

KapMan Life Science Academy's

# MCQs

For

## IIT JAM Biological Science and Biotechnology



**Exclusive for IIT JAM Biological Science and Biotech**

By Manpreet Sharma & Dheeraj Singh

2<sup>nd</sup> Edition

**Published By:**

KapMan Life Science Academy

E, South Extension I

New Delhi-110049

**Marketed By:**

KapMan Life Science Academy

Production editor: Dheeraj Singh

Cover design: Kamlesh Kumari

Marketing director: Arun Kumar & Sandeep Chaudhary

**Contact Us:**

Website: [www.kapmanacademy.co.in](http://www.kapmanacademy.co.in)

Mobile No: **92053-37935**

Email: [kapmanacademy@gmail.com](mailto:kapmanacademy@gmail.com)

**Edition 2<sup>nd</sup>**

**2017**

This book comprehends the information obtained from accurate and highly reliable sources. We have made reasonable efforts to publish consistent and reliable data, but the author and the publisher cannot assume responsibility for the validity of all materials or for the consequences of their use.

No part of this book may be reproduced by any mechanical, photographic, or electronic process, or in the form of a phonographic recording, nor it may be stored in a retrieval system, transmitted, or otherwise copied for public or private use, without written permission from the publisher and authors

**KapMan Life Science Academy**

**New Delhi**

# MCQ

## IIT JAM Biological Science

## IIT JAM Biotechnology

### Mr. Manpreet Sharma

CSIR-NET-JRF, GATE, BARC, DRDO

### Er. Dheeraj Singh

(GATE/NCBS/TIFR)

M.Tech (BITS, Mishra Ranchi)



**KapMan Life Science Academy**

**New Delhi**

***Dedicated to***

***My Beloved Mother Smt. Kamlesh Rani***

***And Father Shri Ram Narayan Sharma***

## **Contents**

<b>About Authors</b>	<b>5</b>
<b>Preface</b>	<b>6</b>
<b>Exam pattern of IIT JAM</b>	<b>7-8</b>
<b>Syllabus of Biological Science</b>	<b>9</b>
<b>Syllabus of Biotechnology</b>	<b>10-11</b>
<b>Abbreviations</b>	<b>12-14</b>
• <b>Chapter 1: General Biology</b>	<b>15-61</b>
• <b>Chapter 2: Basics of Biochemistry, Molecular Biology, Biophysics</b>	<b>62-102</b>
• <b>Chapter 3: Microbiology, Cell Biology and Immunology</b>	<b>103-140</b>
• <b>Chapter 4: Mathematical Sciences</b>	<b>141-153</b>
• <b>IIT JAM Biological Science Previous Years Papers</b>	<b>154-163</b>
• <b>IIT JAM 2015</b>	
• <b>IIT JAM 2016</b>	
• <b>Tips to Crack IIT JAM</b>	<b>164-166</b>
• <b>Important Pathways in Biological Science</b>	<b>167-190</b>
• <b>Others</b>	<b>190-192</b>

## **ABOUT AUTHORS**

### **Mr. Manpreet Sharma**

Mr. Manpreet Sharma (CSIR- UGC-NET-JRF 2011/2013/2014, BARC, DRDO, DU Exam qualified) is the founder and CEO of Kapman Life Science Academy who have also done His Research work in CSIR, DRDO-INMAS and Delhi University. His research work was on Cancer biology and Radiation Biology. Mr Manpreet is passionate about Life Science and Research world and is eager to provide best quality class books for CSIR UGC NET JRF, IIT JAM and GATE in the field of Bio-science, Biotechnology and Life Science.

### **Er. Dheeraj Singh**

Er. Dheeraj Singh (TIFR/GATE/NCBS) is the editor and reviewer of book “MCQ for IIT JAM”. He qualified the GATE Exam with top ranking. He has done his M.Tech from Birla Institute of technology and Science, Mishra, Ranchi. His research work was on Biofuel and Bioprocess Technology and now he is the part of KapMan Life Science Academy. Er. Dheeraj Singh is ardent about Biological Science and wants to provide best quality books for competitive exams.

## PREFACE

It is always a dream to enter in IITs, IISc, JNU, TIFR and other MSc exams for better future. Every year IITs and IISc conduct the exam for MSc entrance in the field of Biological Science and Biotechnology. This textbook has the primary goal to practice for IIT JAM Entrance exams and Other MSc entrance exams as well. I have tried to present the best MCQs designed especially for IIT JAM and MSc entrance Exams. About 1200 MCQs covered the all subject for practice so that students can understand the pattern of questions that may be asked in IIT JAM/TIFR/JNU/MSc entrance exams. I have also tried to cover the previous year's exams for better understanding the pattern of question asked. The most noteworthy feature of this book is its crystal clear, up-to-date and critical thinking MCQ rather than the mere questions and answers. I have tried to resist the temptation to include more and more MCQs which may add the information but not increasing understanding of the basic concepts and critical thinking. I hope that this text book will be beneficial both to teachers and students.

I wish to acknowledge my heartfelt gratitude to my friends Dr. Sandeep Chaudhary (PhD from INMAS-DRDO) and Dr. Ayush Attery (PhD from NII, Delhi) for their professional guide and encouragement for undertaking this book. I am also very thankful to Er. Sachin Saini (Scientist B at SSPL-DRDO) and Kamlesh Kumari (PhD from South campus DU) for their sustained and technical support.

I also wish to acknowledge to Dr. Arun Kumar (PhD from INMAS-DRDO) and my beloved brother Er. Lakhveer Sharma for their precious contribution.

Needless to say in my maiden efforts I have taken all care exhaustively and concisely cover the best critical thinking and analytical MCQs as per updated syllabus of IIT JAM Biological Science and Biotechnology.

I look forward to receiving for your comments and suggestions towards improving this book further.

Delhi, 2017

Manpreet Sharma

## IIT JAM Exam pattern

The IIT JAM examination for all the seven test papers will be carried out as ONLINE Computer Based Test (CBT) where the candidates will be shown the questions in a random sequence on a computer screen. For all the seven test papers, the duration of the examination will be 3 hours. The medium for all the test papers will be English only. There will be a total of 60 questions carrying 100 marks. The entire paper will be divided into three sections, A, B and C. All sections are compulsory. Questions in each section are of different types as given below:

**Section–A** contains a total of 30 Multiple Choice Questions (MCQ) involving 10 questions of one mark each and 20 questions of two mark each. Each MCQ type question has four choices out of which only one choice is the correct answer. Candidates can mark the answer by clicking the choice.

**Section–B** contains a total of 10 Multiple Select Questions (MSQ) carrying two marks each. Each MSQ type question is similar to MCQ but with a difference that there may be one or more than one choice(s) that are correct out of the four given choices. The candidate gets full credit if he/she selects all the correct answers only and no wrong answers. Candidates can mark the answer(s) by clicking the choice(s).

**Section–C** contains a total of 20 Numerical Answer Type (NAT) questions involving 10 questions of one mark each and 10 questions of two mark each. For these NAT type questions, the answer is a signed real number, which needs to be entered using the virtual numeric keypad on the monitor. No choices will be shown for these types of questions. Candidates have to enter the answer by using a virtual numeric keypad.

**Negative Marking:** In all sections, questions not attempted will result in zero mark. In Section – A (MCQ), wrong answer will result in negative marks. For each wrong answer of 1 mark questions, 1/3 marks will be deducted and similarly for each wrong answer of 2 marks questions, 2/3 marks will be deducted. In Section – B (MSQ), there are no negative and no partial marking provisions. There is no negative marking in Section – C (NAT) as well.

There is provision of using online virtual calculator and hence, the candidates should not bring any calculator with them. Mobile phones or any other electronic devices are strictly prohibited inside examination hall. Charts, graph sheets, tables, are also NOT allowed inside the examination hall. A scribble pad will be provided for rough work and this has to be returned back at the end of the examination.

The candidates are required to select the answer for MCQ and MSQ type questions, and to enter the answer for NAT questions using only a mouse on a virtual numeric keypad (the keyboard of the computer will be disabled). At the end of the 3-hours the computer will automatically close the examination. Use of unfair means by a candidate in JAM, whether detected at the time of examination, or at any other stage, will lead to cancellation of his/her candidature as well as disqualification of the candidate from appearing in JAM in future.

The candidates are advised to visit the JAM website for more details on the patterns of questions for IIT-JAM, including examples of the questions. Candidates will also be able to take a mock examination through a 'Mock Test' link that will be made available on the website closer to the examination date.

## **BIOLOGICAL SCIENCES (BL) SYLLABUS FOR IIT JAM EXAM**

**General Biology:** Taxonomy of plants and animals; pro-and eukaryotic organisms; cell organelles and their function; multicellular organization; general physiology; energy transformations; internal transport systems of plants and animals; photosynthesis; respiration; regulation of body fluids and excretory mechanisms; reproductive biology; plant and animal hormones and their action; nervous systems; animal behavior; plant and animal diseases; Mendelian genetics and heredity; basics of developmental biology; biology of populations and communities; evolution; basic principles of ecology; genesis and diversity of organisms.

### **Basics of Biochemistry, Molecular Biology, Biophysics:**

Buffers; trace elements in biological systems; enzymes and proteins; vitamins; biological oxidations, photosynthesis; carbohydrates and lipids and their metabolism; digestion and absorption; detoxifying mechanisms; nucleic acids; nucleic acid metabolism; nature of gene and its function; genetic code; synthesis of nucleic acids and proteins; regulation of gene expression; operons.

Structure of biomolecules; intra and intermolecular forces; thermodynamics and kinetics of biological systems; enzyme mechanisms and kinetics; principles of X-ray diffraction; IR- and UV- spectroscopy; analytical and biochemical techniques

**Microbiology, Cell Biology and Immunology:** Classification of microorganisms and their characterization; nutrient requirement for growth; laboratory techniques in microbiology; pathogenic microorganisms and disease; applied microbiology; viruses and fungi; microbial genetics; cell theory; cell architecture; cell division; types of chromosome structure; biochemical genetics- inborn errors of metabolisms; innate and adaptive immunity, antigen antibodies; principles of processes of development.

**Mathematical Sciences:** Mathematical functions (algebraic, exponential, trigonometric) and their derivatives (derivatives and integrals of simple functions); permutations and combinations; basic probability and volumetric calculations.

## **BIOTECHNOLOGY (BT) SYLLABUS FOR IIT JAM EXAM**

The Biotechnology (BT) test paper comprises of Biology (44% weightage), Chemistry (20% weightage), Mathematics (18% weightage) and Physics (18% weightage).

### **BIOLOGY (10+2+3 level)**

**General Biology:** Taxonomy; Heredity; Genetic variation; Conservation; Principles of ecology; Evolution; Techniques in modern biology.

**Biochemistry and Physiology:** Carbohydrates; Proteins; Lipids; Nucleic acids; Enzymes; Vitamins; Hormones; Metabolism – Glycolysis, TCA cycle, Oxidative Phosphorylation; Photosynthesis. Nitrogen Fixation, Fertilization and Osmoregulation; Vertebrates-Nervous system; Endocrine system; Vascular system; Immune system; Digestive system and Reproductive System.

**Basic Biotechnology:** Tissue culture; Application of enzymes; Antigen-antibody interaction; Antibody production; Diagnostic aids.

**Molecular Biology:** DNA; RNA; Replication; Transcription; Translation; Proteins; Lipids and Membranes; Operon model; Gene transfer.

**Cell Biology:** Cell cycle; Cytoskeletal elements; Mitochondria; Endoplasmic reticulum; Chloroplast; Golgi apparatus; Signaling.

**Microbiology:** Isolation; Cultivation; Structural features of virus; Bacteria; Fungi; Protozoa; Pathogenic micro-organisms.

### **CHEMISTRY (10+2+3 level)**

Atomic Structure: Bohr's theory and Schrodinger wave equation; Periodicity in properties; Chemical bonding; Properties of s, p, d and f block elements; Complex formation; Coordination compounds; Chemical equilibria; Chemical thermodynamics (first and second law); Chemical kinetics (zero, first, second and third order reactions); Photochemistry; Electrochemistry; Acid-base concepts; Stereochemistry of carbon compounds; Inductive, electromeric, conjugative effects and resonance; Chemistry of Functional Groups:

Hydrocarbons, alkyl halides, alcohols, aldehydes, ketones, carboxylic acids, amines and their derivatives; Aromatic hydrocarbons, halides, nitro and amino compounds, phenols, diazonium salts, carboxylic and sulphonic acids; Mechanism of organic reactions; Soaps and detergents; Synthetic polymers; Biomolecules – amino acids, proteins, nucleic acids, lipids and carbohydrates (polysaccharides); Instrumental techniques – chromatography (TLC, HPLC), electrophoresis, UV-Vis, IR and NMR spectroscopy, mass spectrometry.

### **MATHEMATICS (10+2 level)**

Sets, Relations and Functions, Mathematical Induction, Logarithms, Complex numbers, Linear and Quadratic equations, Sequences and Series, Trigonometry, Cartesian System of Rectangular Coordinates, Straight lines and Family, Circles, Conic Sections, Permutations and Combinations, Binomial Theorem, Exponential and Logarithmic Series, Mathematical Logic, Statistics, Three Dimensional Geometry, Vectors, Matrices and Determinants, Boolean Algebra, Probability, Functions, limits and Continuity, Differentiation, Application of Derivatives, Definite and Indefinite Integrals, Differential Equations.

### **PHYSICS (10+2 level)**

Physical World and Measurement, Elementary Statics and Dynamics, Kinematics, Laws of Motion, Work, Energy and Power, Electrostatics, Current electricity, Magnetic Effects of Current and Magnetism, Electromagnetic Induction and Alternating Current, Electromagnetic waves, Optics, Dual Nature of Matter and Radiations, Atomic Nucleus, Solids and Semiconductor Devices, Principles of Communication, Motion of System of Particles and Rigid Body, Gravitation, Mechanics of Solids and Fluids, Heat and Thermodynamics, Oscillations, Waves.

## **ABBREVIATIONS**

<b>μm</b>	<b>micrometer</b>
<b>Å</b>	<b>angstrom</b>
<b>A260</b>	<b>absorbance at 260 nm</b>
<b>Ab</b>	<b>antibody</b>
<b>AD</b>	<b>activation domain</b>
<b>ADA</b>	<b>adenosine deaminase</b>
<b>ADP</b>	<b>adenosine 5'-diphosphate</b>
<b>AFLP</b>	<b>amplified fragment length polymorphism</b>
<b>AFM</b>	<b>atomic force microscopy</b>
<b>Ag</b>	<b>antigen</b>
<b>AMP</b>	<b>adenosine 5'-monophosphate</b>
<b>ATP</b>	<b>adenosine 5'-triphosphate</b>
<b>bis</b>	<b>bisacrylamide N,N'-methylenebisacrylamide</b>
<b>bp</b>	<b>base pair</b>
<b>BrdU</b>	<b>5-bromo-2-deoxyuridine</b>
<b>cccDNA</b>	<b>covalently closed circular DNA</b>
<b>CD</b>	<b>circular dichroism</b>
<b>cDNA</b>	<b>complementary DNA</b>
<b>CM</b>	<b>carboxymethyl</b>
<b>CNBr</b>	<b>cyanogen bromide</b>
<b>cpm</b>	<b>counts per minute</b>
<b>Da</b>	<b>dalton</b>
<b>dATP</b>	<b>deoxyadenosine triphosphate</b>
<b>DAPI</b>	<b>4',6-diamidino-2-phenylindole dihydrochloride</b>
<b>DBD</b>	<b>DNA binding domain</b>
<b>DBM</b>	<b>diazobenzyloxymethyl</b>
<b>ddNTP</b>	<b>dideoxynucleoside triphosphate</b>
<b>DEAE</b>	<b>diethylaminoethyl</b>
<b>DMS</b>	<b>dimethyl sulfate</b>
<b>dNTP</b>	<b>deoxynucleoside triphosphate</b>

<b>ELISA</b>	<b>enzyme-linked immunosorbent assay</b>
<b>EMSA</b>	<b>electrophoretic mobility shift assay</b>
<b>ER</b>	<b>electromagnetic radiation</b>
<b>EtBr</b>	<b>ethidium bromide</b>
<b>FACS</b>	<b>fluorescence activated cell sorter</b>
<b>FISH</b>	<b>fluorescence in situ hybridization</b>
<b>FITC</b>	<b>fluorescein isothiocyanate</b>
<b>FRAP</b>	<b>fluorescence recovery after photobleaching</b>
<b>FRET</b>	<b>fluorescence (Förster) resonance energy transfer</b>
<b>GC</b>	<b>gas chromatography</b>
<b>GFP</b>	<b>green fluorescent protein</b>
<b>GLC</b>	<b>gas-liquid chromatography</b>
<b>GSC</b>	<b>gas-solid chromatography</b>
<b>HAT</b>	<b>hypoxanthine-aminopterin-thymidine</b>
<b>HGPRT</b>	<b>hypoxanthine-guanine phosphoribosyl transferase</b>
<b>HPLC</b>	<b>high performance liquid chromatography</b>
<b>Ig</b>	<b>immunoglobulin</b>
<b>IR</b>	<b>infrared</b>
<b>kb</b>	<b>kilobase</b>
<b>kcal</b>	<b>kilocalorie</b>
<b>Kd</b>	<b>partition or distribution coefficient</b>
<b>kDa</b>	<b>kilodalton</b>
<b>LC</b>	<b>liquid chromatography</b>
<b>mAb</b>	<b>monoclonal antibody</b>
<b>MALDI</b>	<b>matrix-assisted laser desorption/ionization</b>
<b>Mb</b>	<b>megabase pair</b>
<b>MRI</b>	<b>magnetic resonance imaging</b>
<b>MS</b>	<b>mass spectrometry</b>
<b>NA</b>	<b>numerical aperture</b>
<b>nm</b>	<b>nanometer</b>
<b>NMR</b>	<b>nuclear magnetic resonance</b>
<b>ORD</b>	<b>optical rotatory dispersion</b>

<b>PAGE</b>	<b>polyacrylamide gel electrophoresis</b>
<b>PCR</b>	<b>polymerase chain reaction</b>
<b>PE</b>	<b>phycoerythrin</b>
<b>PFGE</b>	<b>pulsed-field gel electrophoresis</b>
<b>PI</b>	<b>propidium iodide</b>
<b>RACE</b>	<b>rapid amplification of cDNA ends</b>
<b>RAPD</b>	<b>random amplification of polymorphic DNA</b>
<b>RFLP</b>	<b>restriction fragment length polymorphism</b>
<b>RIA</b>	<b>radioimmunoassay</b>
<b>RPM</b>	<b>revolution per minute</b>
<b>RT-PCR</b>	<b>reverse transcription polymerase chain reaction</b>
<b>SDS sodium</b>	<b>dodecylsulfate</b>
<b>SEM</b>	<b>scanning electron microscope</b>
<b>STM</b>	<b>scanning tunneling electron microscopy</b>
<b>Taq</b>	<b>Thermus aquaticus</b>
<b>TdT</b>	<b>terminal deoxynucleotidyl transferase</b>
<b>TEM</b>	<b>transmission electron microscope</b>
<b>TEMED</b>	<b>N, N, N', N'-tetramethylethylenediamine</b>
<b>TLC</b>	<b>thin layer chromatography</b>
<b>Tm</b>	<b>melting temperature</b>
<b>Tris</b>	<b>tris(hydroxymethyl)aminomethane</b>
<b>UV</b>	<b>ultraviolet</b>

## Ecological principles and Biodiversity

### 1. Select the correct statement about biodiversity

- A. The desert areas of Rajasthan and Gujarat have a very high level of desert animal species as well as numerous rare animals
- B. Large scale planting of BT cotton has no adverse effect on biodiversity
- C. Western Ghats have a very high degree of species richness and endemism
- D. Conservation of biodiversity is just a fad pursued by the developed countries

### 2. Biodiversity of a geographical region represents

- A. Genetic diversity present in the dominant species of the region
- B. Species endemic to the region
- C. Endangered species found in the region
- D. The diversity in the organisms living in the region

### 3. Which one of the following is not used for ex situ plant conservation?

- A. Field gene banks
- B. Seed banks
- C. Shifting cultivation
- D. Botanical Gardens

### 4. Which of the following represent maximum number of species among global biodiversity?

- A. Algae
- B. Lichens
- C. Fungi
- D. Mosses and Ferns

### 5. Prolonged liberal irrigation of agricultural fields is likely to create the problem of

- A. Aridity
- B. Metal toxicity
- C. Salinity
- D. Acidity

### 6. Which one of the following is not included under in situ conservation?

- A. National park

- B. Wild life sanctuary
- C. Zoological garden
- D. Biosphere reserve

**7.  $-1^{\circ}\text{C}$  to  $13^{\circ}\text{C}$  annual variations in the intensity and duration of temperature and 50 to 250 cm annual variation in precipitation, account for the formation of major biome as:**

- A. Tropical forest
- B. Coniferous forest
- C. Temperate forest
- D. Grassland

**8. Concept of ecological pyramids was proposed by**

- A. Odum
- B. Clements
- C. Tansley
- D. Charles Elton

**9. The term 'Ecosystem' was coined by**

- A. Odum
- B. Clements
- C. Arthur G. Tansley
- D. Elton

**10. Xeric environment is characterized by**

- A. High precipitation
- B. Low atmospheric humidity
- C. Extremes of temperatures
- D. High rate of vaporization

**11. Which one of the following types of organisms occupy more than one trophic level in a pond ecosystem?**

- A. Frog
- B. Phytoplankton
- C. Fish
- D. Zooplankton

**12. Which one of the following statements is correct for secondary succession?**

- A. It is similar to primary succession except that it has a relatively fast pace
- B. It begins on a bare rock
- C. It occurs on a deforested site
- D. It follows primary succession

**13. Total amount of living material at the various trophic levels of a food chain is depicted by pyramids of**

- A. Numbers
- B. Energy
- C. Biomass
- D. All of these

**14. Which one of the following statements for pyramid of energy is incorrect, whereas the remaining three are correct?**

- A. It is upright in shape
- B. Its base is broad
- C. It shows energy content of different trophic level organisms
- D. It is inverted in shape

**15. Which of the following ecosystems has highest rate of gross primary production?**

- A. Grasslands
- B. Mangroves
- C. Coral reefs
- D. Equatorial rain forests

**16. When the two ecosystems overlap each other, the area is called**

- A. Habitat
- B. Niche
- C. Ecotone
- D. Ecotype

**17. The tiny free-swimming animals on the surface of water constitute**

- A. Phytoplankton
- B. Symbionts
- C. Benthos
- D. Zooplankton

**18. The biomass available for consumption by the herbivores and the decomposers is called**

- A. Gross primary productivity
- B. Net primary productivity
- C. Secondary productivity
- D. Standing crop

**19. Transfer of energy in different trophic levels of an ecosystem is called**

- A. Bioenergetics
- B. Biosystem
- C. Geobiocoenosis
- D. Holocoenotic

**20. The species, though insignificant in number, determine the existence of many other species in a given ecosystem. Such species is known as**

- A. Keystone species
- B. Sacred species
- C. Endemic species
- D. Extinct species

**21. DDT residues are rapidly passed through food chain causing biomagnification because DDT is**

- A. Water soluble
- B. Lipo soluble
- C. Moderately toxic
- D. Non-toxic to aquatic animals

**22. Animals living at the bottom of the sea are known as**

- A. Lentic
- B. Pelagic
- C. Benthic
- D. Lotic

**Why Waiting...! Crack the IIT JAM and other MSc exam...!**

**Order your copy Now....! Visit us at [www.kapmanacademy.co.in](http://www.kapmanacademy.co.in) or call us at 92053-37935**