P R E F A C E

The idea of the book entitled **"SET Life Science"** was born because of the lack of any comprehensive book that has a collection of SET life-science papers, an exam conducted by various government organizations at the state level. These compiled questions besides covering all the aspects of SET exams, will also be valuable resources for various entry-level life science competitive examinations in particular conducted by CSIR, DBT, ICAR, ICMR, ASRB, IARI, and National Eligibility Test, but not limited.

This book covers questions from SET exams of Andhra Pradesh, Assam, Chhattisgarh, Gujarat, Jammu and Kashmir, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan, Tamil Nadu, Telangana and West Bengal.

The questions cover practice for all the subjects of life science such as Biochemistry, Cell Biology, Molecular Biology, Signaling, Cancer, Immunology, Developmental Biology, Plant Physiology, Animal Physiology, Genetics, Taxonomy, Diversity, Ecology, Evolution, Biotechnology and Bio-techniques.

The ultimate purpose of this book is to equip the reader with brainstorming challenges and solutions for life science and applied aspect examinations. It contains predigested information on all the academic subjects of life science for good understanding, assimilation, self-evaluation, and reproducibility. Although we have made every effort to make the book error-free, we are under no illusion. We welcome comments, criticism, and suggestions from the readers to evolve the content.

Kailash Choudhary
Dadasaheb Sondge

A C K N O W L E D G E M E N T

First and foremost, I'd like to thank our entire Institute for Advanced Studies (IFAS) students for inspiring me to write this book. I would like to express my gratitude to Er. Radheshyam Choudhary, the Founding CEO of IFAS Edutech Pvt. Ltd., for his continuous support, continual motivation, and critical insights that have helped us transform our dream into reality.

My special thanks to Mr. Lalji Kanojiya, Mr. Digambar Jagtap, Mr. Pranshu Dwivedi, Mr. Vishal Bhujbal, Miss. Mamta Marar, Mr. Dipak Kumar and Mr. Yogesh Bishnoi for reviewing and assisting me in preparing the systematic layout; your comments were invaluable in improving the content of this book.

I also want to thank Dr. Rakesh Kumawat for their assistance in sorting and compiling questions by chapter and section. Thank you also to Miss. Jeel Patel, Miss. Vaishnavi Bhilare, Miss. Priyanka Jena, Miss. Pradnya Nikam and Miss. Rupali Gharage for proofreading and verifying answers. I should not forget to express my gratitude to the IFAS team, where I was able to continue my teaching and especially learn the many facets of the process of building this book.

This book is the result of a collaborative effort, and it would not have been possible without the outstanding members of the IFAS Publication team. During the production of this book, it was a pleasure to collaborate with many other dedicated and creative members of IFAS publications. Special thanks to Mr. Vikendra Metha for turning our ideas into a beautiful cover page design and text diagram. Mr. Govind Kumar Prajapat and his team should also be thanked for formatting and typesetting.

And finally, my humble greetings to all who put in their significant efforts and are unmentioned.

Kailash Choudhary
Dadasaheb Sondge

SET EXAM SCHEME

LIFE SCIENCE

The set examination scheme has changed from time to time.

The examination scheme given below is applicable from 2019 onwards.

The University Grants Commission (U.G.C.), while prescribing the revised pay Scale for teachers in Colleges and universities, in accordance with the Fourth Pay Commission, has prescribed that the person being appointed as Assistant Professor shall qualify for the new scales provided he/she clears, the Eligibility Test, to be conducted by the U.G.C., in addition to the minimum qualifications already prescribed. The U.G.C accordingly conducts the National Educational Tests (NET), for many subjects. The U.G.C. and the CSIR (Council for Scientific and Industrial Research) conducts combined tests for science subjects. In view of the fact that the number of candidates who are required to be qualified for being appointed as Assistant Professors, under the new pay scale, is fairly large, the U.GC has authorized the State Governments or the state Agencies on behalf of the State Governments to conduct the State Eligibility Test (SET) for Assistant Professor, provided, the SET is duly accredited by the U.G.C.

The SET is conducted by a state agency nominated by the state government as per the guidelines of UGC. The test is Objective Mode and consists of two papers. All two papers consist of only objective-type questions and held on the day of Examination in two separate sessions without break as under:

Session	**Paper**	**Number of Multiple Choice Questions**	**Marks**	**Duration**
First	I	50 questions all of which are compulsory	$50 \times 2 = 100$	1 hour
Second	II	100 questions all of which are compulsory	$100 \times 2 = 200$	2 hours

Paper-I shall be of general nature, intended to assess the teaching/research aptitude of the candidate. It is primarily designed to test reasoning ability, comprehension, divergent thinking, and general awareness of the candidate. Paper I shall consist of fifty (50) objective-type compulsory questions of two marks each.

Paper-II of life science will contain 100 compulsory MCQs, of two marks each and the duration of this paper has been made as two hours (120 minutes), as per UGC letter No. F.4-2/90(NET/SET Policy) dated 19th January, 2019."

There will be no negative marking

INDEX

Chapter 1: Molecules & Their Interaction Relevant

1.1: Structure of Atoms, Molecules & Chemical Bonds 1
1.2: Composition, Structure and Function of Biomolecules 2
1.3: Stabilizing Interactions 7
1.4: Principles of Biophysical Chemistry 8
1.5: Bioenergetics, Glycolysis, Oxidative Phosphorylation, Coupled Reaction, Group Transfer, Biological Energy Transducers..... 11
1.6: Principles of Catalysis, Enzymes and Enzyme Kinetics, Enzyme Regulation, Mechanism of Enzyme Catalysis, Isozymes..... 18
1.7: Conformation of Proteins: (Ramachandran Plot, Secondary Structure, Domains, Motif and Folds) 22
1.8: Conformation of Nucleic Acids: (helix (A, B, Z), t-RNA, micro-RNA)..... 25
1.9: Stability of Proteins and Nucleic Acids 26
1.10: Metabolism of Carbohydrates, Lipids, Amino Acids Nucleotides and Vitamins 27

Chapter 2: Cellular Organization

2.1: Membrane Structure and Function 34
2.2: Structural Organization and Function of Intracellular Organelles 45
2.3: Organization of Genes and Chromosomes..... 54
2.4: Cell Division and Cell Cycle 58
2.5: Microbial Physiology..... 63

Chapter 3: Fundamental Processes

3.1: DNA Replication, Repair & Recombination 66
3.2: RNA Synthesis and Processing..... 77
3.3: Protein Synthesis and Processing..... 85
3.4: Control of Gene Expression at Transcription and Translation Level 92

Chapter 4: Cell Communication & Cell Signalling

4.1: Host Parasite Interaction 102
4.2: Cell Signalling Hormones & Their Receptors..... 105
4.3: Cellular Communication..... 114
4.4: Cancer 117
4.5: Innate and Adaptive Immune System..... 122

Chapter 5: Developmental Biology

5.1: Basic Concepts of Development 135
5.2: Gametogenesis, Fertilization and Early Development..... 137
5.3: Morphogenesis and Organogenesis in Animals..... 143
5.4: Morphogenesis & Organogenesis in Plants ... 149
5.5: Programmed Cell Death, Aging and Aenescence 154

Chapter 6: Plant Physiology

6.1: Photosynthesis..... 156
6.2: Respiration and Photorespiration..... 164
6.3: Nitrogen Metabolism – Nitrate and Ammonium Assimilation; Amino Acid Biosynthesis..... 166
6.4: Plant Hormones – Biosynthesis, Storage, Breakdown & Transport; Physiological Effects & Mechanisms of Action 169
6.5: Sensory Photobiology 175
6.6: Solute Transport and Photoassimilate Translocation..... 177
6.7: Secondary Metabolites 183
6.8: Stress Physiology..... 185

Chapter 7: Animal Physiology

7.1: Blood and Circulation..... 187
7.2: Cardiovascular System 190
7.3: Respiratory System 193
7.4: Nervous System 195

7.5: Sense Organs – Vision, Hearing and Tactile Response 200
7.6: Excretory System 202
7.7: Thermoregulation 206
7.8: Stress and Adaptation 206
7.9: Digestive System Digestion, Absorption, Energy Balance, BMR 206
7.10: Endocrinology and Reproduction 208

Chapter 8: Inheritance Biology

8.1: Mendelian Principles: Dominance, Segregation, Independent Assortment 216
8.2: Concept of Gene: Allele, Multiple Alleles, Pseudoallele, Complementation Tests 218
8.3: Extensions of Mendelian Principles 219
8.4: Gene Mapping Methods 226
8.5: Extra Chromosomal Inheritance 228
8.6: Microbial Genetics 230
8.7: Human Genetics: Pedigree Analysis, Lod Score For Linkage Testing, Karyotypes, Genetic Disorders 232
8.8: Quantitative Genetics: Polygenic Inheritance, Heritability and Its Measurements, QTL Mapping 236
8.9: Mutation 237
8.10: Structural and Numerical Alterations of Chromosomes 238
8.11: Recombination: Homologous and Non-Homologous Recombination Including Transposition 242

Chapter 9: Diversity

9.1: Principles & Methods of Taxonomy 243
9.2: Levels of Structural Organization 251
9.3: Outline Classification of Plants, Animals & Microorganisms 256
9.4: Natural History of Indian Subcontinent 267
9.5: Organisms of Health and Agricultural Importance 268
9.6: Organisms of Conservation Concern 273

Chapter 10: Ecological Principles

10.1: The Environment: Physical Environment; Biotic Environment; Biotic & Abiotic Interactions 274
10.2: Habitat and Niche 275
10.3: Population Ecology 277
10.4: Species Interactions 280
10.5: Community Ecology 282
10.6: Ecological Succession 288
10.7: Ecosystem Ecology 290
10.8: Biogeography 296
10.9: Applied Ecology 298
10.10: Conservation Biology 304

Chapter 11: Evolution & Behaviour

11.1: Emergence of Evolutionary Thoughts Lamarck 310
11.2: Origin of Cells and Unicellular Evolution: 312
11.3: Paleontology and Evolutionary History: 315
11.4: Molecular Evolution 318
11.5: The Mechanisms: Population Genetics 322
11.6: Brain, Behavior and Evolution 332

Chapter 12: Applied Biology

12.1: Microbial Fermentation & Production of Small & Macromolecules 338
12.2: Application of Immunological Principles, Vaccines, Diagnostics. Tissue and Cell Culture Methods for Plants and Animals 341
12.3: Transgenic Animals and Plants, Molecular Approaches to Diagnosis and Strain Identification 344
12.4: Genomics and Its Application to Health and Agriculture, Including Gene Therapy 352
12.5: Breeding in Plants and Animals, Including Marker – Assisted Selection 353
12.6: Bioremediation and Phytoremediation 355
12.7: Biosensors 358

Chapter 13: Method in Biology

13.1: Molecular Biology and Recombinant DNA Methods..... 359
13.2: Histochemical and Immunotechniques..... 382
13.3: Biophysical Method..... 384
13.4: Statistical Methods..... 388
13.5: Radiolabeling Techniques..... 392
13.6: Microscopic Techniques..... 393
13.7: Electrophysiological Methods..... 397
13.8: Methods in Field Biology..... 398

CHAPTER-1
BIOCHEMISTRY

MOLECULES & THEIR INTERACTION RELEVANT TO BIOLOGY

Unit-1.1: Structure of Atoms, Molecules & Chemical Bonds

[MH-2015]

1. Water is effective in screening the electrostatic interactions between dissolved ions because it has
   (A) a high dielectric constant
   (B) a high fluidity property
   (C) a high electrical conductivity
   (D) a neutral pH value

[MH-2015]

2. When two uncharged atoms are brought very close together, the two nuclei are said to be in van der Waals contact, when the net:
   (A) attraction is maximum
   (B) repulsion is maximum
   (C) attraction is equal to repulsion
   (D) attraction is minimum

[WB-2015]

3. The energy is most favourable at the van der Waals contact distance. Owing to electron-electron repulsion, the energy rises rapidly as the distance between the atoms becomes shorter than the
   (A) Contact distance
   (B) Polar distance
   (C) Bond length
   (D) Electric dipole

[CG-2017]

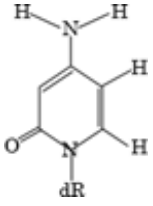
4. Which of the following covalent bond types are found in the structure of 'ATP'
   (A) N-glycosidic, thioester phosphodiester
   (B) Phosphoanhydride, phosphomonoester, N-glycosidic
   (C) Ester, ether, phospho anhydride
   (D) Ether, thioester, phosphomonoester

[MP-2017]

5. The magnitude of ionization potential depends upon:
   (A) Radius of the atom
   (B) Magnitude of positive charge on the nucleus
   (C) Number of electron orbits
   (D) All are correct

[TN-2017]

6. Name the following structure



   (A) Deoxy cystidine
   (B) 5-methyl – Deoxycystidine
   (C) heterochromatin
   (D) Deoxy uridine

[CG-2018]

7. The strong tendency of the water to exclude _____. is frequently referred to as hydrophobic bond.
   (A) Non-polar groups (B) Polar groups
   (C) Hydroxyl group (D) Both (B) and (C)

[JK-2018]

8. Which of the following shows the types of bonding in decreasing order of strength?
   (A) Covalent, hydrogen, Van der Waals
   (B) Covalent, Van der Waals, Hydrogen
   (C) Hydrogen, Van der Waals, Covalent
   (D) Van der Waals, Hydrogen, Covalent

[MH-2018]

9. Carbon-14 undergoes beta decay upon which it is converted into a new element having:
   (A) Increased atomic number
   (B) Decreased atomic number
   (C) Increased mass number
   (D) Decreased mass number

[MH-2019]

10. By what process does Thorium-230 decay to radium-226?
    (A) Gamma emission (B) Alpha emission
    (C) Beta emission (D) Electron capture

[WB-2020]

11. Configuration of a protein can only be altered by breaking
    (A) Hydrogen bond
    (B) Disulfide bond
    (C) Hydrophobic interaction
    (D) Ionic interaction

[GJ-2021-DEC]

12. Po (atomic mass 216 and atomic number 84) undergoes decay to form Po (atomic mass 212 and atomic number 84). Po →→→ Po. What radioactive particles are emitted in this decay?
    (A) $2a + 2^-$ (B) $a + \beta^-$
    (C) $2a + 2\beta^+$ (D) $a + 2\beta^-$

[GJ-2022]

13. Water is an excellent solvent for polar molecules. The reason is that water
(A) Greatly strengthens electrostatic forces
(B) Greatly weakens electrostatic forces
(C) Greatly strengthens hydrogen bond formation
(D) Greatly weakens hydrophobic interaction

[MH-2024]

14. Hydrogen bonds are present in water structure. Presence of hydrogen bonds gives a characteristic property to water, which is:
(A) High melting and high boiling points
(B) High melting and low boiling points
(C) Low melting and high boiling points
(D) Low melting and low boiling points

[GJ-2024]

15. Match the items in Group - A with their corresponding functions in Group - B, and choose the correct option.

Group - A	Group - B
1. C, H, O and N	a. elements that activate or inhibit enzymes
2. Mg and P	b. elements of biomolecules and structural elements
3. Na and K	c. elements of energy related chemical compounds
4. Zn and Mg	d. alters the osmotic potential of cell

Code:
(A) 1-d; 2-c; 3-a; 4-b (B) 1-b; 2-c; 3-d; 4-a
(C) 1-d; 2-a; 3-c; 4-b (D) 1-a; 2-c; 3-d; 4-b

Answer Key									
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
A	C	A	B	D	A	A	A	A	B
11	**12**	**13**	**14**	**15**					
A	D	C	A	B					

Unit-1.2: Composition, Structure and Function of Biomolecules

(Carbohydrates, Lipids, Proteins, Nucleic Acids and Vitamins).

[KA-2015]

1. The relationship between D-Glucose and d-Glucose is
(A) Both are the same
(B) D-refers to optical rotation and d-refers to configuration
(C) D-refers to configuration and d-refers to optical activity
(D) D configuration always gives rise to dextro rotation

[MH-2015]

2. What is the role of peptidoglycan?
(A) extracellular adhesive
(B) gives rigidity and strength to exoskeletons
(C) gives rigidity and strength to cell envelope
(D) energy storage

[MH-2015]

3. Which of the following enzyme reactions is termed as acyl group transfer reaction?
(A) Chymotrypsin (B) Lysozyme
(C) Hexokinase (D) Isomerase

[MH-2016]

4. Water readily dissolves charged biomolecules by replacing
(A) water molecules by solute molecules
(B) solute-solute hydrogen bonds by solute-water hydrogen bonds
(C) big molecules by small molecules
(D) positive charges by negative charges

[GJ-2016]

5. Which one of the following sugar is present in all cells of aquatics monocotyledons?
(A) Sorbose (B) Rhamnose
(C) Galactose (D) Apiose

[GJ-2016]

6. The most common storage polysaccharide in yeast is
(A) Glycogen (B) Starch
(C) Dextrans (D) Cellulose

[GJ-2016]

7. Which of the following is a keto triose?
(A) Glyceraldehyde (B) Dihydroxyacetone
(C) Erythrose (D) Arabinose

[GJ-2016]

8. Milk protein casein is a:
(A) Nucleoprotein (B) Phosphoprotein
(C) Lipoprotein (D) Glycoprotein

[GJ-2016]

9. Which of the following is not a conjugated protein?
(A) Peptone (B) Phosphoprotein
(C) Lipoprotein (D) Glycoprotein

10. Match Column I with Column II.

Column I	Column II
(a) Thiamine Pyrophosphate	(i) L-amino acid oxidase
(b) Biotin	(ii) Transaminases
(c) Pyridoxal phosphate	(iii) Pyruvate carboxylase
(d) Flavin mononucleotide	(iv) Pyruvate Decarboxylase

Codes:
(A) a-ii, b-i, c-iv, d-iii (B) a-I, b-iii, c-iv, d-ii
(C) a-iii, b-I, c-ii, d-iv (D) a-iv, b-iii, c-ii, d-i

[AP-2017]

11. The three amino acids present in glutathione are:
    (A) Glutamic acid, cysteine, Glycine
    (B) Cysteine, alanine, proline
    (C) Alanine, Serine, Aspartic acid
    (D) Leucine, Glycine, Glutamic acid

[CG-2017]

12. Glycogen is a branched polymer of glucose, it has:
    (A) No reducing ends.
    (B) No non-reducing ends.
    (C) One reducing end and several non-reducing ends.
    (D) One non-reducing end and several reducing ends.

[CH-2017]

13. Some inorganic elements that serve as co-factor for enzymes. Match Table-I and Table - II.

Table – I	Table – II
(A) Cytochrome oxidase	(i) K^+
(B) Pyruvate kinase	(ii) Cu^{2+}
(C) Dinitrogenase	(iii) Ni^{2+}
(D) Urease	(iv) Mo

Choose the correct answer:

	(A)	(B)	(C)	(D)
(A)	(i)	(ii)	(iii)	(iv)
(B)	(iii)	(iv)	(i)	(ii)
(C)	(ii)	(i)	(iv)	(iii)
(D)	(iv)	(i)	(ii)	(iii)

[GJ-2017]

14. Which one of the following is a structural homopolysaccharide?
    (A) Hyaluronic acid
    (B) Inulin
    (C) Chitin
    (D) Starch

[KA-2017]

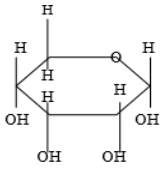
15. Why do fats give more energy than carbohydrates?
    (A) Fats have carboxyl group
    (B) Fats are more reduced than carbohydrates
    (C) Fats are larger than carbohydrates
    (D) Fats have more number of bonds than carbohydrates

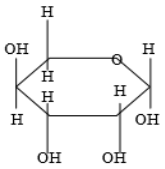
[MP-2017]

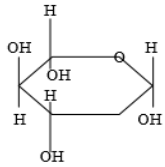
16. Chitin, is a linear polymer with:
    (A) α D-galactouronic units with (1→ 4) linkage
    (B) N - acetyl-D-glucosamine units with β (1→ 4)
    (C) 4-O-methylglucoronic acid with β (1→ 4) linkage 4
    (D) β-D-glucose units with β (1→ 4) linkage -D

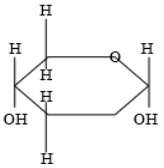
[TN-2017]

17. Which is the furanose form of D-ribose?

1) 

2) 

3) 

4) 

[TN-2017]

18. What products are obtained when 1-palmityl-2-oleyl-3-phosphatidyl serine is hydrolyzed by a phospholipase A1
    (A) palmitic acid and 2-oleoyl-3-phosphatidyl serine
    (B) oleic acid and 1-palmitoyl – 3- phosphatidyl serine
    (C) phosphoserine and 1-palmitoyl – 2 – oleoyl – glycerol
    (D) serine and 1-palmotyl – 2 – oleoyl – phosphatic acid

[MH-2017]

19. Raffinose is a carbohydrate and aminor constituent of sugar beets. Which class of arbohydrates from below does it belong to?
    (A) Monosaccharide (B) Disaccharide
    (C) Trisaccharide (D) Polysaccharide

[MH-2017]

20. Phytochelatins are low-molecular- weight thiols consisting of the:
    (A) Organic acids (B) Amino acids
    (C) Fatty acids (D) Nucleic acids

[MH-2017]

21. The genome of which of the following virus obeys Chargaff's rule?
    (A) TMV (B) Mu phage
    (C) ox 174 (D) Adenovirus

[TN-2017]

22. The empirical formula of thiamine is
    (A) C_{12} H_4 N_{17} OS (B) C_{12} H_{17} N_4 OS
    (C) C_{17} H_{12} N_4 OS (D) C4 H_{17} N_{12} OS

[WB-2017]

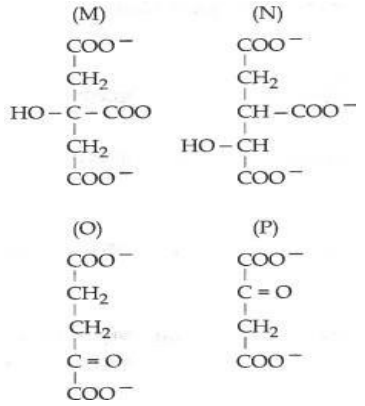
23. Teichoic acid is composed of repetitive units of
    (A) N-acetyl glucosamine
    (B) Ribitol phosphate
    (C) Glucose-6-phosphate
    (D) Glucosamine

[WB-2017]

24. The gla domain is found in
    (A) Fibrinogen (B) Fibrin polymer
    (C) Prothrombin (D) Kininogen

[CG-2018]

25. Indicate names of the following molecules:



(A) (M) - Citrate (N) - Oxaloacetate (O) - Isocitrate (P) -α-ketoglutarate
(B) (M) Oxaloacetate (N) - Isocitrate (O) -α-ketoglutarate (P) – Citrate
(C) (M) -Isocitrate (N) - Citrate (0) - Oxaloacetate (P) a-ketoglutarate
(D) (M) Isocitrate (N) - a-ketoglutarate (0) - Oxaloacetate (P) – Citrate

[AP-2018]

26. Which one of the following acts as the precursor for the biosynthesis of lysine?
(A) Cysteine
(B) Pyrroline-5-carboxylate
(C) 2-oxoglutarate
(D) Ornithine

[AP-2018]

27. Assertion (A): Storage polysaccharides show more branches than structural polysaccharides in their structure.
Reason (R): Branched polysaccharides have more free ends and can form more glycoside bonds.
(A) Both (A) and (R) are true and (R) is the correct explanation of (A)
(B) Both (A) and (R) are true, but (R) is not the correct explanation of (A)
(C) (A) is true but (R) is false
(D) (A) is false but (R) is true

[AP-2018]

28. If the average molecular weight of an amino acid is 120 daltons, then what is the weight in grams of a single molecule of protein containing 300 amino acids?
(A) 6.02×10^{-23} g (B) 270×10^{-18} g
(C) 53.85×10^{-22} g (D) 5.98×10^{-20} g

[GJ-2018]

29. Which one of the following aldose sugar is most abundant in biological systems?
(A) D-Mannose (B) D-Gulose
(C) D-Xylose (D) D-Arabinose

[JK-2018]

30. Which of the following statements is NOT true?
(A) Oxidation and reduction reactions occur simultaneously.
(B) When a sugar molecule is oxidized to CO, and H.0.0, molecules are reduced.
(C) Hydrogenation reactions are oxidation and dehydrogenation reactions are reduction
(D) Hydrogenation reactions are reduction and dehydrogenation reactions are oxidation

[JK-2018]

31. Which of the following is an example of structural polysaccharide?
(A) Starch (B) Cellulose
(C) Glycogen (D) Sucrose

[JK-2018]

32. Fatty acids are termed as unsaturated if
(A) they have one or more double bonds
(B) they are insoluble in water
(C) they are insoluble in alcohol
(D) they have no double bonds

[MH-2018]

33. Maleic acid and Fumaric acid are:
(A) Geometric isomers (B) Chiral isomers
(C) Enantiomers (D) Diastereomers

[MH-2018]

34. Artificial sweetener aspartame is:
(A) L- Aspartyl- L -Phenylalanine methyl ester.
(B) L-Aspartyl- D - Phenylalanine methyl ester
(C) D- Aspartyl - D - Phenylalanine methyl ester
(D) D- Aspartyl - L- Phenylalanine methyl ester

[WB-2018]

35. Name the vitamins that are found in the liver of marine fishes.
(A) Vit C & D (B) Vit B & D
(C) Vit A & B (D) Vit A & D

[WB-2018]

36. Cobalt is an essential component of
(A) Vitamin B (B) Vitamin B,
(C) Vitamin B (D) Vitamin B2

[WB-2018]

37. Besides its anti-oxidant activity, vitamin E causes
(A) Increased release of prostacyclin
(B) Increased adherence of blood cell components to inner lining of blood vessels
(C) Stimulation of protein kinase C
(D) Vasoconstriction

[WB-2018]

38. $CH_3(CH_2)_{16}.COOH$ represents
(A) An unsaturated fatty acid
(B) A saturated fatty acid
(C) A triglyceride
(D) A lipoid

[MH-2019]

39. Glycogen, starch and cellulose are polymers of glucose. Which of the following statements are true about these polymers?
    (i) β Glycogen and starch are having α1-4 and α 1-6 glycosidic bonds.
    (ii) Cellulose is having 1-4 glycosidic linkage.
    (iii) All these polymers are giving energy for the cells.
    (iv) Glycogen is present in animals and starch in plants.
    (v) Amylase enzyme is useful in digestion of these polymers.
    (A) (i), (ii) and (v) (B) (i), (ii) and (iv)
    (C) (ii), (iii) and (iv) (D) (ii), (iii) and (v)

[MH-2019]

40. Maple syrup urine disease, one of the inherited metabolic disorders is caused because of blockage of oxidative decarboxylation of -keto acids derived from valine, leucine and isoleucine. Which of the following enzyme is missing or defective in the patient?
    (A) Homogentisate reductase
    (B) Branched chain dehydrogenase
    (C) Oxaloacetate decarboxylase
    (D) Acetoacetate carboxylase

[MH-2019]

41. Isoenzymes are.....
    (A) Oligomeric proteins which have different physico-chemical properties and catalyse the same reaction.
    (B) Monomeric proteins which have different physico-chemical properties and catalyse the samereaction.
    (C) Oligomeric proteins which have same physico-chemical properties and catalyse different reactions
    (D) Monomeric proteins which have same physico-chemical properties and catalyse different reactions

[KA-2020]

42. The constituent monosccharide in chitin is
    (A) D-Glucose (B) D-Xylose
    (C) N-acetly D-glucosamine (D) D-Galactose

[MH-2020]

43. Which of the following statements about monosaccharides is correct?
    P- Epimers of monosaccharides differ in chemical properties.
    Q- In aldoses, C_1 is the anomeric carbonR- Anomers differ in configuration at the glycosidic carbon.
    S- Epimers differ in configuration at any carbon other than glycosidic carbon.
    (A) R and s (B) P and Q
    (C) Q, R and S (D) P, Q, R and S

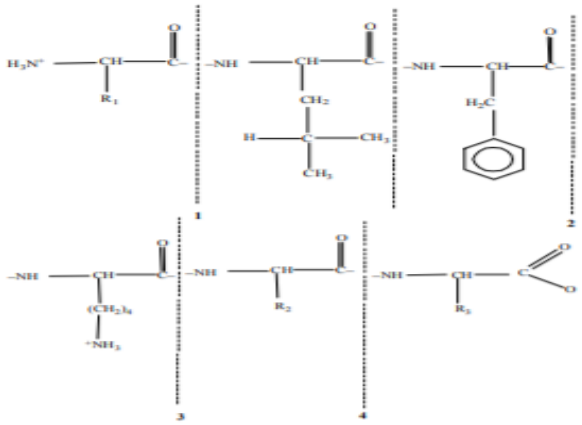
[MH-2020]

44. Fungi can synthesize one of the following structural polysaccharide from the beta-glucose:
    (A) amylopectin (B) chitin
    (C) cellulose (D) lignin

[WB-2020]

45. Collagen instability and connective tissue abnormalities are caused due to the absence of
    (A) Vitamin A (B) Vitamin C
    (C) Vitamin D (D) Vitamin H

[WB-2020]

46. 

    Aminopeptidase catalyzes the hydrolysis of amino acids from the N-terminal end of a protein, while carboxypeptidase catalyzes the hydrolysis of amino acids from the C-terminal end of a protein. Chymotrypsin catalyzes the hydrolysis of peptide bonds following aromatic amino acids, while trypsin catalyzes the hydrolysis of peptide bonds following lysine and arginine. Select the correct order from the following:
    (A) 1-Aminopeptidase, 2-Chymotrypsin, 3-Trypsin, 4-Carboxypeptidase
    (B) 1-Chymotrypsin, 2-Trypsin, 3-Aminopeptidase, 4-Carboxypeptidase
    (C) 1-Chymotrypsin, 2-Trypsin, 3-Carboxypeptidase, 4-Aminopeptidase
    (D) 1-Aminopeptidase, 2-Trypsin, 3-Chymotrypsin, 4-Carboxypeptidase

[WB-2020]

47. Protamines, small arginine rich proteins, are characteristically
    (A) large sized DNA fragments
    (B) sequences of DNA that are unique in nature
    (C) histone like proteins found in fish sperm
    (D) moderately repeated DNA sequence

[WB-2020]

48. Proteomics technique used to analyse the characteristics of molecular protein network involved in living cell is termed as
(A) Functional proteomics
(B) Expression proteomics
(C) Structural proteomics
(D) Protein mining

[GJ-2022]

49. Amino acid threonine has how many optical isomers?
(A) 1 (B) 2
(C) 3 (D) 4

[GJ-2022]

50. What happens to the osmotic potential of the pure water, if we add NaCl and sugars?
(A) Osmotic potential of the pure water becomes negative
(B) Osmotic potential of the pure water becomes positive
(C) Solutes do not show any effect on the osmotic potential
(D) Osmotic potential of the pure water becomes zero

[GJ-2022]

51. A drop of water on glass slide takes a bead shape and why not alcohol?
(A) Water has high surface tension
(B) Alcohol has high surface tension
(C) Water has low surface tension
(D) Both (A) and (C)

[JK-2022]

52. Name the two amino acids that are components of artificial sweetener, 'aspartame'.
(A) Aspartic acid and phenylalanine
(B) Arginine and tyrosine
(C) Aspartic acid and tryptophan
(D) Aspartic acid and glutamic acid

[WB-2023]

53. Which of the following statements is not correct for teichoic acids?
(A) Teichoic acids are anionic polymers found in the cell walls of Gram-positive bacteria.
(B) They are composed of glycerol phosphate orribitol phosphate residues joined through phosphodiester linkage.
(C) They are covalently linked to N-acetyl-muramic acid of the peptidoglycan layer.
(D) They are composed of N-acetylglucosamine residues linked by $\beta(1-4)$ linkages.

[RJ-2023]

54. Consider the following steps of beta oxidation:
1. Activation of fatty acid
2. Elongation cycle of fatty acid via ACP intermediates
3. Conversion of acetyl -Co A into Malonyl CoA
4. Transport of fatty acid in mitochondria
5. Breakdown of fatty acid in mitochondria matrix

Which of the following are not involved in beta oxidation?
(A) 1,2 and 3. (B) 2 and 3
(C) 3,4 and 5 (D) 3 and 5

[MH-2024]

55. Hookworm infection can lead to deficiency of:
(A) Vitamin B_{12} (B) Iron
(C) Vitamin B_6 (D) Folic acid

[NE-SLET-2024]

56. Match the items of Column-I with those of Column-II and select the correct match from the codes given below:

Column-I	Column-II
(a) The amino acid with maximum number of codons	1. Glutamine
(b) The characteristic amino acid in lysozyme active site	2. Tryptophan
(c) The amino acid precursor in heme biosynthesis	3. Serine
(d) The amino acid contributing the most to protein absorbance at 280 nm	4. Glycine

Code:
(A) a-2, b-1, c-4, d-3 (B) a-3, b-1, c-4, d-2
(C) a-4, b-2, c-3, d-1 (D) a-2, b-4, c-3, d-1

[CG-2024]

57. The correct composition of greenhouse gases is in the order of-
(A) $CO_2 > N_2O > CH_4 > CFCs$
(B) $CO_2 > CFCs > CH_4 > N_2O$
(C) $CO_2 > CH_4 > CFCs > N_2O$
(D) $CFCs > CO_2 > CH_4 > N_2O$

[MP-2024]

58. Which of the following Vitamins is water soluble?
(A) Vitamin-A (B) Vitamin-D
(C) Vitamin-K (D) Vitamin-B Complex

[GJ-2024]

59. The maximum buffering capacity at physiologic pH would be provided by a protein rich in
(A) Arginine (B) Glutamic acid
(C) Valine (D) Histidine

[GJ-2024]

60. In scurvy, which of the following amino acids that is normally part of collagen is NOT synthesized?
(A) Hydroxytryptophan (B) Hydroxytyrosine
(C) Hydroxyhistidine (D) Hydroxyproline

[GJ-2024]

61. Which of the following is the important reactive group of glutathione in its role as an antioxidant?
(A) Serine (B) Sulfhydryl
(C) Tyrosine (D) Carboxyl

[GJ-2024]

62. Which of the following is a modified monosaccharide that plays a crucial roll in the structure of bacterial cell walls, specifically in peptidoglycan?
(A) N-acetylmuramic acid
(B) N-acetylmannosamine
(C) N-acetylgalactosamine
(D) N-acetylneuraminic acid

Answer Key									
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
B	C	A	B	D	C	B	B	A	D
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
A	C	C	C	B	B	D	A	C	B
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
D	B	B	C	A	C	B	D	A	C
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
B	A	A	A	D	D	A	B	B	B
41	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**
A	C	D	D	B	D	C	A	B	A
51	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
A	A	D	D	B	B	B	D	D	D
61	**62**								
B	A								

Unit-1.3: Stabilizing Interactions

(Van der Waals, Electrostatic, Hydrogen Bonding, Hydrophobic Interaction, etc.)

[KA-2015]

1. Association of a nucleotide base with a complementary one by the formation of specific hydrogen bonding is
(A) Peptide bond (B) Base pairing
(C) Recombination (D) Mismatching

[KA-2016]

2. Which one of the following compounds have both covalent and coordinate bonds?
(A) NH_4Cl (B) Fe_3O_4
(C) $MgCl_2$ (D) H_2SO_4

[GJ-2016]

3. Which one of the following coenzymes acts as a donor of one carbon unit?
(A) Tetrahydrofolate
(B) Riboflavin
(C) Lipoic acid
(D) Pyridoxal phosphate

[KA-2016]

4. Which of the following is strongest among weak forces of interactions?
(A) Ionic (B) Hydrogen bond
(C) Van der waal's (D) Dipole-dipole

[MH-2016]

5. The forces that hold the non-polar regions of the molecules together are called:
(A) hydrophilic interaction
(B) hydrophobic interaction
(C) ionic interaction
(D) amphipathic interaction

[MH-2016]

6. Codon-anticodon pairing occurs by:
(A) Covalent bonds
(B) Electrostatic interactions
(C) Hydrogen bonds
(D) Hydrophobic interactions

[CG-2018]

7. The solubility of gases in water depends on their interaction with water molecules. Four gases i.e., Carbon dioxide, Oxygen, Sulphur dioxide and Ammonia are dissolved in water. In terms of their solubility, which of the following statements is correct?
(A) Ammonia > Oxygen > Sulphur dioxide > Carbon dioxide
(B) Oxygen > Carbon dioxide > Sulphur dioxide > Ammonia
(C) Sulphur dioxide > Oxygen > Ammonia > Carbon dioxide
(D) Ammonia > Sulphur dioxide > Carbon dioxide > Oxygen

[JK-2018]

8. Which type of bond is broken when ice melts?
(A) Ionic (B) Polar covalent
(C) Hydrogen (D) Non-polar covalent

[JK-2018]

9. Which of the following has the highest chemical bond energy?
(A) Hydrogen bond (B) Triple bond
(C) Ionic bond (D) Double bond

[MH-2018]

10. Hydrogen bond can be formed between the pair of atoms such as:
(A) Hydrogen and Carbon
(B) Hydrogen and Nitrogen
(C) Oxygen and Nitrogen
(D) Oxygen and Carbon

[KA-2020]

11. Match the following with reference to protein structure and modifying reagents.

Column A		Column B	
i	Mercapto ethanol	a	Peptide bond
ii	Guanidine hydrochloride	b	Disulphide bridge
iii	Urea	c	Hydrogen bond
iv	Dithiothreitol	d	Ionic bond

Code:
(A) i-a ii-d iii-b iv-c
(B) i-b ii-c iii-c iv-b
(C) i-c ii-b iii-a iv-d
(D) i-d ii-a iii-c iv-a

[RJ-2023]

12. Glycophorin A is the major sialoglycoprotein of the human erythrocyte membrane, which has 3 domains composed of 2 hydrophilic segments which are separated by a region of amino acids. How many amino acids are present in this region?
(A) 10 amino acids (B) 20 amino acids
(C) 37 amino acids (D) 5 amino acids

[MH-2023]

13. In which of the following the hydrogen bond is NOT formed?
(A) between water and amino group of an amino acid
(B) between carbonyl group of protein and amino group of protein
(C) between hydroxy group of alcohol and water
(D) between methyl group of alanine and water

(MP-2023)

14. What is the correct order of the following Hydrides according to decrease in their bond angles?
(A) $H_2O > H_2S > H_2Se > H_2Te$
(B) $H_2S > H_2Se > H_2Te > H_2O$
(C) $H_2Se > H_2Te > H_2O > H_2S$
(D) $H_2Te > H_2O > H_2S > H_2Se$

(MP-2023)

15. Intramolecular hydrogen bonding is-
(A) Hydrogen fluoride (B) m-Chlorophenol
(C) Water (D) o-Chlorophenol

[WB-2024]

16. Which one of the following organic groups has least probability of hydrogen bond formation with water?
(A) Amine (B) Methyl
(C) Hydroxyl (D) Carbonyl

Answer Key									
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
B	D	A	A	B	C	A	C	B	B
11	**12**	**13**	**14**	**15**	**16**				
A	C	D	A	D	B				

Unit-1.4:- Principles of Biophysical Chemistry
(pH, Buffer, Reaction Kinetics, Thermodynamics, Colligative Properties).

[KA-2015]

1. The entropy of a thermodynamic system refers to
(A) Heat given off by the reaction
(B) Tendency of a system to randomness
(C) Maximum energy of the transition states
(D) Effect of temperature on the reaction velocities

[MH-2015]

2. In a highly acidic solution (pH = 1.3) the amino acid glycine exists in:
(A) $^{+3}NH - CH_2 - COO^-$
(B) $^{+3}NH—CH_2—COOH$
(C) $NH_2 - CH_2 - COOH$
(D) $NH_2 - CH_2 - COO^-$

[MH-2015]

3. A beaker marked 'X' has 100 ml of water at 80°C while another beaker marked 'Y' has 200 ml water at 20°C. If we mix the two completely in 500 ml beaker and record the temperature immediately, the temperature will be closest to:
(A) 20°C (B) 40°C
(C) 80°C (D) 50°C

[KA-2016]

4. Which among the following is not a thermodynamic system?
(A) Open system (B) Isolated system
(C) Closed system (D) Surrounding

[KA-2016]

5. Which among the following is a buffer?
(A) Mixture of acid and base
(B) Mixture of weak acid and strong base
(C) Mixture of strong acid and weak base
(D) A weak acid and its conjugate base

[MH-2016]

6. A solution of acidic buffer with a pH of 4.0 is ……. times more acidic than same buffer with a pH of 6
(A) 2 (B) 100
(C) 1000 (D) 10

[MH-2016]

7. Which of the following reactions will not proceed in the direction written, assuming that the reactants are initially present in a 1 : 1 molar ratio ?
(A) ATP + Creatine ? Creatine Phosphate + ADP
(B) ATP + Glycerol ? Glycerol 3-phosphate + ADP
(C) ATP + Fructose ? Fructose 6-phosphate + ADP
(D) ATP + Glucose ? Glucose 6-phosphate + ADP

[AP-2017]

8. Which of the following statements is true?

(A) Free energy is kinetic energy
(B) If a reaction is endergonic the products are of lower free energy than reactants
(C) Entropy is the amount of order in energy
(D) In exergonic reactions, free energy of the products is lower than the reactants

[GJ-2017]

9. The solution of acetic buffer with pH 4.00 is how many times stronger than the same buffer with pH 6.
(A) 2 (B) 100
(C) 1000 (D) 10

[CH-2017]

10. The following small peptide substrate are used for determining elastase activity and the following data have been recorded

	Km(mM)	Kcat(S-1)
PAPA ↓ G	4.02	26
PAPA ↓ A	1.51	37
PAPA ↓ F	0.64	18

The arrow indicates the cleavage site. From the above observations, it appears that:
(A) PAPAF is digested more rapidly.
(B) PAPAG is digested most rapidly.
(C) A hydrophobic residue at the C-terminus seems to be favored
(D) A smaller residue at the C-terminus seems to be favored

[KA-2017]

11. Choose the right arrangement in the increasing order of energy.
(A) erg < calorie < joule (B) joule < calorie < erg
(C) erg < joule < calorie (D) calorie < erg < joule

[KA-2017]

12. The pka of acetic acid is 4.76. If a buffer is prepared using acetic acid sodium acetate, and the pH of the solution is 5.76, what will be the ratio of acetic acid concentration to sodium acetate concentration?
(A) 1:1 (B) 1:10
(C) 10:1 (D) 1: 100

[MH-2017]

13. In the antigen antibody reaction, the association constant (Ka at equilibrium is represented by:
(A) [Ag -Ab complex]
(B) [Free Ag] /[Free Ab]
(C) [Free Ag] [Free Ab]/[Ag - Ab complex)
(D) [Ag -Ab complex)/[Free Ag] [Free Ab]

[MH-2017]

14. When a weak acid is mixed with its salt, pH of the solution becomes:
(A) More acidic (B) Remains same
(C) Neutral (D) Less acidic

[MH-2017]

15. The amount of energy that must be added to break a bond is exactly equal to the amount that is released upon formation of the bond. Which law of thermodynamics among the following is applicable to this situation?
(A) First (B) Second
(C) Third (D) Fourth

[TN-2017]

16. Indicate the ionic species that predominates at pH 4, 8 and 11 for ammonia
(A) pH 4, NH4+; pH 8, NH4+; pH 11, NH3
(B) pH 4, NH4+; pH 8, NH3+; pH 11, NH2
(C) pH 4, NH4+; pH 8, NH3+; pH 11, NH3
(D) pH 4, NH3+; pH 8, NH3+; pH 11, NH2

[TN-2017]

17. Estimate the volume of a solution of 5 M NaOH that must be added to adjust the pH from 4 to 9 in 100 mL of a 100 mM solution of phosphoric acid
(A) 4 mL (B) 2 mL
(C) 1 mL (D) 0.5 mL

[AP-2018]

18. If the pH of a solution is 8, its hydroxyl ion concentration is
(A) 10^{-8}
(B) ten times more than that of pH 7 solution
(C) 10^{-2}
(D) 10^{8}

[AP-2018]

19. An increase in entropy
I. is an increase in order
II. occurs when a NaCl solution is diluted
III. occurs when a hydrocarbon molecule is removed from an aqueous environment
IV. occurs in the system when amino acids are linked to form a protein
(A) I, II are correct (B) I, IV are correct
(C) II, III are correct (D) II, IV are correct

[JK-2018]

20. In thermodynamics "free energy" refers to
(A) energy that can be harnessed to do work or drive chemical reaction.
(B) excess energy from a reaction that a cell does not use.
(C) energy required to initiate a chemical reaction
(D) energy which is left after a reaction has completed

[MH-2018]

21. If an aqueous solution has a hydrogen ion concentration of 10^{-3} M, what is the concentration of hydroxyl ion?
(A) 10^{-14} M (B) 10^{-10} M
(C) 10^{-11} M (D) 10^{-12} M

CHAPTER-5 DEVELOPMENTAL BIOLOGY

Unit - 5.1: Basic Concepts of Development

Potency, Commitment, Specification, Induction, Competence, Determination and Differentiation; Morphogenetic Gradients; Cell Fate and Cell Lineages; Stem Cells; Genomic Equivalence and the Cytoplasmic Determinants; Imprinting; Mutants and Transgenics In Analysis of Development

[KA-2015]

1. Which one of the following is not an internal factor of differentiation?
   (A) Polarity (B) Inductive effect
   (C) Mutual incompatibility (D) Cytoplasm

[AP-2017]

2. **Assertion (A)**: A nucleus taken from a somatic cell and implanted into an enucleated egg cell of a frog, often gives rise into an adult individual
   Reason (R): Differentiated donor nucleus could be totipotent
   (A) (A) is correct but (R) is not the correct explanation of (A)
   (B) Both (A) and (R) are true
   (C) (A) is false but (R) is true
   (D) (A) is true but (R) is false

[CG-2017]

3. Which of the inferences (A-(D) given below would you draw from the following tissue transplantation experiments performed with the early and late gastrula stages of the newt?

	Host regions	Donor regions	Differentiation of donor tissue
	Early Gastrula		
(i)	Prospective neurons	Prospective epidermis	Epidermis
(ii)	Prospective epidermis	Prospective neurons	Neurons
	Late Gastrula		
(i)	Prospective neurons	Prospective epidermis	Neurons
(ii)	Prospective epidermis	Prospective neurons	Epidermis

   M. Cells of early newt gastrula exhibit conditional development.
   N. Cells of early newt gastrula exhibit
   O. Cells of late newt gastrula exhibit conditional development.
   P. Cells of late newt gastrula exhibit autonomous development.
   The correct inferences are:
   (A) M and P (B) M and N
   (C) N and O (D) N and P

[KA-2017]

4. Identify the correct statement with regard to the Embryonic Stem cells (ES).
   (A) They are not derived from inner cell mass of Blastocyst
   (B) Cannot proliferate into different cell types
   (C) They can generate primitive ectoderm
   (D) They are not pluripotent cells

[MP-2017]

5. The initial cell division during the development is -
   (A) Anticlinal (B) Periclinal
   (C) Random (D) Oblique

[TN-2017]

6. Stem cell factor is produced mainly by
   (A) stem cells
   (B) thymic Epithelium
   (C) bone marrow stromal cells
   (D) megakaryocytes

[MH-2017]

7. In birds and reptiles the primordial germ cells originate in the:
   (A) Epiblast (B) Hypoblast
   (C) Germinal crescent (D) Embryonic allantois

[AP-2018]

8. Match the following:

List – I	List – II
I. Unipotent	1. Cell that can differentiate into cell types of the adult organism
II. Oligopotent	2. Cell that differentiates into multiple different, but closely related all types
III. Pluripotent	3. Cell is more restricted than multipotent but can still differentiate into a few closely related cell types
IV. Multipotent	4. Cell that differentiates into any one cell-type but capable of self renewal

	I	II	III	IV
(A)	4	3	1	2
(B)	2	3	4	1
(C)	4	1	3	2
(D)	4	3	2	1

[WB-2018]

9. Basic principles of embryonic development were pronounced by
   (A) Von Baer (B) Weismann
   (C) Haeckel (D) Morgan

[KA-2020]

10. Shinya Yamanaka received his Nobel Prize for discovery of
    (A) Induced pluripotent stem cells
    (B) Oncogene
    (C) Okazaki fragments
    (D) Cancer stem cells

[KA-2021]

11. Drosophila displays _____ method of embryonic development.
    (A) Ametabolous (B) Hemimetabolous
    (C) Holometabolous (D) Paurometabolous

[KA-2021]

12. Embryonic stem cells are obtained from the inner cell mass of the as a precursor.
    (A) Epiblast (B) Hypoblast
    (C) Tonoplast (D) Blastocyst

[JK-2022]

13. In chick, development of wing feather thigh feathers and claws depends on epithelial specificity conferred by induction from mesenchymal components from different sources of the dermis. This may be attributed to
    (A) Autocrine interaction
    (B) Regional specificity of induction
    (C) Genetic specificity of interaction
    (D) Autonomous development

[MH-2023]

14. In Drosophila, the fate of early blastomeres is determined through:
    (A) Autonomous specification
    (B) Conductional specification
    (C) Syncytial specification
    (D) Maternal specification

[RJ-2023]

15. The process by which the cells become structurally and functionally distinct during development is called as
    (A) differentiation (B) determination
    (C) specification (D) both (A) and (C)

[WB-2023]

16. The establishment of the anterior-posterior or dorsal-ventral body axis is called
    (A) Pattern formation (B) Morphogenesis
    (C) Differentiation (D) Growth

[MH-2024]

17. The mid-blastula transition is the point in the development when _____
    (A) Translation of maternal mRNA is initiated
    (B) Cell determination is fixed
    (C) Cell-division in the zygote begins
    (D) Transcription of zygotic genes begins

[MH-2024]

18. Which of the following is not a property of stem cells?
    (A) Ability to self-renew
    (B) Ability to differentiate into different types of cells
    (C) They are unspecialised cells with cell markers
    (D) They are actively dividing cells with cell marker changes

[WB-2024]

19. Which of the following statements is incorrect?
    (A) In meiosis, one cycle of DNA replication is followed by two rounds of chromosome segregation
    (B) Astral type of mitosis is present in majority of the animal cells
    (C) Two homologous chromosomes in meiotic prophase I are held together by synaptonemal complex
    (D) Pluripotent cells have the ability to regenerate an entire organism in vitro

[MP-2024]

20. In animals Nervous system is derived from:
    (A) Ectoderm (B) Mesoderm
    (C) Endoderm (D) All of the above

Answer Key									
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
D	A	A	C	A	C	C	A	A	A
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
C	D	B	D	A	A	D	D	D	A

Unit- 5.2: Gametogenesis, Fertilization and Early Development:

(Production of Gametes, Cell Surface Molecules In Sperm-Egg Recognition In Animals; Embryo Sac Development and Double Fertilization In Plants; Zygote Formation, Cleavage, Blastula Formation, Embryonic Fields, Gastrulation and Formation of Germ Layers In Animals; Embryogenesis, Establishment of Symmetry In Plants; Seed Formation and Germination.)

[WB-2015]

1. Which is the correct sequence of the events leading to the formation of mature sperm?
   (A) Primary spermatocytes-secondary spermatocytes-spermatids-spermatogonia-sperms.
   (B) Spermatogonia-spermatids-primary spermatocytes-secondary spermatocytes-sperms.
   (C) Spermatogonia-primary spermatocytes-secondary spermatocytes-spermatids- sperms.
   (D) Spermtogonia-spermatid-secondary-spermatocytes –sperm

[GJ-2016]

2. Double fertilization is a characteristic feature of:
   (A) Dicots
   (B) Monocots
   (C) Gymnosperms
   (D) Both dicots and monocots

[GJ-2016]

3. One of the following sequences is correct for vertebrate development:
   (A) Blastula - Gastrula - Neurula
   (B) Blastula - Morula - Neurula
   (C) Gastrula - Morula - Blastula
   (D) Neurula - Morula - Gastrula

[JK-2016]

4. Odd number of cells during cleavage is found in the embryo.
   (A) Mice (B) Frog
   (C) Fish (D) Snake

[JK-2016]

5. Fertilization of ova and implantation of zygote in human takes place in:
   (A) Fallopian tube and uterus, respectively
   (B) Uterus and cervix, respectively
   (C) Ovary and fallopian tube, respectively
   (D) Vagina and cervix, respectively

[KA-2016]

6. The correct sequence of process of development after fertilization and cleavage is
   (A) Gastrulation - Organogenesis – growth
   (B) Organogenesis – gastrulation – growth
   (C) Gastrulation – blastulation – growth
   (D) Organogenesis – morulation – blastulation

[KA-2016]

7. A series of mitotic cell divisions that changes zygote into multicellular embryo
   (A) Gastrulation
   (B) Gametogenesis
   (C) Blastulation
   (D) Cleavage

[KA-2016]

8. Following events in the basic life cycle are in the right order?
   i. Fertilization, cleavage
   ii. Adulthood, senescence
   iii. Gastrulation, Germ layer formation
   iv. Organogenesis, metamorphosis
   Which of the statements given above are right?
   (A) i, ii, iii, iv (B) i, iii, iv, ii
   (C) i, iv, iii, ii (D) i, ii, iv, iii

[MH-2016]

9. Which of the following (in sperm) is primarily responsible for hydrolytic activity during sperm-egg interaction?
   (A) ZP-1 (B) Acrosin
   (C) Spermease (D) Glycolipase

[AP-2017]

10. Dolly sheep was genetically similar to:
    (A) The mother from which nucleated fertilized egg was taken
    (B) The mother from which nuclear DNA of udder cell was taken
    (C) The surrogate mother
    (D) Father from which the sperm was taken

[AP-2017]

11. The correct sequence of events during fertilization in mammals is:
    (A) Capacitation, activation of egg, acrosomal reaction and entry of sperm in egg
    (B) Capacitation, acrosomal reaction, activation of egg and entry of sperm in egg
    (C) Acrosomal reaction, activation of egg, capacitation and entry of sperm in egg
    (D) Activation of egg, acrosomal reaction, entry of sperm in egg and capacitation

[AP-2017]

12. Match the extraembryonic fetal membrane with its functional significance in birds:

List I	List II
(a) Amnion	(i) Excretion
(b) Chorion	(ii) Protection against mechanical shock
(c) Yolk sac	(iii) Nutrition
(d) Allantois	(iv) Absorption of water, albumen and gases exchange

Codes:

	(a)	(b)	(c)	(d)
(A)	(i)	(ii)	(iv)	(iii)
(B)	(ii)	(iv)	(iii)	(i)
(C)	(iii)	(i)	(ii)	(iv)
(D)	(iv)	(iii)	(i)	(ii)

[AP-2017]

13. Consider the following process:
(a) Involution
(b) Epiboly
(c) Invagination
Which of the above accomplish the gastrulation in frog ?
(A) (a) and (b) (B) (b) and (c)
(C) (a) and (c) (D) (a), (b) and (c)

[CG-2017]

14. Which of the following statements are correct?
M. Genes may affect the competence of tissues to respond normally.
N. The blastula is a multi-layered hollow spherical structure enclosing a cavity, the blastocoel.
O. The function of Acrosome in sperm head is to protect the nucleus.
P. The animal pole of the ovum marks the anterior end of the embryo.
Choose the correct answer:
(A) O and P (B) P and N
(C) N and M (D) P and M

[GJ-2017]

15. The embryonic stage in the frog in which differentiation of mesoderm takes place, is called as:
(A) Blastula (B) Gastrula
(C) Morula (D) Nerula

[GJ-2017]

16. A mesolecithal egg undergoes holoblastic cleavage, is represented in:
(A) Birds (B) Amphioxus
(C) Amphibians (D) Echinoderms

[KA-2017]

17. The sphere of relatively nondescript cells that result from a rapid series of mitotic divisions of the zygote is called a
(A) Determination (B) Gastrulation
(C) Blastula (D) Morphogenesis

[KA-2017]

18. The process in which undifferentiated cells are assigned developmental fates is called
(A) Blastula (B) Gastrula
(C) Determination (D) Morphogenesis

[MP-2017]

19. The plane of second cleavage division with respect to animal-vegetal axis is always
(A) Vertical and at right angle to first cleavage
(B) Horizontal and right angle to first cleavage
(C) Vertical and parallel to first cleavage
(D) All are correct

[MP-2017]

20. Axial filament of spermatozoon is formed from
(A) Nucleus (B) Mitochondria
(C) Distal centriole (D) Proximal centriole

[MP-2017]

21. The rate of cleavage is
(A) Inversely proportional to the amount of yolk
(B) Directly proportional to the amount of yolk
(C) No effect
(D) All are correct

[MP-2017]

22. Capacitation of mammalian sperm takes place in
(A) Epididymis
(B) Female reproductive tract
(C) Seminiferous tubule
(D) All are correct

[MH-2017]

23. Which of the following are responsible for prevention of polyspermy?
(A) Change in the membrane potential of egg plasma membrane
(B) Cortical granule exocytosis/cortical reaction
(C) Both (A) and (B)
(D) Molecular changes in the zona pellucida proteins

[MH-2017]

24. The embryonic stage in frog in which differentiation of mesoderm takes place is called:
(A) Blastula (B) Gastrula
(C) Morula (D) Neurula

[TN-2017]

25. Animals that exhibit discoidal cleavage pattern in their meroblastic eggs
(A) Sea Urchin and Amphioxus
(B) Annelids and Mollusks
(C) Mammals and Nematodes
(D) Birds and Reptiles

[TN-2017]

26. Which of the following is the correct pair if you relate Cleavage to the Animal Group

(i) Radial cleavage – Echinoderms
(ii) Spiral - Annelids
(iii) Bilateral - Tunicate
(iv) Rotational cleavage - Mammal
(A) i and ii correct (B) iii and iv correct
(C) ii and iii correct (D) All are correct
[WB-2017]

27. The kind of cleavage found in an oligolecithal egg is
(A) Meroblastic (B) Holoblastic
(C) Spiral cleavage (D) Superficial cleavage
[TN-2017]

28. Polyspermy, the process where two sperms are likely to fertilize the egg, shall be blocked by
(i) Electrical impulse mediated by sodium ions
(ii) Depolarization of the egg membrane
(iii) Calcium ion mediation
(iv) Released content of the cortical granule
(A) i and ii correct
(B) ii and iii correct and iv is incorrect
(C) iii is correct while i and iv are incorrect
(D) iv is correct whereas ii and iii are incorrect
[TN-2017]

29. Match the types of egg with animal group and find the odd man out
(a) Microlecithal – Mammal
(b) Centrolecithal –Insects
(c) Mesolecithal – Birds
(d) Telolecithal – Amphibians
(A) a, b and c are correct
(B) b is correct and c and d are incorrect
(C) c is correct while a and d are incorrect
(D) d is correct whereas b and c are incorrect
[AP-2018]

30. The protein of zona pellucida that induces sperm to undergo acrosome reaction
(A) Zona protein 1 (B) Zona protein 2
(C) Zona protein 3 (D) Zona protein 4
[CG-2018]

31. Match Group A with Group B.

Group A	Group B
(M) Non-flagellate sperm	(1) Ascaris
(N) Meiosis	(2) Early cleavage stage cells
(O) Sertoli cells	(3) Nutrition
(P) G1 phase of the cell cycle is absent	(4) Reduction Division

Code:

(M)	(N)	(O)	(P)
(A) (2)	(1)	(3)	(4)
(B) (1)	(4)	(2)	(3)
(C) (1)	(4)	(3)	(2)

(D) None of the above
[CG-2018]

32. During fertilization in amphibians, the fusion of egg and sperm plasma is preceded by the sequence:
(M) Release of enzymatic content from the acrosomal vesicle through exocytosis.
(N) Binding and interaction of the sperm to vitelline membrane.
(O) Passage of sperm through an extracellular envelope.
(P) Chemo attraction of the sperm to the egg by soluble factors secreted by the egg.
Which of the following is the correct sequence?
(A) (M), (P), (O) and (N)
(B) (P), (M), (N) and (O)
(C) (M), (O), (N) and (P)
(D) (O), (N), (M) and (P)
[CG-2018]

33. Space filled with fluid in the center of blastoderm:
(A) enteron (B) archenteron
(C) blastocoel (D) enterocoel
[JK-2018]

34. Capacitation refers to changes in the
(A) sperm before fertilization.
(B) sperm after fertilization.
(C) ovum before fertilization.
(D) ovum after fertilization.
[JK-2018]

35. The equivalent of the amphibian dorsal blastopore lip in birds is
(A) Nucleus of Pander.
(B) Hensen's node.
(C) intermediate mesoderm.
(D) roof of foregut
[JK-2018]

36. *C. elegans* is a powerful developmental model because
(A) its genome resembles the human genome.
(B) the fate of every cell has been mapped.
(C) the fate of germ cells is predetermined.
(D) each cell glows green with GFP.
[KA-2018]

37. During which stage of development, an embryo becomes triploblastic?
(A) Organogenesis (B) Fertilization
(C) Gastrulation (D) Blastulation
[MH-2018]

38. Organisms where various blastomeres become restricted to form only specific structures as soon as they are formed or during development the first few cleavages are:
(A) Tunicates (B) Amniotes
(C) Amphibians (D) Mammals

[MH-2019]

39. Starting with a fertilized egg (zygote), a series of sequential five cell divisions would produce an early embryo with how many cells?
(A) 8 (B) 16
(C) 32 (D) 64

[AP-2019]

40. A chemotactic molecule isolated from the egg jelly of sea urchin that acts as a sperm activating peptide
(A) Bindin (B) Resact
(C) Dynein (D) Fertilin

[AP-2019]

41. The correct sequence of gastrulation in frog
(i) Involution
(ii) Epiboly
(iii) Invagination
(A) (ii)→(iii) →(i) (B) (iii) →(i) →(ii)
(C) (i) →(iii) →(ii) (D) (ii) →(i) →(iii)

[CH-2019]

42. During development of which one of the following organisms, bilateral meroblastic cleavage is found?
(A) Bird (B) Mollusc
(C) Snake (D) Fish

[KA-2021]

43. In amphibians, vegetal cells opposite the region of sperm entry will form the _____ part of the body.
(A) Dorsal (B) Ventral
(C) Lateral (D) Tectum

[MH-2021]

44. Which of the following is NOT true of Spermatogenesis?
(A) Four gametes are formed per meiosis
(B) Sex chromosomes are excluded from recombination and transcription during the first meiotic prophase
(C) Meiosis occurs continuously in mitotically dividing stem cells
(D) Differentiation of the gamete occurs; while in diploid, during first meiotic prophase

[MH-2021]

45. In the fertilized egg, cortical granule reaction required for slow block polyspermy, is initiated by:
(A) Na^+ (B) Mg^{2+}
(C) K^+ (D) Ca^{2+}

[AS-2021]

46. Match the items of Column-I with those of Column-II and select the correct match by using the codes given below:

Column-I	Column-II
(a) Radial cleavage	1. Echinoderms
(b) Spiral cleavage	2. Tunicates
(c) Bilateral cleavage	3. Mammals
(d) Rotational cleavage	4. Annelids

Codes:
(A) a-1, b-2, c-3, d-4 (B) a-3, b-2, c-1, d-4
(C) a-4, b-3, c-1, d-2 (D) a-1, b-4, c-2, d-3

[AS-2021]

47. Match the items of Column-I with those of Column-II and select the correct match from the codes given below:

Column-I	Column-II
(a) Bindin	1. Sperm activating peptide
(b) Cortical granule reaction	2. N-acetyl glucosamine sugar
(c) Resect	3. Calcium ion
(d) Acrosome reaction	4. Sperm-egg contact

Codes:
(A) a-4, b-3, c-1, d-2 (B) a-4, b-2, c-3, d-1
(C) a-4, b-2, c-3, d-1 (D) a-2, b-3, c-1, d-4

[AS-2021]

48. Two statements are given below, one of them is Assertion (Ass) and the other one is Reason (R). Select the correct answer by using the codes given below:
Assertion (Ass): The yolk sac stores vitellus, which is the main source of nutrition in non-placental embryonic development.
Reason (R): Extra embryonic membranes of mammals are derived from the trophoblast
Codes:
(A) Both (Ass) and (R) are true and (R) correctly explains (Ass)
(B) Both (Ass) and (R) are true, but (R) does not correctly explain (Ass)
(C) (Ass) is true but (R) is false
(D) Both (Ass) and (R) are false

[GJ-2022]

49. Brain and central nervous system develop from which germ layer or layers?
(A) Ectoderm
(B) Mesoderm
(C) Endoderm
(D) Ectoderm and mesoderm

[JK-2022]

50. Which one of the following shows holoblastic cleavage?
(A) Mammal (B) Fish
(C) Bird (D) Insect

[JK-2022]

51. During sea urchin gastrulation the sheet of epithelial cells (future endoderm) infolds into the blastocoel. This type of cell movement during gastrulation is called as
(A) Invagination (B) Involution
(C) Ingression (D) Epiboly

[JK-2022]

52. Izumo, present in the acrosomal membrane and Juno, an oocyte membrane protein involved in sperm-egg fusion in mammals. Which one of the following experiments and their outcomes unequivocally demonstrate that Izumo's interaction with Juno will lead to sperm-egg fusion?
    (A) Immunostaining of sperms and egg with antibodies against Juno and Izumo demonstrating their specificity of expression
    (B) Overexpression of Juno in the oocyte to demonstrate sperm binding
    (C) Developing independent kidney cell lines expressing either Juno or Izumo and demonstrating that these cells adhere to each other
    (D) Demonstrating interaction of Izumo and Juno by FRET (Fluorescence Resonance Energy Transfer)

[JK-2022]

53. When a sperm fuses with a sea urchin egg, a wave of calcium release is seen starting from the point of sperm entry that propagates across the egg. The calcium wave can be viewed if the egg is stained with a dye that fluoresces on binding to calcium. Compounds like A23187 and EDTA are used to analyze the origin and outcome of these waves. A23187 is a calcium ionophore that allows the diffusion of Ca^{2+}, across lipid membranes, permitting them to travel across otherwise impermeable barriers EDTA chelates Ca^{2+}, by binding to and holding onto it. In order to find out if the observed wave is due to release of Ca^{2+}, from within the cell or influx of Ca^{2}, from outside, different experiments were proposed. Which one of the following treatments will help in answering the question?



    (A) Placing sea urchin eggs in seawater containing A231872
    (B) Inducing fertilization of sea urchin eggs in calcium free water
    (C) Treating sea urchin eggs with EDTA before fertilization
    (D) Treating sea urchin eggs with A231872 before fertilization

[WB-2022]

54. 'Abruptio Placentae' is a condition in which the placenta detaches prematurely from the wall of the uterus and can result in fetal death. The most likely reason for fetal death in this condition would be
    (A) a lack of placental steroid production
    (B) vaginal blood loss
    (C) inability to get oxygen and nutrients from the mother to the fetus
    (D) hypersecretion of pituitary gonadotropins in response to loss of fetal steroid production

[WB-2023]

55. During gastrulation, splitting of one cellular sheet into two parallel sheets is known as
    (A) Epiboly (B) Delamination
    (C) Involution (D) Ingression

[WB-2023]

56. Cleavage polyembryony in plant is a type of polyembryony where
    (A) multiple embryos originate as a result of cleavage of the zygote into small units.
    (B) multiple embryos originate from cells of the embryo sac other than the egg.
    (C) multiple embryos arising from cells outside the embryo sac.
    (D) multiple embryos originate from outside the ovular tissue.

[WB-2023]

57. Which one of the following statements is not true regarding differentiation of different cell types originating from embryonic germ layers?
    (A) Neurons of brain originate from ectoderm layer
    (B) Bone tissues originate from mesoderm layer
    (C) Facial muscles originate from mesoderm layer
    (D) Red Blood cells originate from endoderm layer

[MP-2023]

58. Which type of cell division takes place in Gametogenesis?
    (A) Amitotic and Mitotic
    (B) Amitotic and Meiotic
    (C) Only Meiotic
    (D) Mitotic and Meiotic

[MP-2023]

59. The surface layer of sperm contains a proteinous substance, known as:
    (A) Antifertilizin (B) Zygotin
    (C) Fertilizen (D) Tubulin

[MP-2023]

60. Prime function of 'Corpus luteum' is:
    (A) Secreation of digestive juices
    (B) Exocrine
    (C) Endocrine
    (D) Functionless

[MP-2023]

61. Which cavity is found in Gastrula stage of an embryo?
(A) Blastocoel (B) Gastrocoel
(C) Amphiblastula (D) Uterine Cavity

[MP-2023]

62. In which egg micropyle is present?
(A) Insects (B) Elephant
(C) Frog (D) Birds

[MH-2024]

63. Which of the following groups of transcription factors (TFs) is responsible for maintaining the pluripotency of stem cells?
(A) Oct 4, Nanog and Stat 3
(B) Oct 4, Nanog and SOX 2
(C) Eomesodermin, Cdx 2 and SOX 2
(D) Cdx 2, Nanog and SOX 2

[MH-2024]

64. In plants, when the apical cell of the 2-celled pro-embryo divides longitudinally and further the basal cell plays only a minor role or none in the development of the embryo proper then the embryo is type.
(A) Asterad (B) Onagrad
(C) Solanad (D) Chenopodial

[CG-2024]

65. The function of fertilization membrane is-
(A) To protect the egg
(B) To protect the sperm head
(C) Favours fusion of egg & sperm
(D) Prevent the entry of late arriving Spermatozoa

[CG-2024]

66. A Human Sperm can penetrate an Orum when it remains for sometime in the fallopian tube of the female, this is called as-
(A) Maturation (B) Capacitation
(C) Resistance (D) Fertilization

[CG-2024]

67. Match the following-

Column A (Ovular structure)	Column B (Post-fertilization structure)
(I) Ovule	(a) Endosperm
(II) Funiculus	(b) Aril
(III) Nucellus	(c) Seed
(IV) Polar nuclei	(d) Perisperm

Code:
(A) I-a, II-b, III-c, IV-d (B) I-c, II-b, III-d, IV-a
(C) I-d, II-c, III-a, IV-b (D) I-a, II-d, III-c, IV-b

[CG-2024]

68. Barr body is found in man and associated with-
(A) Male Sex Organ
(B) Female Autosome
(C) Male Autosomes
(D) Female Sex Chromosomes

[WB-2024]

69. The 'mid-blastula transition' is the point in development when
(A) translation of maternal mRNA is initiated
(B) cell division in the embryo ends
(C) transcription of zygotic genes begins
(D) blastocoel formation occurs

[WB-2024]

70. During development in placental mammal, the fertilized egg undergoes division to form a blastocyst. The outermost cells of the blastocyst differentiate to form 'a thin layer of cells', which then invades the uterus and begins to form the placenta. This 'thin layer of cells' is known as
(A) Allantois (B) Endometrium
(C) Myometrium (D) Trophoblast

[MP-2024]

71. Rotational cleavage is unique and different from other animals in:
(A) Amphibians (B) Protostomes
(C) Mammals (D) Echinoderms

[MP-2024]

72. The correct sequence of process of development after fertilization and cleavage is :
(A) Gastrulation-organogenesis-growth
(B) Organogenesis-gastrulation-growth
(C) Gastrulation-blastulation-growth
(D) Organogenesis - Morulation - blastulation

[GJ-2024]

73. Holoblastic cleavage
(A) is absent in invertebrates
(B) is restricted to a discoidal region of the egg
(C) occurs throughout the egg
(D) is exhibited in aves

Answer Key

1	2	3	4	5	6	7	8	9	10
C	D	A	A	A	A	D	B	B	B
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
B	B	D	C	B	C	C	C	A	C
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
A	B	C	B	D	D	B	A	B	C
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
D	B	C	A	B	B	C	B	C	B
41	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**
B	B	A	D	D	D	A	B	A	A
51	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
A	D	B	C	B	A	D	C	A	C
61	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**
B	D	B	B	D	B	B	D	C	D
71	**72**	**73**							
C	A	C							

Unit - 5.3: Morphogenesis and Organogenesis in Animals:

Cell Aggregation and Differentiation In Dictyostelium; Axes and Pattern Formation In Drosophila, Amphibia and Chick; Organogenesis – Vulva Formation In Caenorhabditis Elegans, Eye Lens Induction, Limb Development and Regeneration In Vertebrates; Differentiation of Neurons, Post Embryonic Development- Larval Formation, Metamorphosis; Environmental Regulation of Normal Development; Sex Determination.

[KA-2015]

1. A cell or its group alters the developmental fate of another cell. This phenomenon is called
   (A) Induction (B) Competence
   (C) Germplasm theory (D) Cell fate

[KA-2015]

2. Which of the following statements is correct?
   (A) In the presence of sry, all sexual differentiation follows the female pathway in humans
   (B) In the absence of sry, all sexual differentiation follows the female pathway in humans
   (C) In the absence of her – 1, all sexual differentiation follows the female pathway in humans
   (D) In the absence of her – 1, all sexual differentiation follows the male pathway in humans

[WB-2015]

3. Which chromosomes serve as MALE sex switch in Birds?
   (A) XY (B) ZZ
   (C) ZW (D) XO

[GJ-2016]

4. Environmental sex determination is observed in.
   (A) Bonelia (B) Corals
   (C) Nereis (D) Starfish

[JK-2016]

5. Which one of the following genes in relation to sex determination/differentiation is most conserved in several organisms?
   (A) dmrt1 (B) sry
   (C) vasa (D) sox9

[KA-2016]

6. Dictyostelium morphogenesis requires
   (A) GTP (B) ATP
   (C) cAMP (D) CTP

[MH-2016]

7. Sex in Drosophila is determined by:
   (A) X/A ratio
   (B) ZZ/ZW chromosomes
   (C) XX/XY chromosomes
   (D) Environmental regulation

[MH-2016]

8. Dorsal lip of blastopore of frog is equivalent to …… of chick embryo.
   (A) Koller's sickle
   (B) Hensen's node
   (C) Area opaca
   (D) Area pellucida

[MH-2016]

9. The male sex differentiation in the echiuroid worm Bonellia is:
   (A) governed by the temperature of sea water in which the larvae live
   (B) determined by an XO type of chromosomal interaction
   (C) determined when the larvae come in contact with bonellin secreted by the female
   (D) induced when the number of females becomes very large

[CG-2017]

10. Match Column - A with Column - B:

Column-A		Column-B	
(a)	Acrosome	(i)	Evocator
(b)	Neural	(ii)	Molting Induction Hormone
(c)	Alimentary	(iii)	Penetration of canal ovum
(d)	Ecdysone	(iv)	Endoderm

Choose the correct answer:

	(a)	(b)	(c)	(d)
(A)	(iii)	(i)	(iv)	(ii)
(B)	(ii)	(iii)	(iv)	(i)
(C)	(iii)	(iv)	(i)	(ii)
(D)	(i)	(ii)	(iii)	(iv)

[CG-2017]

11. During lens formation in the Xenopus, the following statements have been proposed:
    M. Lens induction can be achieved in the absence of an optic vesicle after priming the head ectoderm by the anterior neural plate.
    N. The optic vesicle can induce the presumptive trunk ectoderm to form the lens.
    O. Only the head ectoderm can respond to direct signals from the optic vesicle, to form the lens.
    P. The anterior neural plate primes the head ectoderm via BMP4 and Fgf8 prior to signals from the optic vesicle.

    Which of the above combinations is correct?
    (A) M and O (B) O and P
    (C) N and O (D) N and P

[CG-2017]

12. Segmentation genes in Drosophila are divided into three groups (gap, pair rule and segment polarity) based on their mutant phenotype. Below are some of the major genes expressed in a sequential manner (with respect to the group) affecting segmentation pattern.
    M. $Hairy \rightarrow Paired \rightarrow tailless \rightarrow patched$
    N. $Hunchback \rightarrow even-skipped \rightarrow fushi\ tarazu \rightarrow wingless$
    O. $odd-skipped \rightarrow giant \rightarrow paired \rightarrow wingless$
    P. $Tailless \rightarrow hairy \rightarrow fushi\ tarazu \rightarrow gooseberry$
    Which of the above sequence(s) of gene expressed from early to late embryo is/ are **correct**?
    (A) M and N (B) M only
    (C) P only (D) M and P

[CG-2017]

13. In tadpoles, if the tail is amputated it can regenerate. However if the tail is amputed and then exposed to retinoic acid, it develops limbs instead of regenerating the tail. This could be due to the following reason:
    M. Retinoic acid is a morphogen and induces genes responsible for limb formation.
    N. Retinoic acid raises the positional values in that region for limb development to take place.
    O. This is a random phenomenon and is not well understood
    P. Retinoic acid possibly acts as a mutagen and the phenotype observed is a result of several mutations.
    Which combination of the above statements is true?
    (A) M and O (B) M and P
    (C) N and O (D) M and N

[GJ-2017]

14. Temperature dependent sex determination (TSD) is frequently observed in one of the following chordates:
    (A) Cephalochordates (B) Fishes
    (C) Crocodilians (D) Birds

[KA-2017]

15. "Bicoid" mRNA is localized in the region of Drosophila egg.
    (A) Anterior (B) Posterior
    (C) Dorsal (D) Ventral

[KA-2017]

16. Wings of Drosophila are attached to segment.
    (A) Prothorax (B) Mesothorax
    (C) Metathorax (D) Abdomen

[MP-2017]

17. The mechanism of sex determination in Coccinia indica is through _____
    (A) XY machanism XY
    (B) Pheromonal cross talk
    (C) Hormonal regulation
    (D) XO system

[KA-2017]

18. GFP is used as a Drosophila
    (A) Reporter (B) Inhibitor
    (C) Activator (D) Enhancer

[MP-2017]

19. In mammals the power of regeneration is greatest in organ
    (A) Lung (B) Liver
    (C) Heart (D) Pancreas

[MP-2017]

20. During the development of Triturus the presence of grey crescent in egg causes
    (A) Formation of "belly"
    (B) Normal development of embryo
    (C) Abnormal development of embryo
    (D) All are correct

[WB-2017]

21. What happens when 'loss of function' mutation occurs in 'tra' and tra-z genes of Drosophila?
    (A) Both XX and XY embryo will die.
    (B) Only XX embryo will develop as male.
    (C) Only XY embryo will develop as male.
    (D) Both XX and XY embryo will develop as male

[MH-2017]

22. Drosophila fly with only one X chromosome (XO condition in the absence of Y chromosome will develop as:
    (A) Female (B) Male
    (C) Meta-male (D) Intersex

[AP-2018]

23. Out of 1090 cells produced during development of *Caenorhabditis elegans*, how many cells are normally destined to die by apoptosis?
    (A) 111 (B) 121
    (C) 131 (D) 141

[WB-2017]

24. Spemann's organizer in amphibians is
    (A) Epidermal in origin
    (B) Endodermal in origin
    (C) Mesodermal in origin
    (D) Ectodermal in origin

[TN-2017]

25. In-situ DNA nick labeling technique is used to quantitate the fraction of cells in
    (A) apoptotic pathways
    (B) S phase
    (C) M phase
    (D) G1 phase

[AP-2018]

26. Match the following:

List – I	List – II
I. ZW-ZZ	1. Grasshopper
II. ZO-ZZ	2. Drosophila
III. XX-XO	3. Hen
IV. XX-XY	4. Butterfly

Code:

	I	II	III	IV
(A)	1	4	3	2
(B)	3	2	1	4
(C)	3	4	1	2
(D)	2	4	1	3

[CG-2018]

27. The third cleavage in frog's development is:
(A) meroblastic and vertical
(B) vertical and equatorial
(C) holoblastic and unequatorial
(D) holoblastic and equatorial

[CG-2018]

28. In amphibians, when due to some injury, the eye lens is damaged, the fully differentiated iris cells can regenerate the lens. It is achieved through the following possible processor:
(M) Iris cells through some signaling undergo differentiation into lens cells to regenerate the lens.
(N) Stem cells present in iris tissue differentiate into lens cells.
(O) Iris cells transform into lens cells spontaneously.
(P) Iris cells induce in a stepwise manner, specific genes responsible for their differentiation and then conversion to lens cells.
Which of the following is correct?
(A) (M) and (N) (B) (M) and (O)
(C) (M) and (P) (D) (N) and (O)

[KA-2018]

29. The classical four wings mutant fly Drosophila melanogaster resulted from
(A) Overexpression of ultrabithorax protein
(B) Homozygous for three mutant alleles of the ultrabithorax gene
(C) Loss of abdominal A gene products
(D) Over expression of abdominal A gene products

[KA-2018]

30. Match the following:

Category-1		Category-2	
(A)	Nanos	1.	Gap gene
(B)	Bicoid	2.	Formation of anterior structures of embryo
(C)	Kruppel	3.	Segment polarity gene
(D)	Engrailed	4.	Formation of posterior structures of embryo

(A) a – 2, b – 4, c – 3, d – 1
(B) a – 4, b – 2, c – 1, d – 3
(C) a – 3, b – 1, c – 2, d – 4
(D) a – 1, b – 3, c – 4, d – 2

[KA-2018]

31. What would be the phenotype of Drosophila, when the X chromosomal: Autosomal set ratio (X: A ratio) is 0.67?
(A) Male (B) Intersex
(C) Metamale (D) Met female

[MH-2018]

32. Difference in chromosomal determination of sex between Drosophila and human is because:
(A) In Drosophila, the ratio of X chromosome to autosome determines maleness or femaleness whereas in human, the Y chromosome determines maleness.
(B) As seen in human, mere presence of two X chromosomes triggers female developmental pathway in Drosophila.
(C) In both human and Drosophila the Y chromosome determines maleness
(D) As seen in Drosophila, presence of single X chromosome in the absence of Y chromosome can tigger maleness in human.

[MH-2018]

33. Wolffian lens regeneration in Amphibia is an example of
(A) Differentiation only
(B) De-differentiation only
(C) De-differentiation followed by proliferation
(D) Trans-differentiation

[AP-2019]

34. The egg of the following group contains the nucleus of Pander
(A) Mammal (B) Hen
(C) Frog (D) Reptile

[AP-2019]

35. The following fetal membranes consist of ecto and endoderm
(i) Yolk sac
(ii) Amnion
(iii) Chorion
(iv) Allantois
(A) (i) and (ii) are correct
(B) (ii) and (iii) are correct
(C) (iii) and (iv) are correct
(D) (i) and (iv) are correct

[AP-2019]

36. The correct sequence of appearance of the following during development of central nervous system of vertebrate
(i) Neural plate
(ii) Neural groove
(iii) Neural tube
(A) (iii)→(ii) →(i) (B) (ii) →(i) →(iii)
(C) (i) →(ii) →(iii) (D) (ii) →(iii) →(i)

[AP-2019]

37. The transcription factors necessary for eye lens induction
(i) SOX 9
(ii) SOX 2
(iii) PAX 6
(iv) DAX 1
The correct combination is
(A) (ii) and (iii) (B) (i) and (ii)
(C) (iii) and (iv) (D) (i) and (iv)

[CG-2019]

38. Match the following from Group - I with Group-II:

Group-I		Group-II	
a	Auditory placode	i	Changing cell shape
b	External gills	ii	Mesoderm
c	Microfilaments	iii	Protrusions of epidermis
d	Notochord	iv	Lateral line sense organ
e	Colouration in Insects	v	Cooperation of genes
f	Hormonal control of development	vi	Mammary gland development in mice

Code:

	(a)	(b)	(c)	(d)	(e)	(f)
(A)	(iv)	(ii)	(v)	(ii)	(i)	(vi)
(B)	(iv)	(iii)	(i)	(ii)	(v)	(vi)
(C)	(iii)	(ii)	(i)	(vi)	(v)	(iv)
(D)	(ii)	(iii)	(i)	(iv)	(vi)	(v)

[MH-2019]

39. Hox genes are critical for the proper placement of segment structures of animals during early embryonic development except:
(A) Different vertebrae of humans
(B) Caecum in humans
(C) Antennae in fruit flies
(D) Wings in fruit flies

[MH-2019]

40. ..... is involved in the specification of germ cells in all animals studies
(A) Sry (B) Sox 9
(C) Wnt 4 (D) Vasa

[KA-2020]

41. During morphogenesis, the formation of anterior structure in the Drosophila embryo requires the product of _____ gene.
(A) Hunchback (B) Pax-6
(C) Bicoid (D) Nanos

[KA-2020]

42. Which of the following is the master gene involved in sex determination in Drosophila?
(A) Sxl (B) Sdc
(C) Xol (D) Nanos

[WB-2020]

43. Which of the following pair of proteins regulate production of anterior structure in Drosophila embryo?
(A) Bicoid and Nanos
(B) Bicoid and Hunchback
(C) Caudal and Nanos
(D) Caudal and Hunchback

[KA-2020]

44. Products of maternal genome molecules that are placed in the Drosophila egg are
(A) DNA (B) Proteins
(C) RNA (D) Enzyme

[KA-2021]

45. The gene that is NOT involved in body patterning in Drosophila
(A) Gap gene
(B) Segment polarity gene
(C) SXL gene
(D) Pair rule gene

[KA-2021]

46. Which one of the following is maternally contributed RNA in the early development of Drosophila embryo?
(A) Sevenless (B) Engrail
(C) Bicoid (D) Wingless

[KA-2021]

47. In vertebrates the combination of Pax 6, Sox 2, Sox 3 and L-Maf transcription factors in the ectoderm of optic vesicle ensures the production of eye
(A) Retina (B) Lens
(C) Lid (D) Cornea

[AS-2021]

48. Match the items of Column-I with those of Column-II and select the correct match by using the codes given below:

Column-I	Column-II
(a) Yolk Sac	1. elimination of metabolic waste
(b) Chorion	2. shock absorption
(c) Allantois	3. food storage and digestion
(d) Amnion	4. exchange of substance between mother and embryo

Codes:

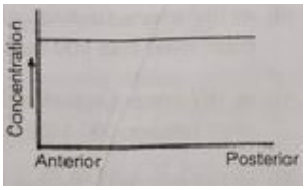
	(a)	(b)	(c)	(d)
(A)	4	3	1	2
(B)	4	3	2	1
(C)	3	4	2	1
(D)	3	4	1	2

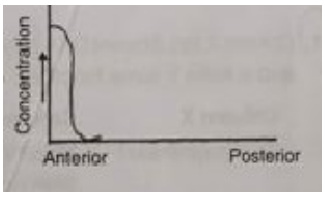
[AS-2021]

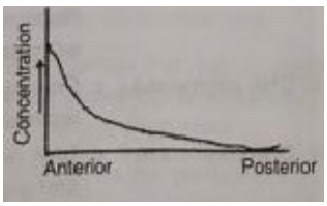
49. The anteroposterior axis in Drosophila is created by the regional synthesis of transcription factor encoded by the
(A) Bicoid and Nanos protein
(B) Hunchback and Caudal genes
(C) Twist and Snail genes
(D) Zerknult and Decapentaplegic

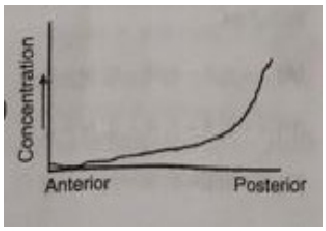
[JK-2022]

50. The level of bicoid protein was measured in early cleavage embryo of Drosophila.
Which one of the following graphs is a correct representation of bicoid gradient along the anterior-posterior axis?

(A) 

(B) 

(C) 

(D) 

[MH-2023]

51. The folding of sheet of cells, the migration of cells and apoptosis are all mechanisms of:
(A) cleavage pattern (B) pattern formation
(C) morphogenesis (D) differentiation

[RJ-2023]

52. What could be the possible reason that prevents the cell adjacent to the progenitor vulva cell from differentiating into the vulva cell in *C. elegans*?
(A) Inability of these cells to bind and respond to LIN 3-signaling.
(B) These cells are too far to receive LIN 3 signal.
(C) These cells undergo apoptosis by receiving signals from hypodermal cell.
(D) Cells deactivate LIN 3 signal due to condensed chromatin in the regions responsive to LIN 3 signal.

[RJ-2023]

53. There are signaling centers responsible for vertebrate limb development. Which of the following is responsible for specification of the limb field?
(A) TGF-B (B) Retinoic acid
(C) Hox (D) FGF

[MH-2023]

54. In chick, gastrulation involves inward movement of cells through the:
(A) Blastoderm (B) Yolk
(C) Cleavage furrow (D) Primitive streak

[RJ-2023]

55. Embryonic development in Drosophila is an orderly sequence of change and is controlled by the differential expression of genes. Which one of the following genes are egg polarity gene in development of Drosophila?
(A) Hox
(B) caudal and hunchback
(C) Gap gene
(D) hedgehog and wingless

[RJ-2023]

56. Which of the following is the homologue of β-catenin in Drosophila?
(A) Armadillo (B) Engrailed
(C) Fushi tarazu (D) Cubitus interruptus

[RJ-2023]

57. Which one of the following is the primary organizer in case of chick development?
(A) Brachet's cleft
(B) Spemann's organizer
(C) Nieuwkoop centre
(D) Hensen's node

[RJ-2023]

58. You are doing research on fruit flies and if there would be a mutation occurring in a homeotic gene, which of the following developmental abnormalities would be observed by you?
1. A fly with the correct number of segments has two additional thoracic segments and two less abdominal segments.
2. One abdominal segment has legs.
3. Four abdominal segments will be, missing
(A) 1 and 3 (B) 2 and 3
(C) 1 and 2 (D) only 3

[WB-2023]

59. A researcher obtained one Drosophila specimen with four wings. He exclaimed this as a bizarre phenotype, as Drosophila is a dipteran insect. He screened out the gene responsible for this mutation. What gene he could identity for this bizarre phenotype?
(A) Exuperantia (exu) (B) Krüppel (kr)
(C) Torso (tor) (D) Ultrabithorax (ubx)

[WB-2023]

60. A researcher injected exogenous ß-catenin at the future ventral side of a Xenopus gastrula. What result did he obtain?
(A) No change in embryonic development.
(B) The embryo failed to form its anterior-posterior axis.
(C) A secondary body axis developed at the injected side.
(D) Dorsal lip of the blastopore degenerated.

[MP-2023]

61. Face of cisternae forming Dictyosome is having:
(A) Proximal face generally convex
(B) Distal face generally concave
(C) Proximal face generally concave
(D) Distal face generally convex

[MP-2023]

62. The best known cell line obtained from Human Carcinoma is:
(A) BHK cells (B) CHO cells
(C) L and 3T3 cells (D) HeLa cells

[MH-2024]

63. Which of the following signalling molecules plays a key role in the patterning of neural tube along its anterior-posterior axis?
(A) Wnt4 (B) BMP4
(C) FGF4 (D) Retinoic acid.

[MH-2024]

64. Which one of the following extra embryonic membrane found as unique feature in terrestrial vertebrates only?
(A) Yolk sac (B) Chorion
(C) Allantois (D) Amnion

(NE-SLET-2024)

65. Match the items of Column-I with those of Column-II and select the correct match by using the codes given below:

Column-I (Structures)	Column-II (Originated from)
(a) Retina	1. Endodermal cells
(b) Nephric tubules.	2. Ectodermal cells
(c) Pigment pattern of skin	3. Neural crest cells
(d) Allantois	4. Mesodermal cells

Codes:

	(a)	(b)	(c)	(d)
(A)	4	2	1	3
(B)	2	4	3	1
(C)	2	3	1	4
(D)	1	3	4	2

(NE-SLET-2024)

66. Select the correct answer from the following statements using codes:
(i) Homeobox is a part of the promoter in eukaryotic genes that code for proteins involved in segmentation.
(ii) DNA triple helix formation requires Hydrogen bonding and Hoogstien bonding.
(iii) cl gene of phage lambda encodes the lambda repressor which represses the lytic cycle.
(iv) Homeobox is a conserved DNA sequence found in genes that code for proteins that regulate development.

Codes:

	(i)	(ii)	(iii)	(iv)
(A)	True	True	False	False
(B)	False	False	True	True
(C)	False	True	True	True
(D)	True	False	False	True

[CG-2024]

67. Match the following-

Column (A)	Column (B)
(I) Invagination	(a) Involution
(II) Delamination	(b) Chordamesoderm
(III) Inward rotation of cell	(c) Insinking
(IV) Primary organizer	(d) Mass separation

Code:
(A) I-a, II-b, III-c, IV-d (B) I-d, II-c, III-b, IV-a
(C) I-c, II-d, III-a, IV-b (D) I-a, II-d, III-c, IV-b

[CG-2024]

68. In meridional plane of cleavage, the cleavage furrow-
(A) Passes through Animal-Vegetal Axis
(B) Passes through Horizontal axis
(C) Passes Above the equator
(D) Passes Below the equator

[WB-2024]

69. In Drosophila, bicoid (bcd) gene controls embryonic gene expression by transcriptional activation and translational repression. If bcd mRNA is injected at the middle of a bicoid mutant (bcd) Drosophila embryo, what would be the expected phenotype?
(A) Normal body segmentation will occur
(B) Formation of acron at both the termini
(C) Formation of telson at both the termini and head at the middle
(D) Absence of telson and abdomen

[WB-2024]

70. A decrease in Bcl-2/Bax ratio will impact a cell by
    (A) preventing apoptosis
    (B) inducing apoptosis
    (C) inducing metastasis
    (D) inducing growth

[WB-2024]

71. A researcher was observing tail regeneration of Planeria injecting with RNAi for β-catenin mRNA into the blastema. What would be the expected result of his experiment?
    (A) Planeria with an extended tail
    (B) Planeria with two tails
    (C) Planeria with heads at both ends
    (D) Planeria with regeneration of a normal tail

[MP-2024]

72. The portion of the Drosophila body plan which will produce the wings is called:
    (A) Telson (B) Dorsal
    (C) Abdomen (D) Thorax

[MP-2024]

73. Neural crest cells taking the dorsolateral route will become:
    (A) Dorsolateral route ganglion
    (B) Sympathetic ganglion
    (C) Adrenal Medulla
    (D) Melanocytes

[GJ-2024]

74. What is the primary factor responsible for proliferation of blastemal cells during limb regeneration in salamanders?
    (A) Fgf8 from neurons only
    (B) Fgf8 from AEC and newt Anterior Gradient protein from neurons
    (C) newt Anterior Gradient protein from AEC and Fgf8 from neurons
    (D) newt Anterior Gradient protein from neurons only

[GJ-2024]

75. Which of the following morphogenetic movements can be defined as the splitting of one cellular sheet into two sheets?
    (A) Involution (B) Ingression
    (C) Epiboly (D) Delamination

Answer Key									
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
A	B	B	A	C	C	A	B	C	A
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
B	D	D	C	A	B	D	A	B	B
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
D	B	C	C	A	C	A	A	C	B
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
B	A	D	B	A	C	A	B	B	D
41	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**
C	A	B	B	C	C	B	D	D	B
51	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
C	A	B	D	B	A	D	C	D	C
61	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**
B	D	D	D	B	C	C	A	C	B
71	**72**	**73**	**74**	**75**					
C	D	D	B	D					

Unit-5.4:- Morphogenesis and Organogenesis in Plants:

Organization of Shoot and Root Apical Meristem; Shoot and Root Development; Leaf Development and Phyllotaxy; Transition to Flowering, Floral Meristems and Floral Development in Arabidopsis and Antirrhinum

[KA-2015]

1. The term homeobox refers to
   (A) A specific nucleotide sequence of some genes that regulate development
   (B) A group of genes that determine polarity during development
   (C) Glycoproteins that assist cells during morphogenetic movements
   (D) Peptide sequence of aminoacids that turn other genes on or off

[GJ-2016]

2. Male gametophyte in Angiosperms possesses:
   (A) One vegetative cell and two male gametes
   (B) One vegetative cell and one male gamete
   (C) Two vegetative cells and two male gametes
   (D) Two vegetative cells and one male gamete

[KA-2016]

3. Petals are formed in the 2nd Whorl due to
   (A) Class A genes (B) Class A+B genes
   (C) Class B+C genes (D) Class C genes

[AP-2017]

4. If a leaf cell of an angiosperm plant had 24 chromosomes, then its stigma cell, antipodal cell and endosperm nucleus would contain: