Cycle-1

Assessment & Accreditation by NAAC

CRITERION II: TEACHING, LEARNING & EVALUATION

QnM-2.2.1: The institution assesses the learning levels of the students and organises special Programmes for advanced learners and slow learners

Gondia Education Society's

MANOHARBHAI PATEL COLLEGE
OF ARTS, COMMERCE & SCIENCE

SADAK ARJUNI, Dist. Gondia.(Maharashtra) 441807
Affiliated to Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur
E-mail:mbpatelsadakarjuni@gmail.com   Phone (07199) 233224

Estd. 2009

Ref.No. MBPC/ 336 /20222023   Date : 28/02/2023

Declaration

The information, reports, true copies of the supporting documents, numerical data, etc. furnished in this file is verified by IQAC and found correct.

Hence this certificate.

Mr. A. M. Patil
IQAC Coordinator
Manoharbhai Patel College
Sadak Arjuni

Dr. A. S. Dwivedi
Chairman IQAC and Principal
Manoharbhai Patel College
Sadak Arjuni

JAM Coaching

(Joint Admission for Master Coaching Course)

The Department of joint venture of Chemistry, Zoology, Botany for the preparation of JAM exam was organized. Advanced learners from the final year of Bachelor of science were selected and given extra coaching from the perspective of JAM exam. A regular progress of the students was checked by test conducted during the coaching. This course conducted apart from regular curricula proved very fruitful and helped students to great extent.

Summer 17-18	Arti Pisaram. Chandwar	20150166022967 21
Summer 17-18	Chandani Eknath Dogarwar	20150166022954 66
Summer 17-18	Disha Dattprasad Bansod	20150166022964 46
Summer 17-18	Nidhi Rajenderasingh Kachhwaya	20150166022967 52
Summer 17-18	Neleema Dodhram Vaidhya	20150166022953 15
Summer 17-18	Rajani Bhaulal Turkar	20150166022953 31
Summer 17-18	Rashmi Siddharth Ramteke	20150166023961 03
Summer 17-18	Sampkala Chetram Nikesar	20150166023756 87
Summer 17-18	Shital Shekar Shivankar	20150166022949 62
Summer 17-18	Akash Bhojraj Dogarwar	20150166022957 41
Summer 17-18	Amar Omprakash Shahare	20150166022953 46
Summer 17-18	Amol Jagdish Choudhary	20150166022949 85
Summer 17-18	Ayush Hetram Ganvir	20105066023755 05

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JAM Coaching

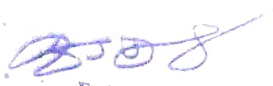## (Joint Admission for Master Coaching Course)

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Summer 18-19	DIKSHIT HIRALAL LANJE	2015016602295610
Summer 18-19	DIPALI CHANRABHAN FUNDE	2015016602294820
Summer 18-19	DIVYA SURESH RAUT	2015016602295650
Summer 18-19	GAUTAMI DHANAJAY VAIDYA	2015016602296690
Summer 18-19	JITENDRA ZITU NARETI	20173074204012
Summer 18-19	KAJAL VIJAY TEMBHURNE	2015016602296230
Summer 18-19	KALYANI DILIP KORE	20173074203946
Summer 18-19	KEMILA RAMESH CHANDEWAR	201301660049576
Summer 18-19	KUNAL CHANDRBHAN BADOLE	20173074204016
Summer 18-19	KUSUMBAI ZALU FULLUKE	20173074203952
Summer 18-19	MAHENDRA RIMLAL PARSURAMKAR	NU/A15/83941
Summer 18-19	MRUNALI DEWANAND MESHRAM	2015016602295590
Summer 18-19	NILAM ARUN SHAHARE	2015016600786590
Summer 18-19	NITA PYARELAL MADAVI	20173074203967
Summer 18-19	PAWAN JAIPAL BHANDARKAR	20173074204022
Summer 18-19	PRAFUL SAGAR RAMTEKE	20173074204023
Summer 18-19	PRIYANKA RAJIRAM HATTIMARE	2015016602295620
Summer 18-19	PUNAM LEHANDAS SATDEVE	2013016600322270
Summer 18-19	RAJNI PREMLAL BRAMHANKAR	2015016602365650
Summer 18-19	RAVINDRA RUPVILASBAPU KURSUNGE	2015016602295080

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Summer 18-19	SUNITA DEORAM TARONE	20173074203993
Summer 18-19	TOMESHWAR SURESH LANJE	20173074204034

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Summer 19-20	APARNA DURYODHAN MESHRAM	2015016602375860
Summer 19-20	ASHWINI MANIRAM SHENDE	20173074203930
Summer 19-20	BHARTI NARENDRA KHOTELE	20181074206125
Summer 19-20	BHRUNALI RAJKUMAR LANJE	20181074206126
Summer 19-20	BHUMESHWARI GOWARDHAN NEWARE	20181074206127
Summer 19-20	CHANDATAI SHIVCHARAN BENDWAR	20181074206129
Summer 19-20	CHETAN JAYLAL RAUT	20181074206130
Summer 19-20	DAMINI ANANDRAO CHANDEWAR	20181074206133
Summer 19-20	DIPALI BHAURAO BRAMHANKAR	2015016602363780
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Summer 19-20	HIMANI MANOHAR BADOLE	20181074206141
Summer 19-20	JAYSHRI DIPAK DONODE	2015016602296340
Summer 19-20	JAYSHRI JIVAN NAIK	20181074206144
Summer 19-20	KAJAL DEORAM BHENDARKAR	20181074206148
Summer 19-20	KALYANI KAILSH BRAMHANKAR	20181074206150
Summer 19-20	KARISHMA DEVDAS WALTHARE	20181074206151
Summer 19-20	KARISHMA SHIVDAS BOLANE	20181074206152
Summer 19-20	KOMESH CHAITRAM ZODE	201730742044015
Summer 19-20	NALINA RAMESH BHENDARKAR	20173074203963
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Summer 19-20	PRAGATI BHAURAO GAHANE	20181074206172
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Summer 19-20	SEEMA VINOD KATRE	20181074206193
Summer 19-20	SHITAL MOHANLAL BANKAR	20181074206194
Summer 19-20	SHRIYA PRAKASH JANBANDHU	20181074206196
Summer 19-20	SONALI ZAMRAJ SHENDE	20181074206199

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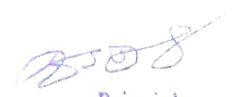| Summer 19-20	SUSHAMA GIRDHARI KAPGATE	20181074206204
Summer 19-20	SUSHAMA HOMRAJ IRLE	20181074206205
Summer 19-20	SUSHAMA KRISHNA GABHANE	20181074206206
Summer 19-20	TEJASWINI YOGRAJ KIRNAPURE	20181074206207
Summer 19-20	VISHAKHA OMKAR KOCHE	20181074206210
Summer 19-20	YIGITA RAJU BHENDARKAR	20181074206213
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Summer 20-21	CHANDANI MARKAND UIKEY NALINA	20173074203934
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Summer 20-21	DIPALI HIVINDRAKUMAR RAUT POURNIMA	20173074203940
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Summer 20-21	HASINA DIGAMBAR PARDHI MUNESHWARI	20191074212465
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Summer 20-21	KARISHMA CHANDAN MANKAR PUSHPA	20191074212471
Summer 20-21	KHUSHBU SUKHDEV KORE CHHAYA	20181074206154
Summer 20-21	KIRTI VIJAY ZODE MANDA	20191074212476
Summer 20-21	LINA VINOD GAHANE VIDHYA	20191074212478
Summer 20-21	LOKESHWARI YUVRAJ RAUT SHANU	20181074206158
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Summer 20-21	MANISHA SURESH YERNE REKHA	20181074206160
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Summer 20-21	MONIKA TEKCHAND LANJE LEELA	20191074212482
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Summer 20-21	NEHA KRISHNA SHIVANKAR UMA	20191074212485
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Summer 20-21	NILIMA LEKHARAM KORE LEELA	20191074212487
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Summer 20-21	PRANALI HANSRAJ HATZADE LALITA	20181074206173
Summer 20-21	PRATIKSHA GANGADHAR KARPATE SUNITA	20191074212497
Summer 20-21	PRIYANKA JANIRAM KHANDWAYE KHELAN	20191074212500
Summer 20-21	PRIYANKA PRAKASH MOHURLE KIRAN	20181074206179
Summer 20-21	PRIYANKA NAJUKRAM ZINGARE KHEMUTAI	20181074206178
Summer 20-21	PUJA HEMRAJ TEKAM KALAVATI	20181094001098
Summer 20-21	RIMA NARESH NAGRIKAR VARSHA	20173074203981
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Summer 20-21	RUPALI DHANRAJ LANJEWAR USHA	20181074206188
Summer 20-21	RUPALI YADORAO DOYE MANDA	20191074212505
Summer 20-21	RUPALI RAMESH MANDALE ANUSAYA	20181074206189
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Summer 20-21	SAPNA SHALIKRAM MUNGMODE VAISHALI	20191074212507
Summer 20-21	SARIKA LAXMAN WANJARI KALPANA	20191074212508
Summer 20-21	SHILPA SIDDHARTH MESHRAM RAMESHILA	20191074212510
Summer 20-21	SHITAL MADHORAO MUNGMODE SAVITA	20191074212512
Summer 20-21	SHITAL NANDKISHOR MESHRAM SUNANDA	20191074212513
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Summer 20-21	SNEHA WAKTU ALONE POONAM	20191074212519
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Summer 20-21	SWATI BABURAO MATALE DURGA	20173074203994

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Manoharbhai Patel College of Arts, Commerce & Science

Sadak Arjuni, Dist. Gondia-441807

JAM-2018

Test Paper of Chemistry

Multiple choice questions   Total- 51

1. The most convenient method to prepare an aminecontaining one carbon atom less is

    A] Gabriel phthalimide synthesis

    B] Reductive amination of aldehydes

    C] Hofmann bromamide reaction

    D] Reduction of isonitriles

2. Reduction of aromatic nitro compounds using Sn and HC1 gives

    A] Aromatic primary amines

    B] Aromatic secondary amines

    C] Aromatic tertiary amines   D] Aromatic amides

3. Amine that cannot be prepared by Gabriel phthalimide synthesis is

    A] Aniline   B] Benzyl amine

    C] Methyl amine   D] iso - butylamine

4. Tertiary amines have lowest boiling points amongest isomeric amines because

    A] They have highest molecular mass

    B] They do not form hydrogen bonds

    C] They are more polar in nature

D] They are most basic in nature

5. The decreasing order of boiling points of ethyldimethylamine, *n*-butylamine and diethyla-mine is *n*- Butylamine > Diethylamine > Ethyldimethylamine. This trend of boiling point can be explained as

A] Boiling point increases with increase in molecular mass

B] Tertiary amines have highest boiling point due to highest basicity

C] Intermolecular hydrogen bonding is maximum in primary amines and absent in tertiary amines

D] Intramolecular hydrogen bonding is present in tertiary amines

6. Basic strength of different alkyl amines depends upon

A] +I effect   B] Steric effect   C] Solvation effect   D] All of these

7. Primary amines react with benzoyl chloride to give

A] Benzamides B] Ethanamides   C] Imides   D] Imines

8. Acetylation of a secondary amine in alkaline medium yields

A] N, N-dialkylacetamide   B] N, N-dialkylamine

C] N, N-dialkylamide   D] Acetyl dialkylamine

9. Which of the following amines will give carbylaminesreaction?

A] $(C_2H_5)_3N$ only   B] $(C_2H_5)_2NH$ only

C] $C_2H_5NH_2$ only   D] $C_3H_7NHC_2H_5$ only

10. Which of the following will form isocyanide on reaction with $CHCl_3$ and KOH?

A] $C_6H_5NHCH_3$ B] $CH_3C_6H_4NH_2$

C] $C_6H_5NHC_4H_9$ D] $C_6H_5N(C_2H_5)_2$

11. Which of the following compounds cannot be identified by carbylamine test?

A] $CH_3CH_2NH_2$ B] $(CH_3)_2CHNH_2$

C] $C_6H_5NH_2$D] $C_6H_5NHC_6H_5$

12. Hofmann bromamide degradation reaction is shownby_____

A] $ArNH_2$ B] $ArCONH_2$

C] $ArNO_2$ D]$ArCH_2NH_2$

13. Which of the following is used as Hinsberg's reagent?

A] $C_6H_5SO_2Cl$ B] $C_6H_5SO_3H$

C] $C_6H_5NHCH_3$ D] $C_6H_5COCH_3$

14. The reaction of benzenesulphonyl chloride with ethylamine yields

A] N-ethylbenzenesulphonamide, insoluble in alkali

B] N, N-diethylbenzenesulphonamide, soluble in alkali

C] N, N-diethylbenzenesulphonamide, insoluble in alkali

D] N-ethylbenzenesulphonamide, soluble in alkali

15. Which of the following amines does not react with Hinsberg's reagent?

A] $CH_3CH_2-NH_2$ B] $CH_3-NH-CH_3$

C] $(CH_3CH_2)_3N$ D] All of these

16. Primary, secondary and tertiary amines may beseparated by using

A] Iodoform   B]Acetone

C] Benzenesulphonyl chloride   D] Acetyl chloride

17. Which of the following statements is *correct*?

A] Pyridine is a tertiary amine.

B] Pyrrole has less aromatic character than furan.

C] Pyridine is isoelectronic with benzene.

D] Pyrrole is a strong base.

18. What is the correct order of reactivity (most reactive first) of pyrrole, furan and thiophene towards electrophiles?

A]furan > pyrrole > thiophene

B] furan > thiophene > pyrrole

C] thiophene > pyrrole > furan

D] pyrrole > furan > thiophene

19. Nitration of pyrrole is best carried out using:

A] nitric acid.

B] ammonium nitrate.

C] concentrated nitric and sulfuric acids.

D] acetyl nitrate.

20.If you wanted to carry out an electrophilic substitution in pyridine, an initial step could be to react pyridine with H_2O_2 in acetic acid. What happens in this step?

A] 2-Hydroxypyridine is formed.

B] Pyridine-*N*-oxide is formed.

C] 1,4-Dihydropyridine is formed.

D] 2-Pyridone is formed.

21. If solvent is non polar ans electron transition is $\pi \Rightarrow \pi*$ which type of shift are seen in graph ?

A. Hypso chromich shift

B. Red shift

C. Blue shift

D. A and C

22. In Fischer-indole synthesis of 2-phenylindole, starting materials used are :

(A) Phenyl hydrazine and acetophenone (B) Phenyl hydrazine and benzaldehyde

(C) Phenyl hydrazine and acetone (D) Phenyl hydrazine and acetaldehyde

23. Reaction of an organolithium reagent with an aldehyde gives:

A] Alcohol B]Ketone

C] Ether D] Epoxide

24. Which of the following electrophilic substitution reaction is not possible in pyridine?
a) Nitration
b) Sulphonation
c) Bromination
d) Friedel craft reaction

25. Which of the following is the product for the below reaction?

a) 3- methyl-pyridine-5-sulphonic acid

b) 3- methyl-pyridine-4-sulphonic acid

c) 3- methyl-pyridine-6-sulphonic acid

d) 3- methyl-pyridine-1-sulphonic acid

26. Which of the following is a not a five membered ring?

a) Pyridine

b) Pyrrole

c) Furan

d) Thiophene

27. In Dumas' method of estimation of nitrogen 0.35 g of an organic compound gave 55 mL of nitrogen collected at 300 K temperature and 715 mm pressure. The percentage composition of nitrogen in the compound would be

(Aqueous tension at 300 K = 15 mm)

(A) 14.45

(B) 15.45

(C) 16.45

(D) 17.45

28. In Kjeldahl's method, ammonia from 5 g of food neutralizes 30 cm^3 of 0.1 N acid. The percentage of nitrogen in the food is _____.

(A) 8.4

(B) 0.84

(C) 1.68

(D) 16.8

29 .The reagent used in dumas method is:

Aferrous acid

Bcuprous oxide

C] N, N-dialkylamide   D] Acetyl dialkylamine

9. Which of the following amines will give carbylaminesreaction?

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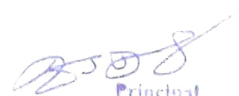
30. In Carius method for the quantitative estimation of sulphur. it is estimated by_____ .

A BaS

B CaSO4

C BaSO4

D BaCl2

31. What is Grignard reagent

A] R-Mg X
B] R-Li

C] R$_2$ Zn

D] All of above

32. Grignard reagent react with CO_2 to form

A] Acetic acid   B] Acetone   C] Ethanol   D] Propan-2-ol

33. Methyl lithium react with ketone to gives

A] Ethanol   B] Iso-propyl alcohol   C] Tert- butyl alcohol   D] n- propyl alchol

34. Reformatsky reaction leads to formation of

A] Acetone   B] Carboxylic acid   C] α,β-unsaturated acid   D] None of these

35. Which of the following are organometallic reagents

(A) CH_3CH_2ONa (B) CH_3CH_2Li
(C) $CH_3CH_2BH_2$ (D) all of these

36. Which of the following "pictures" best represents the polarity of organometallic compounds ?

(A) R M   (D) R+ M-   (C) R- M+   (D) all of these
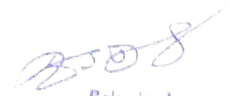
37. On which factors the vibrational stretching frequency of diatomic molecule depend?
A) Force constant
B) Atomic population
C) Temperature
D) Magnetic field

38. The vibrations, without a center of symmetry are active in which of the following region?
a) Infrared but inactive in Raman
b) Raman but inactive in IR
c) Raman and IR
d) Inactive in both Raman and IR

39. What is the correct increasing order of stretching frequencies for $C \equiv C$, $C = C$ and $C - C$?
a) $C - C > C = C > C \equiv C$
b) $C \equiv C > C = C > C - C$
c) $C - C > C = C < C \equiv C$
d) $C \equiv C < C - C > C = C$

40. The frequency of vibration of a bond is a function of which factor?
a) Force constant of the bond
b) Masses of the atoms involved in bonding
c) Force constant of the bond and Masses of the atoms
d) Bond order

41. Which of the following statements is true concerning infrared spectroscopy?

A] IR spectroscopy is useful in determining the size and shape of a compound's carbon skeleton.

B] An IR spectrometer shines infrared light on a compound and records the positions where the light is blocked by the compound. This results in the spectrum's peaks.

C] When the infrared light frequency matches the frequency of bond vibration in a molecule, a peak is recorded on the spectrum.

D] Functional groups can be identified by looking in the fingerprint region of the spectrum

Approximately where would a carbonyl peak be found on an IR spectrum?

Possible Answers:

42. The peak location will vary depending on the compound being analyzed.

A] $1000 cm^{-1}$

B] $1700 cm^{-1}$

C] $2800 cm^{-1}$

D] 2500 Cm-1

43. Normal mode vibration in NH_3 molecule is

A] 5 B] 6 C] 4 D] 2

44. Normal mode of vibration of linear molecule is

A] 3N - 5 B] 3N - 6 C] 3N – 4 D] Both A & B

45. Select the wavelength range corresponding to UV-visible region.

(A) 400-800 nm

(B) 200-800 nm

(C) 25 μm-2.5 μm

(D) 2.5 μm – 1mm

46. The possible transitions for water molecule in UV-visible region are

(A) $\sigma \rightarrow \sigma^*$

(B) $n \rightarrow \pi^*$, $\pi \rightarrow \pi^*$

(C) $\sigma \rightarrow \sigma^*$, $n \rightarrow \pi^*$

(D) $n \rightarrow \sigma^*$

47. Molar extinction coefficient has units of

(A) lit.mol^{-1}.cm^{-1}

(B) dl.g^{-1}cm^{-1}

(C) No units

(D) lit.g^{-1}cm^{-1}

48. Which of the following statement is not correct ?

(A) Absorptivity changes with the intensity of the light

(B) Absorbance is independent of intensity of the light

(C) Absorbance has no units

(D) Absorptivity is a constant and depends on the nature of the molecule

49. Which of the following leads to chemical deviation from Beer's law

(A) Change in refractive index

(B) Change in pH of the solution

(C) Polychromatic radiation

(D) Both a and b

50. Absorption spectra is a plot of

(A) Absorbance Vs Concentration

(B) Absorbance Vs wavelength

(C) % T Vs Wavelength

(D) % T Vs Concentration
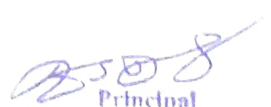
51.when absorption intensity of compound is decreased it is called

A. Red shift

B. Blue shift

C. Hypochromic shift

D. Hyperchromic shift

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SECTION – A
MULTIPLE CHOICE QUESTIONS (MCQ)

Q. 1 – Q.10 carry one mark each.

Q.1 The correct order of the boiling points of the compounds is

(A) $CH_4 > SiH_4 > SnH_4 > GeH_4$
(B) $SiH_4 > CH_4 > GeH_4 > SnH_4$
(C) $SnH_4 > GeH_4 > CH_4 > SiH_4$
(D) $SnH_4 > GeH_4 > SiH_4 > CH_4$

Q.2 In the following Latimer diagram, the species that undergoes disproportionation reaction is

$$MnO_4^- \xrightarrow{+0.56} MnO_4^{2-} \xrightarrow{+0.27} MnO_4^{3-} \xrightarrow{+0.93} MnO_2 \xrightarrow{+0.15} Mn_2O_3 \xrightarrow{-0.25} Mn(OH)_2 \xrightarrow{-1.56} Mn$$

(A) MnO_4^{2-} (B) MnO_4^{3-} (C) Mn_2O_3 (D) $Mn(OH)_2$

Q.3 A yellow precipitate is formed upon addition of aqueous $AgNO_3$ to a solution of

(A) phosphite   (B) pyrophosphate
(C) metaphosphate   (D) orthophosphate

Q.4 The compounds having C_3-axis of symmetry are
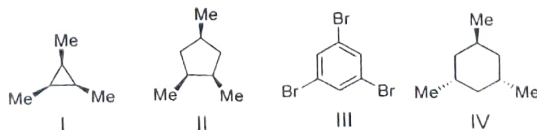
(A) I, III and IV   (B) I, II and III   (C) I and III   (D) III and IV

Q.5 The correct order of rate of solvolysis for the following compounds is
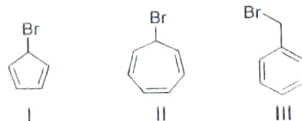
(A) III > II > I   (B) II > I > III   (C) III > I > II   (D) II > III > I

Q.6 In the following sequence of reactions, the overall yield (%) of O is
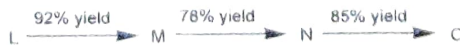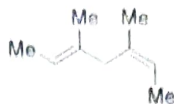
$$L \xrightarrow{92\% \ yield} M \xrightarrow{78\% \ yield} N \xrightarrow{85\% \ yield} O$$

(A) 61   (B) 85   (C) 74   (D) 68

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Q.7 Catalytic hydrogenation of the following compound produces saturated hydrocarbon(s). The number of stereoisomer(s) formed is

$$Me \diagdown \underset{Me}{\overset{Me}{\diagup}} \diagdown \underset{Me}{\overset{Me}{\diagup}} \diagdown Me$$

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

Q.8 The number of normal modes of vibration in naphthalene is

(A) 55   (B) 54   (C) 48   (D) 49

Q.9 The number of degrees of freedom of liquid water in equilibrium with ice is

(A) 0   (B) 1   (C) 2   (D) 3

Q.10 A straight line having a slope of $-\Delta U^0/R$ is obtained in a plot between

(A) $\ln K_p$ versus T   (B) $\ln K_c$ versus T
(C) $\ln K_p$ versus 1/T   (D) $\ln K_c$ versus 1/T

Q. 11 – Q. 30 carry two marks each.

Q.11 In a typical conductometric titration of a strong acid with a weak base, the curve resembles
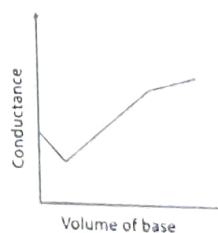
(A)
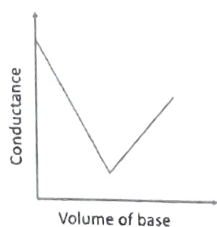
(B)
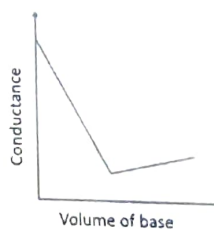
(C)
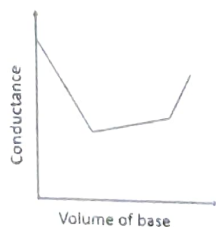
(D)

Q.12 The coordination number of Al in crystalline $AlCl_3$ and liquid $AlCl_3$, respectively, is

(A) 4 and 4   (B) 6 and 6   (C) 6 and 4   (D) 3 and 6

CY

Q.13   The homogeneous catalyst used in water-gas shift reaction is

(A) $PdCl_2$

(B) Cr_2O_3

(C) $[RhCl(PPh_3)_3]$

(D) $[RuCl_2(bipyridyl)_2]$

Q.14   Nitrosyl ligand binds to d-metal atoms in linear and bent fashion and behaves, respectively, as

(A) NO^+ and NO^+
(B) NO^+ and NO^-
(C) NO^- and NO^-
(D) NO^- and NO^+

Q.15   The metal ion (M^{2+}) in the following reaction is

$$M^{2+} + S^{2-} \longrightarrow \text{Black precipitate} \xrightarrow{\text{hot conc. } HNO_3} \text{White precipitate}$$

(A) Mn^{2+}
(B) Fe^{2+}
(C) Cd^{2+}
(D) Cu^{2+}

Q.16   The correct order of wavelength of absorption (λ_{max}) of the Cr-complexes is (en = ethylenediamine)

(A) $[CrF_6]^{3-} > [Cr(H_2O)_6]^{3+} > [Cr(en)_3]^{3+} > [Cr(CN)_6]^{3-}$
(B) $[Cr(H_2O)_6]^{3+} > [CrF_6]^{3-} > [Cr(en)_3]^{3+} > [Cr(CN)_6]^{3-}$
(C) $[Cr(CN)_6]^{3-} > [Cr(en)_3]^{3+} > [Cr(H_2O)_6]^{3+} > [CrF_6]^{3-}$
(D) $[Cr(en)_3]^{3+} > [Cr(CN)_6]^{3-} > [Cr(H_2O)_6]^{3+} > [CrF_6]^{3-}$

Q.17   The correct order of enthalpy of hydration for the transition metal ions is

(A) $Cr^{2+} > Mn^{2+} > Co^{2+} > Ni^{2+}$
(B) $Ni^{2+} > Co^{2+} > Mn^{2+} > Cr^{2+}$
(C) $Ni^{2+} > Co^{2+} > Cr^{2+} > Mn^{2+}$
(D) $Cr^{2+} > Mn^{2+} > Ni^{2+} > Co^{2+}$

Q.18   Among the following compounds, the pair of enantiomers is
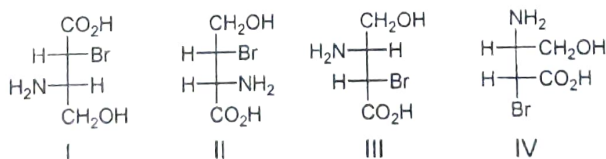
(A) I and IV
(B) I and III
(C) II and III
(D) III and IV

Q.19   The number of proton NMR signals for the compounds **P** and **Q**, respectively, is
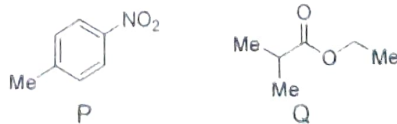
(A) 3 and 4
(B) 3 and 5
(C) 4 and 3
(D) 5 and 4

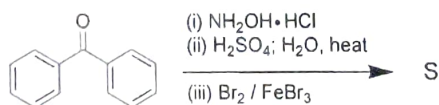Q.20   The correct set of reagents for the following conversion is

(A) (i) NaNH₂/liq.NH₃; (ii) NaNO₂/dil. HCl; (iii) CuCN, heat

(B) (i) HNO₃/H₂SO₄; (ii) Zn/HCl; (iii)) NaNO₂/dil. HCl; (iv) CuCN, heat

(C) (i) Mg/ether, H₃O⁺ ; (ii) (EtO)₂CO; (iii) NH₄OH; (iv) PCl₅

(D) (i) Mg/ether, H₃O⁺ ; (ii) HNO₃/H₂SO₄; (iii) NaNO₂/dil. HCl; (iv) CuCN, heat

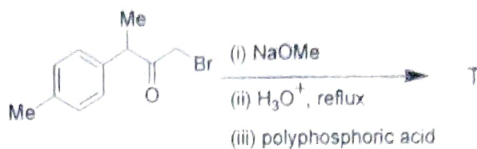Q.21   The product **R** in the following reaction is
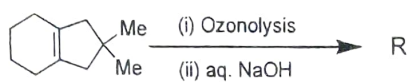
(A)

(B)

(C)

(D)

Q.22   The major product S of the following reaction is
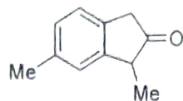

(A)

(B)

(C)

(D)

Q.23   In the following reaction, the major product **T** is

(i) NaOMe
(ii) H$_3$O$^+$, reflux
(iii) polyphosphoric acid

→ **T**

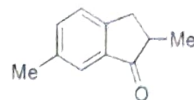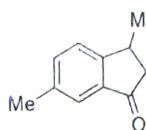(A)   (B)

(C)   (D)
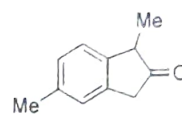
Q.24   The following conversion is carried out using

(A) hydroboration-oxidation followed by Jones oxidation
(B) Wacker oxidation followed by haloform reaction
(C) oxymercuration-demercuration followed by Jones oxidation
(D) ozonolysis followed by haloform reaction

Q.25   In the following reactions, the major products **E** and **F**, respectively, are

(i) NaOH/CO$_2$
125 °C, 4–7 atm
(ii) H$_3$O$^+$
E
(CH$_3$CO)$_2$O
F

(A)   (B)
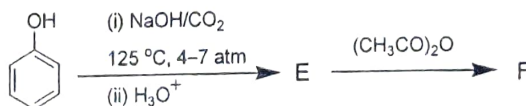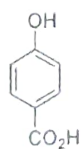
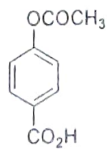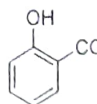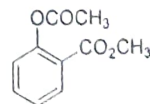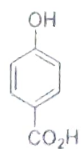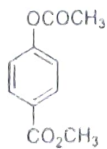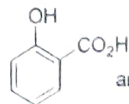
(C)   (D)
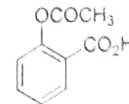
Q.26 $\dfrac{dy}{dx} = -\dfrac{y}{x}$ is a differential equation for a/an

(A) circle (B) ellipse
(C) bell-shaped curve (D) hyperbola

Q.27 Value of the given determinant is

$$\begin{bmatrix} 1 & 3 & 0 \\ 2 & 6 & 4 \\ -1 & 0 & 2 \end{bmatrix}$$

(A) –12 (B) 0 (C) 6 (D) 12

Q.28 Ionisation energy of hydrogen atom in ground state is 13.6 eV. The energy released (in eV) for third member of Balmer series is

(A) 13.056 (B) 2.856 (C) 0.967 (D) 0.306

Q.29 For a first order reaction $A(g) \rightarrow 2B(g) + C(g)$, the rate constant in terms of initial pressure (p_0) and pressure at time t (p_t), is given by

(A) $\dfrac{1}{t} \ln \dfrac{p_0}{p_t - p_0}$ (B) $\dfrac{1}{t} \ln \dfrac{2p_0}{3p_0 - p_t}$ (C) $\dfrac{1}{t} \ln \dfrac{3p_0}{p_t - p_0}$ (D) $\dfrac{1}{t} \ln \dfrac{3p_0}{3p_t - p_0}$

Q.30 For a particle in one-dimensional box of length L with potential energy $V(x) = 0$ for $L > x > 0$ and $V(x) = \infty$ for $x \geq L$ and $x \leq 0$, an acceptable wave function consistent with the boundary conditions is (A, B, C and D are constants)

(A) $A\cos\left(\dfrac{n\pi x}{L}\right)$ (B) $B(x + x^2)$ (C) $Cx^3(x - L)$ (D) $\dfrac{D}{\sin\left(\dfrac{n\pi x}{L}\right)}$

SECTION - B
MULTIPLE SELECT QUESTIONS (MSQ)
Q. 31 – Q. 40 carry two marks each.

Q.31 The "heme" containing protein(s) is/are

(A) cytochrome C (B) hemocyanin (C) hemerythrin (D) myoglobin

Q.32 Among the following, the species having see-saw shape is/are

(A) SF_4 (B) XeF_4 (C) ClF_4^- (D) ClF_4^-

Q.33 The indicator(s) appropriate for the determination of end point in the titration of a weak acid with a strong base is/are

(A) phenolphthalein (B) thymol blue
(C) bromophenol blue (D) methyl orange

Q.34 Jahn-Teller distortion is observed in octahedral complexes with d-electron configuration of

(A) d^3- high spin   (B) d^5- low spin   (C) d^6- high spin   (D) d^6- low spin

Q.35 Among the following, the correct statement(s) is/are

(A) Guanine is a purine nucleobase
(B) Glycine and proline are achiral amino acids
(C) DNA contains glycosidic bonds and pentose sugars
(D) Sucrose is a non-reducing sugar

Q.36 The INCORRECT statement(s) among the following is/are

(A) $[4\pi + 2\pi]$ cycloaddition reactions are carried out in presence of light
(B) $[2\pi + 2\pi]$ cycloaddition reaction between a keto group and an alkene is photochemically allowed
(C) $[4\pi + 2\pi]$ cycloaddition reactions are thermally allowed
(D) Transoid dienes undergo Diels-Alder reactions

Q.37 The following conversion is an example of
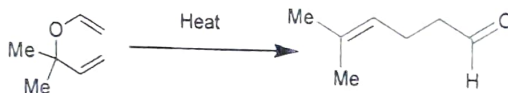
(A) oxy-Cope rearrangement   (B) sigmatropic rearrangement
(C) Claisen rearrangement   (D) pericyclic reaction

Q.38 IR active molecule(s) is/are

(A) CO_2 (B) CS_2
(C) OCS   (D) N_2

Q.39 Intensive variable(s) is/are

(A) temperature   (B) volume
(C) pressure   (D) density

Q.40 Wave nature of electromagnetic radiation is observed in

(A) diffraction   (B) interference
(C) photoelectric effect   (D) Compton scattering

SECTION – C

NUMERICAL ANSWER TYPE (NAT)

Q. 41 – Q. 50 carry one mark each.

Q.41   The number of isomeric structures of di-substituted borazine $(B_3N_3H_4X_2)$ is _____

Q.42   The number of S–S bond(s) in tetrathionate ion is _____

Q.43   The number of unpaired electron(s) in K_2NiF_6 is _____

Q.44   The number of reducing sugars among the following is _____
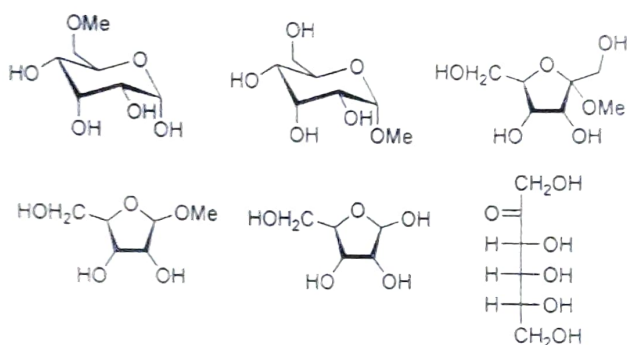
Q.45   The maximum number of dipeptides that could be obtained by reaction of phenylalanine with leucine is _____

Q.46   Among the following, the number of aromatic compound(s) is _____
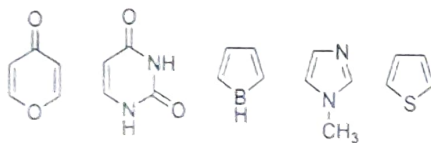
Q.47   At an operating frequency of 350 MHz, the shift (in Hz) of resonance from TMS (tetramethylsilane) of a proton with chemical shift of 2 ppm is _____

Q.48 At 298 K and 1 atm, the molar enthalpies of combustion of cyclopropane and propene are –2091 kJ mol⁻¹ and –2058 kJ mol⁻¹, respectively. The enthalpy change (in kJ mol⁻¹) for the conversion of one mole of propene to one mole of cyclopropane is _____

Q.49 For a cell reaction, $Pb(s) + Hg_2Cl_2(s) \rightarrow PbCl_2(s) + 2Hg(l)$, $\left(\frac{\partial E^\circ}{\partial T}\right)_p$ is 1.45×10^{-4} VK⁻¹. The entropy change (in J mol⁻¹ K⁻¹) for the reaction is _____

[Given: 1 F = 96500 C mol⁻¹]

Q.50 For a reaction $2A + B \rightarrow C + D$, if rate of consumption of A is 0.1 mol L⁻¹s⁻¹, the rate of production of C (in mol L⁻¹s⁻¹) is _____

Q. 51 – Q. 60 carry two marks each.

Q.51 The standard reduction potentials of Ce^{4+}/Ce^{3+} and Fe^{3+}/Fe^{2+} are 1.44 and 0.77 V, respectively. The $\log_{10} K$ (K is the equilibrium constant) value for the following reaction is _____
(final answer should be rounded off to two decimal places)

$$Ce^{4+} + Fe^{2+} \rightleftharpoons Ce^{3+} + Fe^{3+}$$

[Given: $RT/F = 0.0257\ V$]

Q.52 A radioactive element undergoes 80% radioactive decay in 300 min. The half-life for this species in minutes is _____

Q.53 Silver crystallizes in a face-centered cubic lattice. The lattice parameter of silver (in picometer) is

_____

[Given: Avogadro's number = 6.023×10^{23} mol⁻¹, molar mass of silver = 107.87 g mol⁻¹ and density of crystal = 10.5 g cm⁻³]

Q.54 The amount of bromine (atomic wt.= 80) required (in gram) for the estimation of 42.3 g of phenol (molecular wt. = 94 g mol⁻¹) is _____

Q.55 The total number of pair of enantiomers possible with molecular formula $C_5H_{12}O$ is _____

Q.56 In 200 g of water, 0.01 mole of NaCl and 0.02 mole of sucrose are dissolved. Assuming solution to be ideal, the depression in freezing point of water (in °C) will be _____
(final answer should be rounded off to two decimal places)

[Given: $K_f(H_2O) = 1.86$ K kg mol^{-1}]

Q.57 The adsorption of a gas follows the Langmuir isotherm with $K = 1.25$ kPa^{-1} at 25 °C. The pressure (in Pa) at which surface coverage is 0.2 is _____

Q.58 The separation of 123 planes (in nm) in an orthorhombic cell with $a = 0.25$ nm, $b = 0.5$ nm and $c = 0.75$ nm is _____
(final answer should be rounded off to two decimal places)

Q.59 A vessel contains a mixture of H_2 and N_2 gas. The density of this gas mixture is 0.2 g L^{-1} at 300 K and 1 atm. Assuming that both the gases behave ideally, the mole fraction of N_2 (g) in the vessel is _____
(final answer should be rounded off to two decimal places)

[Given: R = 0.082 L atm mol^{-1} K^{-1}, atomic wt. of hydrogen = 1.0 and atomic wt. of nitrogen = 14.0]

Q.60 Consider an isothermal reversible compression of one mole of an ideal gas in which the pressure of the system is increased from 5 atm to 30 atm at 300 K. The entropy change of the surroundings (in J K^{-1}) is _____
(final answer should be rounded off to two decimal places)

[Given: R = 8.314 J mol^{-1} K^{-1}]

END OF THE QUESTION PAPER

JAM 2017 ANSWER KEY

Model Answer Key for CY Paper

Paper:CHEMISTRY
Code:CY

SECTION – A (MCQ)

Q. No.	KEY	Q. No.	KEY
01	D	16	A
02	B	17	C
03	D	18	B
04	C	19	A
05	D	20	A
06	A	21	D
07	C	22	C
08	C	23	C
09	B	24	B
10	D	25	D
11	B	26	D
12	C	27	A
13	D	28	B
14	B	29	B
15	D	30	C

SECTION – B (MSQ)

Q. No.	KEYS
31	A, D
32	A, C
33	A, B
34	B, C
35	A, C, D
36	A, D
37	B, C, D
38	A, B, C
39	A, C, D
40	A, B

SECTION – C (NAT Type)

| Q. No.	KEY RANGE	Q. No.	KEY RANGE
41	4 to 4	56	0.35 to 0.39
42	3 to 3	57	200 to 200
43	0 to 0	58	0.14 to 0.15
44	3 to 3	59	0.10 to 0.12
45	2 to 2 or 4 to 4	60	14.80 to 15.00
46	4 to 4		
47	700 to 700		
48	33 to 33		
49	27.90 to 28.10		
50	0.05 to 0.05		
51	11.30 to 11.38		
52	128 to 130		
53	408 to 409		
54	216 to 216		
55	4 to 4		

SECTION – A

MULTIPLE CHOICE QUESTIONS (MCQ)

Q. 1 – Q.10 carry one mark each.

Q.1   The antigen binding site of an antibody is present

(A) at the constant region   (B) at the C-terminal

(C) at the variable region   (D) between the constant and the variable region

Q.2   Which of the following is **NOT** involved in eukaryotic translation?

(A) Ribosome   (B) Spliceosome   (C) mRNA   (D) tRNA

Q.3   Which of the following statements is correct?

(A) Gram negative bacteria are colored purple after Gram staining

(B) Gram negative bacteria are commonly more resistant to antibiotics than Gram positive bacteria

(C) Gram negative bacteria cell wall consists of a thick layer of peptidoglycan outside the plasma membrane

(D) Cell wall of Gram negative bacteria does not contain an outer membrane

Q.4   The role of enzyme E synthesized by phage ϕX174 during host infection is to

(A) block peptidoglycan synthesis   (B) enhance synthesis of viral +RNA

(C) inhibit lipid metabolism   (D) stimulate dsDNA replication

Q.5   Among CH_4, H_2O, NH_3 and PH_3, the molecule having the smallest percent s character for the covalent bond (X–H) between the central element (X = C, O, N or P) and hydrogen is

(A) CH_4 (B) H_2O (C) NH_3 (D) PH_3

Q.6   The result of an electrophoretic separation of a mixture of amino acids **X**, **Y** and **Z** at $pH = 5.0$ is represented as (Given the isoelectric points of **X**, **Y**, and **Z** are 9.87, 3.22 and 5.43, respectively)
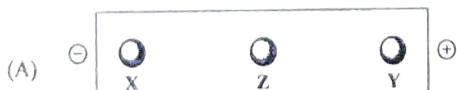
Q.7 $\cos(x + yx) =$

(A) $\cos(x)\cos(yx) - \sin(x)\sin(yx)$ (B) $\cos(x)\cos(yx) + \sin(x)\sin(yx)$

(C) $\cos(x)\sin(yx) - \sin(x)\cos(yx)$ (D) $\cos(x)\sin(yx) + \sin(x)\cos(yx)$

Q.8   If $\begin{bmatrix} x & y \\ p & q \\ u & v \end{bmatrix} R = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$, then the order of R is

(A) 2×3 (B) 3×2 (C) 2×2 (D) 3×3

Q.9   The average energy of a diatomic gaseous molecule at temperature T is $\frac{5}{2}k_BT$ where k_B is Boltzmann's constant. The average energy of this molecule per degree of freedom is

(A) $\frac{1}{2}k_BT$ (B) $\frac{2}{3}k_BT$ (C) k_BT (D) $\frac{3}{2}k_BT$

Q.10 The refractive index of diamond is 2.419. If the speed of light in vacuum is 3×10^8 m s^{-1}, then the speed of light in diamond is

(A) 1.240×10^8 m s^{-1} (B) 1.352×10^8 m s^{-1} (C) 1.521×10^8 m s^{-1} (D) 2.433×10^8 m s^{-1}

Q. 11 – Q. 30 carry two marks each.

Q.11 Which of the following is true of protein synthesis **ONLY** in prokaryotes?

(A) Translation and transcription are coupled
(B) The codon AUG codes for the start signal
(C) The tRNA anticodon can bind to two or more different codons
(D) The functional ribosomes contain two subunits constructed of proteins and RNA

Q.12 Match the entries in Group I with that in Group II

Group I   Group II

P) Phytase   1) paper and pulp processing
Q) Xylanase   2) delignification
R) Laccase   3) gluten complex reduction
S) Bromelain   4) improve mineral availability
                  5) phosphorylation

(A) P-4, Q-1, R-3, S-5   (B) P-4, Q-1, R-2, S-3
(C) P-5, Q-4, R-5, S-2   (D) P-5, Q-1, R-2, S-3

Q.13 If an aldol cleavage of glucose-6-phosphate occurs in glycolysis, it will result in

(A) products of equal carbon chain length   (B) products of unequal carbon chain length
(C) removal of phosphate group   (D) three C_2 compounds

Q.14   The natural geographical distribution of kangaroos is limited to the Australian continent because

(A) abiotic factors determine the distribution
(B) dispersal is limited by accessibility to other continents
(C) kangaroos have not selected habitats in other continents
(D) predators limit the distribution in other continents

Q.15   Which of the following is NOT an example of an adaptive defense mechanism against predation?

(A) Bright colors of bird pollinated flower   (B) Insect that resembles a stick
(C) Nicotine in the tobacco plant   (D) Spines on porcupine

Q.16   Match the entries in Group I with that in Group II

Group I   Group II

P) Nucleolus   1) lipid storage
Q) Sphaerosomes   2) breakdown of fatty acids
R) Peroxisomes   3) transport of macromolecules
S) Plasmodesmata   4) RNA synthesis

(A) P-4, Q-3, R-1, S-2   (B) P-4, Q-1, R-2, S-3
(C) P-2, Q-1, R-3, S-4   (D) P-1, Q-3, R-4, S-2

Q.17   The nitrogenase of diazotrophs

(A) contains Cu-S center and uses 12 NADH to reduce one N_2
(B) contains one (4Fe-4S) cluster and uses 8 $FADH_2$ to reduce one N_2
(C) is a complex of Fe-protein and MoFe-protein and uses 16 ATPs to reduce one N_2
(D) is a MoFe protein and uses 4 ATP and 4 $FMNH_2$ to reduce one N_2

Q.18   During eukaryotic cell division, the amount of DNA doubles

(A) between prophase and anaphase of mitosis
(B) between prophase I and prophase II of meiosis
(C) between the G1 and G2 phases of the cell cycle
(D) during the M phase of the cell cycle

Q.19   The correct sequence of the following events in the human female reproductive cycle is

I: Secretion of FSH
II: Growth of corpus luteum
III: Growth of follicle and oogenesis
IV: Ovulation
V: Sudden increase in the levels of LH

(A) I, II, IV, V, III   (B) II, I, III, IV, V   (C) I, III, V, IV, II   (D) I, V, III, IV, II

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

(A)   (B)

(C)   (D)
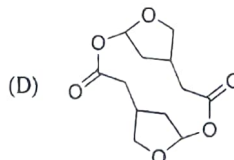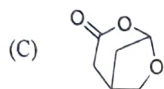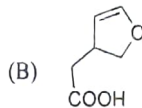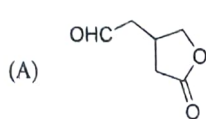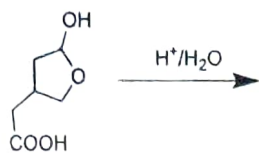
Q.21   The reaction that produces *o*-bromophenol as the major product is

(A)

(B)

(C)

(D)
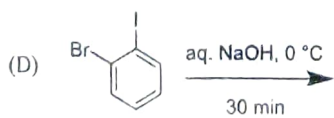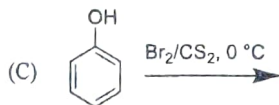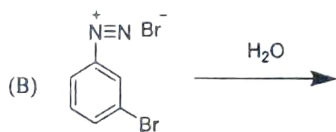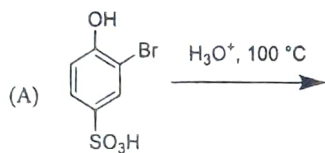
Q.22   For an autocatalytic second order reaction R → P, the rate law is
[where v is rate of the reaction and k is the rate constant]

(A) $v = k\,[R]$ (B) $v = k\,[R]\,[P]$ (C) $v = k\,[R]^2$ (D) $v = k\,[P]^2$

Q.23 In metal-carbonyl complexes, the π-back bonding is

(A) pπ – dπ type
(B) dπ – dπ type
(C) dπ – π* type
(D) dπ – σ* type

Q.24 If $u(x)$ and $v(x)$ are differentiable at $x = 0$, and if $u(0) = 5$, $u'(0) = -3$, $v(0) = -1$ and $v'(0) = 2$, then the value of $\frac{d}{dx}\left(uv + \frac{u}{v}\right)$ at $x = 0$ is

(A) –20
(B) –7
(C) 6
(D) 13

Q.25 Two dice are thrown simultaneously. The probability that the sum of the numbers obtained is divisible by 7 is

(A) $\frac{1}{6}$
(B) $\frac{1}{36}$
(C) 0
(D) $\frac{1}{18}$

Q.26 If one of the diameters of a circle has end points (2, 0) and (4, 0), then the equation of that circle is

(A) $x^2 – 3x + y^2 + 5 = 0$
(B) $x^2 – 4x + y^2 + 6 = 0$
(C) $x^2 – 5x + y^2 + 7 = 0$
(D) $x^2 – 6x + y^2 + 8 = 0$

Q.27 If P = {1, 2, –1, 3}, Q = {0, 4, 1, 3} and R = {1, 6, 7}, then P∩(Q∪R)=

(A) {1, 2}
(B) {1, 3}
(C) {2, 1}
(D) {2, 3}

Q.28 The position of a particle along the y-axis is $y = P t^4 + Q$. For the equation to be dimensionally consistent, the dimension of P in terms of length [L] and time [T] is

(A) LT^{-1}
(B) LT^{-2}
(C) LT^{-3}
(D) LT^{-4}

Q.29 Two inductors P and Q having inductance ratio 1:2 are connected in parallel in an electric circuit. The energy stored in the inductors P and Q are in the ratio

(A) 1 : 4
(B) 1 : 2
(C) 2 : 1
(D) 4 : 1

Q.30 A body X of mass M moving with velocity v hits a stationary body Y of mass m. If M >> m and X moves with the velocity v', then the velocity of Y after an elastic collision is

(A) $2v$
(B) $v + v'$
(C) $v - v'$
(D) $2v'$

SECTION - B

MULTIPLE SELECT QUESTIONS (MSQ)

Q. 31 – Q. 40 carry two marks each.

Q.31   The cells involved in allergic reactions and containing surface receptors of IgE antibodies and histamine are

(A) Basophils   (B) Mast cells   (C) Monocytes   (D) Neutrophils

Q.32   Which of the following is(are) **INCORRECT** in the regulation of the *trp* operon?

(A) It is an example of a negatively controlled repressible operon
(B) The amino acid Trp inactivates the repressor
(C) The amino acid Trp induces the operon
(D) The repressor binds to the operator in the presence of amino acid Trp

Q.33   Which of the following organs are correctly paired with their function?

(A) Large intestine – Protein digestion
(B) Oral cavity – Starch digestion
(C) Pancreas – Bile production
(D) Small intestine – Fat digestion

Q.34   The $\Delta G^{0\prime}$ for homolactic fermentation converting glucose to lactate is -196 kJ mol^{-1}. If $\Delta G^{0\prime}$ for the formation of ATP is $+30.5$ kJ mol^{-1}, then

(A) homolactic fermentation is 31% energy efficient
(B) the efficiency of energy conservation is 69%
(C) the energy stored in the form of ATP is 31%
(D) the process results in the loss of 31% of energy

Q.35   Bacterial plasmid genes of non-chromosomal origin are associated with
A) providing resistance against antibacterial agents
B) the degradation of toxic materials
C) the production of certain toxins
D) the transfer of genetic material from one cell to another cell

Q.36   The elements with atomic numbers 19, 37 and 55

(A) form cubic chloride salts with the coordination number of cation being 6
(B) form ionic fluorides with general formula MF
(C) have lowest density of solids in their respective periods
(D) have lowest ionization energy in their respective periods

Q.37   Fehling's solution

(A) contains a copper complex of tartaric acid
(B) forms a brick-red precipitate with glucose
(C) forms a white precipitate with aldehydes
(D) is used as a test reagent for reducing sugars

Q.38 Which of the following point(s) lies(lie) on the plane $2x + 3y + z = 6$?

(A) $(0, 0, 6)$ (B) $(0, 2, 0)$ (C) $(1, 1, 1)$ (D) $(3, 0, 0)$

Q.39 Kinetic theory of an ideal gas is based upon the following assumption(s)

(A) Gases are made of molecules with negligible volume
(B) The gaseous molecules do not possess kinetic energy
(C) The molecules are in constant random motion
(D) Intermolecular forces of attraction are negligible

Q.40 The electric field and capacitance of a capacitor in the absence of dielectric material are E and C, respectively. When the capacitor is filled with a dielectric material, the electric field and capacitance of the capacitor becomes E' and C', respectively. Which of the following is(are) correct?

(A) E' > E and C' = C   (B) E' < E and C' > C
(C) E' = E and C' > C   (D) E' > E and C' < C

SECTION – C
NUMERICAL ANSWER TYPE (NAT)

Q. 41 – Q. 50 carry one mark each.

Q.41 Antigen and antibody interaction is shown by the following scheme

$$Ab + Ag \; \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} \; Ab\text{-}Ag$$

Where Ab is antibody, Ag is antigen and Ab-Ag is antigen-antibody complex. The values of k_1 and k_{-1} are 5×10^{-5} μM^{-1} s^{-1} and 2×10^{-7} s^{-1}, respectively. The dissociation constant for the complex is _____ nM.

Q.42 The population of a bacterial culture increases from one thousand to one billion in five hours. The doubling time of the culture (correct to 1 decimal place) is _____ min.

Q.43 The K_M and v_{max} of lactate dehydrogenase for conversion of pyruvate to lactate are 1 mM and 5 nM s^{-1}, respectively. At 0.25 mM pyruvate, the velocity of the reaction catalyzed by lactate dehydrogenase is _____ nM s^{-1}.

Q.44 A linear DNA contains five restriction sites for EcoRI and three restriction sites for BamHI. The number of fragments that will be generated after digestion with EcoRI is _____.

Q.45 Total number of singlets observed in the ^{1}H NMR of the following compound is _____

OCH$_3$
OH
CHO
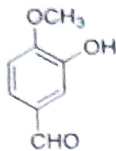
Q.46 The $[H^+]$ of 0.1 N acetic acid solution is 1.33×10^{-3}. The pH of the solution (correct to two decimal places) is _____.

Q.47 The positive root of the equation $x^4 + x^2 - 2 = 0$ is _____.

Q.48 $\int_0^1 x\, dx + \int_1^2 (2-x)\, dx = $ _____.

Q.49 One gram of radioactive nuclei with a half life of 300 days is kept in an open container. The weight of nuclei remaining after 900 days (correct to 1 decimal place) is _____ mg.

Q.50 Two sources P and Q produce electromagnetic waves with wavelengths λ and 2λ, respectively. Source P ejects a photon with a maximum kinetic energy of 4.0 eV from a metal with work function 2.0 eV. The maximum kinetic energy (eV) of a photon ejected by source Q from the same metal is _____.

Q. 51 – Q. 60 carry two marks each.

Q.51 The standard oxidation potentials for oxidation of NADH and H$_2$O are + 0.315 V and –0.815 V, respectively. The standard free energy for oxidation of 1 mole of NADH by oxygen under standard conditions (correct to 1 decimal place) is _____ kJ. [Faraday Constant is 96500 C mole^{-1}]

Q.52 The K_M and v_{max} of an enzyme are 4 mM and 0.1 nM h^{-1} respectively. In the presence of 1.5 mM inhibitor, the K_M' and v_{max}' of the enzyme are 6 mM and 0.1 nM h^{-1}, respectively. The value of inhibition constant, K_I (correct to 1 decimal place) is _____ mM.

Q.53 The relationship between $log_{10}(MW)$ [where MW = molecular weight in kDa] of a mixture of protein standards and their retention factors (R_f) obtained from native-PAGE is $log_{10}(MW) = -2R_f + 3$. If the measured retention factor for a protein with 180 amino acids is 0.5, then the number of identical monomers in the protein is _____.

Q.54   In bacteria, a ribosome synthesizes a protein containing 300 amino acids from mRNA in 20 seconds. If the average lifetime of a mRNA is 2 minutes, the number of ribosomes that can translate a single mRNA containing 1350 nucleotides is _____ .

Q.55   In 2 N H_2SO_4, an organic compound shows fluorescence with quantum yield, $\phi_f = 0.42$ and fluorescence rate constant, $k_f = 5.25 \times 10^7$ s^{-1}. The observed fluorescence life time of it under the same conditions (correct to 1 decimal place) is _____ ns.

Q.56   In acidic solution, permanganate ion is reduced by ferrous ion. The number of electrons involved in the reduction of permanganate ion is _____ .

Q.57   If $\vec{a}$ and $\vec{b}$ are unit vectors and the angle between them is $\frac{\pi}{3}$, then the magnitude of $\vec{a} - \vec{b}$ is _____ .

Q.58   Using the letters in the word TRICK a new word containing five distinct letters is formed such that T appears in the middle. The number of distinct arrangements is _____ .

Q.59   An X-ray tube operates at 30 kV. If one electron converts 10% of its energy into a photon at first collision, then the wavelength of the photon (correct to two decimal places) is _____ Å. [h = 4.14×10^{-15} eVs^{-1}, c = 3×10^3 ms^{-1} and e = 1.6×10^{-19} C]

Q.60   In a mass spectrometer, a deuteron with kinetic energy 17 MeV enters a uniform magnetic field of 2.4 T with its velocity perpendicular to the field. The deuteron moves in a circular path in the magnetic field. The radius of its path in the magnetic field (correct to two decimal places) is _____ cm. [mass of deuteron is 3.34×10^{-27} kg, 1 MeV = 1.6×10^{-13} J and e = 1.6×10^{-19} C]

END OF THE QUESTION PAPER

JAM 2017 ANSWER KEY

Model Answer Key for BT Paper

Paper: BIOTECHNOLOGY   Code: BT

SECTION – A (MCQ)

Q. No.	KEY	Q. No.	KEY
01	C	16	B
02	B	17	C
03	B	18	C
04	A	19	C
05	D	20	A
06	A	21	A
07	A	22	B
08	A	23	C
09	A	24	C
10	A	25	A
11	A	26	D
12	B	27	B
13	B	28	D
14	B	29	C
15	A	30	B

SECTION – B (MSQ)

Q. No.	KEYS
31	A, B
32	B, C
33	B, D
34	A, C
35	A, B, C, D
36	B, C, D
37	A, B, D
38	A, B, C, D
39	A, C, D
40	B or C or B, C

SECTION – C (NAT Type)

Q. No.	KEY RANGE	Q. No.	KEY RANGE
41	4 to 4	56	5 to 5
42	14.0 to 16.0	57	1 to 1
43	1 to 1	58	24 to 24
44	6 to 6	59	4.10 to 4.20 or 0.00 to 0.01
45	3 to 3	60	34.00 to 36.00
46	2.86 to 2.89		
47	1 to 1		
48	1 to 1		
49	124.0 to 126.0		
50	1 to 1		
51	−219.0 to −217.0		
52	2.9 to 3.1		
53	5 to 5		
54	4.0 to 4.1		
55	7.9 to 8.1		