರದ ಮೇಲೆ, ಕೆಳಗೆ ಕಾಣಿಸಿದಂತೆ ಅಂಡಾಕೃತಿಯನ್ನು ಕಪ್ಪಾಗಿಸಬೇಕು.
   ಉದಾಹರಣೆ: (A) (B) ● (D)
   (C) ಸರಿಯಾದ ಉತ್ತರವಾಗಿದ್ದಾಗ.
5. ಪ್ರಶ್ನೆಗಳಿಗೆ ಉತ್ತರಗಳನ್ನು, **ಪತ್ರಿಕೆIII ಪುಸ್ತಿಕೆಯೊಳಗೆ ಕೊಟ್ಟಿರುವ** OMR **ಉತ್ತರ ಹಾಳೆಯಲ್ಲಿ ಮಾತ್ರವೇ ಸೂಚಿಸತಕ್ಕದ್ದು.** OMR ಉತ್ತರ ಹಾಳೆಯಲ್ಲಿನ ಅಂಡಾಕೃತಿ ಹೊರತುಪಡಿಸಿ ಬೇರೆ ಯಾವುದೇ ಸ್ಥಳದಲ್ಲಿ ಗುರುತಿಸಿದರೆ, ಅದರ ಮೌಲ್ಯಮಾಪನ ಮಾಡಲಾಗುವುದಿಲ್ಲ.
6. OMR ಉತ್ತರ ಹಾಳೆಯಲ್ಲಿ ಕೊಟ್ಟ ಸೂಚನೆಗಳನ್ನು ಜಾಗರೂಕತೆಯಿಂದ ಓದಿರಿ.
7. ಎಲ್ಲಾ ಕರಡು ಕೆಲಸವನ್ನು ಪುಸ್ತಿಕೆಯ ಕೊನೆಯಲ್ಲಿ ಮಾಡತಕ್ಕದ್ದು.
8. ನಿಮ್ಮ ಗುರುತನ್ನು ಬಹಿರಂಗಪಡಿಸಬಹುದಾದ ನಿಮ್ಮ ಹೆಸರು ಅಥವಾ ಯಾವುದೇ ಚಿಹ್ನೆಯನ್ನು, ಸಂಗತವಾದ ಸ್ಥಳ ಹೊರತು ಪಡಿಸಿ, OMR ಉತ್ತರ ಹಾಳೆಯ ಯಾವುದೇ ಭಾಗದಲ್ಲಿ ಬರೆದರೆ, ನೀವು ಅನರ್ಹತೆಗೆ ಬಾಧ್ಯರಾಗಿರುತ್ತೀರಿ.
9. ಪರೀಕ್ಷೆಯು ಮುಗಿದನಂತರ, ಕಡ್ಡಾಯವಾಗಿ OMR ಉತ್ತರ ಹಾಳೆಯನ್ನು ಸಂವೀಕ್ಷಕರಿಗೆ ನೀವು ಹಿಂತಿರುಗಿಸಬೇಕು ಮತ್ತು ಪರೀಕ್ಷಾ ಕೊಠಡಿಯ ಹೊರಗೆ OMR ನ್ನು ನಿಮ್ಮೊಂದಿಗೆ ಕೊಂಡೊಯ್ಯ ಕೂಡದು.
10. ಪರೀಕ್ಷೆಯ ನಂತರ, ಪರೀಕ್ಷಾ ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆಯನ್ನು ಮತ್ತು ನಕಲು OMR ಉತ್ತರ ಹಾಳೆಯನ್ನು ನಿಮ್ಮೊಂದಿಗೆ ತೆಗೆದುಕೊಂಡು ಹೋಗಬಹುದು.
11. **ನೀಲಿ/ಕಪ್ಪು ಬಾಲ್‌ಪಾಯಿಂಟ್ ಪೆನ್ ಮಾತ್ರವೇ ಉಪಯೋಗಿಸಿರಿ.**
12. **ಕ್ಯಾಲ್ಕುಲೇಟರ್ ಅಥವಾ ಲಾಗ್ ಟೇಬಲ್ ಇತ್ಯಾದಿಯ ಉಪಯೋಗವನ್ನು ನಿಷೇಧಿಸಲಾಗಿದೆ.**
13. **ಸರಿ ಅಲ್ಲದ ಉತ್ತರಗಳಿಗೆ ಋಣ ಅಂಕ ಇರುವುದಿಲ್ಲ.**

Instructions for the Candidates

1. Write your roll number in the space provided on the top of this page.
2. This paper consists of seventy five multiple-choice type of questions.
3. At the commencement of examination, the question booklet will be given to you. In the first 5 minutes, you are requested to open the booklet and compulsorily examine it as below :
   (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 and do not accept an 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 pages/questions missing or duplicate or not in serial order or any other discrepancy should be got replaced immediately by a correct booklet from the invigilator within the period of 5 minutes. Afterwards, neither the Question Booklet will be replaced nor any extra time will be given.**
4. Each item has four alternative responses marked (A), (B), (C) and (D). You have to darken the oval as indicated below on the correct response against each item.
   Example : (A) (B) ● (D)
   where (C) is the correct response.
5. Your responses to the question of Paper III are to be indicated in the **OMR Sheet kept inside the Booklet**. If you mark at any place other than in the ovals in OMR Answer Sheet, it will not be evaluated.
6. Read the instructions given in OMR carefully.
7. Rough Work is to be done in the end of this booklet.
8. If you write your name or put any mark on any part of the OMR Answer Sheet, except for the space allotted for the relevant entries, which may disclose your identity, you will render yourself liable to disqualification.
9. You have to return the test OMR Answer Sheet to the invigilators at the end of the examination compulsorily and must NOT carry it with you outside the Examination Hall.
10. You can take away question booklet and carbon copy of OMR Answer Sheet soon after the examination.
11. **Use only Blue/Black Ball point pen.**
12. **Use of any calculator or log table etc., is prohibited.**
13. **There is no negative marks for incorrect answers.**

CHEMICAL SCIENCE

PAPER – III

Note : This paper contains **seventy-five (75)** objective type questions. **Each** question carries **two (2)** marks. **All** questions are **compulsory**.

1. Which one of the following is incorrect with respect to the property indicated ?

(A) Electronegativity : $F_2 > Cl_2 > Br_2$

(B) Electron affinity : $Cl_2 > F_2 > Br_2$

(C) Oxidizing power : $F_2 > Cl_2 > Br_2$

(D) Bond energy : $F_2 > Cl_2 > Br_2$

2. Which one of the following sets indicate the correct variation in electronegativities ?

(A) F > N < O > C

(B) F > N > O > C

(C) F < N < O < C

(D) F < O > N > C

3. Nitric oxide has the electronic configuration (K electrons) $\sigma_s^2\ \sigma_s^{*2}\ \pi_{x,y}^4\ \sigma_{pz}^2\ \pi_{x,y}^{*1}$. Which one of the following statements is correct ?

(A) on ionization to form NO^+, its bond order decreases and bond length increases

(B) on ionization to form NO^+, its bond order and bond length decrease

(C) on ionization to form NO^+, its bond order and bond length increase

(D) on ionization to form NO^+, its bond order increases and bond length decreases

4. The states of hybridization of nitrogen in the species NO_2^+, NO_2^- and NH_4^+ are respectively

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

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

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

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

5. Super acid which is known as magic acid is a solution of

(A) HF-SbF_5

(B) HSO_3F-SbF_5

(C) HSO_3F-Nb $(SO_3F)_5$

(D) HSO_3F-Ta $(SO_3F)_5$

6. Two hypothetical acids HA and HB have the dissociation constants 1×10^{-3} and 1×10^{-5} respectively in water. How many times HA is stronger than HB ?

(A) 10 times

(B) 100 times

(C) 1000 times

(D) Not definite

7. The lowest energy visible spectral band of an octahedral Nickel (II) complex is due to the transition

(A) $3_{T_{2g}} \longleftarrow 3_{T_{1g}}$

(B) $3_{A_{2g}} \longleftarrow 3_{T_{1g}}$

(C) $3_{T_{2g}} \longleftarrow 3_{A_{2g}}$

(D) $3_{T_{1g}} \longleftarrow 3_{A_{2g}}$

8. Which one of the following complexes has the highest magnetic moment ?

(A) $[Fe(CN)_6]^{4-}$

(B) $[Vo(H_2O)_5]^{2+}$

(C) $[Cr(NH_3)_6]^{3+}$

(D) $[Co(H_2O)_6]^{3+}$

9. The reaction

$[Co(H_2O)_5\ Cl]^{2+} + [Cr(H_2O)_6]^{2+} \longrightarrow [Co(H_2O)_6]^{2+} + [Cr(H_2O)_5Cl]^{2+}$ is an example of

(A) Isomerization reaction

(B) Inner sphere electron transfer reaction

(C) Outer sphere electron transfer reaction

(D) Hydrolysis reaction

10. Predict the number of Mo – Mo bonds in $[(\eta^5 - C_5H_5)Mo(CO)_2]_2$ molecule using 18-electron rule.

(A) One

(B) Two

(C) Three

(D) Four

11. The product(s) of the reaction of $[Ir\ Cl(CO)(PPh_3)_2]$ and CH_3I is/are

(A) $[Ir\ Cl(COCH_3)I(PPh_3)_2]$

(B) $[Ir\ Cl(CO)(CH_3)(I)(PPh_3)_2]$

(C) $[Ir\ I(CO)(PPh_3)_2] + CH_3Cl$

(D) $[Ir\ Cl(CO)(CH_3)I(PPh_3)] + PPh_3$

12. The correct order of CO stretching frequency in the series $V(CO)_6^-$, $Mn(CO)_6^+$ and $Cr(CO)_6$ is

(A) $V(CO)_6^- < Mn(CO)_6^+ < Cr(CO)_6$

(B) $Cr(CO)_6 > V(CO)_6^- > Mn(CO)_6^+$

(C) $V(CO)_6^- < Cr(CO)_6 < Mn(CO)_6^+$

(D) $Cr(CO)_6 > Mn(CO)_6^+ > V(CO)_6^-$

13. The complex that would show a d-d band in the electronic spectrum is

(A) $[MnO_4]^-$

(B) $[FeCl_4]^-$

(C) [Cu(1, 10-phenanthroline)$_2$]$^+$

(D) $[Fe(CN)_6]^{4-}$

14. Based on Wade's rule, the predicted structure of the metal cluster $[Fe_4C(CO)_{12}]^{2-}$ is

(A) Nido

(B) Arachno

(C) Closo

(D) Octahedral

15. The metalloenzyme involved in the key step of the skin pigment melanine formation is

(A) Superoxide dismutase

(B) Myoglobin

(C) Tyrosinase

(D) Nitrogenase

16. The ground term symbol of the metal ion present in coenzyme B_{12} is

(A) 5_{D_0}

(B) 5_{D_4}

(C) 1_{S_0}

(D) $2_{D_{3/2}}$

17. The function of hemoglobin is to

(A) Store oxygen in muscle unit

(B) Catalyse biochemical process

(C) Transport oxygen from lungs to various tissues through blood

(D) Help in muscular movement

18. Calculate the absorbance of a 1×10^{-4}m solution of a compound at 500 nm whose molar _____ absorptivity '$\in$' is 5000 litres $mol^{-1}cm^{-1}$ if a 1 cm cell is used.

(A) 0.5 (B) 5.0

(C) 5×10^7 (D) 10

19. A radioactive substance has a half life period of 5760 years. A 100 mg of the sample will be reduced to 25 mg in

(A) 2880 years

(B) 11520 years

(C) 1440 years

(D) 17280 years

20. The number of ^{1}H-NMR signals exhibited by $(\eta^1 - C_p)(\eta^5 - C_p)Fe(CO)_2$ at room temperature and at low temperature (– 80°C) are respectively

(A) 1 and 2

(B) 2 and 3

(C) 2 and 4

(D) 1 and 4

21. Match the following :

List – I (Techniques)	**List – II (Type of equilibrium)**
i) Gas-liquid chromatography	a) Partition between liquid and mobile liquid
ii) Partition chromatography	b) Partition between fluid and bonded surface
iii) Affinity chromatography	c) Partition between gas and liquid
iv) Supercritical fluid chromatography	d) Partition between immiscible liquids

(A) i – c, ii – a, iii – b, iv – d

(B) i – c, ii – d, iii – a, iv – b

(C) i – d, ii – a, iii – b, iv – c

(D) i – a, ii – d, iii – c, iv – b

22. Match the following :

List – I	**List – II**
i) The catalyst is in different physical phase from the reactants	a) Autocatalysis
ii) The phenomenon of one of the products of reaction itself acts as catalyst	b) Negative catalysis
iii) The phenomenon when a catalyst reduces the rate of a reaction	c) Heterogeneous catalysis
iv) When the catalyst is in the same phase as the reactants	d) Homogeneous catalysis

(A) i – b, ii – d, iii – c, iv – a

(B) i – c, ii – a, iii – b, iv – d

(C) i – b, ii – a, iii – c, iv – d

(D) i – c, ii – d, iii – b, iv – a

23. The paramagnetic nature of a sample can be detected by

(A) NMR spectroscopy

(B) IR spectroscopy

(C) Mossbauer spectroscopy

(D) ESR spectroscopy

24. A Fe(III) in a 0.8202 g sample was determined by coulometric reduction to Fe(II) at a platinum cathode. Calculate the percentage of $Fe_2(SO_4)_3$ (Mol.wt = 399.88) in the sample if 103.2775 C were required for the reaction.

(A) 26.09% (B) 52.18%

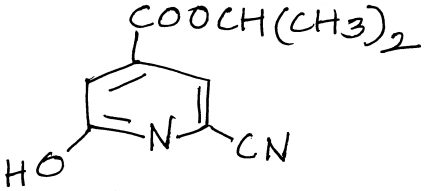
(C) 13.03% (D) 39.12%

25. A thin sample of gold was irradiated in a thermal neutron flux of 10^{12} neutrons cm^2 sec^{-1} for 25.6 hrs. In the reaction the nucleide 198 Au is produced with a half life of 64 hrs. If the thermal neutron cross section is 98 barns, calculate the specific activity of the sample.

(A) 3.92 Curie/g (B) 1.96 Curie/g

(C) 0.86 Curie/g (D) 1.26 Curie/g

26. The IUPAC name of the compound is



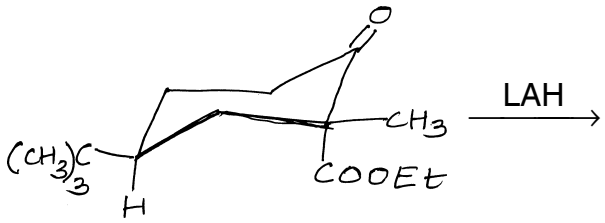
(A) Isopropyl 2-cyano-6-hydroxypyridine-4-carboxylate

(B) Isopropyl 6-cyano-2-hydroxypyridine-4-carboxylate

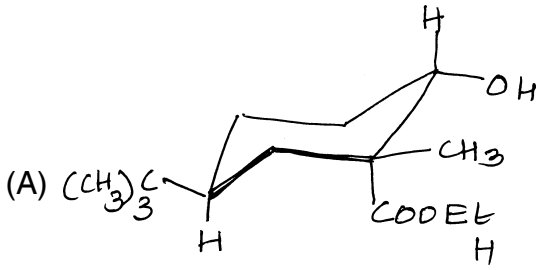
(C) Isopropyl 3-cyano-5-hydroxypyridine carboxylate

(D) Isopropyl-3-hydroxy-5-cyanopyridine carboxylate

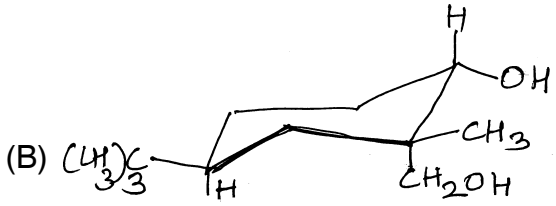
27. The predominant product of the following reaction is



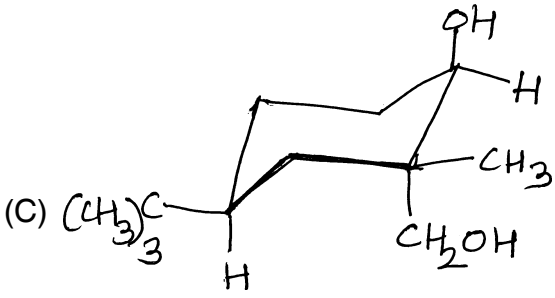
(A)



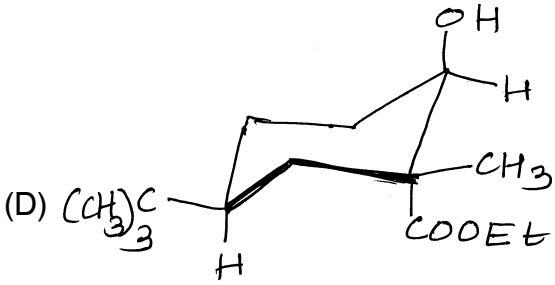
(B)



(C)



(D)



28. The absolute configuration R or S to each chiral center in the following compound is

(A) R, R

(B) S, R

(C) S, S

(D) R, S

29. The correct order of stability of carbanions is

i) $Ph\overset{\ominus}{C}H_2$

ii) $\overset{\ominus}{C}H_2NO_2$

iii) $\overset{\ominus}{C}H_2COOEt$

iv) $\overset{\ominus}{C}H_2COCH_3$

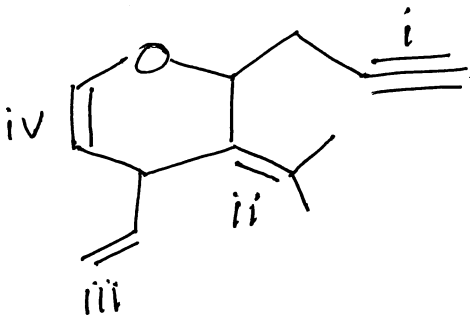
(A) iii < i < ii < iv

(B) iv < i < iii < ii

(C) ii < iv < iii < i

(D) i < iii < iv < ii

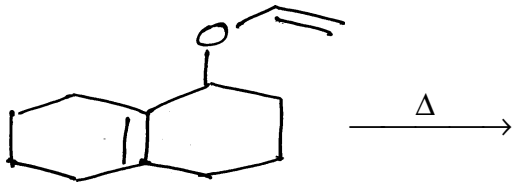
30. The reactivity of different multiple bonds in decreasing order for electrophilic addition reactions is



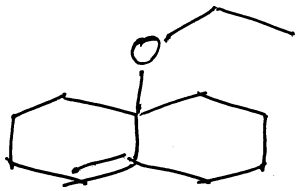
(A) i, ii, iii, iv (B) ii, iii, iv, i

(C) iv, iii, ii, i (D) iv, ii, iii, i

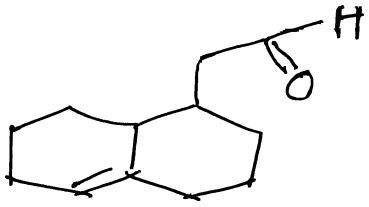
31. The product formed in the following thermal reaction is



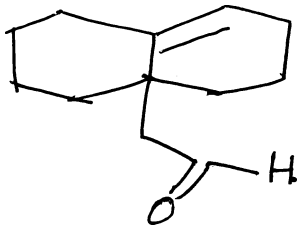
(A)



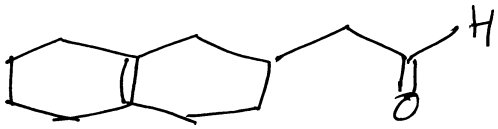
(B)



(C)



(D)



32. Match List-I (Reaction) with List-II (Reactive intermediates involved) and select the correct answer from the options given below :

List – I	List – II
i) Dieckmann condensation	a) Nitrene
ii) Friedal-Crafts alkylation	b) Carbene
iii) Hofmann rearrangement	c) Carbocation
iv) Riemer-Tiemann reaction	d) Carbanion

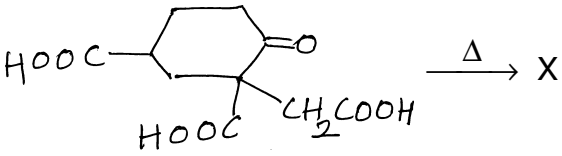
(A) i – d, ii – c, iii – b, iv – a

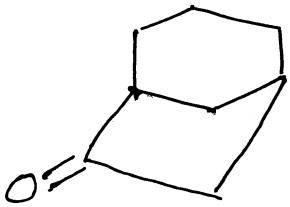
(B) i – d, ii – c, iii – a, iv – b

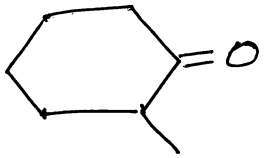
(C) i – c, ii – d, iii – b, iv – a

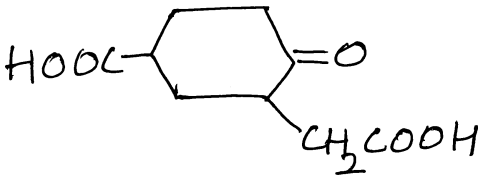
(D) i – c, ii – d, iii – a, iv – b

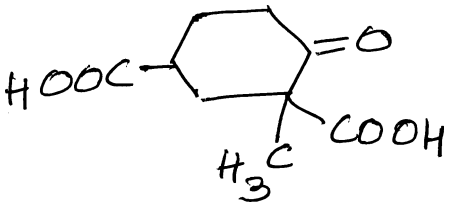
33. In the given reaction, the product X is



(A) 

(B) 

(C) 

(D) 

34. The effective transformation of acetophenone into ethylbenzene can be achieved by using

i) Clemmensen reduction

ii) Wolff-Kishner reduction

iii) Rosenmund reduction

iv) Mozingo reduction

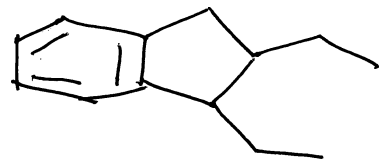
(A) i, ii and iv are correct

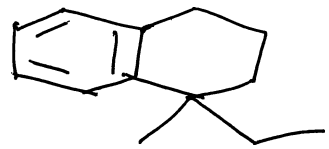
(B) i, ii and iii are correct

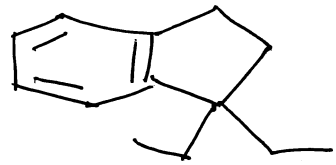
(C) i and ii are correct

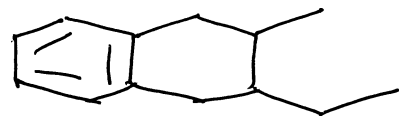
(D) i, ii, iii and iv are correct

35. 3-Ethyl-5-phenylpentene in acidic medium rearranges to

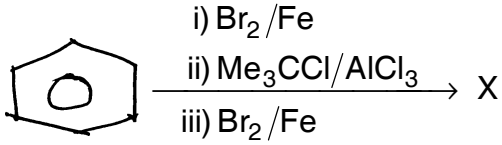
(A) 

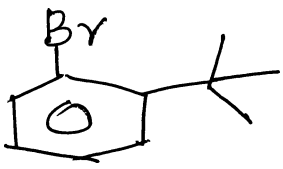
(B) 

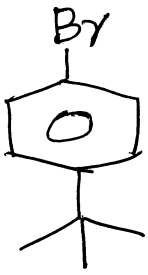
(C) 

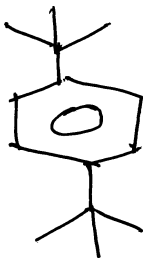
(D) 

36. In the reaction, X is



(A) 

(B) 

(C) 

(D)

37. Conversion of o-nitroaniline into o-dinitrobenzene is carried out by

(A) $Na_2Cr_2O_7/H_2SO_4$

(B) F_3CCO_3H

(C) MnO_2/CH_2Cl_2

(D) $(NH_4)_2S_2O_8/H_2SO_4$

38. The precursors for the biosynthesis of quinine and papaverine are

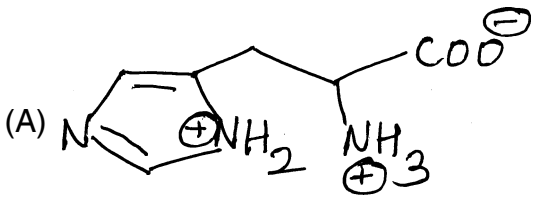
(A) Trp and Phe

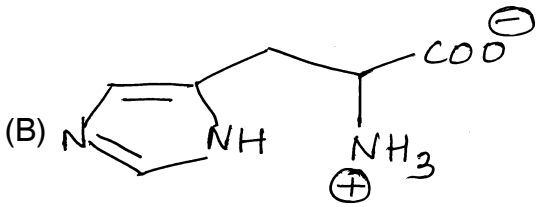
(B) Tyr and Phe

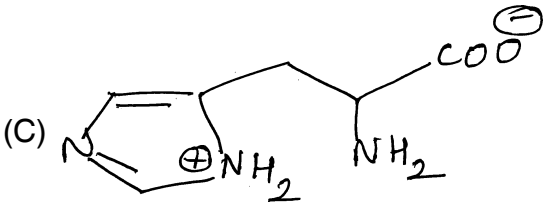
(C) Trp and Tyr

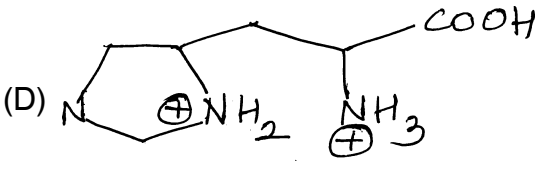
(D) Tyr and Gly

39. The structure of histidine predominantly exists at physiological pH (7.3) is

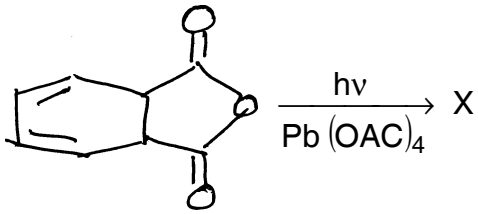
(A) 

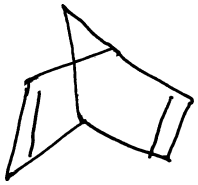
(B) 

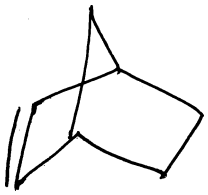
(C) 

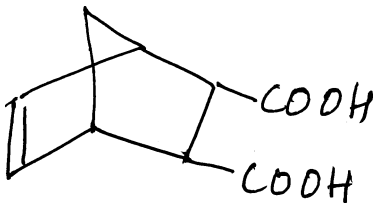
(D) 

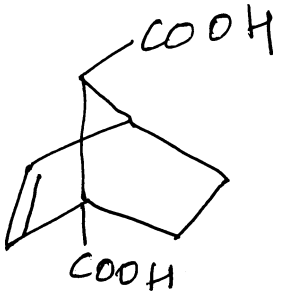
40. In the reaction, X is



(A) 

(B) 

(C) 

(D) 

41. Reaction of tetrahydrofuran with two moles of trimethylsilyl iodide yields

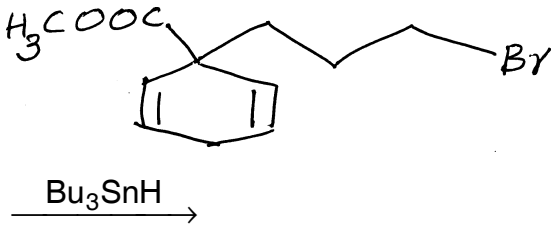
(A) Iodobutane

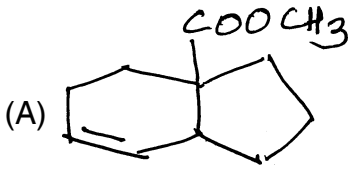
(B) 1, 4-Butanediol

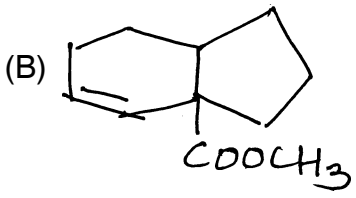
(C) 4-Iodobutanol

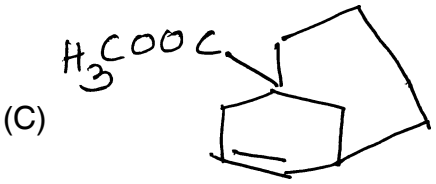
(D) 1, 4-Diiodobutane

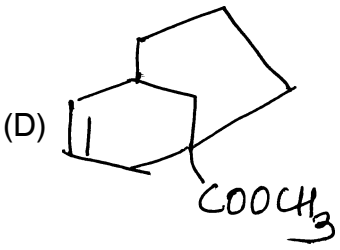
42. The product formed in the following reaction is



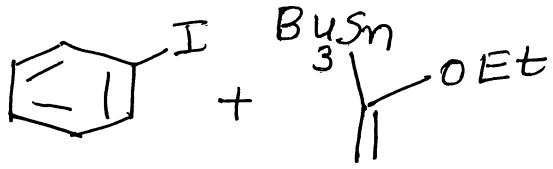
(A) 

(B) 

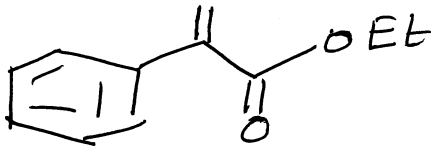
(C) 

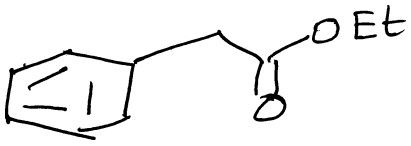
(D) 

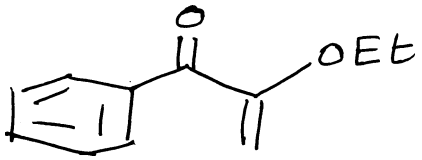
43. In the reaction, X is

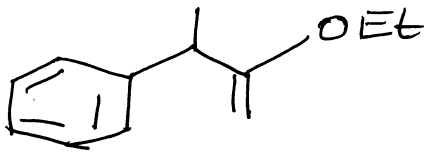


$\xrightarrow[\text{ether}]{Pd(PPh_3)_4/CO}$ X

(A) 

(B) 

(C) 

(D) 

44. Match the following :

i) Maphensin	a) Anti-inflammatory agent
ii) Ibuprofen	b) Anti-ulcer drug
iii) Albuterol	c) Muscle relaxant
iv) Omeprazole	d) Bronchodilating agent

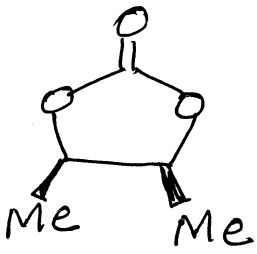
(A) i – d, ii – b, iii – a, iv – c

(B) i – a, ii – c, iii – b, iv – d

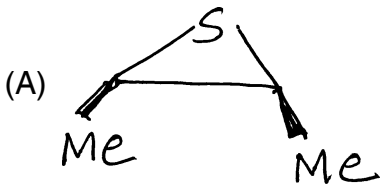
(C) i – b, ii – d, iii – c, iv – a

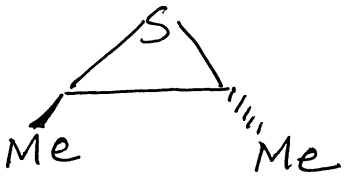
(D) i – c, ii – a, iii – d, iv – b

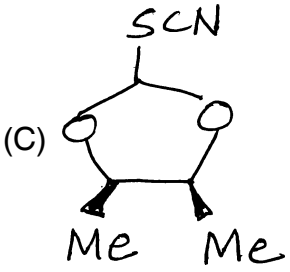
45. In the reaction, X is

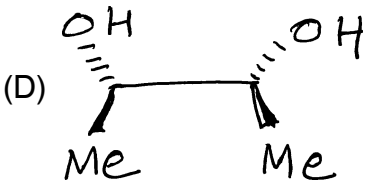


+ KSCN $\longrightarrow$ X

(A) 

(B) 

(C) 

(D) 

46. Choose the correct statement(s)

i) (R)-α-Bromopropionic acid gives (S)-Lactic acid with concentrated alkali

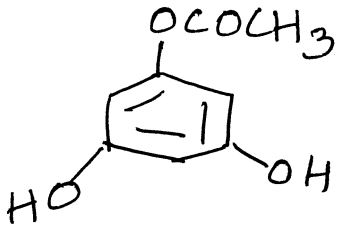
ii) (R)-α-Bromopropionic acid gives (R)-Lactic acid with concentrated alkali

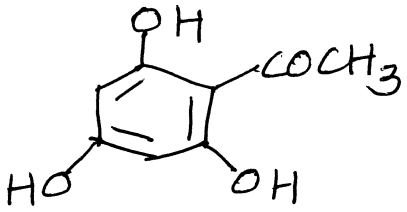
iii) (R)-α-Bromopropionic acid gives (R)-Lactic acid with dilute alkali

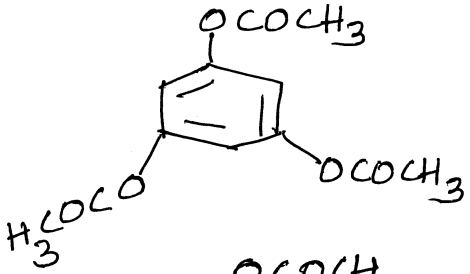
iv) (R)-α-Bromopropionic acid gives (S)-Lactic acid with dilute alkali

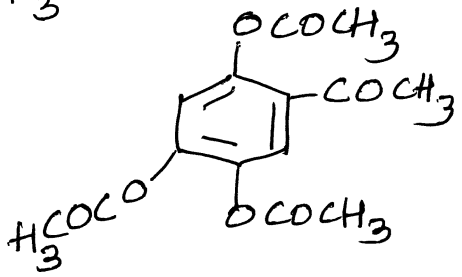
(A) i and iii are correct
(B) i and iv are correct
(C) ii and iv are correct
(D) i, ii, iii and iv are correct

47. 1, 3, 5-Trihydroxybenzene and CH_3CN reacts with HCl in presence of $ZnCl_2$ followed by hydrolysis gives

(A) 

(B) 

(C) 

(D) 

48. Oct-4-ene shows c = c frequency in the range of

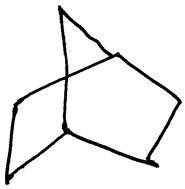
(A) 1680 – 1660 cm^{-1} (very weak)

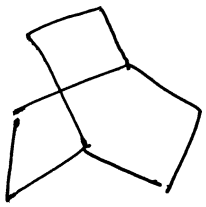
(B) 1680 – 1600 cm^{-1} (strong)

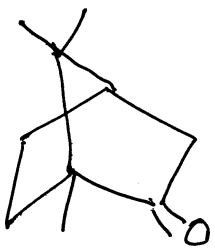
(C) No peak in this regoin

(D) 1680 – 1600 cm^{-1} (medium)

49. In the broad band decoupled $^{13}CNMR$ spectrum, the number of signals appearing for the following bicyclic compounds i-iii respectively are

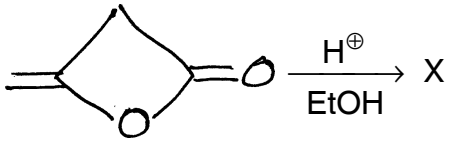
i) 

ii) 

iii) 

(A) 3, 4 and 8
(B) 3, 2 and 7
(C) 2, 4 and 8
(D) 3, 2 and 10

50. In the reaction, X exhibits the following spectral data

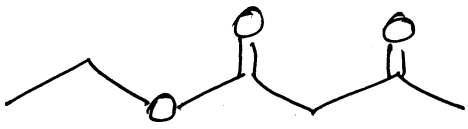


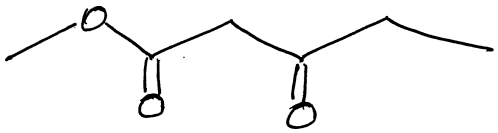
Molecular formula : $C_6H_{10}O_3$

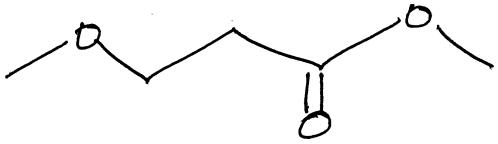
IR : 1745 and 1710 cm^{-1}

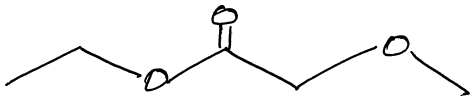
PMR : δ 1.28 (3H, t, J = 7 Hz); 2.21 (3H, S); 3.24 (2H, S) and 4.2 (2H, q, J = 7 Hz)

The structure of X is

(A) 

(B) 

(C) 

(D) 

51. Match the following :

List – I (Group)	List – II (Vibration Wavenumber, $\bar{\nu}/cm^{-1}$)
i) C – H strech	a) 1640 – 1780
ii) O – H strech	b) 1350 – 1420
iii) C = O strech	c) 3590 – 3650
iv) NO_3^-	d) 2850 – 2960

(A) i – d, ii – c, iii – a, iv – b

(B) i – c, ii – d, iii – a, iv – b

(C) i – a, ii – b, iii – d, iv – c

(D) i – b, ii – d, iii – c, iv – a

52. Dimension of the surface tension

i) JS^{-1}

ii) JM^2

iii) Nm^{-1}

iv) JM^{-2}

(A) i and ii are correct

(B) i and iv are correct

(C) ii and iii are correct

(D) iii and iv are correct

53. Fourier synthesis

(A) A map of interatomic vectors obtained by Fourier analysis of diffraction intensities

(B) The construction of the electron density distribution from structure factors

(C) Systematic absences

(D) Measuring the structure factor

54. The dipole moment of HCl is 3.697×10^{-30} C.M. and the bond length is 127.5 pm. What are the net charges on the H and Cl atoms ?

(A) 1.81 e

(B) 18.1 e

(C) 0.181 e

(D) 0.181×10^{-10}e

55. Which one of the following statements is not true ?

(A) S orbitals are spherically symmetric

(B) A harmonic oscillator obeys Hooke's law

(C) Spin quantum number, S, for an electron S = 1

(D) An azeotrope is a mixture that boils without change of composition

56. The rate constant K_1 for the reaction

$$H^+(aq) + \overline{O}H(aq) \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} H_2O(l)$$ is

$1.4\times10^{11}\ dm^3\ mol^{-1}s^{-1}$. If the initial conditions are $\left[H^+\right]_0 = \left[\overline{O}H\right]_0 = 0.10$ mol dm^{-3}, the half life of the reaction is

(A) 0.71 s

(B) 7.1×10^{-8}s

(C) 0.71×10^{-11}s

(D) 7.1×10^{-11}s

57. Choose the correct statements :

i) Glass electrode is sensitive to hydrogen ion activity

ii) Cathode is an electrode at which oxidation occurs

iii) Charge density = $\frac{\text{Charge in a small region}}{\text{Volume of the regoin}}$

iv) The geometric mean of x and y is $(xy)^{1/2}$

(A) i and ii are correct

(B) i, iii and iv are correct

(C) ii and iii are correct

(D) i, ii, iii and iv are correct

58. What is the pH of 0.01/M aniline solution ? (Ionization constant = 4.27×10^{-10})

(A) 7.81

(B) 4.8

(C) 5.9

(D) 3.90

59. The reaction $A \rightarrow B$ is spontaneous when

i) $\mu_A > \mu_B$ (where μ is the chemical potential)

ii) $\Delta G = 0$

iii) ΔG is +ve

iv) ΔG is –ve

(A) i and iv are correct

(B) ii and iii are correct

(C) i and ii are correct

(D) ii and iv are correct

60. Pick out the fermions

i) Electron

ii) Proton

iii) Neutron

iv) Deuteron

(A) iv is correct

(B) i and iv are correct

(C) iii and iv are correct

(D) i, ii and iii are correct

61. Which one of these statements is not true ?

(A) $C_V = \frac{3}{2}R$ (monoatomic ideal gas)

(B) Partition function is independent of temperature

(C) Closed system is a system with boundary through which matter cannot be transferred

(D) Moment of inertia, $I = mr^2$

62. Stirling's approximation

(A) l n n ! $\approx$ n l n n for large values of n

(B) l n n ! $\approx$ n l n n for small values of n

(C) l n n ! $\simeq$ n l n n – n for large values of n

(D) l n n ! $\simeq$ n l n n + n for small values of n

63. Match the following :

List – I (Molecule)	**List – II (Point group)**
i) H_2O	a) $C_{\infty v}$
ii) HCl	b) C_{2h}
iii) CH_4	c) Td
iv) trans-CHCl = CHCl	d) C_{2v}

(A) i – d, ii – a, iii – c, iv – b

(B) i – b, ii – c, iii – a, iv – d

(C) i – c, ii – a, iii – b, iv – d

(D) i – a, ii – d, iii – c, iv – b

64. Arrange the following ions in the increasing order of ionic mobility

$H^+, \overline{O}H, K^+, F^-$

(A) $F^- < K^+ < \overline{O}H < H^+$

(B) $H^+ < \overline{O}H < F^- < K^+$

(C) $\overline{O}H < F^- < K^+ < H^+$

(D) $F^- < \overline{O}H < K^+ < H^+$

65. Assertion (A) : BeH_2 is linear and H_2O bent.

Reason (R) : The major difference between BeH_2 and H_2O is the number of valence electrons on central atom.

(A) Both A and R are true, but R is not the correct explanation

(B) Both A and R are true and R is the correct explanation

(C) A is true but R is false

(D) A is false but R is true

66. Which one of the following statements is not true ?

(A) A catalyst does not affect the equilibrium constant

(B) Thermodynamic equilibrium constant is expressed in terms of activities

(C) Partially miscible liquids are liquids that mix in all proportions at all temperatures

(D) An eutectic is the mixture with lowest melting point

67. An even function is

i) $f(-x) = f(x)$

ii) Product of two even functions

iii) Product of two odd functions

iv) Product of an even and an odd function

(A) i, ii and iii are correct

(B) iv is correct

(C) ii and iv are correct

(D) i and iv are correct

68. Linear momentum of photon of wavelength 350 nm is equal to

(A) 0.189×10^{-27} kgms^{-1}

(B) 1.89×10^{-27} kgms^{-1}

(C) 1.89×10^{-26} kgms^{-1}

(D) 1.89×10^{-28} kgms^{-1}

69. Match the following :

i)	Bohr frequency condition	a)	$\Theta = \frac{h\nu}{k}$
ii)	Debye temperature	b)	$\Delta E = h\nu$
iii)	Linear momentum	c)	$\Omega\Psi = w\Psi$
iv)	Gigen value equation	d)	h/λ

(A) i – b, ii – a, iii – d, iv – c

(B) i – c, ii – a, iii – d, iv – b

(C) i – a, ii – b, iii – c, iv – d

(D) i – d, ii – b, iii – a, iv – c

70. For an adiabatic change

(A) $\Delta S_{sur} > 0$

(B) $\Delta S_{sur} = 0$

(C) $\Delta S_{sur} < 0$

(D) $\Delta S_{sur} \to \infty$

71. A method of analysis yields weights for gold that are low by 0.4 mg. The percent relative errors caused by this uncertainty if the weight of gold in the sample are 700 mg and 250 mg

(A) 0.6% and 2%

(B) – 0.06% and – 0.2%

(C) – 0.06% and – 0.002%

(D) – 0.12% and – 0.2%

72. Asymmetric streching vibration of CO_2

(A) Raman inactive and IR active

(B) Raman active and IR active

(C) Raman active and IR inactive

(D) Both Raman and IR inactive

73. Molecular weight M, is related to degree of polymerisation this way (m-mol.wt. of monomer)

(A) $M = D_{(P)}$

(B) $M = D_{(P)}.m$

(C) $M = \frac{D_{(P)}}{m}$

(D) $M = \frac{D_{(P)}m}{1+m}$

Where $D_{(P)}$ is the degree of polymerisation

74. The number average molecular weight of the polymer, M_n, is given by the equation

(A) $M_n = \sum n_i M_i$

(B) $M_n = \frac{\sum n_i M_i}{\sum n_i}$

(C) $M_n = \left(\frac{\sum n_i M_i}{\sum n_i}\right) + 1$

(D) $M_n = \frac{\sum n_i M_i}{1+\sum n_i}$

75. Number of space groups and space lattices in triclinic system are respectively

(A) 1, 2

(B) 2, 1

(C) 2, 2

(D) 3, 1

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Space for Rough Work