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# INTER DISCIPLINARY TOPICS FOR CHEMICAL SCIENCE

## QUESTION BANK

For Higher Competitive Exams CSIR-NET/JRF,GATE,TIFR

K.M.AMISH



Nanoscience and Technology  
 Catalyst and Green Chemistry  
 Medicinal Chemistry  
 Supramolecular Chemistry  
 Environmental Chemistry

Energy Audit Services

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Multidimensional Educational Technical

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# **INTER DISCIPLINARY TOPICS FOR CHEMICAL SCIENCE**

## **QUESTION BANK KOOKLET**

### **STRUCTURACTURAL PROPERTISE & HISTRY BASED**

#### **FOR CSIR, NET, JRF.GATE,TIFR**

(Junior Research Fellowship and Eligibility for Lectureship)

Many Other Competitive Exams



Written by

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**INTER DISCIPLINARY TOPIC FOR CHEMICAL SCIENCE**  
**For CSIR, NET, JRF,GATE,TIFR (QUESTION BANK)**  
(Junior Research Fellowship and Eligibility for Lectureship)

By

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## The Greek Alphabet for you

Letter	Name
A α	alpha, άλφα
B β	beta, βήτα
Γ γ	gamma, γάμμα
Δ δ	delta, δέλτα
E ε	epsilon, έψιλov
Z ζ	zeta, ζήτα
H η	eta, ήτα
Θ θ	theta, θήτα
I ι	iota, ιώτα
K κ	kappa, κάππα
Λ λ	lambda, λάμδα
M μ	mu, μυ

Letter	Name
N ν	nu, νυ
Ξ ξ	xi, ξι
O ο	omicron, όμικρον
Π π	pi, πι
P ρ	rho, ρώ
Σ σ/ς <sup>[note 1]</sup>	sigma, σίγμα
T τ	tau, ταυ
Υ υ	upsilon, ύψιλov
Φ φ	phi, φι
X χ	chi, χι
Ψ ψ	psi, ψι
Ω ω	omega, ωμέγα

## Fundamental constant for you

Constant	Symbol	Value
✓ acceleration due to gravity	g	9.8 m s <sup>-2</sup>
✓ atomic mass unit	amu, m <sub>u</sub> or u	1.66 x10 <sup>-27</sup> kg
✓ Avogadro's Number	N	6.022 x 10 <sup>23</sup> mol <sup>-1</sup>
✓ Bohr radius	a <sub>o</sub>	0.529 x 10 <sup>-10</sup> m
✓ Boltzmann constant	k	1.38 x 10 <sup>-23</sup> J K <sup>-1</sup>
✓ electron charge to mass ratio	-e/m <sub>e</sub>	-1.7588 x 10 <sup>11</sup> C kg <sup>-1</sup>
✓ electron classical radius	r <sub>e</sub>	2.818 x 10 <sup>-15</sup> m
✓ electron mass energy (J)	m <sub>e</sub> c <sup>2</sup>	8.187 x 10 <sup>-14</sup> J
✓ electron mass energy (MeV)	m <sub>e</sub> c <sup>2</sup>	0.511 MeV
✓ electron rest mass	m <sub>e</sub>	9.109 x 10 <sup>-31</sup> kg
✓ Faraday constant	F	9.649 x 10 <sup>4</sup> C mol <sup>-1</sup>
✓ fine-structure constant	α	7.297 x 10 <sup>-3</sup>
✓ gas constant	R	8.314 J mol <sup>-1</sup> K <sup>-1</sup>
✓ gravitational constant	G	6.67 x 10 <sup>-11</sup> Nm <sup>2</sup> kg <sup>-2</sup>
✓ neutron mass energy (J)	m <sub>n</sub> c <sup>2</sup>	1.505 x 10 <sup>-10</sup> J
✓ neutron mass energy (MeV)	m <sub>n</sub> c <sup>2</sup>	939.565 MeV
✓ neutron rest mass	m <sub>n</sub>	1.675 x 10 <sup>-27</sup> kg
✓ neutron-electron mass ratio	m <sub>n</sub> /m <sub>e</sub>	1838.68
✓ neutron-proton mass ratio	m <sub>n</sub> /m <sub>p</sub>	1.0014
✓ permeability of a vacuum	μ <sub>o</sub>	4π x 10 <sup>-7</sup> N A <sup>-2</sup>
✓ permittivity of a vacuum	ε <sub>o</sub>	8.854 x 10 <sup>-12</sup> F m <sup>-1</sup>
✓ Planck constant	h	6.626 x 10 <sup>-34</sup> J s
✓ proton mass energy (J)	m <sub>p</sub> c <sup>2</sup>	1.503 x 10 <sup>-10</sup> J
✓ proton mass energy (MeV)	m <sub>p</sub> c <sup>2</sup>	938.272 MeV
✓ proton rest mass	m <sub>p</sub>	1.6726 x 10 <sup>-27</sup> kg
✓ proton-electron mass ratio	m <sub>p</sub> /m <sub>e</sub>	1836.15
✓ Rydberg constant	r <sub>∞</sub>	1.0974 x 10 <sup>7</sup> m <sup>-1</sup>
✓ speed of light in vacuum	C	2.9979 x 10 <sup>8</sup> m/s



## REFACE

This book has been written with an aim to provide a source for *CSIR, NET, JRF*, students of Chemical Science opting five disciplinary topics as an open elective and is exactly based on the syllabus.

The objective of this book, *Interdisciplinary Topics* is to introduce various topics according to the syllabus outline in easy and effective way. According to the topics of syllabus the whole book is divided into five parts in total. The first part covers to “*Chemistry in Nanoscience and Technology*” and part second is “*Catalyst and Green Chemistry*” and part third is on “*Medicinal Chemistry*” and part four is on “*Supramolecular Chemistry*” and last part five is on “*Environmental Chemistry*”

The main features of this book are it is in **structure and properties based** and future application on different topic which is given in this book in **multicolored**. It is strictly based on the syllabus of C.S.I.R., NET, JRF students for Chemical Science. That book is text as well as competitive simply, coherent and completed. All topics in this book are in detailed in simple language, attached with external knowledge side of the pages and having different question marks which is required to understanding of the topic and after completed chapters giving large exercise of related topics. The main focus of writer of the book Illustration and diagram are used in almost in dimensional based effective way to explain difficult images or diagrams of the topics. Offers the readers a multitude of actual and potential systems for planning, designing and implementing various emerging technologies.

The final form of this book is the outcome of an extensive survey of related literature than our knowledge. We have tried to consult the best available sources of information in respect to various topics discussed. We sincerely hope that the book will go a long way to satisfy the long felt need of students for a friendly book on Chemical science.

We gratefully acknowledge the assistance and constructive comments of Institutes or colleges and Research students during the preparation of this book. *Any suggestions for improvement of the book are welcome and will be gratefully acknowledged.*

**K. M. AMISH**

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**ABOUT THE BOOK:-** We are extremely delighted to present this version of Chemical Sciences which will cover the total need of the student preparing for CSIR-UGC (NET) examination for selection of scholars for Junior Research Fellowship of CSIR and UGC and for determining the eligibility for Lectureship in the Colleges and Universities of India. Our major objective is also to develop confidence among the candidates who are taking competitive examination in the field related to Chemical Sciences after Postgraduation by providing them solved objective as well as short descriptive type questions which covers both fundamental and practical aspects of the topic. This book is designed to satisfy the challenging requirements of NET (CSIR-UGC), GATE, SET, ONGC, IARI, BARC and Ph.D. Entrance of Various Indian University. The final form of this book is the outcome of an extensive survey of related literature than our knowledge. We have tried to consult the best available sources of information in respect to various topics discussed. We sincerely hope that the book will go a long way to satisfy the long felt need of students for a friendly book on Chemistry. **There are numerous features in this first edition that are designed to make learning Interdisciplinary topics for chemical science more effective and more enjoyable, structural properties history based.** The objective of this book, *Interdisciplinary Topics* is to introduce various topics according to the syllabus outline in easy and effective way. According to the topics of syllabus the whole book is divided into five parts in total. The first part covers to “*Chemistry in Nanoscience and Technology*” and part second is “*Catalyst and Green Chemistry*” and part third is on “*Medicinal Chemistry*” and part four is on “*Supramolecular Chemistry*” and last part five is on “*Environmental Chemistry*” **We appreciate that Interdisciplinary is often troublesome, and therefore have taken care to give help with this enormously important aspect of chemical science.**

We gratefully acknowledge the assistance and constructive comments of our colleagues and Research students during the preparation of this book. Any suggestions for improvement of the book are welcome and will be gratefully acknowledged.

**Key points of the book:-** The first key point is to present the subject matter in a logical order, from the simple to the more complex. Each part builds on the content of CSIR NET/JRF based syllabus.

- ✓ The second key point the philosophy that we strive to maintain throughout the text is that if a topic or concept is worth treating, then it is worth treating in sufficient detail and to the extent students have the opportunity to fully understand it without having to consult other sources.
- ✓ The third key point is to include features in the book that will expedite the learning process. These learning aids include the following;
- ✓ Numerous illustrations, now presented in full color, and photographs to help visualize what is being presented
- ✓ Learning objectives to focus student/ scholars attention on what they should be getting from each chapter
- ✓ Why study .....’ and Interdisciplinary is so important, items as well as case studies that provide relevance to topic discussions
- ✓ Concept Check, objective questions that test whether a student understands the subject matter on a conceptual level
- ✓ Starting of part summary of all used topics are given in the first pages, with page numbering.
- ✓ History terms, and description of history highlighted in the left side of the pages related to topics
- ✓ Need information to understand this page, highlighted in the margins in the down of the all pages
- ✓ End of part objective questions and problems designed to progressively develop students, understanding of concepts and facility with skills
- ✓ Answers to selected problems, so students can check their Answers sheets
- ✓ Aglossary, a global list of symbols, and reference to facilitate understanding of the subject matter

**Exercises and problems:-** The core of testing understanding is the collection of end of Part Exercises and Objective problems. The Exercises are straightforward objective level test that give practice with manipulating data. The problems are more searching. They are divided into partition.

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## ABBREVIATION

### Abbreviation of Chemistry in Nanoscience and Technology

• ECE:-	Engineering computer science
• EEM:-	Scanning tunneling microscope
• NSTC:-	National Science and Technology Council
• NNI:-	National Nanotechnology Initiative
• SPM:-	Scanning probe microscope
• DNA:-	Deoxy nucleic acid
• CNT:-	Carbon Nano tube
• RBC:-	Red blood cell
• RSM:-	Nano Structured Materials
• SGM:-	Sol-gel method
• VPDm:-	Vapour phase deposition method
• BMP:-	Ball milling Photolithography
• EBL:-	Electron beam lithography
• 2-D	Two-dimensional
• QHE:-	Quantum Hall effect
• YGM:-	Yield gram quantities
• RSR:-	Royal Society Research
• SWCN:-	Single-walled carbon Nanotubes
• IBM:-	International Business Machines
• TEM:-	Transmitted electron microscope
• MWCNT:-	Multi wall carbon Nanotubes
• TP:-	Tera Pascal
• XRD:-	X-Ray diffraction
• AERE:-	Atomic Energy Research Establishment
• BCN:-	Boron carbon nanotube
• BNN:-	Boron nitride nanotube
• MS:-	Mass spectrometry
• Å <sup>o</sup> :-	Angstroms
• @:-	Encapsulated inside the cage
• MRI:-	Magnetic resonance imaging
• CQDs:-	Carbon quantum dots
• QDs:-	Quantum dots
• LEDs:-	Lilied Electrode diodes
• TV:-	Television
• PL:-	Photoluminescence
• QCY:-	Quantum confinement yields
• BSE:-	Back-scattered electrons
• AFM:-	Atomic force microscopy
• SFM:-	Scanning force microscopy
• STM:-	Scanning tunneling microscope
• UV-S:-	Ultraviolet-Visible spectrophotometer
• BLL:-	Beer-Lambert law
• SERS:-	Surface-enhanced Raman scattering
• DLS:-	Dynamic Light Scattering

- DSC:- Differential scanning calorimetry
- LS:- Light scattering
- SDM:- Single domain magnetic
- QDSC:- Quantum dot solar cells
- ROS:- Reactive oxygen species
- FLB:- Fluorescence light bulbs
- ETG:- Electric transmission grid
- MIT:- Massachusetts Institute of Technology
- NEHI:- Nanotechnology Environmental & Health Implications
- IR:- Infra-Red
- PEGHCC:- Polyethylene glycol-hydrophilic carbon clusters
- ORD:- Office of Research and Development
- NMR:- Nuclear Magnetic Resonance
- NEHI:- Nanotechnology Environmental and Health Implications
- CD:- Cardiovascular disease

### Abbreviation of Catalyst and Green Chemistry

- EPA:- Environmental Protection Agency
- GFEA:- German Federal Environmental Agency
- P:- Prevent wastes
- R:- Renewable materials
- O:- Omit derivatisation steps
- D:- Degradable chemical products
- U:- Use of safe synthetic methods
- C:- Catalytic reagents
- T:- Temperature, Pressure ambient
- I:- In-Process monitoring
- V:- Very few auxiliary substrates
- E:- E-factor, maximise feed in product
- L:- Low toxicity of chemical products
- Y:- Yes, it is safe
- QD:- Qualitative development
- R&D:- Research and Development
- PUP:- Oxford University Press
- FE:- Forestry and Environmental
- GGS:- **Green Growth Strategy**
- DMC:- Dimethyl carbonate
- DESs:- Deep Eutectic Solvents
- HPLC:- High Pressure Liquid Chromatography
- DAR:- Diels-Alder reactions
- OMC:- Organometallic complexes
- PAAM:- Polymers of amino acid monomers
- EHA:- Ethylhexanoic acid
- SCR:- Selective Catalytic Reduction
- NOX:- Nitrogen oxides
- EGR:- Exhaust gas recirculation
- PI:- Pharmaceutical industry
- HTR:- Hydroxide transfer reactions
- PTC:- Phase-transfer catalyst

- QAS:- Quaternary ammonium salts
- LEC:- Low energy consumption
- OMT:- Organometallic transformations
- QPS:- Quaternary phosphonium salts
- PEG:- Polyethylene glycols
- HTPTC:- High-temperature phase-transfer catalysts
- CPTC:- Chiral phase-transfer catalysts
- THF:- Tetra Hydro Furan
- GHG:- Greenhouse gas
- LAB:- Lead acid battery
- GW:- Global warming
- GCA:- Green chemistry approach
- AE:- Atom efficiency
- MI:- Mass intensity
- RME:- Reaction mass efficiency
- MP:- Mass Productivity
- CE:- Carbon efficiency
- EMY:- Effective mass yield
- PMI:- Product mass intensity
- MAOS:- Microwave-Assisted Organic Synthesis
- MEC:- Microwave-Enhanced Chemistry
- US:- Ultrasonics Sonochemistry
- US:- Ultrasound frequency
- UE:- Ultrasound enhances
- PCCR:- Palladium catalyzed coupling reactions
- IUPAC:- International Union of Pure and Applied Chemistry
- TSY:- Time-space
- PPR:- Primary photochemical reactions
- SDR:- Secondary or dark reactions
- MC:- Microelectronic components
- TIM:- Traditional industrial methods
- MT:- Microfluidic technologies
- HTA:- Higher atom economy

### Abbreviation of Medicinal Chemistry

- SARs: Structure–activity relationships
- 3Ds: Three dimensional structure
- PEI: Paul Ehrlich Institute
- IASP: International Association for the Study of Pain
- DASCS: Drug Addiction Sweeps City Streets
- IAQMS:- International Academy of Quantum Molecular Science
- CRO:- Contract Research Organization
- DNLD: De novo Ligand design
- WFN: World Federation of Neurology
- NSAIDs:- Nonsteroidal anti-inflammatory drugs
- WHO: World Health Organization

• TB:-	Tuberculosis
• CVD:-	Cardiovascular disease
• CAD:-	Coronary artery diseases
• SP:-	Streptococcus pyogenesa
• ANS:-	Autonomic nervous system
• PVCs:-	Premature ventricular contractions
• PAT:-	Paroxysmal atrial tachycardia
• NAAIDs:-	Non-steroidal anti-inflammatory drugs
• BP:-	Blood pressure
• RBCs:-	Red blood cells
• NIHI:-	National Institutes of Health initiative
• H1,H2,H3,H4, :-	Histamine
• BBB:-	Blood-brain barrier
• GP&GN-B:-	Gram-positive and Gram-negative bacteria
• HIV /AIDS:-	Human immunodeficiency
• MMV:-	Medicines for Malaria Venture
• IPT:-	Intermittent preventive therapy
• RSGS:-	Rapid –and slow –growing species
• MAC:-	M.avium intracellulare complex
• MDT-TB:-	Multidrug-resistant tuberculosis
• XRD-TB:-	Extensively drug-resistant tuberculosis
• INAH:-	Isonicotinic acid hydrazide
• RNA:-	Ribo nucleic acid
• HAART:-	Highly active antiretroviral therapy
• NRTI:-	Nucleotide reverse transcriptase inhibitors
• NNRTI:-	Nonnucleoside reverse transcriptase inhibitors
• MAP:-	Mean arterial pressure
• CCB:-	Calcium Channel Blockers

### Abbreviation of Supramolecular Chemistry

• ° :-	Degrees
• c :-	Susceptibility
• Å :-	Angstroms
• DE:-	Effective energy barrier
• Cm <sup>3</sup> :-	Cubic centimetres
• AC :-	Alternating current
• Bipy:-	Bipyridine
• Cg:-	Centroid
• DC :-	Direct current
• DMF:-	Dimethylformamide
• DMSO:-	Dimethylsulfoxide
• EA:-	Elemental analysis
• EI:-	Electron impact
• ESI:-	Electrospray ionisation
• Et <sub>2</sub> O:-	Diethyl ether
• FT-IR:-	Fourier transform infrared
• Hg:-	Mercury
• HOPG:-	Highly orientated pyrolitic graphite
• IR:-	Infrared

• K :-	Kelvin
• K <sub>B</sub> :-	Boltzmann constant
• M:-	Molar
• M:-	(IR) medium
• MALDI :-	Matrix-Assisted laser desorption ionisation
• MeOH :-	Methanol
• MeCN:-	Acetonitrile
• Me :-	Methyl
• mg :-	Milligram
• MHz:-	Megahertz
• Min:-	Minute(s)
• mL:-	Millilitres
• MLCT:-	Metal to ligand charge transfer
• Mm:-	Millimeters
• Mmol:-	Millimole
• Mol:-	Mole
• MOF:-	Metal organic framework
• MS	Mass spectrometry
• m/z :-	Mass/charge ratio
• nm :-	Nanometres
• NMR:-	Nuclear magnetic resonance
• Oe:-	Oersted
• P:-	Para
• Ph:-	Phenyl
• Ppm:-	Parts per million
• Q:-	Quartet (NMR)
• QTM:-	Quantum tunnelling of magnetisation
• s :-	(IR) strong
• S :-	Spin ground state
• SCE :-	Saturated calomel electrode
• SMMs:-	Single molecule magnets
• SPM:-	Scanning probe microscopy
• STM :-	Scanning tunnelling microscopy
• ToF-SIMS:-	Time-of-flight secondary ion mass spectrometry
• UHV:-	Ultra high vacuum
• UV-vis:-	Ultraviolet visible
• vdW:-	van der Waals
• vs:-	(IR) very strong
• vs:-	Versus
• w :-	(IR) weak
• XAS:-	X-ray absorption spectroscopy
• XMCD:-	X-ray magnetic circular dichroism
• XRD:-	X-ray diffraction
• XPS :-	X-ray photoelectron spectroscopy

## Abbreviation of Environmental Chemistry

• (aq):-	Aqueous species
• Atm:-	Atmosphere (pressure)
• ATP:-	Adenosine triphosphate
• °C :-	Degrees Celsius (temperature)
• CCD:-	Calcite compensation depth
• CCN:-	Cloud condensation nuclei
• CDT:-	Canyon Diablo troilite
• CEC :-	Cation exchange capacity
• CFC :-	Chlorofluorocarbon
• CIA:-	Chemical index of alteration
• D :-	Deuterium
• DIC:-	Dissolved inorganic carbon
• DIP :-	Dissolved inorganic phosphorus
• DMS:-	Dimethyl sulphide
• DMSP:-	Beta-dimethylsulphoniopropionate
• DNA:-	Deoxyribonucleic acid
• DSi:-	Dissolved silicon
• $E^\circ$ :-	Standard electrode potential (V)
• Eh:-	Redox potential (V)
• EPA:-	Environmental Protection Agency
• FACE :-	Free-air CO <sub>2</sub> enrichment
• FAO:-	Food and Agriculture Organization
• Fs:-	Furans
• G:-	Gibbs free energy (kJmol <sup>-1</sup> )
• g :-	Gram (weight)
• (g):-	Gas





## PART 1: INTRODUCTION TO NANOSCIENCE & NANOTECHNOLOGY

### EXERCISE

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### Multiple Choice Questions

#### Choose Appropriate Alternative

**Q<sup>n</sup>.1, 10 nm = \_\_\_\_\_ m**

- (a)  $10^{-8}$                       (b)  $10^{-7}$                                       (c)  $10^{-9}$                                       (d)  $10^{-10}$

**Q<sup>n</sup>.2, The size of nanoparticles is between \_\_\_\_\_ nm.**

- (a) 100 to 1000      (b) 0.1 to 10                                      (c) 1 to 100                                      (d) 0.01 to 1

**Q<sup>n</sup>.3, The diameter of hydrogen atom is...**

- [A] 1                                      [B] 10                                      [C] 0.1                                      [D] 0.01

**Q<sup>n</sup>.4, Carbon atoms make \_\_\_\_\_ type of bond with other carbon atoms.**

- [A] Covalent                                      [B] ionic                                      [C] metallic                                      [D] hydrogen

**Q<sup>n</sup>.5, Fullerene or bucky ball is made up of \_\_\_\_\_ carbon atoms.**

- [A] 100                                      [B] 20                                      [C] 75                                      [D] 60

**Q<sup>n</sup>.6, The thermal conductivity of a standard SWNT along its length is \_\_\_\_\_ watt/(m.K)**

- [A] 3500                                      [B] 385                                      [C] 35000                                      [D] 35

**Q<sup>n</sup>.7, 1 m = \_\_\_\_\_ nm.**

- [A]  $10^{-9}$                                       [B]  $10^{-8}$                                       [C]  $10^9$                                       [D]  $10^8$

**Q<sup>n</sup>.8, "There is plenty of room at the bottom." This was stated by \_\_\_\_\_.**

- [A] Eric Drexler                                      [B] Richard Feynmann  
[C] Harold Croto                                      [D] Richard Smalley

**Q<sup>n</sup>.9, who coined the word 'nanotechnology'?**

- [A] Eric Drexler                                      [B] Richard Feynmann  
[C] SumioTijima                                      [D] Richard Smalley

**Q<sup>n</sup>.10, According to the definition by CRN, nanotechnology is...**

- [A] Mechanical engineering [B] atomic engineering  
[C] Newtonian mechanics [D] micro-electronics

**Q<sup>n</sup>.11, Nanoscience can be studied with the help of...**

- [A] Quantum mechanics [B] Newtonian mechanics  
[C] macro-dynamics [D] geophysics

**Q<sup>n</sup>.12, Greeks and Romans had used nanoparticles in the manufacture of...**

- [A] Cosmetics for eyes [B] medicines  
[C] metal articles [D] hair-dye

**Q<sup>n</sup>.13, Egyptians were using \_\_\_\_ to prepare make-up for eyes.**

- [A] Nanoaluminium [B] nanocopper  
[C] nanosteel [D] nanolead

**Q<sup>n</sup>.14, The sword of Tipu Sultan was made of...**

- [A] Nanolead [B] nanoaluminium  
[C] Damascus steel [D] Pure iron

**Q<sup>n</sup>.15, \_\_\_\_ contains nanoparticles prepared by using biologically processed metal ores.**

- [A] Homeopathic medicines [B] Modern antibiotics  
[C] Ayurvedic 'Bhasmas' [D] Modern cosmetics

**Q<sup>n</sup>.16, Who was the first scientist to describe that substances having nanodimensions possess altogether different and unique properties?**

- [A] Richard Feynmann [B] Eric Drexler  
[C] Archimedes [D] Michael Faraday

**Q<sup>n</sup>.17, Which of the following does not apply to nanotechnology?**

- [A] It is a general-purpose technology. [B] It can be called Green technology.  
[C] Newtonian mechanics can describe it. [D] It involves rearrangement of atoms.

**Q<sup>n</sup>. 18, The diameter of human hair is \_\_\_\_ nm.**

- [A] 50,000 [B] 75,000 [C] 90,000 [D] 1,00,000

**Q<sup>n</sup>.19, The diameter of human hair is \_\_\_\_ m.**

[A]  $5 \times 10^{-8}$                       [B]  $5 \times 10^{-7}$                       [C]  $5 \times 10^{-6}$                       [D]  $5 \times 10^5$

**Q<sup>n</sup>.20, The cut-off limit of human eye is \_\_\_\_ nm.**

[A] 2,000                      [B] 5,000                      [C] 10,000                      [D] 50,000

**Q<sup>n</sup>.21, The size of E.Coli bacteria is \_\_\_\_ nm.**

[A] 2,000                      [B] 5,000                      [C] 50                      [D] 90

**Q<sup>n</sup>.22, The size of RBC is \_\_\_\_ nm.**

[A] 50                      [B] 90                      [C] 2,000                      [D] 5,000

**Q<sup>n</sup>.23, The thickness of a transistor is \_\_\_\_ nm.**

[A] 50                      [B] 90                      [C] 2,000                      [D] 5,000

**Q<sup>n</sup>.24, The size of a virus is \_\_\_\_ nm.**

[A] 2                      [B] 20                      [C] 50                      [D] 2000

**Q<sup>n</sup>.25, The diameter of a bucky ball is \_\_\_\_ nm.**

[A] 1,000                      [B] 100                      [C] 10                      [D] 1

**Q<sup>n</sup>.26, The width of a typical DNA molecule is \_\_\_\_ nm.**

[A] 1                      [B] 2                      [C] 5                      [D] 10

**Q<sup>n</sup>.27, 1 micrometer (micron) = \_\_\_\_\_ m.**

[A]  $10^{-9}$                       [B]  $10^{-8}$                       [C]  $10^{-7}$                       [D]  $10^{-6}$

**Q<sup>n</sup>.28, 1 micrometer (micron) = \_\_\_\_\_ nm.**

[A] 1,000                      [B] 100                      [C] 10                      [D] 0.01

**Q<sup>n</sup>.29, The full form of STM is...**

[A] Scanning Tunneling Microscope                      [B] Scientific Technical Microscope  
[C] Systematic Technical Microscope                      [D] Super Tensile Microscope

**Q<sup>n</sup>.30, What does 'F' stand for in AFM?**

[A] Fine                      [B] Front                      [C] Force                      [D] Flux

**Q<sup>n</sup>.31, Which ratio decides the efficiency of nanosubstances?**

[A] Weight/volume                      [B] Surface area/volume

[C] Volume/weight

[D] Pressure/volume

**Q<sup>n</sup>.32, The surface area to volume ratio of a sphere with radius 1 cm is R<sub>1</sub> and that of a sphere with radius 5 cm is R<sub>2</sub>. Then R<sub>1</sub> = \_\_\_\_ R<sub>2</sub>.**

[A] 3

[B] 1/3

[C] 5

[D] 1/5

**Q<sup>n</sup>.33, The surface area to volume ratio of a cube with side 1 unit is R<sub>1</sub> and that of a cube with side 10 units is R<sub>2</sub>. Then R<sub>2</sub> = \_\_\_\_ R<sub>1</sub>.**

[A] 1/10

[B] 10

[C] 1/100

[D] 100

**Q<sup>n</sup>.34, The two important properties of nanosubstances are...**

[A] Pressure and friction

[B] sticking and friction

[C] Sticking and temperature

[D] temperature and friction

**Q<sup>n</sup>.35, With the help of \_\_\_\_\_, Robert F. Curl and others discovered fullerene.**

[A] Electron microscope

[B] magnetic resonance

[C] Condensation technique

[D] mass spectrograph

**Q<sup>n</sup>.36, In the structure of fullerene each carbon atom forms covalent bonds with \_\_\_\_ other carbon atoms.**

[A] One

[B] two

[C] three

[D] four

**Q<sup>n</sup>.37, Who had invented the famous 'Geodesic' dome structure?**

[A] Eric Drexler

[B] Buckminster Fuller

[C] Richard Smalley [D] Faraday

**Q<sup>n</sup>.38, The largest cluster of carbon atoms in Bucky balls known till today consists of \_\_\_\_ carbon atoms.**

[A] 60

[B] 75

[C] 180

[D] 540

**Q<sup>n</sup>.39, The smallest cluster of carbon atoms in Bucky balls known till today consists of \_\_\_\_ carbon atoms.**

[A] 75

[B] 60

[C] 20

[D] 15

**Q<sup>n</sup>.40, The tensile strength of an MWNT is \_\_\_\_ Pa.**

[A]  $63 \times 10^6$   
10<sup>9</sup>

[B]  $63 \times 10^7$

[C]  $63 \times 10^8$

[D]  $63 \times$

**Q<sup>n</sup>.41, The compressive strength of a nanotube \_\_\_\_ its tensile strength.**

[A] is less than                      [B] is greater than                      [C] is equal to                      [D] may be greater than

**Q<sup>n</sup>.42, The hardness of a standard SWNT is \_\_\_\_ Pa.**

[A]  $63 \times 10^6$                       [B]  $25 \times 10^6$                       [C]  $25 \times 10^9$                       [D]  $25 \times 10^{-9}$

**Q<sup>n</sup>.43, The bulk modulus of a standard SWNT is \_\_\_\_ that of diamond.**

[A] Less than                      [B] greater than                      [C] equal to                      [D] less than or equal to

**Q<sup>n</sup>.44, How much current can be passed through  $1 \text{ cm}^2$  cross-section of a metal nanotube?**

[A]  $10^{-9}$  A                      [B]  $10^9$  A                      [C] 1000 A                      [D] 0.001 A

**Q<sup>n</sup>.45, The electrical conductivity of a nanotube is \_\_\_\_ times that of copper.**

[A] 10                      [B] 100                      [C] 1000                      [D] 1/100

**Q<sup>n</sup>.46, An MWNT possesses electrical superconductivity up to temperature of...**

[A] 12 K                      [B]  $12^\circ\text{C}$                       [C] 100 K                      [D]  $100^\circ$

**Q<sup>n</sup>.47, At room temperature, the thermal conductivity of a copper wire is \_\_\_\_ watt/(m.K).**

[A] 3500                      [B] 350                      [C] 385                      [D] 38.5

**Q<sup>n</sup>.48, In radial direction, the thermal conductivity of a nanotube is \_\_\_\_ watt/(m.K).**

[A] 3500                      [B] 385                      [C] 350                      [D] 0

**Q<sup>n</sup>.49, The thermal stability of a nanotube is seen up to \_\_\_\_ K in vacuum.**

[A] 100                      [B] 1000                      [C] 2200                      [D] 3100

**Q<sup>n</sup>.50, The thermal conductivity of an SWNT along length is \_\_\_\_ watt/(m.K).**

[A] 35                      [B] 350                      [C] 385                      [D] 3500

**Q<sup>n</sup>.51, The size of a quantum dot is \_\_\_\_ nm.**

[A] 5                      [B] 10                      [C] 50                      [D] 100

**Q<sup>n</sup>.52, The wavelength of visible light is \_\_\_\_ nm.**

[A] 40-70                      [B] 400-700                      [C] 4000-7000                      [D] 40000-70000

**Q<sup>n</sup>.53, The capacity of a normal human eye to see the smallest object is \_\_\_\_  $\mu\text{m}$ .**

[A] 10000                      [B] 1000                      [C] 100                      [D] 10

**Q<sup>n</sup>.54, The width of a carbon nanotube is \_\_\_\_ nm.**

[A] 1                      [B] 1.3                      [C] 2.5                      [D] 10

**Q<sup>n</sup>.55, The thermal stability of a nanotube is seen up to \_\_\_\_ K in air.**

[A] 100                      [B] 1000                      [C] 2000                      [D] 3100

**Q<sup>n</sup>.56, Nanoparticles of which substance were found on the surface of the sword of Tipu Sultan?**

[A] Gold                      [B] Lead                      [C] Carbon                      [D] Silicon

**Q<sup>n</sup>.57, Nano particles of which atom are used to control collateral damage due to explosion?**

[A] Copper                      [B] Aluminium                      [C] Carbon                      [D] Lead

**Q<sup>n</sup>.58, Who prepared and explained nanotubes for the first time?**

[A] SumioTijima                      [B] Richard Smalley  
[C] Eric Drexler                      [D] Richard Feynmann

**Q<sup>n</sup>.59, Which of the following statement/s is are true?**

**i. Volume to surface area ratio is very large for nanomaterials.**

**ii. The cut-off limit of human eye is  $10^{-5}$  m.**

**iii. Hardness of a SWNT is about  $63 \times 10^9$  Pa.**

**iv. Carbon nanotubes are cylindrical fullerenes.**

[A] All four                      [B] (ii) and (iv)  
[C] (i), (ii) and (iv)                      [D] (ii), (iii) and (iv)

**Q<sup>n</sup>.60, Match the objects in Part A with their size in Part B.**

PART A	PART B
(1) Nanoshell	(a) 100 nm
(2) Hydrogen atom	(b) 2000 nm
(3) E. Coli bacteria	(c) 90 nm
(4) Transistor	(d) 0.1 nm

[A] 1-a, 2-c, 3-d, 4-b

[B] 1-b, 2-a, 3-c, 4-d

[C] 1-a, 2-d, 3-b, 4-c

[D] 1-c, 2-d, 3-b, 4-a

**Q<sup>n</sup>.61, Match the items in Part A with appropriate alternative in Part B.**

PART A	PART B
(1) Biotechnology	(a) Quantum dots
(2) Material science	(b) Spintronics
(3) Information technology	(c) Gene therapy
	(d) Swarm robotics

[A] 1-c, 2-d, 3-a

[B] 1-c, 2-b, 3-a

[C] 1-c, 2-a, 3-b

[D] 1-a, 2-b, 3-d

**Q<sup>n</sup>.62, The suffix '-ene' in the name of fullerene shows the presence of \_\_\_\_\_ in the molecule.**

[A] One triple bond

[B] one double bond

[C] Two single bonds

[D] two triple bonds

**Q<sup>n</sup>.63. Which concept marks a fundamental difference between the dynamics of the electromagnetic field (Maxwell equations) and the Schrödinger equation?**

(a) Wave nature

(b) Momentum

(c) Potential

(d) Mass

**Q<sup>n</sup>64 .The intrinsic indetermination on the position of an electron is given by**

- (a) The electron's wavelength
- (b) The extent of the wave packet
- (c) The diameter of the electron
- (d) The size of a pixel of the measuring apparatus

**Q<sup>n</sup>65. At high temperatures, bosons and fermions behave similarly. At low temperatures however,**

- (a) Bosons are likely to occupy higher energy states than fermions
- (b) Two bosons cannot be in the same quantum state
- (c) Two bosons cannot have the same energy
- (d) Bosons are likely to occupy the ground state

**Q<sup>n</sup>66. Which of the below is not a necessary requirement for scanning tunneling microscopy?**

- (a) Tip and sample interact via a van der Waals force
- (b) Tip and sample are conductive
- (c) Tip and sample distance is stable within better than 1 Angström
- (d) Tip and sample are maintained at a different electrostatic potential

**Q<sup>n</sup>67.A mechanical oscillator driven with a small amplitude will sense an external force gradient as an effective Change in its**

- (a) Spring constant
- (b) Mass
- (c) Damping
- (d) Oscillating drive force

**Q<sup>n</sup>68. When scanning tunneling microscopy (STM) reveals periodic structures with atomic dimensions, what is exactly seen?**

- (a) The atomic lattice
- (b) Electronic density of states modulations associated to the atomic lattice
- (c) Fermi level modulations associated to the atomic lattice
- (d) The electron diffraction pattern associated to the atomic lattice

**Q<sup>n</sup>69 .The Schrödinger equation has a counterpart in classical mechanics, namely the equation of**

- (a) Mass conservation
- (b) Momentum conservation
- (c) Energy conservation
- (d) Number of particles conservation

**Q<sup>n</sup>70.What precaution is absolutely necessary for imaging a semiconducting carbon nanotube with STM?**



- (a) Apply a sufficiently high tip sample voltage
- (b) Drive tip with sufficiently high oscillation amplitude
- (c) Use sufficiently low temperatures
- (d) Use sufficiently high vacuum

**Q<sup>n</sup>71. A nanometer sized conductive island is connected between two contacts via tunnel barriers, in the Presence of a third gate electrode. Such a device is often called a single electron transistor. This is because at low Bias voltage,**

- (a) It can deliver only a single electron of current / second.
- (b) It can deliver an electron flow defined with a precision better than 1 electron
- (c) The charge on the island is defined with a precision better than 1 e.
- (d) The charge on the island is exactly 1 e.

**Q<sup>n</sup>72. Interest of increasing wafer diameter from 200 mm to 300 mm**

- (a) The price of a 300 mm wafer is lower
- (b) It is easier to fabricate
- (c) To produce more silicon devices from a single wafer
- (d) To increase the size of a die

**Q<sup>n</sup>73. What is a n type Si semiconductor (SC)**

- (a) A Si semiconductor without impurities
- (b) A Si Semiconductor with impurities from column III and V of Mendeleev table
- (c) A Si Semiconductor with impurities from column III of Mendeleev table
- (d) A Si Semiconductor with impurities from column V of Mendeleev table

**Q<sup>n</sup>74. A Semiconductor diode is made of**

- (a) The junction of two n type SC
- (b) The junction of two p type SC
- (c) The junction of two non-doped SC
- (d) The junction of n and p type SC

**Q<sup>n</sup>75. What is the thickness of the dielectric in a 28 nm MOS transistor**

- (a) Lower than 1  $\mu\text{m}$
- (b) Lower than 10 nm
- (c) Lower than 1 nm
- (d) Lower than 0.1 nm

**Q#76. Since 2007 Intel has replaced the SiO<sub>2</sub> MOS dielectric by**

- (a) A SiOCH dielectric
- (b) A Hafnium-based dielectric
- (c) A porous material
- (d) A crystalline SrTiO<sub>3</sub> dielectric

**Q#77. Plasma etching is**

- (a) Anisotropic with good selectivity
- (b) Isotropic with good selectivity
- (c) Isotropic with poor selectivity
- (d) Anisotropic with poor selectivity

**Q#78. A Plasma assisted CVD process**

- (a) Is made at lower temperature than a CVD process
- (b) Is made at higher temperature than a CVD process
- (c) Is based on the sputtering of a target
- (d) Is based on the decomposition of gaseous precursors thanks to wafer heating

**Q#79. Moore's Law predicts that**

- (a) The number of transistors in an integrated circuit is doubling every 2 months
- (b) The number of transistors in an integrated circuit is doubling every 2 years
- (c) The number of transistors in an integrated circuit is doubling every 4 years
- (d) The number of transistors in an integrated circuit must be kept constant

**Q#80. The process that gives the better conformality is**

- (a) PVD
- (b) CVD
- (c) PECVD
- (d) ALD

**Q#81. To reduce the interconnect delay the best solution is**

- (a) Cu as metal and SiO<sub>2</sub> as dielectric
- (b) Al as metal and SiO<sub>2</sub> as dielectric
- (c) Cu as metal and SiOCH as dielectric
- (d) Al as metal and SiOCH as dielectric

**Q#82. Since 2014 the Fin FET INTEL Transistor is**

- (a) 3D
- (b) Using graphene
- (c) Using nanowires
- (d) Using III-V materials instead of Si

**Q#83. The carrier transport in graphene goes through  $\pi$  –bands that are resulted from..**

- (a) Sp<sup>2</sup> hybridization of valence electrons
- (b) sp<sup>3</sup> hybridization of valence electrons
- (c) Unhybridized s-orbital valence electrons
- (d) Unhybridized p-orbital valence electrons

**Q#84. The kinetic energy of electrons in monolayer graphene is proportional to**

- (a) The value of wave vector, k

- (b) The square value of wave vector,  $k^2$
- (c) The value of electron effective mass,  $m^*$
- (d) The reciprocal value of electron effective mass,  $1/m^*$

**Q<sup>85</sup>. What does the “chirality” (n, m) denote for carbon nanotubes (CNT)?**

- (a) If the CNT is single-walled or multi-walled
- (b) If the CNT is insulating or metallic
- (c) A direction that the grapheme sheet is rolled up to form a tube
- (d) A direction that the CNT extends along

**Q<sup>86</sup>. If a single- walled CNT is semiconducting, the band gap scales with**

- (a) The value of diameter,  $d$
- (b) The square value of diameter,  $d^2$
- (c) The reciprocal value of diameter,  $1/d$
- (d) The reciprocal square value of diameter,  $1/d^2$

**Q<sup>87</sup>. Fullerene molecule is..**

- (a) A cluster of 60 carbon atoms all bonded with  $sp^3$  hybrids
- (b) A shell of 60 carbon atoms all bonded with  $sp^2$  hybrids
- (c) A complex of 60 carbon atoms bonded with mixture of  $sp^2$  and  $sp^3$  hybrids
- (d) A ball shape of 60 carbon atoms bonded with  $2p$  valence electrons

**Q<sup>88</sup>. Exfoliation” is a method to make grapheme by..**

- (a) Lifting off grapheme layers from a large graphite crystal
- (b) Extracting the top most Si atoms from a perfect SiC surface leaving grapheme on the top
- (c) Synthesizing carbon atoms on polymer foils
- (d) Depositing carbon on metal foil

**Q<sup>89</sup>. Graphene epitaxial growth by thermal annealing of SiC is completed by..**

- (a) Segregation to condense a carbon layer on top of the surface
- (b) Silicon sublimation during annealing, while carbon atoms remain on the surface
- (c) An oxidation process to remove silicon atoms
- (d) A reduction process to rearrange carbon atoms on the surface

**Q<sup>90</sup>. As a possible solution for future CMOS technology, why grapheme FETs are more favored than CNT-FETs?**

- (a) Because grapheme FETs are more suitable for large area processed using existing technology
- (b) Because grapheme FETs can bring to ballistic transport
- (c) Because grapheme FETs have a larger current handing capability

(d) Because graphene FETs have a higher on/off current ratio

**Q<sup>91</sup>. The graphene –based sensors are normally highly sensitive for individual gas molecule detection,**

- (a) Because of linear energy dispersion and low density of states near the Dirac point
- (b) Because that the molecules are absorbed on a uniform single atomic sheet
- (c) Because of interaction with  $\pi$  electrons
- (d) Because of high conductance in graphene

**Q<sup>92</sup>. CNTs possess a very high Young's modulus, due to...**

- (a) 4 valence electronic bonds of carbon atoms that equally share stress in any directions
- (b) A perfect construction in tubular form
- (c) Covalent  $sp^2$  bonds formed between the individual carbon atoms
- (d) Delocalized  $\pi$ -electrons that travel across several carbon atoms to increase strength

**Q<sup>93</sup>. What is the usual size range of a Eucaryotic cell?**

- (a) 1-2 nm
- (b) 1-2  $\mu$ m
- (c) 10-20  $\mu$ m
- (d) 100-200  $\mu$ m

**Q<sup>94</sup>. What is a biosensor made of?**

- (a) A probe and a surface
- (b) A sensing layer and a transducer
- (c) A target and a probe molecule
- (d) A biomarker and a probe

**Q<sup>95</sup>. Which material is (are) suitable for electrical signal transducing?**

- (a) PDMS
- (b) Silicon
- (c) Glass
- (d) polyethylene

**Q<sup>96</sup>. Which cell-type is well adapted to signal detection with micro-machined transistors?**

- (a) Muscle cells
- (b) Hepatocytes
- (c) Circulating Tumor Cells
- (d) Neurons

**Q<sup>97</sup>. Please cite 1 anti-cancerous agent**

- (a) Paclitaxel
- (b) Insulin
- (c) Poly (ethylene glycol)
- (d) Polyglutamic acid

**Q<sup>98</sup>. What is the “Enhanced Permeability and retention (EPR) effect?”**

- (a) The retention of the nanoparticles inside the vessel wall
- (b) An enhanced permeability of the vessel wall at the tumor site due to an abnormal organization of the endothelium
- (c) The enhancement of life time of the nanoparticles in the blood flow
- (d) A leaky plasma membrane

**Q<sup>n</sup>99. Cell adhesion to the extracellular matrix is:**

- (a) Mediated by specific trimeric transmembrane receptors
- (b) Mostly mediated by heterodimeric receptors called integrins
- (c) Mostly mediated by heterodimeric receptors that are called cadherins
- (d) Mostly due to hydrophobic interactions with the substrate

**Q<sup>n</sup>100. What is the name of the adhesive structures formed by a cell in response to a substrate presenting a Nano or Micro Topography?**

- (a) Integrins
- (b) Focal adhesions
- (c) Actin
- (d) Lipids

**ANSWER**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
a	c	c	a	d	a	c	b	a	b	a	d	d	c	c	d	c	a	d	c
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
a	d	b	c	d	b	d	a	a	c	b	c	a	b	d	c	b	d	c	d
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
a	c	b	b	c	a	c	d	d	d	a	b	d	b	b	c	b	a	d	c
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
c	b	d	b	d	a	a	b	c	a	c	c	d	d	c	b	a	a	b	d
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
c	a	d	a	c	c	b	a	b	a	a	c	c	b	b	d	a	b	b	b

**Q<sup>n</sup>.No.1, The tensile strength of a carbon nanotube is \_\_\_\_\_ times that of steel?**

- a)10
- b) 25
- c)100
- d)1000

**Q<sup>n</sup>.No.2, Which of the following is an example of top-down approach for the preparation of Nanomaterials?**

- a) Gas phase agglomeration
- b) Molecular self-assembly
- c) Mechanical grinding
- d) Molecular beam epitaxy

**Q<sup>n</sup>.No.3, Which of the following is an example of bottom-up approach for the preparation of nanomaterials?**

- a) Etching
- b) Dip pen Nano-lithography
- c) Lithography
- d) Erosion

**Q<sup>n</sup>.No.4, Quantum confinement results in?**

- a) Energy gap in semiconductor is proportional to the inverse of the square root of size
- b) Energy gap in semiconductor is proportional to the inverse of the size
- c) Energy gap in semiconductor is proportional to the square of size
- d) Energy gap in semiconductor is proportional to the inverse of the square of size

**Q<sup>n</sup>.No.5, Which of the following is the principal factor which causes the properties of Nanomaterials to differ significantly from other materials?**

- a) Size distribution
- b) Specific surface feature
- c) Quantum size effects
- d) All the mentioned

**Q<sup>n</sup>.No.6, Select the incorrect statement from the following options?**

- a) Self-assembly is a top-down manufacturing technique
- b) In self-assembly, weak interactions play very important role
- c) Self-assembling molecules adopt aorganised structure which is thermodynamically more stable than the single, unassembled components
- d) Compared to the isolated components, the self-assembled structure has a higher order

**Q<sup>n</sup>.No.7, Which of the following is the application of nanotechnology to food science and technology?**

- a) Agriculture
- b) Food safety and biosecurity
- c) Product development
- d) All of the mentioned

**Q<sup>n</sup>.No.8, What are the advantages of Nano-composite packages?**

- a) Lighter and biodegradable
- b) Enhanced thermal stability, conductivity and mechanical strength
- c) Gas barrier properties
- d) All of the mentioned

**Q<sup>n</sup>.No.9, The prefix "Nano" comes from a...?**

- a) French word meaning billion
- b) Greek word meaning dwarf
- c) Spanish word meaning particle
- d) Latin word meaning invisible

**Q<sup>n</sup>.No.10, Who first used the term nanotechnology and when?**

- a) Richard Feynman, (1959)
- b) Norio Taniguchi, (1974)
- c) Eric Drexler, (1986)
- d) SumioIijima, (1991)

**Q<sup>n</sup>.No.11, What is a buckyball?**

- a) A carbon molecule ( $C_{60}$ )
- b) Nickname for Mercedes-Benz's futuristic concept car ( $C_{111}$ )
- c) Plastic explosives nanoparticle ( $C_4$ )
- d) Concrete nanoparticle with a compressive strength of 20 nanonewtons ( $C_{20}$ )

**Q<sup>n</sup>.No12, Which of these historical works of art contain nanotechnology?**

- a) Lycurgus cup
- b) Medieval stained glass windows in churches
- c) Damascus steel swords
- d) All of the above

**Q<sup>n</sup>.No.13, Richard Feynman is often credited with predicting the potential of nanotechnology. What was the title of his famous speech given on December 29, 1959?**

- a) There is a tiny room at the bottom
- b) Things get Nanoscopic at the bottom
- c) Bottom? What bottom?
- d) There is plenty of room at the bottom

**Q<sup>n</sup>.No.14, How many oxygen atoms lined up in a row would fit in a one nanometer space?**

- a) None; an oxygen atom is bigger than 1 nm
- b) One
- c) Seven
- d) Seventy

**Q<sup>n</sup>.No.15, Which of these consumer products is already being made using nanotechnology methods?**

- a) Fishing lure
- b) Golf ball
- c) Sunscreen lotion
- d) All of the above

**Q<sup>n</sup>.No.16, If you were to shrink yourself down until you were only a nanometer tall, how thick would a sheet of paper appear to you?**

- a) 170 meters
- b) 1.7 kilometers (a bit more than a mile)
- c) 17 kilometers
- d) 170 kilometers

**Q<sup>n</sup>.No. 17, What is Graphene?**

- a) A new material made from carbon nanotubes
- b) A one-atom thick sheet of carbon
- c) Thin film made from fullerenes
- d) A software tool to measure and graphically represent nanoparticles

**Q<sup>n</sup>.No. 18, Which of these well-known phrases from Star Trek depends on the (fictional) use of nanotechnology?**

- a) Beam me up, Scotty!
- b) Tea. Earl Grey. Hot.
- c) You will be assimilated. Resistance is futile.
- d) All of the above

**Q<sup>n</sup>.No. 19, What is grey goo?**

- a) A hypothetical substance composed of out-of-control self-replicating nanobots that consumes all living matter on Earth
- b) The feeder material used to grow grey nanoparticles in the laboratory
- c) Toxic byproduct resulting from the synthesis of carbon nanotubes
- d) Waste product from the production of nanoglue made from the membranes on the feet of the Madagascan Grey Gecko

**Q<sup>n</sup>.No.20, Nanorobots (nanobots)...?**

- a) Do not exist yet
- b) Exist in experimental form in laboratories
- c) Are already used in nanomedicine to remove plaque from the walls of arteries
- d) Will be used by NASA in the next unmanned mission to Mars

**Q<sup>n</sup>.No. 21, What is the 2017 budget for the U.S. National Nanotechnology Initiative?**

- a) \$587 million
- b) \$917 million
- c) \$1.4 billion
- d) \$2.1 billion

**Q<sup>n</sup>.No.22, Plasmonics is...?**

- a) A field of nanophotonics that holds the promise of molecular-size optical device technology
- b) The science of fluorescent nanoparticles used in modern fireworks
- c) A hypothetical science used in science fiction weaponry (plasma cannons)
- d) The technology used to design and build the laser-guided photonic gyroscopes used in aviation.

**Q<sup>n</sup>.No. 23, What exactly is a quantum dot is/are?**

- a) A semiconductor nanostructure that confines the motion of conduction band electrons, valence band holes, or excitons in all three spatial directions.
- b) The sharpest possible tip of an Atomic Force Microscope
- c) A fictional term used in science fiction for the endpoints of wormholes



d) Unexplained spots that appear in electron microscopy images of nanostructures smaller than 1 nanometer

**Q<sup>n</sup>.No.24, The most important property of nonmaterial is?**

- a) Force
- b) Friction
- c) Pressure
- d) Temperature

**Q<sup>n</sup>.No.25, Who is generally credited with the first serious scientific claim that manufacturing on the molecular or even the atomic scale was possible? The claim was made at California Technical Institute and was called, "There's Plenty of Room at the Bottom"?**

- a) Richard P. Feynman
- b) Ed Regis
- c) K. Eric Drexler
- d) Ralph Merkle

**Q<sup>n</sup>.No.26, In 1986, Dr. K. Eric Drexler published a book for the layman that gave a wide overview of the potential applications of molecular nanotechnology in such areas as computing, medicine, space science, and the military. What was the name of this ground-breaking book?**

- a) Smaller is Better
- b) Engines of Creation
- c) A Crowded Blueprint
- d) The Atomic Cookbook

**Q<sup>n</sup>.No.27, A particular molecule of carbon made up of sixty carbon atoms has received some press as a structure that shows promise as a basic building block in the area of molecular manufacturing. What is the whimsical nontechnical name for these molecules?**

- a) Fullerrods
- b) Nanonodes
- c) Buckyballs
- d) Nanocubes

**Q<sup>n</sup>.No.28,What is the general name for the class of structures made of rolled up carbon lattices?**

- a) Nanorods
- b) Nanotubes
- c) Nanosheets
- d) Fullerrods

**Q<sup>n</sup>.No.29,What is the term used in the field of nanotechnology to describe an as-yet theoretical device that "will be able to bond atoms together in virtually any stable pattern?"**

- a) Stacker
- b) Replicator
- c) Assembler
- d) Constructor

**Q<sup>n</sup>.No.30, As of public record at the end of 2002, which country was making the greatest annual investment in molecular nanotechnology research?**

- a) Russia
- b) United States
- c) Japan
- d) South Korea

**Q<sup>n</sup>.No.31, Which technology is used to make antibiotic drugs?**

- a) Biotechnology
- b) Nano biotechnology
- c) Nanotechnology
- d) Convergence technology

**Q<sup>n</sup>.No.32, In which of these is the main branch of Nano Technology?**

- a) Nano Electronics
- b) Nano Materials
- c) Nano biotechnology
- d) All main branches

**Q<sup>n</sup>. No. 33, If three atoms are kept together with each other, then what will be the length of those three atoms?**

- a) 1 nm
- b) 10 nm
- c) 100 nm
- d) 1000 nm

**Q<sup>n</sup>.No. 34, The shape and size of nanoparticles do not depend on the following properties?**

- a) On pH
- b) Concentrations
- c) On the mobility
- d) None of these

**Q<sup>n</sup>.No. 35, Is the fifth century cup found in some Roman cup called Lycurgus?**

- a) These cups appear green in the light enforced
- b) These cups appear red in the Moving light
- c) Appearance is green in Moving light and looks red in enforced light.
- d) Green in motion and red in rotating

**Q<sup>n</sup>. No.36, The sharpness and strength of the Japanese Samurai sword, it can easily do two pieces of iron, because of it?**

- a) Thickness of sword occurs in micro range
- b) The thickness of the sword occurs in the nano range
- c) Thickness of sword is in the range femto
- d) The thickness of sword occurs in pico range

**Q<sup>n</sup>.No. 37, Which spectroscopy is used to detect the nanoparticles present in the gas?**

- a) Electron spectroscopy
- b) Mass spectroscopy
- c) Mossbauer spectroscopy
- d) Proton spectroscopy

**Q<sup>n</sup>.No.38, Which technology is used to detect the nanoparticles present in the liquid?**

- a) Brownian speed
- b) Raman scattering
- c) Light scattering
- d) All can be used

**Q<sup>n</sup>.No.39, Quantum Dots is/are used?**

- a) Tumor cell treatment
- b) Cancer cell treatments
- c) Liver cell treatments
- d) All can be treated

**Q<sup>n</sup>.No. 40, how many transistors can be applied on a single chip?**

- a) 100 lakh
- b) 100 million
- c) 100 billion
- d) 100 trillion

**Q<sup>n</sup>.No.41, What can we transfer with the help of nanotechnology?**

- a) Gene transfer
- b) Tissue transfer
- c) Cell Transfer
- d) All of the above

**Q<sup>n</sup>.No.42, The color of the wings of the butterfly and the structure of the wings is displayed when?**

- a) Increases the resolution power of the SEM
- b) The scattering of light is inserted on the wings of the butterfly
- c) Dispersion of light is scattered on the Nano structure of the butterfly wings
- d) Increases the resolution power of the TEM

**Q<sup>n</sup>.No.43, Water drop does not make the surface of the lotus leaf round and the drop of water seems to be moving on the leaves, is it that?**

- a) Lotus leaves that is smooth
- b) The drop of water gets converted into nanoparticles
- c) Due to the Nano structure on the smooth surface of lotus leaves
- d) It depends on our eye's resolution power

**Q<sup>n</sup>.No.44, Spider mesh from steel and nylon?**

- a) It is more likely to be stretch
- b) There is more tension
- c) Is less likely to be dashing
- d) Now the research is going on

**Q<sup>n</sup> No. 45, In which Indian Scientist made inventions of Nano technology at the NalandaTakshashilaUniversity, 600 BC?**

- a) Jagdish Chandra Bose
- b) Kanad
- c) Subramanyam Chandrasekhar
- d) Dr. BirbalSahni

**Q<sup>n</sup>.No. 46, What is the main reason for the use of nanoparticles in Drug Delivery?**

- a) Due to their dispersal ability
- b) due to their solubility
- c) Due to their adhesiveness
- d) All of the above





## PART 2: CATALYSIS AND GREEN CHEMISTRY

### EXERCISE

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Choose Appropriate Alternative

#### Multiple Choice Questions

**Q<sup>n</sup>1. The concept of green chemistry was coined by?**

- (a) Paul Anastas (b) Komiya  
(c) Menzer (d) Paquetta

**Q<sup>n</sup> 2. The first known ionic liquid discovered by Walden was?**

- (a) 1-Octyl-3methyl imidazolium bromide (b) Ethyl ammonium nitrate  
(c) 1-Methyl imidazolium tetra fluoroborate (d) Acidic ionic liquids

**Q<sup>n</sup>3. The Emerging Green Technology are?**

- (a) Microwave and photochemistry (b) Sonochemistry and electrochemistry  
(c) Both (a) and (b) (d) Nuclear chemistry

**Q<sup>n</sup>4. Glucose can be used as the starting material in place of benzene in the synthesis of ?**

- (a) Adipic acid (b) Catechol  
(c) Hydroquinone (d) All of these

**Q<sup>n</sup>5. The reaction(s) carried out in aqueous media is (are)?**

- (a) Barbier Grignard reaction (b) Pericyclic reaction  
(c) Transition metal catalyzed reaction (d) All of these

**Q<sup>n</sup>6. The catalyst which functions as a transport shuttle is?**

- (a) Polymer supported catalyst (b) Phase transfer catalyst  
(c) Photocatalyst (d) Oxidation catalyst

**Q<sup>n</sup>7. Enzyme catalysis is applicable in?**

- (a) Aqueous media (b) Nne-aqueous solvents  
(c) Supercritical fluids (d) All of these

**Q<sup>n</sup>8. The first commercial process based on ionic liquids, for the production of alkoxy phenyl phosphine, was developed by?**

- (a) LudwingMaase (b) Dangi  
(c) Muneer (d) Vamathevan

**Q<sup>n</sup>9. The dimerization reaction of (C<sub>60</sub>) Fullerene in presence of KCN to give [2+3] adduct is a?**

- (a) Solid supported organic synthesis
- (b) Solid phase organic synthesis without solvent
- (c) Adsorbent based synthesis
- (d) None of above

**Q<sup>n</sup>10. Commonly used catalyst for solid-liquid systems are?**

- (a) Crown ether
- (b) Polyglycol
- (c) Both (a) and (b)
- (d) Iodine

**Q<sup>n</sup>11. Green chemistry aims to?**

- (a) Design chemical products and process that maximize profits
- (b) Design safer chemical products and processes that reduce or eliminate the use and generation of hazardous substances
- (c) Design chemical products and processes that work most efficiently
- (d) Utilize non-renewable energy

**Q<sup>n</sup>12. Dr. Paul Anastas & Dr. John Warner created 10 Principles of Green Chemistry to reduce or eliminate the use and generation of hazardous substances?**

- (a) True
- (b) False

**Q<sup>n</sup>13. Which of the following are among the 12 Principles of Green Chemistry?**

- (a) Design commercially viable products
- (b) Use only new solvents
- (c) Use catalysts, not stoichiometric reagents
- (d) Re-use waste

**Q<sup>n</sup>14. Green chemists reduce risk by?**

- (a) Reducing the hazard inherent in a chemical product or process
- (b) Minimizing the use of all chemicals
- (c) Inventing technologies that will clean up toxic sites
- (d) Developing recycled products

**Q<sup>n</sup>15. Which of the following is a challenge for green chemists?**

- (a) Awareness of the benefits of green chemistry
- (b) Developing chemicals that are recyclable
- (c) Training for cleaning up chemical spills
- (d) Knowing when to reduce and eliminate hazardous waste

**Q<sup>n</sup>16. Business benefits of green chemistry include?**

- (a) Reduced costs associated with waste treatment and disposal
- (b) Innovating 'greener' products to entice customers
- (c) Greater compliance with environmental legislation
- (d) All of the above

**Q<sup>n</sup>17. Green chemistry is more expensive than traditional chemistry?**

- (a) True (b) False

**Q<sup>n</sup>18. What is the U.S. Presidential Green Chemistry Challenge Award?**

- (a) An award related to recycling  
(b) An award for industry only  
(c) The only chemistry award given by the President  
(d) Challenges companies to become fuel efficient

**Q<sup>n</sup>19. Since 1996, Presidential Green Chemistry Challenge Award winning technologies have helped save or eliminate at least 1.3 billion pounds of hazardous chemicals and solvents?**

- (a) True (b) False

**Q<sup>n</sup>20. The first listed of the 12 Principles of Green Chemistry is?**

- (a) Prevent waste (b) Catalysis  
(c) Atom economy (d) Benign solvents

**Q<sup>n</sup>21. This word is synonymous with green chemistry and also means harmless, or gentle and not life threatening?**

- (a) Sustainable (b) Benign  
(c) User friendly (d) Greenness

**Q<sup>n</sup>22. Which of the following is the greenest solvent?**

- (a) Formaldehyde (b) Benzene  
(c) Ethanol (d) Water

**Q<sup>n</sup>23. The figure above shows a process that is often used as part of which 'green' product design system?**

- (a) Market Flow Analysis (b) Customer Market Flow Analysis  
(c) Life Cycle Assessment (d) Product Life Analysis

**Q<sup>n</sup>24. The definition of green chemistry is the same as the definition of sustainability?**

- (a) True (b) False

**Q<sup>n</sup>25. The term which refers to the breakup within a compound due to microbial activity is?**

- (a) Microbial degradation (b) Agro-degradation  
(c) Photo-degradation (d) Decomposition

**Q<sup>n</sup>26. Which one of the following three terms is used in the 'sustainability triangle'?**

- (a) Micro-economics (b) Planet  
(c) Social responsibility (d) None of these

**Q<sup>n</sup>27. The term used to measure a product or person's environmental impact is?**

- (a) Handprint (b) CO<sub>2</sub> print  
(c) Footprint (d) Hazardous print

**Q<sup>n</sup>28. Used to indicate the level of contaminants present, the term ‘PPM’ means?**

- (a) Parts-per-micron (b) Parts-per-million  
(c) Parts-per-mass (d) Parts-per-molecule

**Q<sup>n</sup>29. Environmental benefits of green chemistry include?**

- (a) Fewer raw materials and natural resources used  
(b) Cleaner production technologies & reduced emissions  
(c) Smaller quantities of hazardous waste to be treated and disposed of  
(d) All of the above

**Q<sup>n</sup>30. The term missing in Risk = Hazard x \_\_\_\_\_ is?**

- (a) Exposure (b) Cancer (c) Benign (d) Reactivity

**Q<sup>n</sup>31. The following term refers to the relative proportion of chemical components?**

- (a) Togetherness (b) Stoichiometry (c) Metric (d) Colligative

**Q<sup>n</sup>32. The word missing on the left side of the figure above is?**

- (a) Enhancing (b) Facilitating (c) Reducing (d) Awareness

**Q<sup>n</sup>33. \_\_\_\_\_ is fulfilling the needs of the present generation without compromising the ability of future generations to meet their needs?**

- (a) Sustainability (b) Green chemistry  
(c) Life Cycle Assessment (d) Recycling

**Q<sup>n</sup>34. \_\_\_\_\_ and moral arguments are often used when discussing sustainability and green chemistry?**

- (a) Environment (b) Technology  
(c) Politics (d) Ethics

**Q<sup>n</sup>35. \_\_\_\_\_, or VOCs, have been replaced and were banned in some paints?**

- (a) Versatile Organic Chemicals (b) Volatile Organic Compounds  
(c) Volatile Organic Components (d) Versatile Odorless Components

**Q<sup>n</sup>36. Shortly after mid-night in 1984, a reaction caused poisonous methyl isocyanate gas to leak from a factory in this city, \_\_\_\_\_ causing 3,700 deaths?**

- (a) Bhopal (b) Hinkley (c) Calcutta (d) Siberia

**Q<sup>n</sup>37. In the late 1960’s, the Cuyahoga River in Ohio overloaded with chemical pollutants and \_\_\_\_\_?**

- (a) Killed fish (b) Polluted surrounding soil  
(c) Caused foaming (d) Caught fire



**Q<sup>n</sup>38. Benzene, a \_\_\_\_\_ substance, is an important industrial solvent used in the production of pharmaceuticals, plastics, and dyes?**

- (a) Odorless
- (b) Non-flammable
- (c) Biodegradable
- (d) Carcinogenic

**Q<sup>n</sup>39. The following legislation gave birth to today's green chemistry initiatives?**

- (a) Clean Water Act of 1972
- (b) Montreal Protocol of 1989
- (c) Pollution Prevention Act of 1990
- (d) Superfund Act of 1980

**Q<sup>n</sup>40. In 1998, this state signed green chemistry legislation promising to remove politics from the evaluation of disputed chemicals?**

- (a) Oregon
- (b) California
- (c) New York
- (d) Florida

**Q<sup>n</sup>41. The following is often referred to as the universal solvent and is a preferred green solvent?**

- (a) Water
- (b) Methanol
- (c) Ethyl Acetate
- (d) Benzene

**Q<sup>n</sup>42. A chemical process with an E-Factor of 1 creates LESS waste than an E-Factor of 25?**

- (a) True
- (b) False

**Q<sup>n</sup>43. Lignin, switch grass, and cellulose are all types of \_\_\_\_\_?**

- (a) Enzymes
- (b) Catalysts
- (c) Bio-based feedstock's
- (d) Anti-cancer compounds

**Q<sup>n</sup>44. \_\_\_\_\_ is an excellent 'green' solvent as well as a greenhouse gas?**

- (a) Methanol
- (b) CFCs
- (c) Carbon monoxide
- (d) Carbon Dioxide

**Q<sup>n</sup>45. \_\_\_\_\_ interfere with hormone systems in animals and humans and are abbreviated EDC's?**

- (a) Endocrine Destructive Components
- (b) Energy Disrupting Chemicals
- (c) Endocrine Disrupting Chemicals
- (d) Enzyme Destructive Components

**Q<sup>n</sup>46. Green chemistry can provide green technology solutions for a sustainable future?**

- (a) True
- (b) False

**Q<sup>n</sup>47. Soybean is used to replace traditional inks in printer cartridges, highlighting which of the Green chemistry principles?**

- (a) Atom economy  
(c) Reduce derivatives
- (b) Use of Renewable Feedstock's  
(d) Prevent waste

**Q<sup>n</sup>48. Bio-polymers exemplify Green Chemistry Principle # 10, which is?**

- (a) Catalysis  
(b) Prevent waste  
(c) Benign solvents & auxiliaries  
(d) Design for degradation

**Q<sup>n</sup>49. The use of solar power is covered within Green Chemistry Principle #6, which is?**

- (a) Atom economy  
(c) Design benign chemicals
- (b) Design for energy efficiency  
(d) Less hazardous synthesis

**Q<sup>n</sup>50. \_\_\_\_\_ was instrumental in winning a 1996 legal settlement of \$333 million for the California town of Hinkley due to chromium in its drinking water?**

- (a) Leonardo diCaprio  
(c) Erin Brockovich
- (b) George Clooney  
(d) Angelina Jolie

**Q<sup>n</sup>51. \_\_\_\_\_ was a co-founder of the worldwide green chemistry movement and the first director of the Green Chemistry Institute, now part of ACS?**

- (a) Joseph Breen  
(c) John Warner
- (b) Albert Einstein  
(d) Paul Anastas

**Q<sup>n</sup>52. This 'green' chemical is used in household cleaners to remove stains and is also a favorite dressing on salads!?**

- (a) Vinegar (acetic acid)  
(c) Hydrochloric acid (HCl)
- (b) Citric acid  
(d) Water

**Q<sup>n</sup>53. An example of green chemistry is?**

- (a) Recycled carpet  
(c) A sublimation reaction
- (b) A product made on Earth Day  
(d) Bio-plastics

**Q<sup>n</sup>54. Biodiesel is an example of which of the 12 Principles of Green Chemistry?**

- (a) #1 – Waste prevention  
(c) #9 – Use of catalysis
- (b) #7 – Use of renewable feedstocks  
(d) #5 – Safer solvents

**Q<sup>n</sup>55. Green chemistry can reduce all but which of the following?**

- (a) Cost  
(c) Awareness
- (b) Risk & Hazard  
(d) Waste

**Q<sup>n</sup>56. A 'green' soy adhesive was developed based on the adhesion protein secreted by mussels sticking on rocks?**

- (a) True (b) False

**Q<sup>57</sup>. An example of chemical toxics prevention is?**

- (a) Removing water from industrial reactions  
(b) Eliminating the formation of chlorinated organics in paper  
(c) Utilizing ammonia instead of vinegar  
(d) Monitoring BPA (Bisphenol A) in plastic bottles

**Q<sup>58</sup>. Green chemistry synthesis could also involve which of the following?**

- (a) High temperature (b) Dichloromethane  
(c) Fossil fuels (d) Microwave

**Q<sup>59</sup>. Bio-catalysis has become very useful in green chemistry manufacturing?**

- (a) True (b) False

**Q<sup>60</sup>. TRI is used by the EPA to track pollution prevention. TRI stands for?**

- (a) Total Reporting Inventory (b) Total Release Impact  
(c) Toxic Release Inventory (d) Toxic Release Impact

**Q<sup>61</sup>. The role of a catalyst is to change \_\_\_\_\_.**

- (a) Gibbs energy of reaction. (b) Enthalpy of reaction.  
(c) Activation energy of reaction. (d) Equilibrium constant.

**Q<sup>62</sup>. In the presence of a catalyst, the heat evolved or absorbed during the reaction \_\_\_\_\_.**

- (a) Increases. (b) Decreases.  
(c) Remains unchanged. (d) May increase or decrease.

**Q<sup>63</sup>. Activation energy of a chemical reaction can be determined by \_\_\_\_\_.**

- (a) Determining the rate constant at standard temperature.  
(b) Determining the rate constants at two temperatures.  
(c) Determining probability of collision.  
(d) Using catalyst.

**Q<sup>64</sup>. Consider the Arrhenius equation given below and mark the correct option.  $-E_a/RT \ln k = A$**

- (a) Rate constant increases exponentially with increasing activation energy and decreasing temperature.  
(b) Rate constant decreases exponentially with increasing activation energy and decreasing temperature.  
(c) Rate constant increases exponentially with decreasing activation energy and decreasing temperature.  
(d) Rate constant increases exponentially with decreasing activation energy and increasing temperature.

**Q<sup>n</sup>65. Which of the following statements is not correct about order of a reaction.**

- (a) The order of a reaction can be a fractional number.
- (b) Order of a reaction is experimentally determined quantity.
- (c) The order of a reaction is always equal to the sum of the stoichiometric coefficients of reactants in the balanced chemical equation for a reaction.
- (d) The order of a reaction is the sum of the powers of molar concentration of the reactants in the rate law expression.

**Q<sup>n</sup>66. Which of the following statements is correct?**

- (a) The rate of a reaction decreases with passage of time as the concentration of reactants decreases.
- (b) The rate of a reaction is same at any time during the reaction.
- (c) The rate of a reaction is independent of temperature change.
- (d) The rate of a reaction decreases with increase in concentration of reactant(s).

**Q<sup>n</sup>67. Rate law for the reaction  $A + 2B \xrightarrow{3/4} C$  is found to be  $\text{Rate} = k [A][B]$**

**Concentration of reactant 'B' is doubled, keeping the concentration of 'A' constant, the value of rate constant will be\_\_\_\_\_.**

- (a) the same
- (b) doubled
- (b) (c) quadrupled
- (d) halved

**Q<sup>n</sup>68. Which of the following statements is incorrect about the collision theory of chemical reaction?**

- (a) It considers reacting molecules or atoms to be hard spheres and ignores their structural features.
- (b) Number of effective collisions determines the rate of reaction.
- (c) Collision of atoms or molecules possessing sufficient threshold energy results into the product formation.
- (d) Molecules should collide with sufficient threshold energy and proper orientation for the collision to be effective.

**Q<sup>n</sup>69. Which of the following statement is not correct for the catalyst?**

- (a) It catalyses the forward and backward reaction to the same extent.
- (b) It alters  $\Delta G$  of the reaction.
- (c) It is a substance that does not change the equilibrium constant of a reaction.
- (d) It provides an alternate mechanism by reducing activation energy between reactants and products.

**Q<sup>n</sup>70. The value of rate constant of a pseudo first order reaction \_\_\_\_\_.**

- (a) Depends on the concentration of reactants present in small amount.
- (b) Depends on the concentration of reactants present in excess.
- (c) It independent of the concentration of reactants.
- (d) Depends only on temperature.

**Q<sup>n</sup>71. Rate law cannot be determined from balanced chemical equation if \_\_\_\_\_.**

- (a) Reverse reaction is involved.
- (b) It is an elementary reaction.
- (c) It is a sequence of elementary reactions.
- (d) Any of the reactants is in excess.

**Q<sup>n</sup>72. Which of the following statements are applicable to a balanced chemical equation of an elementary reaction?**

- (a) Order is same as molecularity.
- (b) Order is less than the molecularity.
- (c) Order is greater than the molecularity.
- (d) Molecularity can never be zero.

**Q<sup>n</sup>73. In any unimolecular reaction \_\_\_\_\_.**

- (a) Only one reacting species is involved in the rate determining step.
- (b) The order and the molecularity of slowest step are equal to one.
- (c) The molecularity of the reaction is one and order is zero.
- (d) Both molecularity and order of the reaction are one.

**Q<sup>n</sup>74. For a complex reaction \_\_\_\_\_.**

- (a) Order of overall reaction is same as molecularity of the slowest step.
- (b) Order of overall reaction is less than the molecularity of the slowest step.
- (c) Order of overall reaction is greater than molecularity of the slowest step.
- (d) Molecularity of the slowest step is never zero or non interger.

**Q<sup>n</sup>75. At high pressure the following reaction is zero order.  $2\text{NH}_3(\text{g}) \xrightarrow[\text{Pt catalyst}]{1130} \text{N}_2(\text{g}) + 3\text{H}_2(\text{g})$**

**Which of the following options are correct for this reaction?**

- (a) Rate of reaction = Rate constant
- (b) Rate of the reaction depends on concentration of ammonia.
- (c) Rate of decomposition of ammonia will remain constant until ammonia disappears completely.
- (d) Further increase in pressure will change the rate of reaction.

**Q<sup>n</sup>76. During decomposition of an activated complex**

- (a) Energy is always released
- (b) Energy is always absorbed
- (c) Energy does not change
- (d) Reactants may be formed

**Q<sup>n</sup>77. According to Maxwell Boltzmann distributon of energy, \_\_\_\_\_.**

- (a) The fraction of molecules with most probable kinetic energy decreases at higher temperatures.
- (b) The fraction of molecules with most probable kinetic energy increases at higher temperatures.
- (c) Most probable kinetic energy increases at higher temperatures.
- (d) Most probable kinetic energy decreases at higher temperatures.

**Q<sup>n</sup>78. In the graph showing Maxwell Boltzman distribution of energy, \_\_\_\_\_.**

- (a) Area under the curve must not change with increase in temperature.
- (b) Area under the curve increases with increase in temperature.
- (c) Area under the curve decreases with increase in temperature.
- (d) With increase in temperature curve broadens and shifts to the right hand side.

**Q<sup>n</sup>79. Which of the following statements are in accordance with the Arrhenius equation?**

- (a) Rate of a reaction increases with increase in temperature.
- (b) Rate of a reaction increases with decrease in activation energy.
- (c) Rate constant decreases exponentially with increase in temperature.
- (d) Rate of reaction decreases with decrease in activation energy.

**Q<sup>n</sup>80. Mark the incorrect statements.**

- (a) Catalyst provides an alternative pathway to reaction mechanism.
- (b) Catalyst raises the activation energy.
- (c) Catalyst lowers the activation energy.
- (d) Catalyst alters enthalpy change of the reaction.

## Answer

1	2	3	4	5	6	7	8	9	10
a	b	c	d	d	b	d	a	b	c
11	12	13	14	14	16	17	18	19	20
b	b	c	a	d	d	b	c	a	a
21	22	23	24	25	26	27	28	29	30
b	d	c	b	a	c	c	b	d	a
31	32	33	34	35	36	37	38	39	40
b	c	a	d	b	a	d	d	c	b
41	42	43	44	45	46	47	48	49	50
a	a	c	d	c	a	b	d	b	c
51	52	53	54	55	56	57	58	59	60
d	a	d	b	c	a	b	d	a	c
61	62	63	64	65	66	67	68	69	70
c	c	b	d	c	a	b	c	b	b
71	72	73	74	75	76	77	78	79	80
a,c,d	a,d	a,b	a,d	a,c,d	a,d	a,c	a,d	a,b	b,d



## PART 3: MEDICINAL CHEMISTRY

### EXERCISE

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### Multiple Choice Questions, Choose Appropriate Alternative

#### Multiple Choice Questions

**Q<sup>n</sup>1. Antipyretics are medicinal compounds which**

- |                     |                                  |
|---------------------|----------------------------------|
| (A) Relieve pain    | (B) Lower body temperature       |
| (C) Control malaria | (D) Kill other harmful organisms |

**Q<sup>n</sup>2. Aspirin is**

- |                     |                           |
|---------------------|---------------------------|
| (A) Barbituric acid | (B) Seconal               |
| (C) Chloroxylenol   | (D) Acetyl salicylic acid |

**Q<sup>n</sup>3. Which of the following is not a tranquillize**

- |                     |                |
|---------------------|----------------|
| (A) Barbituric acid | (B) Seconal    |
| (C) Luminal         | (D) Phenacetin |

**Q<sup>n</sup>4. Which of the following is not an antibiotic**

- |                     |                   |
|---------------------|-------------------|
| (A) Chloramphenicol | (B) Sulphadiazine |
| (C) Penicillin      | (D) Bithional     |

**Q<sup>n</sup>5. 2-Acetoxy benzoic acid is**

- |                  |                 |
|------------------|-----------------|
| (A) Antiseptic   | (B) Antipyretic |
| (C) Antibiotic d | (D) Mordant dye |

**Q<sup>n</sup>6. Which of the following is not an antipyretic**

- |                     |                |
|---------------------|----------------|
| (A) Paracetamol     | (B) Aspirin    |
| (C) Chloramphenicol | (D) Phenacetin |

**Q<sup>n</sup>7. Chloramphenicol is**

- |                 |                               |
|-----------------|-------------------------------|
| (A) Antipyretic | (B) Broad spectrum antibiotic |
| (C) Azo dye     | (D) Tranquillizer             |

**Q<sup>n</sup>8. Aspirin is a**



- (A) Narcotic (B) Antipyretic  
(C) Antimalarial (D) Antiseptic

**Q<sup>n</sup>9. Which of the following is used as an antioxidant in food**

- (A) Saccharin (B) Methylated hydroxyl anisole  
(C) Ormeloxifene (D) Cochineal

**Q<sup>n</sup>10. Sulphonamides act as**

- (A) Hyponotics (B) Antidepressants  
(C) Antimicrobials (D) Antiseptics

**Q<sup>n</sup>11. Progestogens and estrogens are used as**

- (A) Antacids (B) Antifertility drugs  
(C) Antimicrobials (D) Antibiotics

**Q<sup>n</sup>12. Benadryl is used as**

- (A) Antiseptic (B) Disinfectant  
(C) Analgesic (D) Antihistamine

**Q<sup>n</sup>13. Which of the following used as preservative to protect processed food**

- (A) Sodium sulphate (B) Saccharin  
(C) Alitame (D) Sodium metabisulphite

**Q<sup>n</sup>14. Mifepristone is used as**

- (A) Antimicrobial (B) Antimalarial  
(C) Antifertility drug (D) Tranquillizer

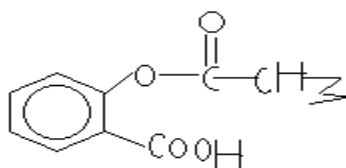
**Q<sup>n</sup>15. Which of the following is not an artificial sweetening agent**

- (A) Sucralose (B) Alitame  
(C) Sodium benzoate (D) Aspartame

**Q<sup>n</sup>16. Which of the following can possibly be used as analgesic without causing addiction and modification**

- (A) Morphine (B) N-Acetyl-paraaminophenol  
(C) Diazepam (D) Tetrahydrocannabinol

**Q<sup>n</sup>17. The following compound is used as**



- |                                   |                |
|-----------------------------------|----------------|
| (A) An anti-inflammatory compound | (B) Analgesic  |
| (C) Hypnotic                      | (D) Antiseptic |

**Q<sup>n</sup>18. Amoxicillin is semi-synthetic modification of**

- |                  |                     |
|------------------|---------------------|
| (A) Penicillin   | (B) Streptomycin    |
| (C) Tetracycline | (D) Chloramphenicol |

**Q<sup>n</sup>19. 2-Acetoxy benzoic acid is**

- |                |                 |
|----------------|-----------------|
| (A) Antiseptic | (B) Aspirin     |
| (C) Antibiotic | (D) Mordant dye |

**Q<sup>n</sup>20. Substance which bring down body temperature are known**

- |                  |                |
|------------------|----------------|
| (A) Antipyretics | (B) Analgesics |
| (C) Antibiotic   | (D) Hypnotics  |

**Q<sup>n</sup>21. A broad spectrum antibiotic is**

- |                 |                     |
|-----------------|---------------------|
| (A) Paracetamol | (B) Penicillin      |
| (C) Aspirin     | (D) Chloramphenicol |

**Q<sup>n</sup>22. The correct structure of drug Paracetamol is**

- |             |             |
|-------------|-------------|
| (A) Pending | (B) Pending |
| (C) Pending | (D) Pending |

**Q<sup>n</sup>23. An ester used as medicine is**

- |                       |                    |
|-----------------------|--------------------|
| (A) Ethyl acetate     | (B) Methyl acetate |
| (C) Methyl salicylate | (D) Ethyl benzoate |

**Q<sup>n</sup>24. A drug that is antipyretic as well as analgesic is**

- |                                  |                         |
|----------------------------------|-------------------------|
| (A) Chlorpromazine hydrochloride | (B) Paraacetamidophenol |
|----------------------------------|-------------------------|

(C) Chloroquin (D) Penicillin

**Q<sup>n</sup>25. Tranquillizers are substances used for the treatment of**

(A) Cancer (B) AIDS (C) Mental diseases (D) Physical disorders

**Q<sup>n</sup>26. The compound is used as**

(A) Antiseptic (B) Antibiotic (C) Analgesic (D) Pesticide

**Q<sup>n</sup>27. Which of the following is not a surfactant**

- (A)  $\text{CH}_3\text{-(CH}_2\text{)}_{15}\text{N}^+(\text{CH}_3)_3\text{Br}^-$   
(B)  $\text{CH}_3\text{-(CH}_2\text{)}_{14}\text{CH}_2\text{NH}_2$   
(C)  $\text{CH}_3\text{-(CH}_2\text{)}_{16}\text{CH}_2\text{OSO}^- \text{Na}^+$   
(D)  $\text{OHC-(CH}_2\text{)}_{14}\text{-CH}_2\text{COO}^- \text{Na}^+$

**Q<sup>n</sup>28. Barbituric acid is used as**

- (A) An antipyretic (B) An antiseptic (C) An antibiotic  
(D) An analgesic (E) A tranquillizer

**Q<sup>n</sup>29. 2-Acetoxy benzoic acid is used as**

- (A) Antimalarial (B) Antidepressant  
(C) Antiseptic (D) Antipyretic

**Q<sup>n</sup>30. Which of the following is not a broad spectrum antibiotic**

- (A) Tetracycline (B) Chloromycetin  
(C) Penicillin (D) None of these

**Q<sup>n</sup>31. Antipyretics are the compounds which**

- (A) Lower the body temperature (B) Relieve pain  
(C) Control malaria (D) none of these

**Q<sup>n</sup>32. Which of the following types of drugs reduces fever**

- (A) Analgesics (B) Antipyretics  
(C) Aspirin (D) Tranquillizers

**Q<sup>n</sup>33. Which of the following is not a broad spectrum antibiotic**

(A) Tetracycline (B) Chloromycetin (C) Penicillin (D) None of these

**Q<sup>n</sup>34. Among the following sweetener which one has the lowest sweetness value**

(A) Alitame (B) Aspartame (C) Saccharine (D) Sucralose

**Q<sup>n</sup>35. Which of the following is bacteriostatic**

(A) Penicillin (B) Erythromycin (C) Aminoglycoside (D) Ofloxacin  
(E) Bithional

**Q<sup>n</sup>36. Tincture of iodine is**

(A) Aqueous solution of I<sub>2</sub> (B) Solution of I<sub>2</sub> in aqueous KI  
(C) Alcoholic solution of I<sub>2</sub> (D) Aqueous solution of KI

**Q<sup>n</sup>37. The compound is used as.....**

(A) Antiseptic (B) Antibiotic (C) Analgesic (D) Pesticides

**Q<sup>n</sup>38. Paracetamol is used as**

(A) Antipyretic (B) Analgesics (C) Antiseptics (D) Antibiotics

**Q<sup>n</sup>39. Which of the following is used as a “morning after pill”**

(A) Norethindrone (B) Ethynylestradiol  
(C) Mifepristone (D) Bithional  
(E) Promethazine

**Q<sup>n</sup>40. LSD (Lysergic acid diethylamide) is**

(A) Sweetening (B) Synthetic fibre (C) Psychedelic drug (D) Antibiotic

**Q<sup>n</sup>41. Which one of the following is a chromophoric group**

(A) -N=N- (B) -OH (C) -SO<sub>3</sub>H (D) -NH<sub>2</sub>

**Q<sup>n</sup>42. With which of the following cations, alization will impart a rose red colour on the fabric**

(A) Fe<sup>3+</sup> (B) Cr<sup>3+</sup> (C) Ba<sup>2+</sup> (D) Al<sup>3+</sup>

**Q<sup>n</sup>43. 2-acetoxy benzoic acid is called**

(A) Antiseptic (B) Aspirin (C) Antibiotic (D) Mordant dye

**Q<sup>n</sup>44. Dettol consist of**

- (A) Cresol + ethanol (B) Xylenol + terpinol  
(C) Chloroxylenol + terpeneol (D) None of these

**Q<sup>n</sup>45. Which of the following is used in anesthesia**

- (A) N<sub>2</sub> (B) N<sub>2</sub>O (C) CH<sub>2</sub> (D) CO<sub>2</sub>

**Q<sup>n</sup>46. Diazo coupling is used to prepare some**

- (A) Vitamin Pesticides (B) Proteins (C) Dyes (D)

**Q<sup>n</sup>47. Which one is broad spectrum antibiotic**

- (A) Procaine Chloramphenicol (B) Plasmoquin (C) Aspirin (D)

**Q<sup>n</sup>48. Drugs used for relieving pain are called**

- (A) Antibiotic (B) Analgesics  
(C) Antipyretics (D) Anaesthetic

**Q<sup>n</sup>49. Drug used to the body temperature in high fever are called**

- (A) Antibiotics (B) An analgesic  
(C) A sedative (D) A psychedelic drugs

**Q<sup>n</sup>50. The chemical name of aspirin is**

- (A) Methyl salicylate (B) Ethyl salicylate  
(C) 2-hydroxybenzoic acid (D) 2-acetoxybenzoic acid

**Q<sup>n</sup>51. Which of the following is used as an antipyretic medicine**

- (A) Quinine (B) Paracetamol (C) Luminal (D) Morphine

**Q<sup>n</sup>52. Among the following which one is used in the treatment of malaria**

- (A) Aspirin (B) Morphine (C) Quinine (D) Reserpine

**Q<sup>n</sup>53. Chloroamphenicol is used as an**

- (A) Analgesic (B) Antibiotic (C) Anaesthetic (D) Antiseptic

**Q<sup>n</sup>54. Chloromphenical is commonly used in the treatment of**

- (A) Tuberculosis (B) Cholera (C) Malaria (D) Typhoid

**Q<sup>n</sup>55. Streptomycin is specific against**

- (A) Typhoid cough      (B) Tuberculosis      (C) Malaria      (D) Whooping cough

**Q<sup>n</sup>56. Which of the following is insecticide**

- (A) DDT      (B) TNT      (C) TNB      (D) Aspirin

**Q<sup>n</sup>57. The compound ..... is used as**

- (A) Antiseptic      (B) Antibiotic      (C) Analgesic      (D) Pesticide

**Q<sup>n</sup>58. A substance which can act both as an antiseptic and disinfectant is**

- (A) Aspirin      (B) Phenol      (C) Analgin      (D) Sodium pentothal

**Q<sup>n</sup>59. Which of the following is a mordant**

- (A) Tannic acid      (B) Metallic hydroxide  
(C) Salts of Al, Cr, Fe, Sn      (D) All of these

**Q<sup>n</sup>60. Heroin is derivative of**

- (A) Morphine      (B) Nicotine      (C) Cocaine      (D) Caffeine

**Q<sup>n</sup>61. Proserpine is**

- (A) Tranquillizer      (B) Antibiotic      (C) Vitamin      (D) Hormone

**Q<sup>n</sup>62. Ampicillin is**

- (A) An analgesic antipyretic      (B) An antibiotic      (C) An antimalarial      (D) An

**Q<sup>n</sup>63. A large numbers of antibiotics have been isolated form**

- (A) Bacteria actiuromycetes      (B) Bacteria staphylococcus  
(C) Bacteria rhizobium      (D) Acids

**Q<sup>n</sup>64. Gammexane is**

- (A) Chlorobenzene      (B) DDT  
(C) Benzene hexo chloride      (D) None of these

**Q<sup>n</sup>65. Which of the following is used for the preservation of colourless food materials such as fruit, juices, and squashes**

- (A) Potassium metabisulphite (B) Sodium sulphate  
(C) Sodium benzoate (D) All of the above

**Q<sup>n</sup>66. Butylated hydroxyanisole (BHA) is widely used as**

- (A) Artificial sweetener (B) Antioxidants  
(C) Edible colors (D) Preservatives

**Q<sup>n</sup>67. Which of the following contain a nitro group**

- (A) Maritius yellow (B) Chloramphenicol  
(C) Benzylpenicillin (D) Sulphapyridine

**Q<sup>n</sup>68. Drug which prevent the formation of acid in the stomach is/are**

- (A) Omepyzoles (B) Lansoprazols  
(C) Phenylbutazone (D) Magnesium trisilicate

**Q<sup>n</sup>69. Non-narcotic analgesics are**

- (A) Phenylbutazone (B) Morphine (C) Heroin (D) Lbuprofen

**Q<sup>n</sup>70. Which of the following are tranquillizers**

- (A) Veronal (B) Luminal (C) Seconal (D) All of the above

**Q<sup>n</sup>71. Aspirin cannot be**

- (A) Antibiotic (B) Sedative (C) Psychedelic (D) All of the above

**Q<sup>n</sup>72. Which of the following can be used as artificial sweeteners**

- (A) Aspartame (B) Alifame (C) Sucralose (D) Saccharin  
(E) All of the above

**Q<sup>n</sup>73. Which of the following are used as analgesics**

- (A) Aspirin (B) Geroin (C) Promethazine (D) Serotonin

**Q<sup>n</sup>74. Which of the following are bacteriostatic antibiotics**

- (A) Penicillin, Tetracycline (B) Erythromycin, Chloramphenicol  
(C) Ofloxacin, Aminoglycosides (D) Tetracycline, Chloramphenicol

**Q<sup>n</sup>75. Which of the following tranquillizers is not derivative of barbituric acid**

- (A) Veronal (B) Equanil (C) Seconal (D) Luminal

**Q<sup>n</sup>76. Among the following the narcotic analgesic is**

- (A) Heroin (B) Ibuprofen (C) Naproxen (D) Aspirin

**Q<sup>n</sup>77. Which of the following are antibacterial**

- (A) Penicillin (B) Sulphapyridine (C) Ofloxacin (D) All of the above

**Q<sup>n</sup>78. Which of the following is narcotics drugs**

- (A) Aspirin (B) Opium (C) Disprin (D) Novelgene

**Q<sup>n</sup>79. Which can be used as analgesic well as antipyretic**

- (A) Aspirin (B) Penicillin (C) Alitame (D) Codeine

**Q<sup>n</sup>80. Match the following column-I and column-II.**

Column-I		Column-II	
A	Penicillin	1	Bacteriostatic
B	Chloramphenicol	2	Antibiotic
C	Phenol	3	Bactericidal
D	Chloroxylenol	4	Antiseptic
		5	Disinfectant

- (A) A (2, 3) B(1, 2) C(4,5) D(4) (B) A(2, 3) B (3) C (4, 5) D(4)  
(C) A(4) B(1,3) C(2,5) D (5) (D) A(3) B(2) C(3,5) D (4,5)

**Q<sup>n</sup>81. What is DDT among the following**

- (A) Greenhouse gas (B) A fertilizer  
(C) Biodegradable pollutant (D) Non-biodegradable pollutant

**Q<sup>n</sup>82. Aspirin is known as**

- (A) Acetyl salicylic acid (B) Phenyl salicylate  
(C) Acetyl salicylate (D) Methyl salicylic acid



**Q<sup>n</sup>83.Regular use of which of the following fertilizer increases the acidity of soil**

- (A) Potassium nitrate (B) Urea  
(C) Superphosphate of lime (D) Ammonium sulphate

**Q<sup>n</sup>84.The smog is essentially caused by presence of**

- (A) O<sub>2</sub> and O<sub>3</sub> (B) O<sub>2</sub> and N<sub>3</sub>  
(C) Oxides of sulphur and nitrogen (D) O<sub>2</sub> and N<sub>2</sub>

**Q<sup>n</sup>85.Which of the following could act as a propellant for rockets**

- (A) Liquid oxygen + liquid argon (B) Liquid hydrogen + liquid oxygen  
(C) Liquid nitrogen + liquid oxygen (D) Liquid hydrogen + liquid nitrogen

**Q<sup>n</sup>86.Several blocks of magnesium are fixed to the bottom of ship to**

- (A) Make the ship lighter (B) Prevent action of water and salt  
(C) Prevent puncturing by under -sea rocks (D) Keep away the sharks

**Q<sup>n</sup>87.When rain is accompanied by a thunderstorm; the collected rain water will have a p<sup>H</sup>value?**

- (A) Slightly higher than that when the thunderstorm is not there  
(B) Un influenced by occurrence of thunderstorm  
(C) Which depends on the amount of dust in air  
(D) Slightly lower than that of rain water without thunderstorm

**Q<sup>n</sup>88.Morphine is used as an**

- (A) Antipyretic (B) Antiseptic  
(C) Analgesic (D) Insecticide

**Q<sup>n</sup>89.Which of the following is not an alkaloid**

- (A) Reserpine (B) Morphine  
(C) Quinine (D) Phenylbutazone

**Q<sup>n</sup>90.The antibiotic used for curing tuberculosis is**

- (A) Penicillin (B) Streptomycin  
(C) Tetracycline (D) Chloromycetin

**Q<sup>n</sup>91. The drugs used to get relief from pain are called**

- (A) Antipyretics (B) Analgesics  
(C) Antibiotics (D) Antiseptics

**Q<sup>n</sup>92. A medicine which promotes secretion of urine is called**

- (A) Diuretic (B) Antipyretic  
(C) Analgesic (D) Sedative

**Q<sup>n</sup>93. The antiseptic action of Dettol is due to**

- (A) Chlorobenzene (B) Chloroxylenol  
(C) Chloroquine (D) Chloramphenicol

**Q<sup>n</sup>94. Which of the following is an ingrain dye**

- (A) Alizarin (B) Cellitron fast blue B  
(C) Para red (D) Indigo

**Q<sup>n</sup>95. Which of the following is a direct dye**

- (A) Congo red (B) Martius yellow  
(C) Phenolphthalein (D) Both (A) and (B)

**Q<sup>n</sup>96. Dyes which are prepared right on the fabric during dyeing process are called**

- (A) Direct dyes (B) Azo dyes  
(C) Disperse dyes (D) Basic dyes

**Q<sup>n</sup>97. Which one is an acidic dye**

- (A) Methyl orange (B) Congo red (C) Orange-I (D) All the tree

**Q<sup>n</sup>98. A dye which is obtained from a largely grown plant in India is**

- (A) Indigo (B) Turmeric (C) Malachite green (D) Martius yellow

**Q<sup>n</sup>99. Which of the following is a disperse dye**

- (A) Congo red (B) Alizarin  
(C) Butter yellow (D) Cellitron fast pink B

**Q<sup>n</sup>100. The PSLV rocket used**





## PART 4: SUPRAMOLECULAR CHEMISTRY

### EXERCISE

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**Choose Appropriate Alternative**

#### Multiple Choice Questions

**Q<sup>n</sup>.1, Supramolecular chemistry has been defined as...**

- a. The study of large molecules
- b. Chemistry beyond the molecule
- c. Chemistry of atoms
- d. The study of covalent bonds

**Q<sup>n</sup>.2, When asked who the forefathers of supramolecular chemistry are/were, which of these would a supramolecular chemist be very unlikely to name?**

- a. Jean-Marie Lehn
- b. George Wittig
- c. Charles Pedersen
- d. Donald Cram

**Q<sup>n</sup>.3, Supramolecular chemistry is primarily concerned with...**

- a. Non-covalent bonding
- b. Atomic forces
- c. Covalent bonding
- d. Thermodynamics

**Q<sup>n</sup>.4, Upramolecules are very common in nature, which of the following is an example of a supramolecule?**

- a. Glucose
- b. Caffeine
- c. Thymine
- d. DNA

**Q<sup>n</sup>.5, Preorganisation is the term that refers to fixing or limiting the geometry of a molecule/s to assist in their binding.**

- a. True
- b. False

**Q<sup>n</sup>. 6, Van der Waal's forces are insignificant in supramolecular chemistry due to the fact that they are very weak.**

- a. True
- b. False

**Q<sup>n</sup>. 7, Using the appropriate supramolecular host, it is possible to bind which of these guests?**

- a. All of these
- b. Cations
- c. Anions
- d. Neutral species

**Q<sup>n</sup>. 8, What type of guest would a crown ether (essentially a cyclic poly ether) be able to bind?**

- a. Anions
- b. Zwitterions (a molecule with both a positive and negative charge)
- c. Neutral species
- d. Cations

**Q<sup>n</sup>. 9, There is a lot of interest in the area of supramolecular catalysis at the moment, why is this?**

- a. It would be useful for cutting down on the amount of solvent in the reaction and hence decreases costs. This is of particular significance to large scale industrial processes.
- b. It would allow very efficient and stereoselective catalysis of often very difficult reactions.
- c. It is thought that a supramolecular catalyst would be capable of replacing catalytic metals in reactions, thereby reducing cost while increasing efficiency.
- d. There is actually very little interest in this area, due to the fact that it is very difficult to make a supramolecular catalyst.

**Q<sup>n</sup>. 10, The 'lock-and-key' principle states that it is possible to bind any guest if the host is big enough.**

- a. True
- b. False

**Q<sup>n</sup>. 11, What is the hybridization state of the central atom in the azide ion,  $[N_3]^-$ ? That is, what orbital hybridization do we attribute to the central nitrogen atom in this ion?**

- A.  $sp^3d^2$                       B.  $sp^3d$                       C.  $sp^3$                       D.  $sp^2$                       E.  $sp$

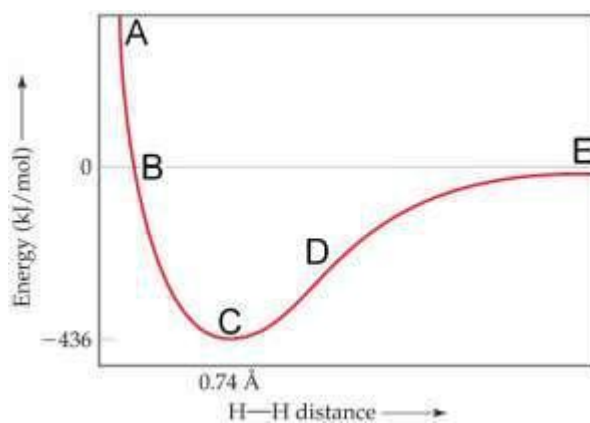
**Q<sup>n</sup>. 12, Pi ( $\pi$ ) bonds are formed through the overlap of what type of orbitals?**

- A.  $s$                       B.  $p$                       C.  $sp$                       D.  $sp^2$                       E.  $sp^3$

**Q<sup>n</sup>. 13, Tungsten, W, has the highest melting point of all the metals in the periodic table. Why?**

- A. Tungsten has half-filled s and d bands.
- B. Tungsten has the highest effective nuclear charge of all the metals.
- C. Tungsten has the highest electronegativity of all the metals.
- D. Tungsten has the highest atomic weight.
- E. Tungsten has the highest conductivity of all the metals.

**Q<sup>n</sup>. 14, A plot of change in potential energy versus distance for two H atoms combining to form H<sub>2</sub> below. At what point (A, B, C, D or E) is the two-atom system the most stable?**



- a. (d)      b. (a)      c. (c)      d. (b)

**Q<sup>n</sup>. 15, What intermolecular force is most important in explaining why the simple sugar glucose, C<sub>6</sub>H<sub>6</sub>O<sub>6</sub>, is soluble in water?**

- A. hydrogen bonding
- B. ion-dipole
- C. dipole-dipole
- D. ionic bonding
- E. London dispersion forces

**Q<sup>n</sup>. 16, What intermolecular force is most responsible for molecular iodine, I<sub>2</sub>, being a solid at room temperature?**

- A. ionic bonding
- B. ion-dipole
- C. dipole-dipole
- D. hydrogen bonding
- E. London dispersion forces

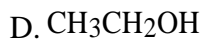
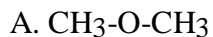
**Q<sup>n</sup>. 17, What intermolecular force is most responsible for sodium chloride, NaCl, being soluble in water?**

- a. ionic bonding
- b. dipole-dipole
- c. ion-dipole
- d. hydrogen bonding
- e. London dispersion forces

**Q<sup>n</sup>. 18, Supramolecular chemistry involves the adjusting of weak intermolecular forces to control assemblies of molecules. Which of the following type of interaction is not important in supramolecular chemistry?**

- a. hydrogen bonding
- b. ion-dipole
- c. dipole-dipole
- d. ionic bonding
- e. London dispersion force

**Q<sup>n</sup>. 19, Considering likely intermolecular forces, which of the following should have the highest boiling point?**



**Q<sup>n</sup>. 20, Propyne,  $\text{H-C}\equiv\text{C-CH}_3$ , has how many sigma ( $\sigma$ ) and how many pi ( $\pi$ ) bonds?**

A. 5  $\sigma$ , 3  $\pi$

B. 5  $\sigma$ , 1  $\pi$

C. 3  $\sigma$ , 2  $\pi$

D. 6  $\sigma$ , 2  $\pi$

E. 8  $\sigma$ , 0  $\pi$

**Q<sup>n</sup>. 21, Of the molecules CO<sub>2</sub>, NH<sub>4</sub><sup>+</sup>, and CO<sub>3</sub><sup>2-</sup>, which has/have delocalized pi ( $\pi$ ) bonding?**

A. CO<sub>2</sub> and NH<sub>4</sub><sup>+</sup>

B. CO<sub>3</sub><sup>2-</sup> only

C. CO<sub>2</sub> and CO<sub>3</sub><sup>2-</sup>

D. CO<sub>2</sub> only

E. NH<sub>4</sub><sup>+</sup> and CO<sub>3</sub><sup>2-</sup>

END

**Q<sup>n</sup>.22, Binding titrations are most widely used for the determination of host-guest association constants (K<sub>a</sub>). Which one of the following statements, in this context, is correct?**

- Contrary to NMR titration, UV/VIS and fluorescence titrations are employed with weakly binding host-guest complexes.
- If the host-guest exchange is fast on the NMR time scale, an integration of peaks assigned to free and bound host and guest species provides concentrations [HG], [H] and [G].
- Concerning the concentration range for titrations, the best nonlinear curve fitting is obtained when most of the data points are in the 80-100% saturation binding regime.
- The stoichiometry of the host-guest complex can be determined using the method of continuous variations (Job's method).

**Q<sup>n</sup>. 23, Cyclophanes - synthesis and related aromatic hydrocarbons. Which one of the following statements does apply?**

- The synthesis of thiaphane 3 should be carried out in rather concentrated solution to avoid slow conversion of the precursors 1 and 2.
- Cyclophane 4a, one of several product isomers from the above reaction, is chiral.
- The inner H-atoms of aromatic annulenes such as 6 show a strong downfield shift in <sup>1</sup>H NMR spectroscopy.
- Cyclophane 5 is a chiral molecule.



**Q<sup>n</sup>. 24, Principles of cation complexation: which one of the following statements is correct?**

- Rate constants for complexation and decomplexation [ $k(\text{compl})$  and  $k(\text{decompl})$ ] are determined by the strength of the interaction between cation and crown ether.
- The better a binding site is preorganized, the higher the binding selectivity of the corresponding host.
- The more basic the donor atoms in ionophores, the stronger their complexes with metal ions.
- The ion transport efficiency of a natural ionophore across a membrane parallels the complexation strength.

**Q<sup>n</sup>. 25, Which one of the following statements applies to Suzuki cross-coupling reactions?**

- The boronates used as starting materials for Suzuki reactions can themselves be prepared in Suzuki-like reactions.
- The reactivity of aryl halides in Suzuki reactions is enhanced by electron-donating substituents at the aromatic nucleus.
- Catalytic amounts of base are sufficient by increasing the nucleophilicity of the boronic acid.
- Exclusion of water is necessary to avoid poisoning of the Pd catalyst.

**Q<sup>n</sup>. 26, Which one of the following statements is true for anion complexation?**

- In natural systems, the strongest H-bonds of carboxylate residues involve the anti lone pairs due to stereoelectronic effects.
- Glycine plays a distinguished role in the biological binding of phosphate residues.
- The ease of anion complexation is reflected by the fact that anions represent ca. 70% of all biological substrates.
- Lysine is an essential binding element for phosphate, carboxylate, and sugar binding.

**Q<sup>n</sup>. 27, Which one of the following statements applies to Sonogashira cross coupling reactions?**

- In the catalytic cycle, the reductive elimination is the rate-determining step.
- The formation of homo-coupling products can be suppressed by using a Palladium(II) instead of a Palladium(0) catalyst.
- The cleavage of Me<sub>3</sub>Si protecting groups is a possible side reaction of Sonogashira couplings.
- Oxygen (O<sub>2</sub>) is necessary to accelerate the oxidative addition of a substrate to the Palladium catalyst.

**Q<sup>n</sup>. 28, Which one of the following statements is true for the complexation of neutral molecules in aqueous solution?**

- a. Complexation strength of a molecule in water is determined by directional interactions, especially H-bonds.
- b. Preorganization of lipophilic binding sites is essential to achieve binding.
- c. Hydrophilic pockets in enzymes and antibodies are ideal for the binding of Phe, Tyr and Trp residues.
- d. Binding analysis by fluorescence titration provides structural information on the complex.

**Q<sup>n</sup>. 29, Which one of the following statements concerning the chemistry of isonitriles is correct?**

- a. A traditional method to prepare isonitriles is the reaction of an alkyl iodide with NaCN.
- b. Due to their high energy content, isonitriles are rather exotic non-natural compounds.
- c. The exothermic oxidation of carbon (II) to carbon(IV) explains the high reactivity of isonitriles.
- d. Nucleophilic attacks on isonitriles take place at the N-atom whereas electrophiles react with the C-atom.

**Q<sup>n</sup>. 30, Which one of the following statements is true for non-covalent interactions involving aromatic rings?**

- a. Primary ammonium ions bind particularly well to "aromatic boxes" in proteins.
- b. Edge-to-face interactions are the most favorable ones between aromatics.
- c. Amide-NH... $\pi$  interactions are stronger than most CH... $\pi$  interactions and often observed in nature.
- d. As opposed to aryl methyl ethers, aryl trifluoromethyl ethers adopt a dihedral angle C(Ar)C(Ar)OC(F<sub>3</sub>) of ca. 90°.

**Q<sup>n</sup>. 31, Which one of the following statements is true for hydrogen bonding?**

- a. The strength of an H-bond depends on the acidity and basicity of donor and acceptor, respectively.
- b. The position of H-atoms is normally determined by X-ray diffraction.
- c. Nitro groups (NO<sub>2</sub>) are good H-bond acceptors.
- d. Sulfonamides can be considered isosteres for peptides due to a similar ability to form H-bonds.

**Q<sup>n</sup>. 32, Which one of the following statements is true for carbohydrate bonding?**

- a. Carbohydrate binding mainly results from H-bonding interactions between receptor and substrate.
- b. Complexation of OH-groups by ionic amino acid residues such as Asp, Glu or Arg is energetically less favorable than bonding to neutral amino acids.

- c. Participation of an OH-group as both H-bond donor and acceptor leads to weakening of the individual H-bonds.
- d. Water plays an important role in the binding of saccharides by carbohydrate transport proteins.

**Q<sup>n</sup>. 33, Which one of the following statements is true for container molecules?**

- a. Carcerand formation is always accompanied by solvent inclusion.
- b. A packing coefficient of 55% (ratio between the guest's van der Waals volume and the interior volume of the capsule) is optimal for complexation involving H-bonding and ion pairing.
- c. The complexation in H-bonded capsules is generally entropy-controlled.
- d. H-bonded capsules accelerate the rate, for example of Diels-Alder reactions, through inclusion of the starting materials inside the capsule.

**Q<sup>n</sup>. 34, Which one of the following statements is true for nanostructures?**

- a. In catenane formation, the Pd-pyridine bond is non-labile under normal conditions.
- b. The formation of full helicates from oligo(2,2'-bipyridine) ligands is dependent on the Cu(I) concentration of the solution.
- c. Molecular squares (based on Pd-Py bonding) can be easily formed by exchanging 2 nitrates on Pd for 4,4'-bipyridine ligands.
- d. In halogen bonding, -F, -Cl, -Br and -I act as donors with acceptors such as carbonyls, pyridines and nitriles.

**Q<sup>n</sup>. 35, Force of attraction which is more stronger than dipole dipole forces is**

- a. London dispersion forces
- b. Hydrogen bonding
- c. van der Waal forces
- d. inter molecular force

**Q<sup>n</sup>. 36, Covalent bond is stronger than Hydrogen bonding about**

- a. thirty times
- b. sixty times
- c. twenty times
- d. seventy times

**Q<sup>n</sup>. 37, Atom which must be present in hydrogen bonding is**

- a. hydrogen
- b. sodium
- c. calcium

d. sulphur

**Q<sup>n</sup>. 38, Which one of the following represents the weakest interaction between two species?**

- a) Hydrogen bond
- b) Disulfide bond
- c) Ionic bond
- d) Dispersion force

**Q<sup>n</sup>. 39, Non-polar molecules can contain polar bonds. True or false?**

- a) True
- b) False

**Q<sup>n</sup>. 40, Which one of the following terms describes a positive and negative charge, which are separated in space within a molecule?**

- a) Salt bridge
- b) Polar bond
- c) Dipole
- d) van der Waals interaction

**Q<sup>n</sup>. 41, Condensation, the transition from gas to liquid, is associated with an increase in intermolecular forces. True or false?**

- a) True
- b) False

**Q<sup>n</sup>. 42, Polar molecules are most likely to be hydrophobic. True or false?**

- a) True
- b) False

**Q<sup>n</sup>. 43, What is the minimum number of hydrogen bonds that operate between base pairs in DNA?**

- a) 1
- b) 2
- c) 3
- d) 4

**Q<sup>n</sup>. 44, Particles that most effects material properties**

- (a) Neutrons
- (b) Protons
- (c) Electrons
- (d) Valence electrons



**Q<sup>n</sup>. 56, The plane (1–11) is parallel to**

- (a) (–11–1)                      (b) (–1–11)                      (c) (111)                      (d) (1–11)

**Q<sup>n</sup>. 57, The angle between [111] and [11–2] directions in a cubic crystal is (in degrees)**

- (a) 0                      (b) 45                      (c) 90                      (d) 180

**Q<sup>n</sup>. 58, Miller indices of the line of intersection of (–1–11) and (110) are**

- (a) [110]                      (b) [101]                      (c) [10–1]                      (d) [–110]

**Q<sup>n</sup>. 59, Repeatable unit of polymers**

- (a) isomer                      (b) copolymer                      (c) homopolymer                      (d) mer

**Q<sup>n</sup>. 60, Pick the thermo-plast from the following**

- (a) Vinyls                      (b) Epoxies  
(c) Resins                      (d) Vulcanized rubber

**Q<sup>n</sup>. 61, For c coordination number of four, anion sits at the center of .....where corners are occupied by**

**cations**

- (a) Cube                      (b) Tetrahedron  
(c) Triangle                      (d) Octahedron

**Q<sup>n</sup>. 62, Layered silicate structures in clays consists the following group**

- (a)  $\text{SiO}_4^{4-}$                       (b)  $\text{Si}_2\text{O}_5^{2-}$                       (c)  $\text{Si}_2\text{O}_7^{6-}$                       (d)  $\text{SiO}_4^{4-}$

**Q<sup>n</sup>. 63, Schottky-defect in ceramic material is**

- (a) Interstitial impurity  
(b) Vacancy- interstitial pair of cations  
(c) Pair of nearby cation and anion vacancies  
(d) Substitutional impurity

**Q<sup>n</sup>. 64, what is the usual size range of a Eucaryotic cell?**

- a.) 1-2 nm                      b.) 1-2  $\mu\text{m}$   
c.) 10- 20  $\mu\text{m}$                       d.) 100- 200  $\mu\text{m}$

**Q<sup>n</sup>. 65, what is a biosensor made of?**

- a) A probe and a surface                      b) A sensing layer and a transducer  
c) A target and a probe molecule                      d) A biomarker and a probe

**Q<sup>n</sup>. 66, which material is (are) suitable for electrical signal transducing?**

- a) PDMS
- b) Silicon
- c) Glass
- d) polyethylene

**Q<sup>n</sup>. 67, which cell type is well adapted to signal detection with micro machined transistors?**

- a) Muscle cells
- b) Hepatocytes
- c) Circulating Tumor Cells
- d) Neurons

**Q<sup>n</sup>. 68, Please cite 1 anti cancerous agent**

- a) Paclitaxel
- b) Insulin
- c) Poly (ethylene glycol)
- d) Polyglutamic acid

**Q<sup>n</sup>. 69, what is the “Enhanced Permeability and retention (EPR) effect?”**

- a) The retention of the nanoparticles inside the vessel wall
- b) An enhanced permeability of the vessel wall at the tumor site due to an abnormal organization of the endothelium
- c) The enhancement of life time of the nanoparticles in the blood flow
- d) A leaky plasma membrane

**Q<sup>n</sup>. 70, what is the name of the adhesive structures formed by a cell in response to a substrate presenting a nano or Micro topography?**

- a) Integrins
- b) Focal adhesions
- c) Actin
- d) Lipids

**ANSWER**

1	2	3	4	5	6	7	8	9	10
b	b	a	d	a	b	a	d	b	b
11	12	13	14	15	16	17	18	19	20
e	b	a	c	a	e	c	d	d	d
21	22	23	24	25	26	27	28	29	30
b	d	d	b	a	b	c	b	c	d
31	32	33	34	35	36	37	38	39	40
a	d	a	c	b	c	a	d	a	c
41	42	43	44	45	46	47	48	49	50
a	b	b	d	c	a	b	d	c	b
51	52	53	54	55	56	57	58	59	60
c	b	c	b	c	a	c	d	d	a
61	62	63	64	65	66	67	68	69	70
b	b	c	c	b	b	d	a	b	b



## ART 5: ENVIRONMENTAL CHEMISTRY EXERCISE

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### Multiple Choice Questions

#### Choose Appropriate Alternative

**Q<sup>n</sup> 1. The major air pollutants is**

- (A) CO (B) Oxides of nitrogen  
(C) Soot (D) Oxides of sulphur

**Q<sup>n</sup> 2. The region closest to earth's surface**

- (A) Stratosphere (B) Mesosphere  
(C) Troposphere (D) Theemosphere

**Q<sup>n</sup> 3. The major source of CO pollution is**

- (A) Industrial processes (B) Vehicular exhaust  
(C) Forest fires (D) Volcanic activity

**Q<sup>n</sup> 4. Increased concentration of CO<sub>2</sub> in atmosphere is responsible for**

- (A) Greenhouse effect (B) Acid rain  
(C) Lack of photosynthesis (D) Death of aquatic life

**Q<sup>n</sup> 5. Which of the following species containing mercury is most toxic**

- (A) CH<sub>3</sub>Hg<sup>+</sup> (B) HgCl<sub>2</sub> (C) Hg<sub>2</sub>Cl<sub>2</sub> (D) Hg metal

**Q<sup>n</sup> 6. Marble acts as a sink for**

- (A) Metallic pollutants (B) NH<sub>3</sub> pollutants  
(C) Acidic pollutants (D) None of these

**Q<sup>n</sup> 7. Which of the following oxide of nitrogen is not common air pollutant**

- (A) NO<sub>2</sub> (B) N<sub>2</sub>O (C) NO (D) N<sub>2</sub>O<sub>5</sub>

**Q<sup>n</sup> 8. The factor responsible for highest CO contamination in air is**



- (A) Forest fires (B) Vehicular exhaust  
(C) Volcanic activity (D) Industrial processes

**Q<sup>n</sup> 9. Which of the following particulates is most toxic**

- (A) Fly ash (B) Soot  
(C) Inorganic compounds (D) Smog

**Q<sup>n</sup> 10. Besides CO<sub>2</sub>, other greenhouse gas is**

- (A) CH<sub>4</sub> (B) N<sub>2</sub> (C) Ar (D) O<sub>2</sub>

**Q<sup>n</sup> 11. Air temperature in troposphere decreases with height at rate of**

- (A) 6.5°C per km (B) 5.5°C per km  
(C) 4.5°C per km (D) 3.5°C per km

**Q<sup>n</sup> 12. The fifth zone of atmosphere is**

- (A) Troposphere (B) Anthrosphere  
(C) Mesosphere (D) Ionosphere

**Q<sup>n</sup> 13. The energy transport plays a vital role in maintaining the earth's radiation balanced and this proceeds through the mechanism of**

- (A) Conduction of energy (B) Convection of energy  
(C) Re-absorption of the outgoing infrared radiation (D) All mechanism are involved

**Q<sup>n</sup> 14. Gaseous and sedimentary cycles are tied to the**

- (A) Nitrogen cycle (B) Oxygen cycle  
(C) Hydrological cycle (D) Phosphorus cycle

**Q<sup>n</sup> 15. The solar energy reaching the surface of earth each year is about**

- (A)  $2.19 \times 10^{22}$  kw (B)  $4 \times 10^{18}$  kw (C)  $1.5 \times 10^{20}$  kw (D)  $5 \times 10^{22}$  kw

**Q<sup>n</sup> 16. At equilibrium O<sub>2</sub>/O<sub>3</sub> ratio is 10<sup>25</sup> while at an altitude of 30km, it is**

- (A)  $3 \times 10^5$  (B)  $2 \times 10^5$  (C)  $10^{30}$  (D)  $10^{20}$

**Q<sup>n</sup> 17. When the environmental lapse rate and the dry adiabatic lapse rate are exactly same, the atmosphere is said to be**

- (A) Unstable (B) Neutrally stable  
(C) Super adiabatic (D) Sub adiabatic

**Q<sup>n</sup> 18. Sinks of atmospheric gases are**

- (A) Ocean and vegetation (B) Soil micro-organisms  
(C) Lime stone wall (D) All act as sinks

**Q<sup>n</sup> 19. Particulate can be formed by**

- (A) Dispersion (B) Coagulation (C) Adhesion (D) All processes

**Q<sup>n</sup> 20. At seveso, Italy, the disaster in july 1976, was due to**

- (A) DDT (B) BHC (C) TCDD (D) 2,4-D

**Q<sup>n</sup> 21. The photodissociation of O<sub>2</sub> could occur if the wavelength of radiation is**

- (A) < 240nm (B) > 240nm (C) 280nm (D) 315nm

**Q<sup>n</sup> 22. Temperature inversion limits**

- (A) Vertical mixing of pollutants (B) Horizontal mixing of pollutants  
(C) Photochemical smog (D) London smog

**Q<sup>n</sup> 23. Pollutants emitted by jet planes are**

- (A) Smoke (B) Aerosols (C) Smog (D) Fog

**Q<sup>n</sup> 24. Aerosols of natural origin with diameter less than 0.2 $\mu$  are called**

- (A) Aitken particles (B) Colloidal particles  
(C) Particulates (D) Suspension

**Q<sup>n</sup> 25. Bhopal gas tragedy is a case of**

- (A) Thermal pollution (B) Air pollution  
(C) Nuclear pollution (D) Soil pollution

**Q<sup>n</sup> 26. The dispersion of air pollutants at a particular place are influenced by**

- (A) Meteorological factors                      (B) Wind speed and wind direction  
(C) Turbulence                                      (D) All of these

**Q<sup>n</sup> 27. The value of adiabatic lapse rate for dry air about**

- (A) 10°C / km                      (B) 6.5°C / km                      (C) 15°C / km                      (D) 4.5°C / km

**Q<sup>n</sup> 28. For many air pollution episodes in the world, the major responsible factor is**

- (A) Dispersion of pollutants                      (B) Inversion  
(C) Lapse rate    (D) Temperature

**Q<sup>n</sup> 29. The cleaning of pollutants may take place by**

- (A) Rain out    (B) Fall out  
(C) Wash out    (D) All

**Q<sup>n</sup> 30. When the atmosphere is very stable, the gaseous effluent forms a**

- (A) Fanning plume                                      (B) Trapping  
(C) Coning    (D) Lofting

**Q<sup>n</sup> 31. When strong lapse rate occurs at the lower layers and inversion in upper layers, the observed plume is**

- (A) Coning                      (B) Fumigatin                      (C) Looping                      (D) None of these

**Q<sup>n</sup> 32. When super adiabatic lapse rates occur, looping plumes are observed because**

- (A) Turbulence is more mechanical than thermal  
(B) Of the development of large thermal eddies in the unstable air  
(C) Rapid upward diffusion  
(D) Inversion layers

**Q<sup>n</sup> 33. The inversion which results from the normal diurnal cooling cycle is**

- (A) Radiational    (B) Subsidence  
(C) Advective    (D) None

**Q<sup>n</sup> 34. The knowledge of meteorological factor is helpful in**

- (A) Location of an industrial plant
- (B) Design of pollution control equipment
- (C) Establishing air quality criteria
- (D) All are correct

**Q<sup>n</sup> 35. The boundaries between temperature and subtropical air circulation zones are known**

- (A) Hadley cell
- (B) Polar fronts
- (C) Horse latitudes
- (D) Polar zones

**Q<sup>n</sup> 36. The fuel which contains only one carbon atom is**

- (A) CNG
- (B) LPG
- (C) Petrol
- (D) Diesel

**Q<sup>n</sup> 37. The alternative fuel(s) is (are)**

- (A) CNG or LPG
- (B) H<sub>2</sub> fuel
- (C) Biodiesel
- (D) All of these

**Q<sup>n</sup> 38. The oxygen added to gasoline are**

- (A) Methyl tertiary butyl ether (MTBE)
- (B) Tertiary butyl alcohol (TBA) and Di-isopropyl ether (DIPE)
- (C) Ethyl tertiary butyl ether (ETBE)
- (D) All act as oxygenates

**Q<sup>n</sup> 39. The biodegradable oxygenate is**

- (A) MTBE
- (B) C<sub>2</sub>H<sub>5</sub>OH
- (C) TBA
- (D) ETBE

**Q<sup>n</sup> 40. Compared to vehicles powered by internal combustion engines, fuel cell powered vehicles**

- (A) Have high energy conversion efficiency
- (B) Create zero pollution
- (C) Emit CO<sub>2</sub> and water vapour only
- (D) All is correct

**Q<sup>n</sup> 41. Green house coefficient of the earth is**

(A) 1.137 (B) 2.60 (C) 2.27 (D) 3.50

**Q<sup>n</sup> 42. The region of atmospheric window lies in the range of**

(A) 8 μm to 12 μm (B) 7.5 μm to 13 μm (C) 4 μm to 7.5 μm (D) 13 μm to 20 μm

**Q<sup>n</sup> 43. The relative instantaneous radiative forcing value for CO<sub>2</sub> is arbitrarily fixed at**

(A) 1 (B) 21 (C) 43 (D) 25

**Q<sup>n</sup> 44. The maximum global warming potential is of**

(A) N<sub>2</sub>O (B) CH<sub>4</sub> (C) CFC (D) CO<sub>2</sub>

**Q<sup>n</sup> 45. The major sink of nitrous oxide is**

(A) Troposphere (B) Stratosphere (C) Oceans (D) Vegetation

**Q<sup>n</sup> 46. El Niño episodes have occurred after every**

(A) 2 to 7 years (B) 4 to 10 years (C) 2 to 5 years (D) 3 to 8 years

**Q<sup>n</sup> 47. In Antarctica, a huge chunk of Larsen ice shelf broke loose and sheered away into the ocean in**

(A) May 2005 (B) March 2002 (C) June 2006 (D) April 2003

**Q<sup>n</sup> 48. El Niño is a meteorological phenomenon marked by**

(A) Lower atmospheric pressure

(B) Higher water temperature

(C) Both (A) and (B)

(D) Lower water temperature

**Q<sup>n</sup> 49. Pacific decadal oscillation has roughly**

(A) 50 year cycle (B) 20 year cycle (C) 7 year cycle (D) 10 year cycle

**Q<sup>n</sup> 50. El Niño is also known as**

(A) Infant terrible (B) Boy terror

(C) Both (A) and (B) (D) La Niña

**Q<sup>n</sup> 51. The existence of ozone belt around the earth is mainly responsible for filtering out**

- (A) Ultraviolet radiation                      (B) Infra red rays  
(C) Cosmic rays                                (D) Microwaves

**Q<sup>n</sup> 52. The maximum concentration of ozone in the stratosphere is**

- (A)  $5 \times 10^{10} \text{ mol cm}^{-2}$                       (B)  $5 \times 10^{12} \text{ mol cm}^{-3}$   
(C)  $5 \times 10^{11} \text{ mol cm}^{-2}$                       (D)  $5 \times 10^9 \text{ mol cm}^{-3}$

**Q<sup>n</sup> 53. In stratosphere, the average thickness of ozone layer is about**

- (A) 230DU            (B) 300DU            (C) 250DU            (D) 200DU

**Q<sup>n</sup> 54. Ozone can absorb short wavelength UV radiation in the range**

- (A) 200 to 240 nm                              (B) 240 to 320 nm  
(C) 320 to 350nm                              (D) 180 to 200nm

**Q<sup>n</sup> 55. Nuclear explosions produce large quantities of**

- (A)  $\cdot\text{OH}$  ions                                      (B)  $\text{Cl}^{\cdot}$  ions  
(C)  $\text{NO}_x$     (D)  $\text{SO}_x$

**Q<sup>n</sup> 56. The zero ODP Value is of**

- (A) HFCs    (B) CFCs  
(C) HCFCs    (D) None of these

**Q<sup>n</sup> 57. Ozone loss over Antarctica was first detected in**

- (A) April 1981                                      (B) October 1980  
(C) May 1980                                        (D) June 1981

**Q<sup>n</sup> 58. A series of chlorofluoro carbons, in 1940, were developed by**

- (A) Chubachi                                        (B) Sherwood  
(C) Du Pont    (D) Chapman

**Q<sup>n</sup> 59. The ODP of a specific chemical takes into account**

- (A) Reactivity of species                      (B) Atmospheric lifetime of the species  
(C) Molar mass of the species                (D) All are correct

**Q<sup>n</sup> 60. Chloro fluoro carbons do not absorb light of wavelength above**

- (A) 290 nm                      (B) 200 nm                      (C) 170 nm (D) 236 nm

**Q<sup>n</sup> 61. The haze is yellow in colour due to the present of**

- (A) NO<sub>2</sub>                      (B) SO<sub>2</sub>                      (C) CO<sub>2</sub>                      (D) NH<sub>3</sub>

**Q<sup>n</sup> 62. Classification smog is also known as**

- (A) Sulphurous smog                      (B) London smog  
(C) Both (A) and (B)                      (D) Photochemical smog

**Q<sup>n</sup> 63. Formation of photochemical smog depend on**

- (A) Atmospheric pollutants  
(B) Vehicular exhaust  
(C) Climate, geographic condition and solar radiation  
(D) All of these

**Q<sup>n</sup> 64. The only sink of PAN is**

- (A) Thermal decomposition                      (B) Humidity  
(C) Aerosol                      (D) NO<sub>x</sub>

**Q<sup>n</sup> 65. A promising free radical scavenger is**

- (A) Dimethyl hydroxylamine                      (B) Diethyl hydroxyl amine  
(C) Diethyl nitrosoamines                      (D) Nitrobenzene

**Q<sup>n</sup> 66. Sulphate have, a green house gas, is known to cause**

- (A) Climate cooling                      (B) Global warming  
(C) Shallow inversion                      (D) Thick fog

**Q<sup>n</sup> 67. While reacting with sulphhydryl groups contained in proteins, PAN acts as**

- (A) An oxidizing agent                      (B) An acetylating agent  
(C) Both (A) and (B)                      (D) Reducing agent

**Q<sup>n</sup> 68. Monitoring is helpful in**

- (A) Evaluating current trends in air quality
- (B) Implementing control measures
- (C) Reducing pollutant concentration to acceptable levels
- (D) All are correct statements

**Q<sup>n</sup> 69. The objective of any air sampling exercise is to**

- (A) Obtain a genuine and representative sample
- (B) Provide information on the nature of pollutants
- (C) Measure the size of the sample
- (D) All of these

**Q<sup>n</sup> 70. The most common technique for sampling particulates is**

- (A) Sedimentation
- (B) Filtration
- (C) Impingement
- (D) Thermal precipitation

**Q<sup>n</sup> 71. Monitoring program can be classified into**

- (A) Ambient monitoring
- (B) Stack monitoring
- (C) Inplant or personal monitoring
- (D) All of these

**Q<sup>n</sup> 72. West-Gaeke spectrophotometric method is used for the analysis of**

- (A) SO<sub>2</sub>
- (B) NO<sub>x</sub>
- (C) PAHs
- (D) Aerosols

**Q<sup>n</sup> 73. Total oxidants can be determined in neutral phosphate buffered KI By**

- (A) Saltzman method
- (B) Colorimetric method
- (C) Both (A) and (B)
- (D) Amperometry

**Q<sup>n</sup> 74. The technique best suited for continuous monitoring of CO from exhaust emission is**

- (A) NDIR
- (B) FTIR
- (C) UV
- (D) NMR

**Q<sup>n</sup> 75. Low levels of CO (less than 10 ppm) can be conveniently measured by**

- (A) IR
- (B) Gas chromatography
- (C) HPLC
- (D) UV

**Q<sup>n</sup> 76. The most sensitive method for the monitoring of ammonia is**



- (A) Indophenol method (B) Nessler method  
(C) Direct method (D) Nitrite method

**Q<sup>n</sup> 77. GC-MS is best suited for the identification of low levels of**

- (A) Hydrocarbons (B) NH<sub>3</sub> (C) O<sub>3</sub> (D) SO<sub>2</sub>

**Q<sup>n</sup> 78. A typical example of raw materials change is the**

- (A) Use of raw sulphur fuel in place of high sulphur ones  
(B) Reduction of formation of NO<sub>x</sub>  
(C) Substituted of bauxite flux by fluorspar  
(D) All of these

**Q<sup>n</sup> 79. The basic mechanism of removing particulate matter from gas streams may involve**

- (A) Gravitational settling (B) Inertial impaction  
(C) Diffusion or electrostatic precipitation (D) All mechanisms are involved

**Q<sup>n</sup> 80. Small size particles can be removing with high efficiency by**

- (A) Fabric filters and high energy scrubbers  
(B) Electrostatic precipitators  
(C) Both (A) and (B)  
(D) Gravitational setting chambers and cyclone separations

**Q<sup>n</sup> 81. The choice of fabric filters is based on**

- (A) Operation temperature  
(B) Corrosiveness of the particles  
(C) Both (A) and (B)  
(D) Interception

**Q<sup>n</sup> 82. A bag filter is not suitable for**

- (A) Flyash from coal burning (B) Radioactive fumes  
(C) Heavy mist from a chemical process (D) All of these

**Q<sup>n</sup> 83. Fabric filter offer the best choice due to**

- (A) Retention of finest particles (B) Large size  
(C) High construction (D) Applicability below 285°C

**Q<sup>n</sup> 84. Venturi scrubbers are particularly suitable when the particulate matter is**

- (A) Sticky (B) Flammable  
(C) High corrosive (D) All of these

**Q<sup>n</sup> 85. Catalytic combustion technique is recommended for gases that are free of**

- (A) NO<sub>x</sub> (B) Particulates or metallic components  
(C) SO<sub>2</sub> (D) CO

**Q<sup>n</sup> 86. A effective means of removing H<sub>2</sub>O, thiophene and mercaptans from crude oil is by**

- (A) Washing the oil with aqueous soda solution  
(B) Treating the oil with sodium carbonate  
(C) Reacting the oil with sodium sulphite  
(D) Washing the oil with sodium sulphate

**Q<sup>n</sup> 87. Hydrocarbon emissions from stationary source can be controlled by**

- (A) Incineration (B) Adsorption and absorption  
(C) Condensation (D) All of these

**Q<sup>n</sup> 88. We get our supply and reserves of fresh water from**

- (A) Hydrological cycle (B) Carbon cycle (C) Snow fall (D) Nitrogen cycle

**Q<sup>n</sup> 89. Of the total water resource, fresh water available for our is**

- (A) Less than 5% (B) Less than 1% (C) More than 10% (D) More than 7%

**Q<sup>n</sup> 90. Ocean water, a vast water resource, is**

- (A) Suitable for agriculture  
(B) Useful for coastal vegetation  
(C) Unfit for human consumption

(D) All of these

**Q<sup>n</sup> 91. Turbidity in water may be checked by coagulants such as**

- (A) Ferric chloride                      (B) Ferric sulphate  
(C) Ferric alum                          (D) All can be used

**Q<sup>n</sup> 92. Ground water contains appreciable concentration of**

- (A)  $\text{Ca}^{2+}$                       (B)  $\text{NO}_3^-$                       (C)  $\text{Cl}^-$                       (D)  $\text{Mg}^{2+}$

**Q<sup>n</sup> 93. If humic substance is extracted with a strong base and the resulting solution acidified, the products are**

- (A) Humin                                      (B) Humic acid  
(C) Fulvic acid                                (D) All of the above

**Q<sup>n</sup> 94. The decomposition products of humic acid are**

- (A) Catechol                                (B) Syringaldehyde  
(C) Both (A) and (B)                      (D) Resorcinol

**Q<sup>n</sup> 95. Micro-organism that serve as aquatic solar fuel cells are called**

- (A) Algae                                      (B) Bacteria  
(C) Fungi                                      (D) Protozoa

**Q<sup>n</sup> 96. Water that acts as hypotonic medium for aquatic organisms is**

- (A) Sea water                                (B) River or lake water  
(C) Pond water                               (D) Ground water

**Q<sup>n</sup> 97. The bacteria that serve as catalyst for the oxidation Fe(II) to Fe (III) by oxygen is/are**

- (A) Gallionella                              (B) Ferrobacillus  
(C) Sphaerotilus                              (D) All of these

**Q<sup>n</sup> 98. The symptoms of any water body pollution are**

- (A) Bad taste of drinking water  
(B) Offensive smell from lakes, rivers and ocean beaches

- (C) Oil and grease floating on water surface
- (D) All are indicative of water pollution

**Q<sup>n</sup> 99. Arsenic poisoning from drinking water leads to**

- (A) Bronchitis, loss of hair, gangrene
- (B) Diarrhea, dysentery
- (C) Typhoid
- (D) Pneumonia

**Q<sup>n</sup> 100. Ganga water pollution is due to dumping of**

- (A) Waste from forests
- (B) Industrial and domestic sewage
- (C) Mine spills
- (D) Transport accidents

**ANSWER**

1	2	3	4	5	6	7	8	9	10
a	c	b	a	a	c	d	c	b	a
11	12	13	14	15	16	17	18	19	20
a	b	d	c	a	a	b	d	d	c
21	22	23	24	25	26	27	28	29	30
a	a	b	a	b	d	a	b	d	a
31	32	33	34	35	36	37	38	39	40
b	b	a	d	c	a	d	d	b	d
41	42	43	44	45	46	47	48	49	50
a	b	a	c	b	a	b	c	a	c
51	52	53	54	55	56	57	58	59	60
a	b	a	b	c	a	b	c	d	a
61	62	63	64	65	66	67	68	69	70
a	c	d	a	b	a	c	d	a	b
71	72	73	54	75	76	77	78	79	80
d	a	c	a	b	b	a	a	d	c
81	82	83	84	85	86	87	88	89	90
c	d	a	d	b	a	d	a	b	c
91	92	93	94	95	96	97	98	99	100
d	a	d	c	a	b	d	d	a	b

**Q<sup>n</sup> 1. The main objective of Ganga Action Plan is to**

- (A) Establish self-sustaining sewage treatment plants system
- (B) Adopt biological conservation measures
- (C) Both (A) and (B)
- (D) Mixing with rain water

**Q<sup>n</sup> 2. In case of river water, acute pollution problem prevail in**

- (A) Hooghly near Kolkata
- (B) Damodar near Durgapur
- (C) Yamuna near Agra and Delhi
- (D) All of these

**Q<sup>n</sup> 3. In marine ecosystem, oil is transported mainly by**

- (A) Wind currents
- (B) Waves and tides
- (C) Both (A) and (B)
- (D) Dissolution

**Q<sup>n</sup> 4. The world's first, disastrous consequence of oil spill occurred on**

- (A) March 1967
- (B) May 1987
- (C) April 1968
- (D) June 1970

**Q<sup>n</sup> 5. Physical effects of oil in water are**

- (A) Reduction in dissolved oxygen
- (B) Reduction in light penetration
- (C) Smothering
- (D) All of these

**Q<sup>n</sup> 6. Oil spill can be cleaned by**

- (A) Dispersion
- (B) Salmonella
- (C) Plasmodium
- (D) Streptococci

**Q<sup>n</sup> 7. Microbial that can ingest dispersed oil droplets are**

- (A) Pseudomonas
- (B) Salmonella
- (C) Plasmodium
- (D) Streptococci

**Q<sup>n</sup> 8.DDT accumulation is about 25000 folds in**

- (A) Gambusiaaffinis (B) Blepherisma  
(C) Rohu fish (D) Trout fish

**Q<sup>n</sup> 9.Coal mines discharge considerable quantities of**

- (A) H<sub>2</sub>SO<sub>4</sub> (B) Fe(OH)<sub>3</sub>  
(C) Both (A) and (b) (D) CaCO<sub>3</sub>

**Q<sup>n</sup> 10.The biodegradable detergents is**

- (A) Alkyl benzene sulphonate (B) Linear alkyl sulphonate  
(C) Lauryl sulphate (D) Both (B) and (C)

**Q<sup>n</sup> 11.BOD is directed measure of**

- (A) Oxygen requirement (B) Organic matter  
(C) Microbial activity (D)DO level

**Q<sup>n</sup> 12.Pesticide are used to**

- (A) Favour growth of insects (B) Kill pests and boost agricultural production  
(C) Reduction production of crops (D) Control animals

**Q<sup>n</sup> 13.Hormone weed killers are**

- (A) 2, 4-D and, 4,5-T (B) DDT and BHC  
(C) Lindane (D) Endrin

**Q<sup>n</sup> 14.Organochlorine insecticides have the greatest biological magnification because they**

- (A) Have high affinity for lipids (B) Are persistent ecopoisons  
(C) Both (A) and (B) (D) Have high affinity for proteins

**Q<sup>n</sup> 15.Pesticides can be biodegraded by**

- (A) Oxidation (B) Reductive dechlorination  
(C) Dehydrochlorination (D) All of these

**Q<sup>n</sup> 16. Extreme nervous excitation is caused by**

- (A) DDT                      (B) HCN                      (C) CH<sub>3</sub>Br                      (D) CH<sub>2</sub>Cl<sub>2</sub>

**Q<sup>n</sup> 17. Bio-fertilizer, a boon for farmers, includes**

- (A) Blue green algae                      (B) Rhizobium  
(C) Azospirillum                      (D) All of these

**Q<sup>n</sup> 18. The effluents from food industry consist of**

- (A) Very high BOD                      (B) Dissolved organic matter  
(C) Suspended organic solvents                      (D) All of them

**Q<sup>n</sup> 19. The process used to remove natural impurities like greases, waxes and fats by boiling with NaOH is called**

- A Scouring                      B Bleaching                      C Merceizing                      D Dyeing

**Q<sup>n</sup> 20. The bacterium, Acetobactorliquefaciens can consume**

- A Fats                      B Azo dyes  
C Proteins                      D Organic matter

**Q<sup>n</sup> 21. The cellulosic solid waste called bagasse can be used**

- A In paper and pulp industry                      B For steam and power generation  
C Both (a) and (b)                      D In textile industry

**Q<sup>n</sup> 22. The first known Indian distillery was established at**

- A Janjmow, Kanpur                      B Karnataka  
C Kolkata                      D Hyderabad

**Q<sup>n</sup> 23. A single unit of distillery produces**

- A 10 litre of spent wash per litre of alcohol  
B 15 litre of spent wash per litre of alcohol  
C 5% yeast sludge  
D 10% yeast sludge

**Q<sup>n</sup>24.COD removal efficiency is 90% in case of**

- A UASB technology
- B ASBR technology
- C AMBR reactor
- D EGSB reactor

**Q<sup>n</sup>25.The energy from dissolved biomass can be harvested by**

- A Microbial fuel cell biotechnology
- B Hydrogen fermentation technique
- C Methanogenic anaerobic digestion based technology
- D All technique can be used

**Q<sup>n</sup>26.Among FBC processes in thermal power plants,the most preferred technology is**

- A Circulating fluidised bed combustion
- B Atmospheric fluidised bed combustion
- C Pressurisedfluidised bed combustion
- D All of these

**Q<sup>n</sup>27.Polymers are categorized into**

- A Plastics
- B Fibres
- C Elastomers
- D All of these

**Q<sup>n</sup>28.The sewage with 500mg L BOD is called**

- A Strong sewage
- B Weak sewage
- C Extremely harmful sewage
- D All of these

**Q<sup>n</sup>29.The extent of sewage treatment requirement mostly depends on the**

- A Content of suspended solids



- B BOD of the sewage
- C Both (A) and (B)
- D Inorganic matter in the sewage

**Q<sup>30</sup>. During secondary treatment of sewage, micro-organisms can bring about**

- A Coagulation of colloidal matter
- B Oxidation of dissolved organic matter to CO<sub>2</sub>
- C Reduction of BOD
- D All of these

**Q<sup>31</sup>. The residual dissolved inorganic impurities from the water can be removed by**

- A Ion-exchange
- B Oxidation
- C Chlorination
- D Coagulation

**Q<sup>32</sup>. For the oxidation of 1 mg of carbon, the dissolved oxygen required is**

- A 1 mg
- B 2.67 mg
- C 3.50 mg
- D 4.67 mg

**Q<sup>33</sup>. The efficiency of trickling filter depends on**

- A Composition of the waste
- B Temperature and p<sup>H</sup>
- C Strength of hydraulic loading
- D All of these

**Q<sup>34</sup>. Refractory organics and toxic metals from the waste water can be removed by**

- A Adsorption
- B Precipitation
- C Evaporation
- D Digestion

**Q<sup>35</sup>. Anaerobic treatments is mainly used for**

- A COD reduction
- B Ludge digestion
- C Sewage oxidation
- D Metal reduction

**Q<sup>36</sup>. The conversion of mercury to methyl mercury is facilitated by**

- A Methyl cobalamin
- B Ascorbic acid

C Biotin D Lactic acid

**Q<sup>n</sup>37. Most organic Pb enters into the atmosphere during**

A Manufacture B Transfer of leaded gasoline  
C Use in vehicles D All of these

**Q<sup>n</sup>38. Copper species dominating in fresh water is**

A Cu- fulvic acid B Cu- humic acid  
C  $\text{Cu}^{2+}$  and  $\text{CuCO}_3$  D  $\text{CuOH}^+$  and  $\text{CuHCO}_3^+$

**Q<sup>n</sup>39. Mercury species which is absorbed on gold coated glass beads is**

A  $(\text{CH}_3)_2\text{Hg}$  B  $\text{Hg}^\circ$  C  $\text{HgCl}_2$  D  $\text{CH}_3\text{HgCl}$

**Q<sup>n</sup>40. In surface water at higher  $\text{p}^{\text{H}}$  values, lead associated with**

A  $\text{Fe}(\text{OH})_3$  B  $\text{MnO}_2$  C Both (A) and (B) D  $\text{NH}_4\text{Cl}$

**Q<sup>n</sup>41. Speciation of arsenic in water has been conducted by reduction with**

A Iodide B  $\text{NaBH}_4$  C  $\text{FeCl}_2$  D All of above

**Q<sup>n</sup>42. Cr(III) can be solubilized following surface oxidation in presence of**

A Fe salts B Solid  $\text{MnO}_2$  C Organic matter D  $\text{NH}_4^+$  ions

**Q<sup>n</sup>43. For arsenic metabolites, the lower detectable limit is**

A  $10^{-7}$  g B  $10^{-11}$  g C  $10^{-10}$  g D  $10^{-5}$  g

**Q<sup>n</sup>44. The analytical procedure (s) for speciation of selenium is/ are**

A Cold trapping B AAS C Flameless AAS D All of above

**Q<sup>n</sup>45. Arsenic speciation in air sample is carried out using a**

A Glass wool filter B Silver glass beads  
C Both (A) and (B) D Platinum glass beads

**Q<sup>n</sup>46. Soil erosion or loss of top soil is caused by**

A drought and flood B Deforestation

C Agriculture

D Fertilizers

**Q<sup>n</sup>47.Pesticides residues**

A Have no effect on environment

B Cause harm to birds, mammals and man

C Are maximum among Indians

D Increase soil fertility

**Q<sup>n</sup>48.Eutrophication results from**

A Industrial effluents

B Vehicular exhausts

C Agricultural run-off and domestic sewage

D Mining activities

**Q<sup>n</sup>49.Pesticides enter in man through**

A Human food chain

B Birds

C Insects

D Animals

**Q<sup>n</sup>50.Integrated Pest Management in agriculture means**

A Control of pest population

B Co-ordination of methods supplementing the effects of natural control agents

C Eradication of pests

D None of these

**Q<sup>n</sup>51.Compounds more resistant to decomposition in soil are**

A Tannins and lignins

B Proteins

C Lipids

D Carbohydrate

**Q<sup>n</sup>52.Mining practices leads to**

A Loss of grazing and fertile land

B Soil erosion from waste dumps

C Damage to flora and fauna

D All of above

**Q<sup>53</sup>. Biopesticides, the ecofriendly pest enemies, are derived from**

A Microbial sources

B Botanical sources

C Biochemical sources

D All of these

**Q<sup>54</sup>. Pheromones are**

A Extremely selective

B Biodegradable and non-toxic

C Very effective at low application rates

D All of these

**Q<sup>55</sup>. Love canal dump site**

A Did not harm the school and local residents

B Compelled the authorities to close the school and evacuate the residents of the area

C Favoured the growth of vegetation in the area

D Consist of harmless constituents

**Q<sup>56</sup>. The calorific value of India's solid waste varies from**

A 800 to 1500 kcal / kg

B 500 to 700 kcal / kg

C 200 to 400 kcal / kg

D 100 to 500 kcal / kg

**Q<sup>57</sup>. Solid waste management is best conducted by**

A Dumping

B Incineration

C Sanitary land fills

D Composting

**Q<sup>58</sup>. Hazardous chemical cause**

A No harm to man

B little harm to animals

C Metabolic disorders in human bodies

D None of these

**Q<sup>59</sup>. Auxiliary operation involved in solid waste treatment is**

A Collection, transport and handling

B Pulverization

C Compaction D All of these

**Q<sup>n</sup>60. Solid waste decomposition in solid mostly carried out by**

- A Facultative bacteria
- B Aerobic bacteria
- C Anaerobic bacteria
- D Microaerophilic bacteria

**Q<sup>n</sup>61. The aerobic and thermophilic decomposition of organic matter present in refused by microbes is called**

- A Incineration B Composting C Pyrolysis D Dumping

**Q<sup>n</sup>62. The technology suitable for medical waste disposal is**

- A Autoclaving B Steam sterilisation C Both ( A) and (B) D Incineration

**Q<sup>n</sup>63. Electronic waste includes discarded**

- A Computers B Televisions C Microwave ovens D All of these

**Q<sup>n</sup>64. Mobile phones contain persistent bioaccumulatiove toxic which include**

- A As, Sb, Be, Pb B Cd, Cu, Ni, Zn  
C Brominated flame retardents D All of them

**Q<sup>n</sup>65. Sanitary land fill treatment is suitable when**

- A The water table is deep
- B Rainfall is low and sewage can be used for farming
- C Both (A) and (B)
- D There is nearby water stream

**Q<sup>n</sup>66. The plant species exhibiting pest management properties are**

- A 1221 B 1005 C 297 D 485

**Q<sup>n</sup>67. The yeast grown as the source of single cell proteins is**

- A Aulosira
- B Candida tropicalis
- C Nostoc
- D Anabaena

**Q<sup>68</sup>.The ecofriendly techniques for sustainable framing system ia / are**

- A Biotechnology
- B Biosensor
- C Bioremediation
- D All of them

**Q<sup>69</sup>.Pentachloro phenol from contaminated soil can be removed by**

- A Flavobacterium
- B Pseudomonas
- C Thiobacillus
- D None of them

**Q<sup>70</sup>.The plasmid which can degrade oxane, hexane and decane is**

- A CAM Plasmid
- B OCT Plasmid
- C XYL Plasmid
- D NAH Plasmid

**Q<sup>71</sup>.The most commonly used biopesticidesources are**

- A Azadirachta indica
- B Baculo virus
- C Trichoderma
- D All of them

**Q<sup>72</sup>.Bioremediation- microbial clean up approach was invented by**

- A C.M. Keller
- B M. Robinson
- C Karl Erik
- D Watson

**Q<sup>73</sup>.An analytical gadget comprising of an immobilized layer of a biological material (e.g enzyme, antibody, hormone, nucleic acid) in conjunction with a transducer which converts biological signals into an electrical signals is called**

- A Biosensor
- B Chemosensor
- C Bio- informatics
- D All of them

**Q<sup>74</sup>.Phenol, pyridines and dimethylamines in solid can be degraded by**

- A Norcardia
- B Pseudomonas
- C Mycobacterium
- D Acetobactor



**Q<sup>83</sup>.Soil moisture can be measure by**

- A Electricity conductivity method
- B Tensitometric method
- C Neutron scattering method
- D All

**Q<sup>84</sup>.Kjeltec auto analyser method is used to determine**

- A  $\text{NH}_4^+\text{-N}$
- B  $\text{NO}_3\text{- N}$
- C Organic N
- D  $\text{NO}_2\text{-N}$

**Q<sup>85</sup>.Precision of the analytic result depends on the**

- A Method of sample collection
- B Method of colour measurement
- C Presence of interfering ions
- D All

**Q<sup>86</sup>.Toxic chemicals are**

- A Effective enzyme inhibitors
- B Hormone inhibitors
- C Antibody inhibitors
- D Antigens

**Q<sup>87</sup>.The load of CO in global atmosphere is nearly**

- A 430 million tonnes
- B 530 million tones
- C 120 million tonnes
- D 250 million tonnes

**Q<sup>88</sup>.In case of minamataepidemic,the causative agent identife was**

- A Mercurousu ion
- B Mercuric ion
- C Organomercurials
- D Inorganic mercury

**Q<sup>89</sup>.Fish concentrates methyl by a factor of**

- A  $10^4$
- B  $10^{10}$
- C  $10^5$
- D  $10^7$

**Q<sup>90</sup>.Cyanides in plants is bonded to glycoside known as**



- A Strach Fructose                      B Amygdalin                      C Cellulose                      D

**Q<sup>91</sup>.Fanconi syndrome is caused by higher levels of**

- A Pb                      B Hg                      C Cd                      D As

**Q<sup>92</sup>.Metal fume fever is caused, if zinc concentration in air is over**

- A 5 mg / m<sup>3</sup>                      B 10 mg / m<sup>3</sup>                      C 15 mg / m<sup>3</sup>                      D 20 mg / m<sup>3</sup>

**Q<sup>93</sup>.Lead inhibits the enzyme**

- A Amino levulinic acid dehydrase  
B Pyruvate dehydrogenase  
C Diphosphoglycerate  
D Amylase

**Q<sup>94</sup>.The threshold limiting value of methyl isocyanate is**

- A 0.05 ppm                      B 0.02 ppm                      C 0.03 ppm                      D 0.06 ppm

**Q<sup>95</sup>.Select the correct statement about ricin**

- A Ricin is the deadliest naturally occurring bio-warfare agent  
B It is four times more toxic than cobra venom  
C It works as a cytotoxin  
D All statements are correct

**Q<sup>96</sup>.The necessary condition for a molecule to absorb infrared radiation is**

- A Selection rule  
B Change in dipole moment  
C Both (A) and (B)  
D Dielectric constant

**Q<sup>97</sup>.The factors that complicate the infrared spectrum of the sample are**

- A Overtones
- B Fermi resonance
- C Hydrogen bonding
- D All the above

**Q<sup>98</sup>.The technique best suited for continuous monitoring of CO from exhaust emission is**

- A NDIR            B FTIR                    C IR            D AAS

**Q<sup>99</sup>.Flame ionization detector is 1000 times more sensitive than**

- A Electron capture detector
- B Thermal conductivity detector
- C Thermionic emission detector
- D Photoionization detector

**Q<sup>100</sup>.ICPAES is superior to AAS in respect of determination of**

- A Refractory elements like P, B, Zr, U
- B Heavy metals such as Cu, Cd, Ni
- C Low concentration of Al and Be
- D Lead in petrol

**ANSWER**

1	2	3	4	5	6	7	8	9	10
c	d	c	a	d	d	a	a	c	d
11	12	13	14	15	16	17	18	19	20
a	b	a	c	d	a	d	d	a	b
21	22	23	24	25	26	27	28	29	30
c	a	b	a	d	a	d	a	c	d
31	32	33	34	35	36	37	38	39	40
a	b	d	a	b	a	d	b	a	c
41	42	43	44	45	46	47	48	49	50
a	b	c	d	c	a	b	c	a	b
51	52	53	54	55	56	57	58	59	60



**Q<sup>n</sup> 7. The dispersion of radioactive isotopes in solution can be investigated by**

- A Autoradiography
- B Dialysis
- C Electrophoresis
- D All of them

**Q<sup>n</sup>8. Electromagnetic radiation of different wavelengths can be emitted by matter by**

- A Chemical reaction
- B Phosphorescence
- C Fluorescence
- D All of them

**Q<sup>n</sup>9. Which of the following are not ecologically harmful**

- A Ca-45 or Co-60
- B U-238
- C Cs-137
- D Pu-239

**Q<sup>n</sup>10. Which of the following are essential constituents of protoplasm and important as traces in metabolism**

- A C-14 and K-42
- B Fe-59 and Co-60
- C Both (A) and (B)
- D Sr-90 and Cs-137

**Q<sup>n</sup>11. Sun pumps a steady stream of solar radiation consisting of**

- A UV and visible light
- B Infrared light
- C Gamma rays
- D All of them

**Q<sup>n</sup>12. Radioisotopes enter the environment artificially through**

- A Release of radioactive wastes from nuclear power plants
- B Nuclear installation and research laboratories
- C Nuclear test fallout
- D All of them

**Q<sup>n</sup>13. The first atom bomb was exploded in the atmosphere over**

- A Hiroshima
- B Nagasaki
- C Bikini island
- D Russia

**Q<sup>n</sup>14. Chernobyl's worst nuclear disaster occurred on**

- A May 25, 1986
- B April 25, 1986
- C March 25, 1986
- D December 25, 1986

**Q<sup>n</sup>15. The biggest radiation hazard comes from**

- A X-rays      B Cosmic rays      C Microwaves      D Alpha rays

**Q<sup>n</sup>16. Stack effluents from atomic power plants consist of**

- A H-2, C-14      B Kr-85, I-129  
C Ar-41 Xe-133      D all of them

**Q<sup>n</sup>17. High level radioactive waste can be incorporated into**

- A borosilicate glass or ceramic matrix  
B polycrystalline synrock  
C both (a) and (b)  
D steel tanks

**Q<sup>n</sup>18. Biomedical wastes include**

- A pathological and surgical waste  
B chemical and chemotherapy waste  
C radioactive waste  
D organic solvents waste

**Q<sup>n</sup>19. Hazardous waste consist of**

- A toxic chemicals  
B sludges from petroleum refineries and blast furnaces  
C radioactive waste  
D All of them

**Q<sup>n</sup>20. All nuclear reactors rely on**

- A Thorium      B uranium as fuel      C tritium      D radium

**Q<sup>n</sup>21. The methods for storage and disposal of tailing are site-specific and depend on**

- A topography      B geology  
C climatic conditions      D all of these

**Q<sup>n</sup>22.A uranium mine in Canada is reported to rely totally on**

- A bacterial leaching for uranium production
- B fuel fabrication
- C refineries
- D chemical methods

**Q<sup>n</sup>23.The largest uranium producing countries in the world are**

- A USA
- B South Africa
- C Canada
- D all of these

**Q<sup>n</sup>24.An average sized nuclear power plant generates electricity**

- A 1000 MW
- B 3000MW
- C 500 MW
- D 200 MW

**Q<sup>n</sup>25.A secure landfill**

- A is an essential component of hazardous waste management plan
- B should serve as the resting place for detoxified hazardous waste
- C both (a) and (b)
- D should be used as a receptacle for untreated hazardous waste

**Q<sup>n</sup>26.The heated effluents discharged into rivers have**

- A reduced concentration of dissolved oxygen
- B reduction level of CO<sub>2</sub>
- C Increased concentration of DO
- D Increased concentration of CO<sub>2</sub>

**Q<sup>n</sup>27.Sources of thermal pollution are**

- A nuclear power plants
- B coal fired power plants
- C hydroelectric power
- D all of them

**Q<sup>n</sup>28. The extent to which heated effluents raise the temperature of waste bodies depends on**

- A nature of power plants
- B wind conditions
- C both (a) and (b)
- D water pollutants

**Q<sup>n</sup>29. The impact of power station on the environment depends on**

- A Meteorological condition
- B its location
- C agriculture and forest land
- D all of these

**Q<sup>n</sup>30. Thermal pollution in natural streams can be prevented by**

- A Using adequate cooling towers or ponds
- B installing chimneys
- C using electronic temperature meter
- D all of them

**Q<sup>n</sup>31. Temperature inversion limits**

- A Horizontal mixing of pollutants
- B vertical mixing of pollution
- C photochemical smog
- D all of them

**Q<sup>n</sup>32. Select the correct statements(s) about the thermal springs**

- A Thermal springs are the nature's perfect constant temperature laboratories
- B There is mixing of magnetic and meteoric waters below the ground water level
- C world's largest thermal springs are located in Yellow Stone Park, Wyoming , USA
- D all statements are correct

**Q<sup>n</sup>33. Thermal power plants mainly produce**

- A fly ash
- B CO
- C NO<sub>x</sub>
- D CaSO<sub>4</sub>

**Q<sup>n</sup>34. Thermal effluents damage biotic life by**

- A entrainment
- B synergism
- C impingement
- D all of these

**Q<sup>35</sup>.Photosensitive detector is used in**

- A lux meter
- B Dissolved oxygen meter
- C electronic temperature meter
- D all of these

**Q<sup>36</sup>. Speech frequencies lie between**

- A 200 and 7000Hz
- B 100 and 700Hz
- C 500 and 5000Hz
- D 400 and 4000Hz

**Q<sup>37</sup>.Common scientific acoustic units of noise is**

- A Hz
- B Db
- C  $Nm^{-2}$
- D  $Wm^{-2}$

**Q<sup>38</sup>.Sonic boom**

- A produces shock waves moving faster than the speed of sound
- B is an important aspect of aeroplane noise
- C is the worst killer of peace than noise
- D All are correct statements

**Q<sup>39</sup>.Cassette recorder**

- A can be used for digital recording of sound pressure levels for computer evaluation
- B gives information regarding the frequency content of a noise
- C comprises of a microphone coupled to an amplifier
- D helps in selecting the ear protector

**Q<sup>40</sup>.The extent of hearing impairment depends upon**



A noise intensity B frequency C time of exposure D all of them

**Q<sup>a</sup>41. A normal conversation is done at sound level**

A 80 Db B 60 Db C 100 Db D 40 Db

**Q<sup>a</sup>42. Engineering control of noise involves**

A Suppression of the noise at the source B path control  
C protection of the personnel D all of them

**Q<sup>a</sup>43. To act as an effective sound insulator, the barrier material should have a superficial mass of at least**

A  $9 \text{ kg / m}^2$  B  $7 \text{ kg / m}^2$  C  $10 \text{ kg / m}^2$  D  $2 \text{ kg / m}^2$

**Q<sup>a</sup>44. Typical sound absorbing materials include**

A glass fibre B wood wool slabs C straw slabs D all of these

**Q<sup>a</sup>45. The performance of a sound insulating materials is expressed in terms of**

A noise level index B vibration index  
C sound reduction index D sound coefficient

**Q<sup>a</sup>46. Renewable resources of energy include**

A Solar energy B natural gas C coal gas D fossil fuels

**Q<sup>a</sup>47. In India, the average intensity of solar radiation is**

A  $2.68 \times 10^{24} \text{ J per year}$  B 2.1 to 2.5 Kj per  $\text{cm}^2$  per day  
C 3.65 Kj per  $\text{cm}^2$  per day D 3.45 Kj per  $\text{cm}^2$  per day

**Q<sup>a</sup>48. The conversion of ocean thermal energy into electrical energy is about 150 MW in**

A vizhinjam fishing harbor B kerala  
C Andaman and Nicobar Islands D Japan

**Q<sup>a</sup>49. Tidal power plants are in operation in**

A Russia B France C Nova Scotia D all of them

**Q<sup>50</sup>.The world's largest producer of wind generation power is**

- A Japan            B California            C CIS            D India

**Q<sup>51</sup>.The world's largest geothermal energy production facility exists near**

- A China            B Bhavanagar            C Fransico in US            D  
Italy

**Q<sup>52</sup>.The solar power concept for producing electricity was developed by**

- A Charles Abbott in 1930            B Charles Robert in 1925  
C L.D. Meyers            D W.H. Wischmeier

**Q<sup>53</sup>.The ingredients used for generating power from solar ponds are**

- A plenty sunshine            B water and brine  
C both (a) and (b)            D water and MgSO<sub>4</sub>

**Q<sup>54</sup>.Environmental audit is also known as**

- A environmental surveillance  
B environmental review  
C environmental assurance  
D all of them

**Q<sup>55</sup>.The first comprehensive environmental legislation in US came into force on**

- A 1<sup>st</sup> January, 1970            B 26 January, 1970  
C 1<sup>st</sup> May, 1970            D 15 August, 1970

**Q<sup>56</sup>. Which of the following gases is not a green house gas?**

- (a) CO            (b) O<sub>3</sub>            (c) CH<sub>4</sub>            (d) H<sub>2</sub>O vapour

**Q<sup>57</sup>. Photochemical smog occurs in warm, dry and sunny climate. One of the following is not amongst the components of photochemical smog, identify it.**

- (a) NO<sub>2</sub>            (b) O<sub>3</sub>            (c) SO<sub>2</sub>            (d) Unsaturated hydrocarbon

**Q<sup>58</sup>. Which of the following statements is not true about classical smog?**

- (a) Its main components are produced by the action of sunlight on emissions of automobiles and factories.
- (b) Produced in cold and humid climate.
- (c) It contains compounds of reducing nature.
- (d) It contains smoke, fog and sulphur dioxide.

**Q<sup>n</sup>59. Biochemical Oxygen Demand, (BOD) is a measure of organic material present in water. BOD value less than 5 ppm indicates a water sample to be \_\_\_\_\_.**

- (a) Rich in dissolved oxygen.
- (b) Poor in dissolved oxygen.
- (c) Highly polluted.
- (d) Not suitable for aquatic life.

**Q<sup>n</sup>60. Which of the following statements is wrong?**

- (a) Ozone is not responsible for green house effect.
- (b) Ozone can oxidise sulphur dioxide present in the atmosphere to sulphurtrioxide.
- (c) Ozone hole is thinning of ozone layer present in stratosphere.
- (d) Ozone is produced in upper stratosphere by the action of UV rays on oxygen.

**Q<sup>n</sup>61. Sewage containing organic waste should not be disposed in water bodies because it causes major water pollution. Fishes in such a polluted water die because of**

- (a) Large number of mosquitoes.
- (b) Increase in the amount of dissolved oxygen.
- (c) Decrease in the amount of dissolved oxygen in water.
- (d) Clogging of gills by mud.

**Q<sup>n</sup>62. Which of the following statements about photochemical smog is wrong?**

- (a) It has high concentration of oxidising agents.
- (b) It has low concentration of oxidising agent.
- (c) It can be controlled by controlling the release of NO<sub>2</sub>, hydrocarbons, ozone etc.
- (d) Plantation of some plants like pinus helps in controlling photochemical smog.

**Q<sup>n</sup>63. The gaseous envelope around the earth is known as atmosphere. The lowest layer of this is extended upto 10 km from sea level, this layer is \_\_\_\_\_.**

- (a) Stratosphere
- (b) Troposphere
- (c) Mesosphere
- (d) Hydrosphere

**Q<sup>n</sup>64. Dinitrogen and dioxygen are main constituents of air but these do not react with each other to form oxides of nitrogen because \_\_\_\_\_.**

- (a) The reaction is endothermic and requires very high temperature.
- (b) The reaction can be initiated only in presence of a catalyst.

- (c) Oxides of nitrogen are unstable.
- (d) N<sub>2</sub> and O<sub>2</sub> are unreactive.

**Q<sup>65</sup>. The pollutants which come directly in the air from sources are called primary pollutants. Primary pollutants are sometimes converted into secondary pollutants. Which of the following belongs to secondary air pollutants?**

- (a) CO
- (b) Hydrocarbon
- (c) Peroxyacetyl nitrate
- (d) NO

**Q<sup>66</sup>. Which of the following statements is correct?**

- (a) Ozone hole is a hole formed in stratosphere from which ozone oozes out.
- (b) Ozone hole is a hole formed in the troposphere from which ozone oozes out.
- (c) Ozone hole is thinning of ozone layer of stratosphere at some places.
- (d) Ozone hole means vanishing of ozone layer around the earth completely.

**Q<sup>67</sup> Which order for green house gases is truly based on GWP?**

- (a) CFC > N<sub>2</sub>O > CO<sub>2</sub> > CH<sub>4</sub>
- (b) CFC > CO<sub>2</sub> > N<sub>2</sub>O > CH<sub>4</sub>
- (c) CFC > N<sub>2</sub>O > CH<sub>4</sub> > CO<sub>2</sub>
- (d) CFC > CH<sub>4</sub> > N<sub>2</sub>O > CO<sub>2</sub>

**Q<sup>68</sup>. Which of the following pollutant cannot be degraded by natural process?**

- (a) DDT
- (b) Nuclear waste
- (c) Heavy metals
- (d) all of the above

**Q<sup>69</sup>. Which of the following bacteria are responsible for the Gastrointestinal Disease?**

- (a) Ecoli
- (b) S Faecalis
- (c) Both a and b
- (d) S aureus

**Q<sup>70</sup>. The prescribed upper limit concentration of lead in drinking water is about**

- (a) 30 ppb
- (b) 70 ppb
- (c) 50 ppb
- (d) 60 ppb

**Q<sup>71</sup>. What is the range of pH of acid rain?**

- (a) More than 5.6
- (b) In between 5.6 to 6.6
- (c) Less than 5.6
- (d) In between 6.00 to 6.66

**Q<sup>72</sup>. Which of the following statement is incorrect?**

- (a) Taj Mahal is affected by hydrocarbon.
- (b) Building are adversely affected by acid rain.
- (c) Due to acid rain, micro organisms are affected.

(d) Large amount of acid rain decreases soil fertility.

**Q<sup>73</sup>. Which of the following disease increase due to Green house Gases effect?**

(a) Malaria (b) Dengue (c) Yellow fever (d) All of the above.

**Q<sup>74</sup>. Which of the following chemist associate with Green house Gas effect?**

(a) Jean fowier (b) Chamberlin (c) Swante Arrhenius (d) Both b and c

**Q<sup>75</sup>. Which of the following is used in aerosols?**

(a) NO<sub>x</sub> (b) Sox (c) CFC (d) Cox

**Q<sup>76</sup>. The Diameter of solid dust particle is**

(a) 10<sup>-2</sup> meter (b) 10<sup>-6</sup> meter (c) 10<sup>-4</sup> meter (d) 10<sup>-1</sup> meter

**Q<sup>77</sup>. Which of the following size of particulate will cause diseases related to lungs?**

(a) 10<sup>-2</sup> meter (b) 10<sup>-6</sup> meter (c) 10<sup>-4</sup> meter (d) 10<sup>-1</sup> meter

**Q<sup>78</sup>. Classical Smog Occurs in**

(a) Warm humid climate  
(b) Natural humid climate  
(c) Cool humid climate  
(d) Both a and b

**Q<sup>79</sup> Which of the following metal will pollute water?**

(a) Cd (b) Na (c) K (d) None of the above

**Q<sup>80</sup>. Which of the following ion is encouraging for the formation of algae in water?**

(a) SO<sub>4</sub><sup>2-</sup> (b) PO<sub>4</sub><sup>3-</sup> (c) ASO<sub>4</sub><sup>3-</sup> (d) CO<sub>3</sub><sup>2-</sup>

**Q<sup>81</sup>. Which of the following techniques is/are used to control water pollution?**

(a) Adsorption process  
(b) Ion exchange process  
(c) Reverse Osmosis  
(d) All of the above

**Q<sup>82</sup>. The lowest region that extends upto the height of 10 to 15 km from sea level is called?**

(a) Troposphere (b) Stratosphere

(c) Smoke (d) None of the above.

**Q<sup>83</sup>. Which of the following pollutants are present in troposphere?**

(a) Smog (b) Oxides of Sulphur (c) Both a and b (d) Metal oxides

**Q<sup>84</sup>. Which one is not a Green house Gas?**

(a) H<sub>2</sub>O (b) O<sub>2</sub> (c) CO<sub>2</sub> (d) O<sub>3</sub>

**Q<sup>85</sup>. Which of the following industries will be the best source of producing CO in the atmosphere?**

(a) Dyes (b) petrochemical (c) paper & pulp (d) Both b and c

**Q<sup>86</sup>. Which of the following is responsible for photochemical Smog?**

(a) Sox (b) NO<sub>x</sub> (c) Cox (d) none of the above

**Q<sup>87</sup>. London Smog is built-up of**

(a) Sulphur Oxide and particulate matter of fuel combustion.  
(b) Carbon Oxide and particulate matter of fuel combustion.  
(c) Nitrogen Oxide and particulate matter of fuel combustion.  
(d) Water Vapour and particulate matter of fuel combustion.

**Q<sup>88</sup>. The region closest to the earth's surface is**

(a) Stratosphere (b) Mesosphere (c) Troposphere (d) Thermosphere

**Q<sup>89</sup>. Which of the following oxides of nitrogen is not a common air pollutant?**

(a) NO<sub>2</sub> (b) N<sub>2</sub>O (c) NO (d) N<sub>2</sub>O<sub>5</sub>

**Q<sup>90</sup>. Depletion of ozone layer causes?**

(a) Blood Cancer (b) Bone Cancer (c) Lung Cancer (d) Skin Cancer

**Q<sup>91</sup>. Oxides of sulphur and nitrogen are important pollutants of:**

(a) Water (b) Air (c) Soil (d) Both c and d

**Q<sup>92</sup>. Tajmahal is threatened by pollutant from**

(a) Nitric oxide (b) Carbon oxide (c) Sulphur oxide (d) Chlorine

**Q<sup>93</sup>. Most dangerous metal pollutant of automobile exhaust is ...**

- (a) Lead                                      (b) Arsenic                                      (c) Mercury                                      (d) Cadmium

**Q<sup>94</sup>. DDT is \_\_\_\_\_**

- (a) An antibiotic  
(b) Biodegradable pollutant  
(c) Non-Biodegradable pollutant  
(d) Nitrogen containing insecticide

**Q<sup>95</sup>. COD stands for \_\_\_\_\_**

- (a) Chemical oxygen demand  
(b) Controlled oxygen demand  
(c) Clouds causing ozone depletion  
(d) Chlorinated oxygen demand

**Q<sup>96</sup>. Which of the following will be affected by Smog?**

- (a) Rubber                                      (b) Building  
(c) Carving                                      (d) All of the above

**Q<sup>97</sup>. The pollutants like SO<sub>x</sub>, CO and NO<sub>x</sub> caused for the damage of :**

- (a) Throat                                      (b) Kidney                                      (c) Nervous system                                      (d) Hair loss

**Q<sup>98</sup>. The main components of acid rain in the atmosphere are:**

- (a) Oxide of sulphur and nitrogen  
(b) Oxide of carbon and nitrogen  
(c) Oxide of phosphorous and nitrogen  
(d) Oxide of Carbon

**Q<sup>99</sup>. One free radical of chlorine can destroy molecules of ozone**

- (a) 100                                      (b) 500                                      (c) 250                                      (d) 1000

**Q<sup>100</sup>. Which of the following is responsible for Green house effect?**

- (a) Glass roof                                      (b) Aluminium sheet                                      (c) Metallic roof                                      (d) Jute roof

**Q<sup>101</sup>. Which of the following industry produces the waste of phenolic compounds and suspended solids?**

- (a) Petroleum                                      (b) paper & pulp  
(c) sugar                                      (d) Detergent

**Q<sup>n</sup>102. Which of the following industry produces the waste of animal protein?**

- (a) Petroleum (b) paper & pulp (c) sugar (d) leather

**Q<sup>n</sup>103. The source of chlofluoro carbons pollution is**

- (a) Jet air craftss (b) Refrigerators  
(c) fire extinguishers (d) all of the above

**Q<sup>n</sup>104. In the coming years, skin realated disorders will be more common due to**

- (a) Water pollution  
(b) organic waste material  
(c) Pollutants of atmosphere  
(d) depletion of ozone layer

**Q<sup>n</sup>105. Which of the following is/are gaseous pollutants?**

- (a) Carbon (b) Aerosols  
(c) Dust particles (d) Carbon monoxide

**Q<sup>n</sup>106. Which of the following component causes water pollution?**

- (a) Smog (b) Sodium chloride  
(c) algle (d) Industrial waste

**Q<sup>n</sup>107. The major cause of air pollution in big cities is...**

- (a) Burning of coal  
(b) Domestic exhaust  
(c) Burning of cooking gas  
(d) Vehicular exhaust

**Q<sup>n</sup>108. Depletion of ozone layer in stratosphere may cause...**

- (a) Lung damage (b) global warming  
(c) Global cooling (d) skin cancer

**Q<sup>n</sup>109. Green house effect was first described by...**

- (a) Yues Chauvin (b) Einstein (c) Fourier (d) Newton

**Q<sup>n</sup>110. A substance which may alter environmental constituents or cause pollution is called...**

- (a) Radiator (b) Pollutant (c) Reducer (d) Decomposer

**Q<sup>n</sup>111. The percentage of total amount of CO present in atmosphere, due to forest fires is...**

- (a) 63% (b) 17% (c) 9.5% (d) 7.4%



**Q<sup>n</sup>112. The homosphere constituents how much percent of the total atmosphere**

- (a) 80% (b) 86% (c) 90% (d) 99.99%

**Q<sup>n</sup>113. Acid rain is due to the increase in the concentration of which of the following in the atmosphere?**

- (a) O<sub>3</sub> + NO<sub>2</sub> (b) CO<sub>2</sub> and CO (c) SO<sub>3</sub> and CO (d) SO<sub>2</sub> and NO<sub>2</sub>

**Q<sup>n</sup>114. Which of the following is a solid pollutant...?**

- (a) Carbon (b) Nitric oxide (c) Sulphur dioxide (d) Carbon monoxide

**Q<sup>n</sup>115. The Green house effect is caused by...**

- (a) Methane only (b) CO<sub>2</sub> and SO<sub>2</sub>  
(c) CO<sub>2</sub>, SO<sub>2</sub> and NO<sub>2</sub> (d) CO<sub>2</sub>, CFC, CH<sub>4</sub> and NO<sub>2</sub>

**Q<sup>n</sup>116. The brown haze of photochemical Smog is largely attributable to...**

- (a) NO (b) NO<sub>2</sub> (c) CH<sub>3</sub>COONO<sub>2</sub> (d) CH<sub>2</sub>=CH-CH=O

**Q<sup>n</sup>117. Smog is essentially caused by the presence of...**

- (a) Oxides of sulphur and nitrogen (b) O<sub>2</sub> and N<sub>2</sub>  
(c) O<sub>2</sub> and O<sub>3</sub> (d) O<sub>3</sub> and N<sub>3</sub>

**Q<sup>n</sup>118. Ozone in the stratosphere is depleted by**

- (a) CF<sub>2</sub> Cl<sub>2</sub> (b) C<sub>6</sub>F<sub>16</sub> (c) C<sub>6</sub>H<sub>6</sub>Cl<sub>6</sub> (d) C<sub>6</sub>F<sub>6</sub>

**Q<sup>n</sup>119. The basic component of Smog is**

- (a) PAN (b) PBN (c) Ozone (d) all of these

**Q<sup>n</sup>120. Spraying of DDT on crops causes pollution of**

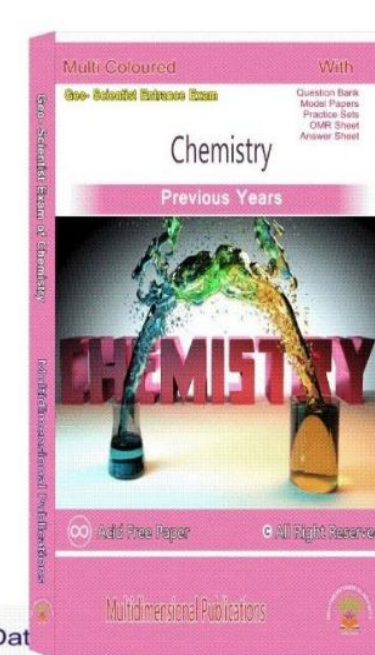
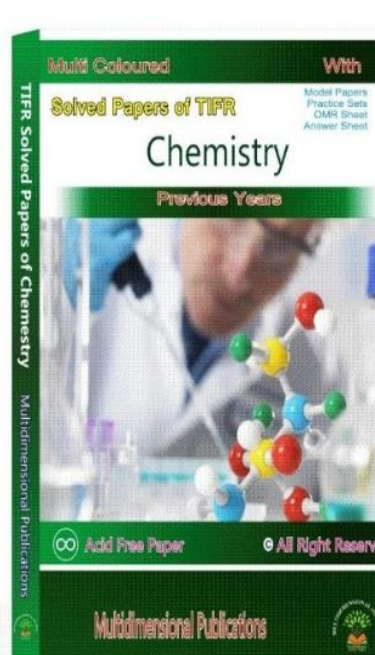
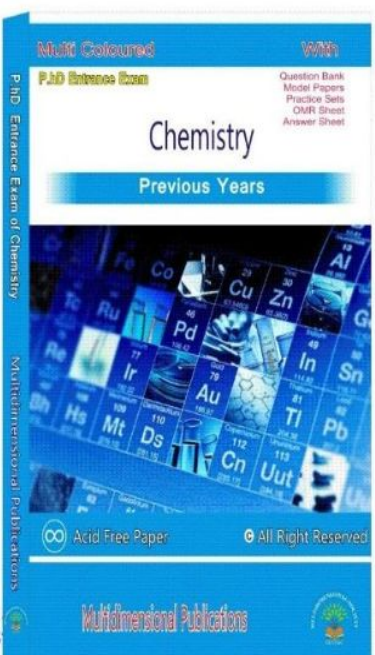
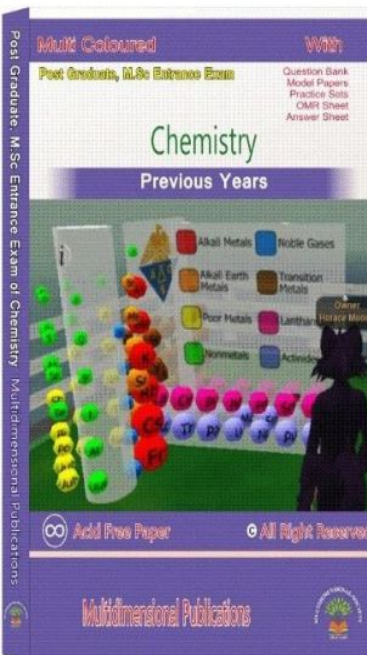
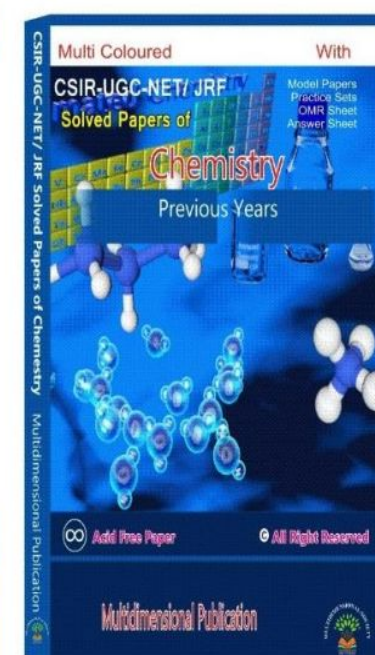
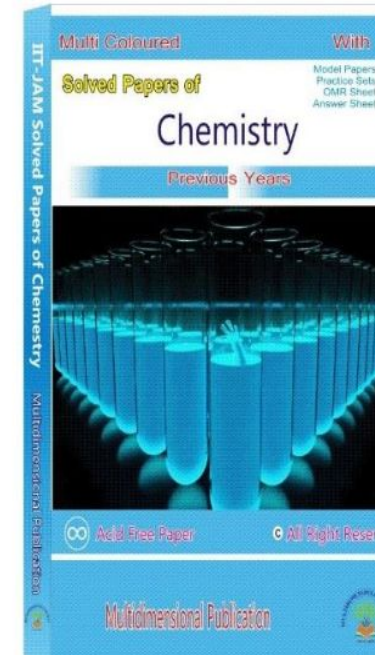
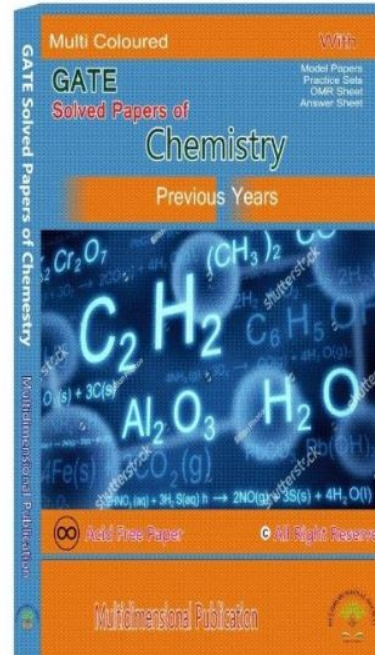
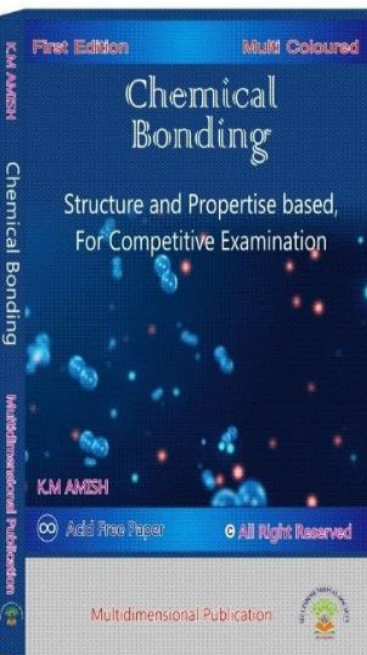
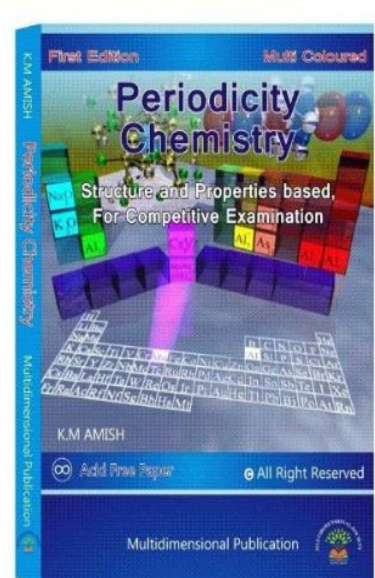
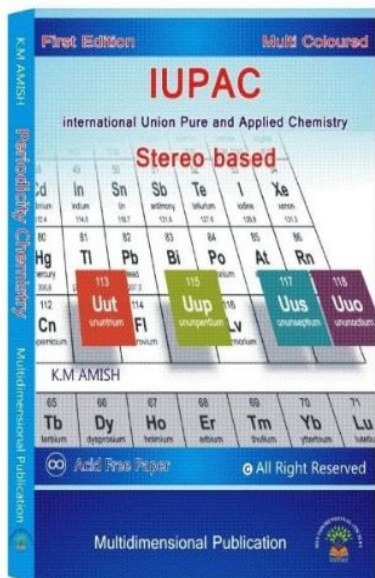
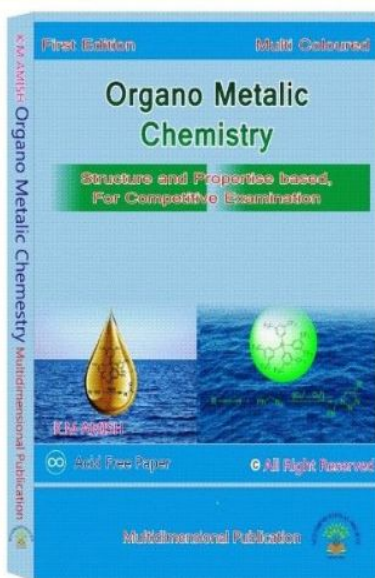
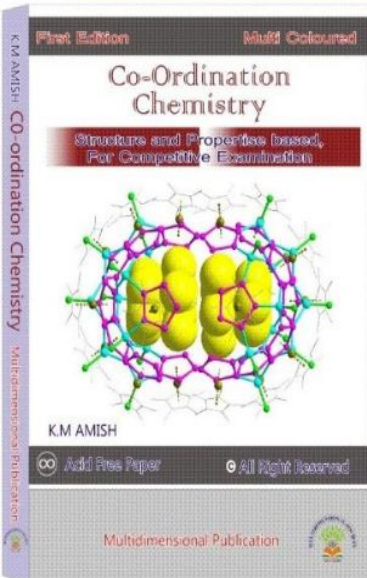
- (a) Air and Water (b) Soil and air (c) Soil and water (d) Crops and air

## ANSWER

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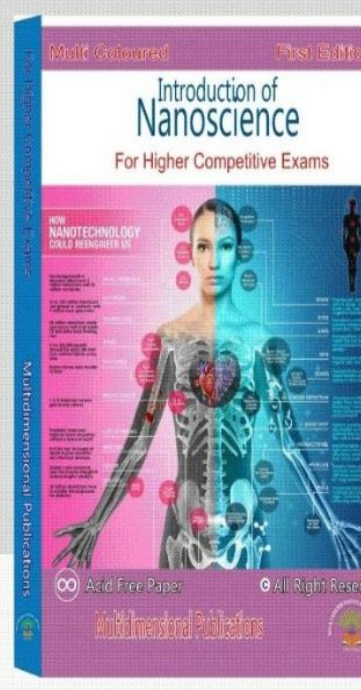
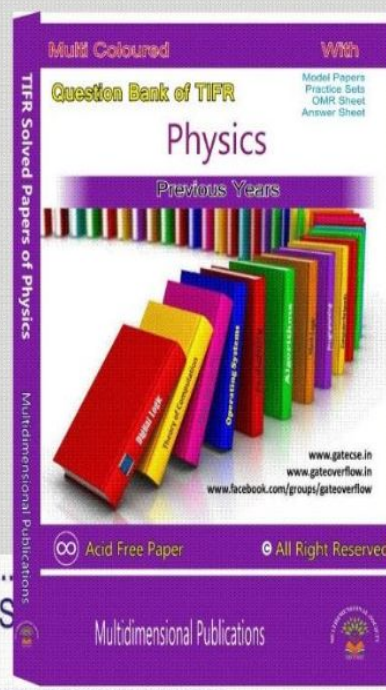
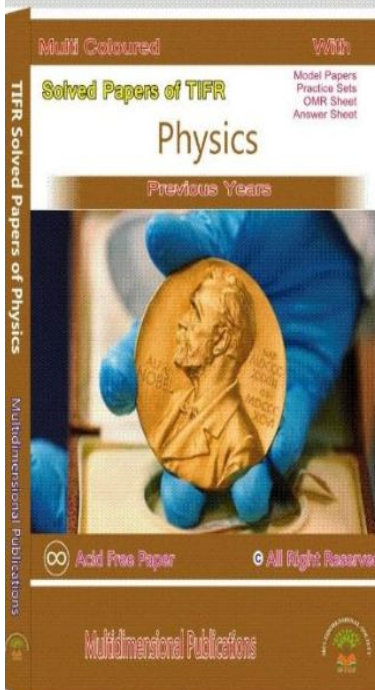
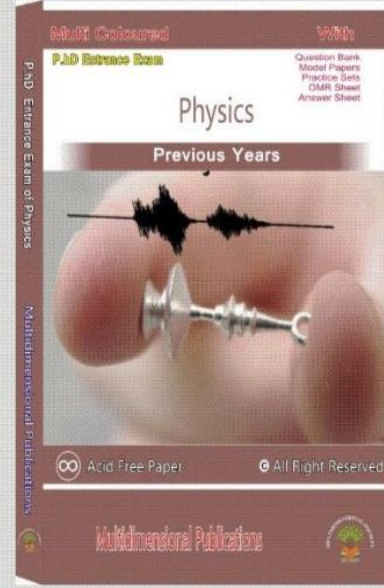
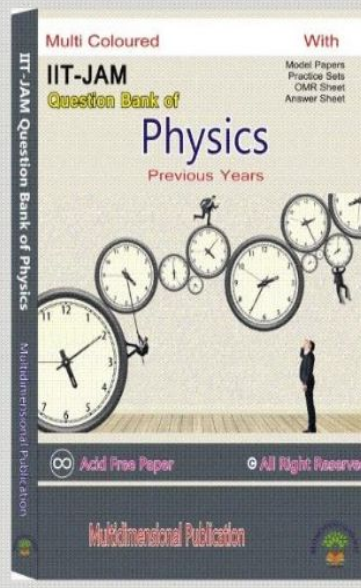
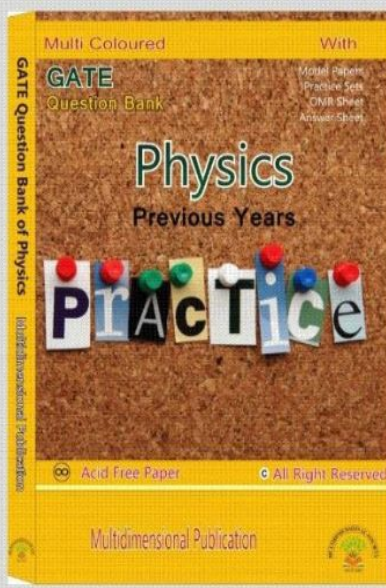
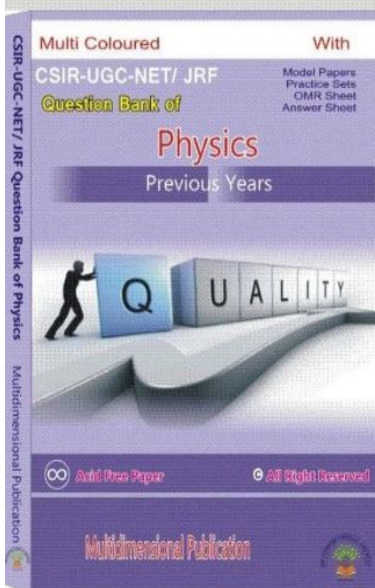
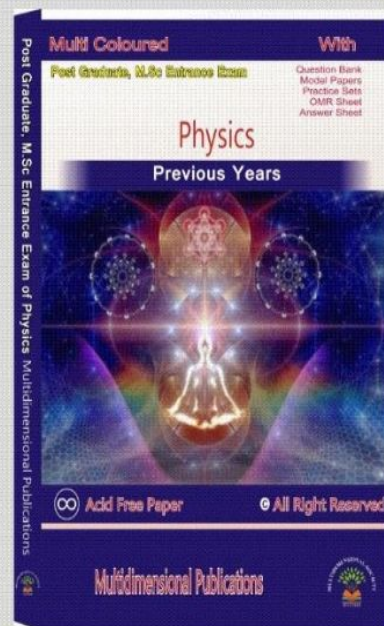
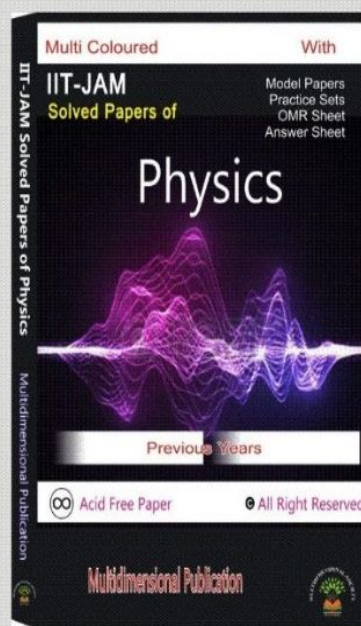
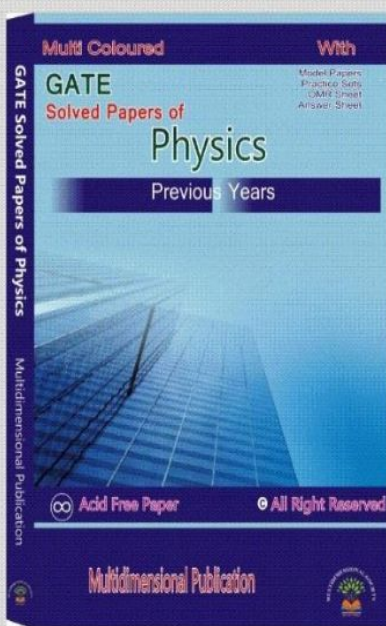
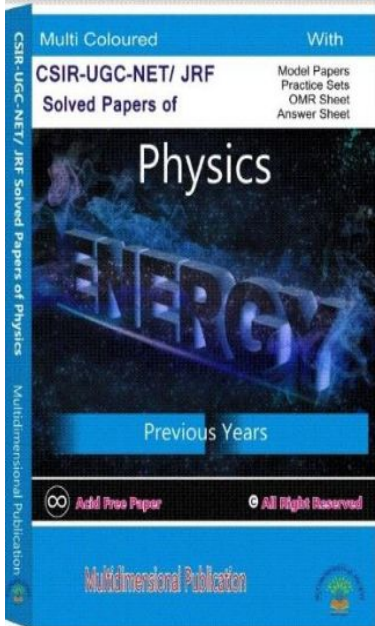
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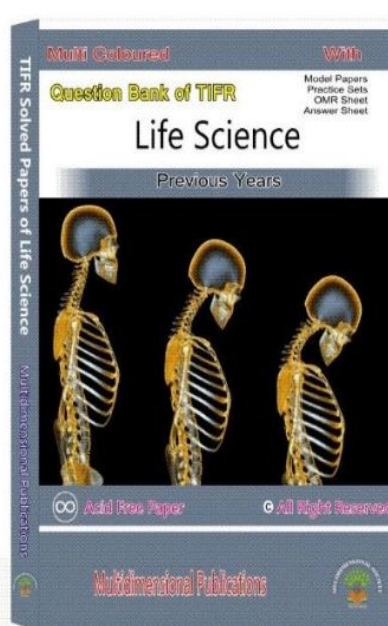
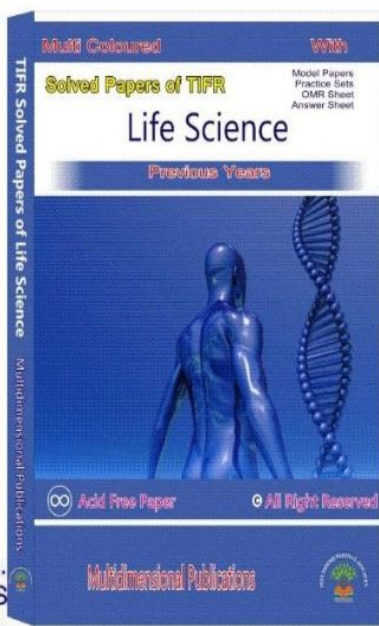
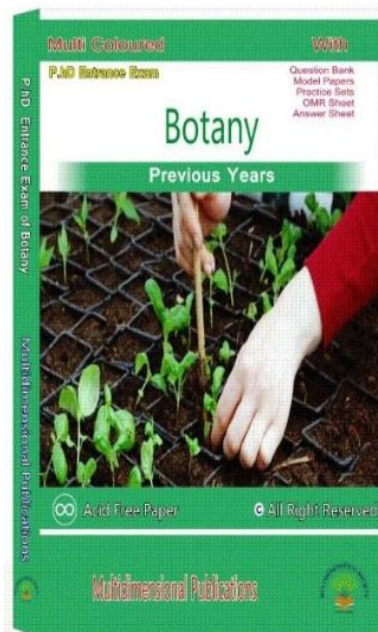
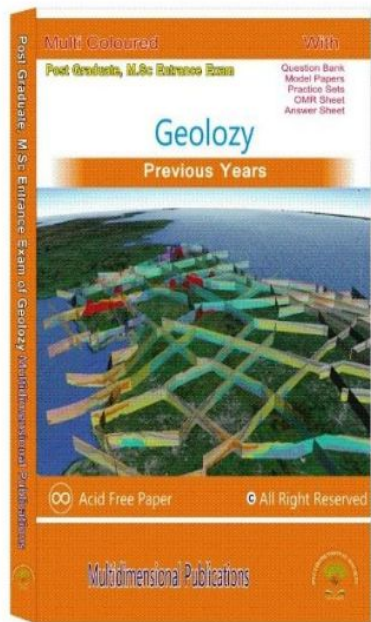
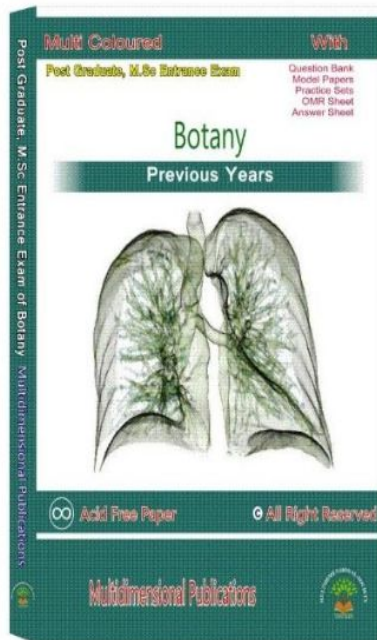
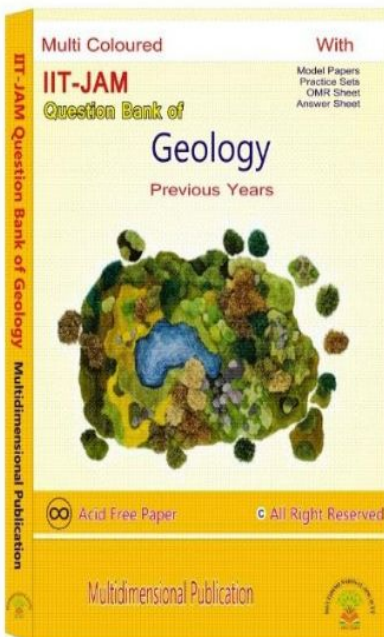
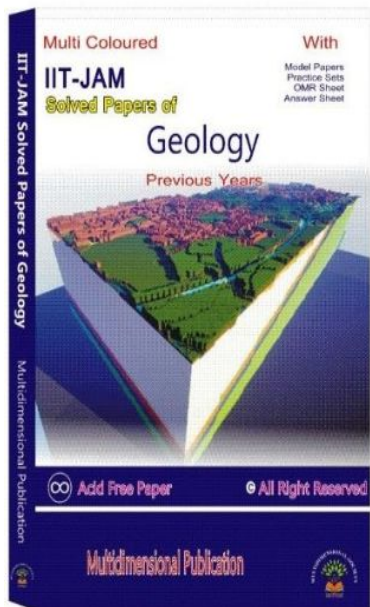
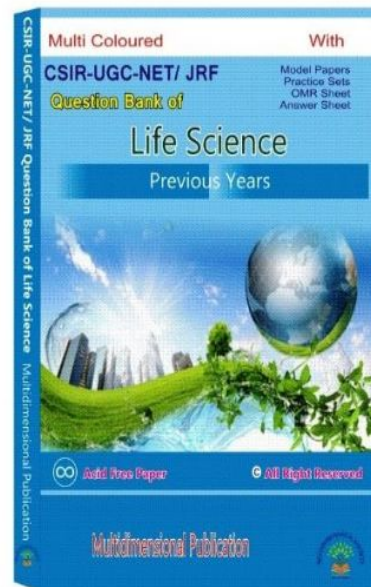
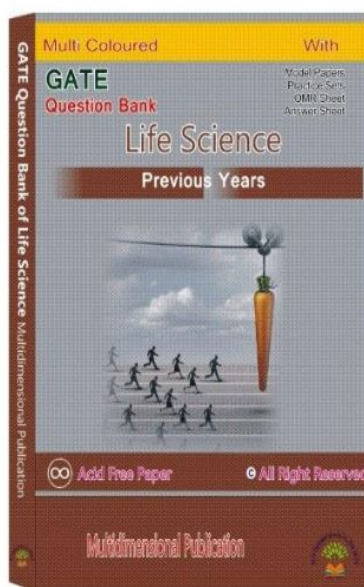
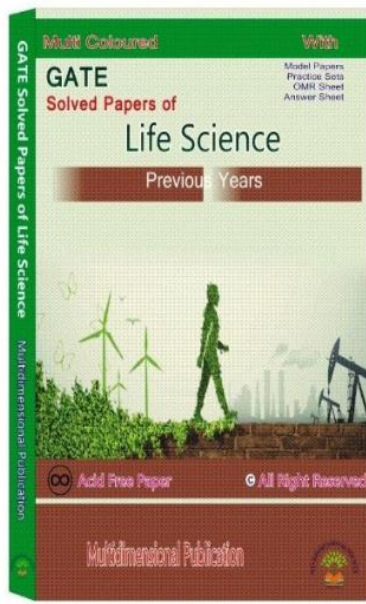
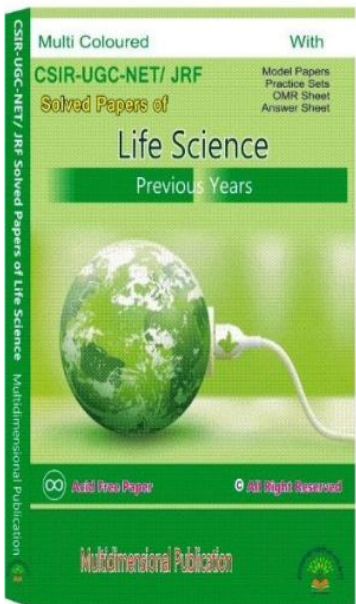
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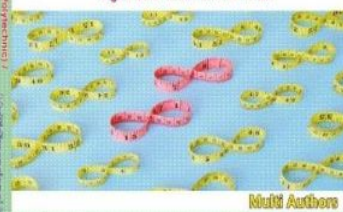
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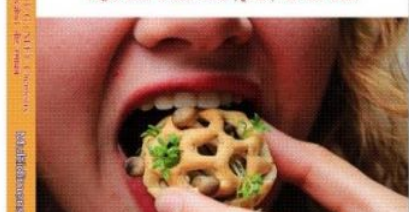
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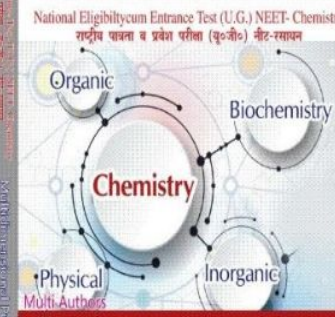
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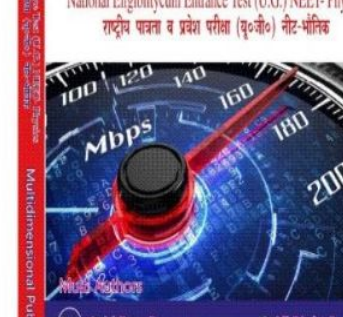
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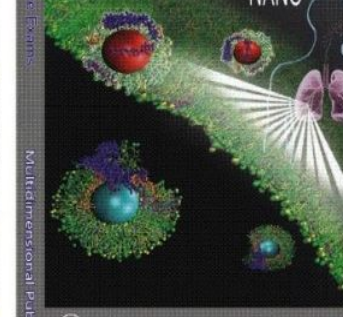
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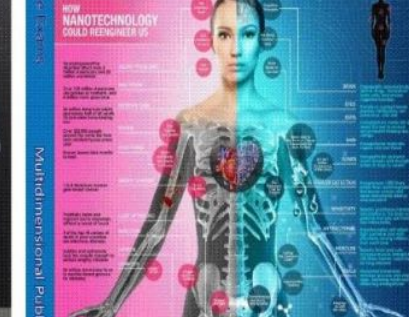
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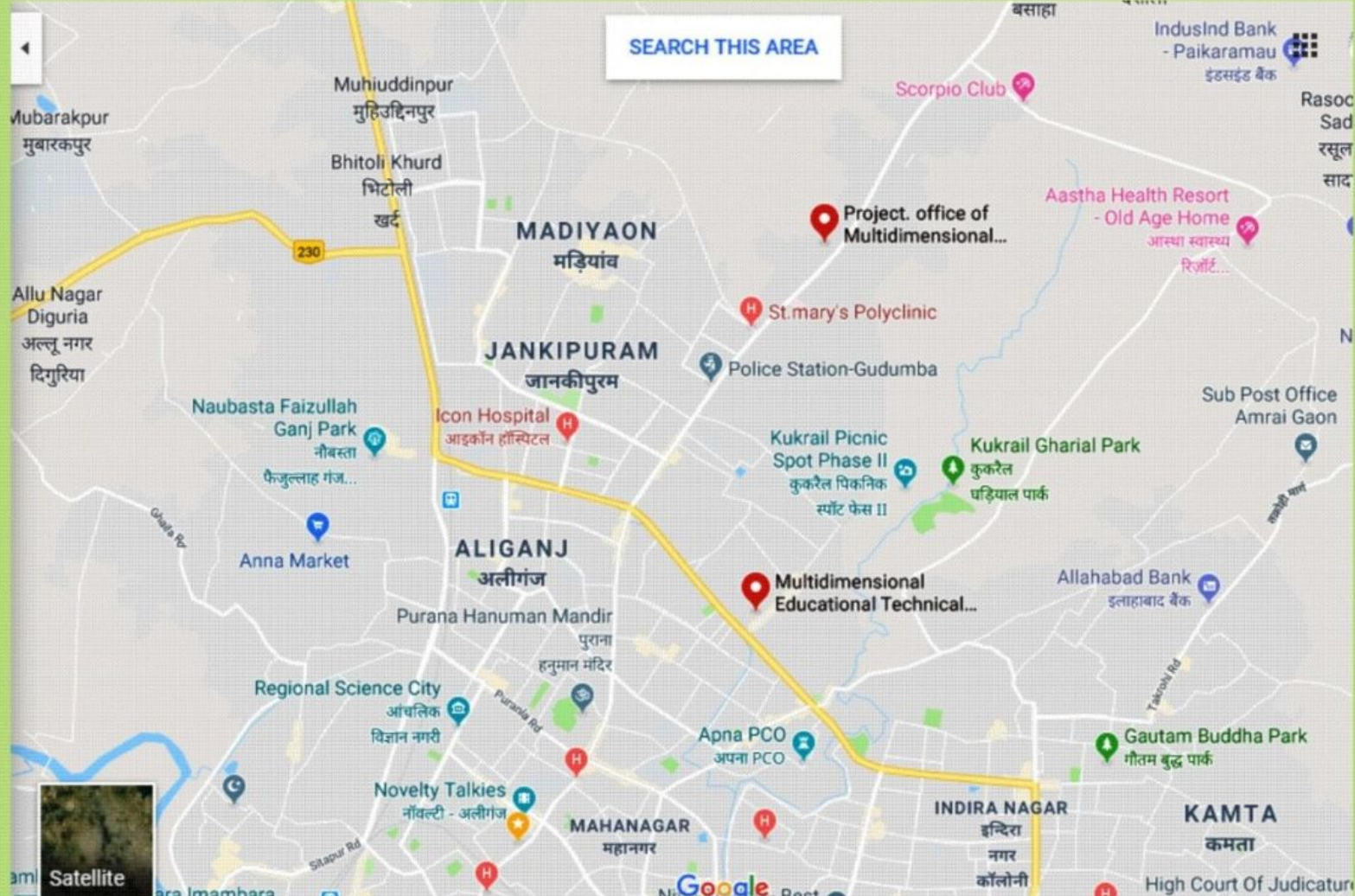
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