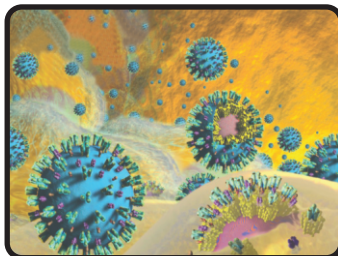


EtG

OLYMPIAD EXPLORER BIOTECHNOLOGY

EduHeal Foundation
Nationwide Biotechnology Olympiad
and other
National/International Biotechnology Olympiads/Talent Search Exams.



Class-12

EtG **BOOKS**

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SYLLABUS GUIDELINES*

Based on CBSE, ICSE & GCSE Syllabus & NCF guidelines devised by NCERT

Key Topics in Mathematics for Class XI and XII

- I. ALGEBRA
Sets, Relations and Functions, Complex Numbers, Matrices and Determinants ,
Quadratic Equations, Permutation and Combination, Binomial Theorem and its
Applications, Sequences and Series
- II. CALCULUS
Differential Calculus, Integral Calculus, Differential Equations
- III. TWO AND THREE DIMENSIONAL GEOMETRY
Two dimensional Geometry, The straight line and pair of straight lines,
Circles and system of Circles, Conic Section, Three dimensional Geometry
- IV. VECTORS
Vector Algebra
- V. STATISTICS
Measures of Central Tendency and Dispersion, Probability
- VI. TRIGONOMETRY
- VII. STATICS AND DYNAMICS
Statics, Dynamics

Key Topics in Physics for Class XI and XII

1. Units and Measurement
2. Description of Motion in one dimension
3. Description of Motion in Two and Three dimensions
4. Laws of Motion
5. Work, Energy and Power
6. Rotational Motion and Moment of Inertia
7. Gravitation
8. Properties of Matter
9. Oscillations
10. Waves
11. Heat and Thermodynamics
12. Transference of heat
13. Electrostatics
14. Current Electricity
15. Thermal and Chemical Effects of currents
16. Magnetic Effects of Currents
17. Magnetostatics
18. Electromagnetic Induction and Alternating Currents
19. Ray Optics
20. Wave Optics
21. Electromagnetic waves
22. Electrons and Photons
23. Atoms, Molecules and Nuclei

Class - 12

V

24. Solids and Semi-Conductor Devices

Key Topics in Chemistry for Class XI and XII

1. Atoms, Molecules and Chemical Arithmetic
2. Elements, their Occurrence and extraction
3. States of Matter Gaseous state
4. Atomic Structures Constituents of the atom
5. Chemical Families – Periodic Properties
6. Chemical Bonding and Molecular structure
7. The Solid State
8. The Gaseous state
9. Solutions
10. Chemical Energetics and Thermodynamics
11. Chemical Equilibrium
12. Redox Reactions and Electrochemistry
13. Rates of Chemical Reactions and Chemical Kinetics
14. Chemistry of Hydrocarbons
15. Purification and Characterisation of Organic Compounds
16. Organic Chemistry Based on Functional Group
17. Organic Chemistry Based on Functional Group II
18. Organic Chemistry Based on Functional Group-II
19. Chemistry of Non-metals
20. Chemistry of Non-metals – II
21. Chemistry of lighter Metals
22. Heavy Metals
23. Chemistry of Representative Elements
24. Transition Metals including Lanthanides
25. Coordination Chemistry and Organo Metallics
26. Nuclear Chemistry
27. Synthetic and Natural Polymers
28. Surface Chemistry
29. Bio Molecules and Biological Processes
30. Chemistry in Action

Key Topics in Biology for Class XI and XII

1. General Biology
2. Systematics and Classification
3. Animal Kingdom
4. Plant Kingdom
5. Cell Biology
6. Genetics
7. Human Biology
8. Angiosperm Botany
9. Ecology and Environment
10. Application of Biology
11. Evolution



For Maths, Physics & Chemistry please refer to Maths and Science Workbooks.

EXERCISE - 1

- Photosystem I is
 - Polypeptide chain and Copper ion
 - An assemblage of 13 polypeptide chain
 - A single unit
 - An assemblage of 13 polypeptide chain and lipids
- The cytochrome *bf* complex is
 - An assemblage of three subunits
 - An assemblage of four subunits
 - A single unit
 - An assemblage of two subunits
- The water splitting enzyme, a constituent of photosystem II contains a cluster of
 - Two magnesium ions
 - Two manganese ions
 - Four manganese ions
 - Two copper ions
- Photosystem I produces
 - NADPH only
 - ATP only
 - Both of the above
 - None of the above
- Pheophytin is
 - Xanthophyll
 - Chlorophyll *b*
 - Chlorophyll *a*
 - Chlorophyll minus magnesium
- Light harvesting complex contains
 - 200 molecules of chlorophyll *a* and bond to polypeptide chains
 - 200 molecules of chlorophyll *a* and *b*
 - 200 molecules of chlorophyll *a*
 - 300 molecules of chlorophyll *a* and *b*
- O₂ evolved in photosynthesis comes from
 - Carbohydrate
 - Carbondioxide
 - Water
 - All of the above
- Chlorophyll *a* & *b* are effective photoreceptors because
 - They contain alternating double and triple bonds
 - They contain more double bonds
 - They contain magnesium atoms
 - They contain alternating single and double bonds
- The majority of lipid in thylakoid membrane is
 - Phospholipids
 - Sulfolipids
 - Galactolipids
 - Sphingolipid
- Photosynthesis takes place in

- (a) Stroma of chloroplast (b) Thylakoid membrane
(c) Chloroplast (d) All of the above
11. In order for glycolysis to continue, NAD must be regenerated through
(a) Fermentation only (b) Respiration only
(c) Both of the above (d) Calvin Cycle
12. Which of the following is an energized nucleotide ?
(a) dCTP (b) dCMP
(c) GMP (d) dAMP
13. An organism that has simple nutritional requirements has biosynthetic ability than that has complex nutritional requirements. The blank is filled by
(a) Lesser (b) Equal
(c) A unique (d) Greater
14. Comparing C₃ and C₄ pathways
(a) C₄ pathway is a short pathway
(b) C₄ pathway is fruitful process
(c) C₃ pathway is fruitful process
(d) C₃ and C₄ pathway are of the same duration
15. C₄ pathway occurs due to
(a) Ribulose 1, 5 - diphosphate
(b) Pyruvate phosphoenol phosphatase
(c) Presence of bundle sheath cells
(d) None of the above
16. Photorespiration produces
(a) DNA (b) ATP
(c) CO₂ (d) NADH
17. The most abundant protein in biosphere is
(a) Rubisco (b) Glycoprotein
(c) Keratin (d) None of these
18. The number of protons per ATP synthesized is
(a) 3 (b) 5
(c) 4
(d) ATP synthesis is not related to protein flow
19. CF₁ Subunit of ATP synthetase consists of
(a) 8 sub units (b) 5 sub units
(c) 9 sub units (d) 7 sub units
20. Cyclic phosphorylation takes place when
(a) NADP⁺ is available as an electron donor
(b) NADP⁺ is not available as an electron acceptor
(c) O₂ is not available as an electron acceptor
(d) Proton gradient does not develop across the thylakoid

21. In comparing the efficiency of fermentation versus respiration with regard to ATP yield, which is more efficient process
(a) Fermentation (b) Respiration
(c) Both (d) None
22. During glycolysis, what type of phosphorylation generates ATP ?
(a) Substrate level phosphorylation
(b) Oxidative phosphorylation
(c) Photophosphorylation (d) Transphosphorylation
23. Which of the following two compounds are required for CO₂ fixation ?
(a) NADPH₂ and ATP (b) Fumaric acid and ATP
(c) Hydrogen sulfide and oxygen
(d) Cytochrome and ATP
24. In glycolysis for each glucose molecule that is broken down there is a net gain of
(a) 4 ATP molecules (b) 2 ATP molecules
(c) 1 ATP molecules (d) 6 ATP molecules
25. The most common dissimilatory pathway for glucose breakdown is
(a) CAM pathway (b) Krebs's cycle
(c) Glycolysis (d) C₄ pathway
26. Which of the following statement about ATP generation is correct ?
(a) Photophosphorylation
(b) Oxidative phosphorylation
(c) Substrate level phosphorylation
(d) All of the above

☺☺☺

1. (b) 2. (b) 3. (c) 4. (a) 5. (d) 6. (a) 7. (c) 8. (d)
9. (c) 10. (b) 11. (c) 12. (d) 13. (d) 14. (b) 15. (b) 16. (c)
17. (a) 18. (b) 19. (c) 20. (b) 21. (b) 22. (a) 23. (a) 24. (b)
25. (c) 26. (d)

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EXERCISE-2

1. The extreme compact state of DNA is brought about by
 - (a) Size of the nucleus
 - (b) Histones
 - (c) The size of the cell
 - (d) Protamines
2. The most compact DNA is found in
 - (a) *Drosophila*
 - (b) Sperm tails
 - (c) Sperm heads
 - (d) *E. coli*
3. The major role in DNA compaction is played by
 - (a) H₁ histone protein
 - (b) The double helix of DNA
 - (c) The negative charge on DNA
 - (d) All the histone proteins
4. The variable histone/histones is/are
 - (a) H_{2A} + H₂
 - (b) H₁ + H₄
 - (c) H₁ only
 - (d) All of these
5. The four types of histone proteins (H₁, H_{2a}, H_{2b}, H₃, H₄) exist
 - (a) In different forms only in plants
 - (b) Only in single forms
 - (c) In a variety of forms
 - (d) None of the above
6. Largest DNA molecule (41 × 10⁶ kd) is found in
 - (a) *Acetabularia*
 - (b) Human
 - (c) *Drosophila*
 - (d) *E. coli*
7. Role of stringent factor is
 - (a) To break the phosphodiester bond
 - (b) To control the number of amino acids being added to the polypeptide chain
 - (c) To catalyze the formation of the unusual nucleotide ppG_{pp}
 - (d) To increase the rate of translation
8. The regulation coordinated with amino acid concentration is called
 - (a) Stringent response
 - (b) SOS response
 - (c) Stringent factor
 - (d) Autoregulation
9. The expression of most genes is regulated primarily at the level of
 - (a) Transduction
 - (b) Transcription
 - (c) Translation
 - (d) Post translational modification
10. During protein DNA interaction, the most important feature is
 - (a) The bonds that form between them
 - (b) Charge of protein only
 - (c) The charge of protein and DNA
 - (d) Their symmetry matching
11. Ubiquitin of all eukaryotes is
 - (a) Perform different functions
 - (b) Essentially similar
 - (c) All of the above
 - (d) None of the above
12. Membrane bound and free ribosomes differ
 - (a) In the type of protein synthesis
 - (b) In their function
 - (c) In their structure
 - (d) All of these
13. Membrane bound ribosomes and free ribosomes are structurally
 - (a) Totally different
 - (b) Slightly different
 - (c) Similar
 - (d) None of these
14. All integral membrane proteins of the cell are formed by the ribosomes bound to the ER except
 - (a) Mitochondria and chloroplast
 - (b) Mitochondria and nucleus
 - (c) Mitochondria only
 - (d) Chloroplast only
15. SRP stops protein synthesis
 - (a) Means of stearic hindrance
 - (b) Acting as an inhibitor
 - (c) Acting as a toxic material
 - (d) None of these
16. Control of ribosomal protein synthesis is exerted at
 - (a) When assembled into ribosomes
 - (b) Post transcriptional level
 - (c) Transcriptional level
 - (d) Translational level
17. In *E. coli* cell, the physiologic inducer is
 - (a) Glucose
 - (b) Allolactose
 - (c) Lactose
 - (d) Fructose
18. The phage is known as prophage when it
 - (a) Is in the lysogenized state
 - (b) Stays in the cell at lytic phase
 - (c) Undergoes lysis
 - (d) Is undergoing mitosis
19. Hypersensitive sites have a range of around
 - (a) 100-300 base pairs
 - (b) 100-150 base pairs
 - (c) 100-200 base pairs
 - (d) 500-1000 base pairs
20. Hypersensitive sites are
 - (a) Regions in immune system responsible for hypersensitivity
 - (b) Sequences of DNA sensitive to DNAase I
 - (c) Sequences of DNA capable of undergoing mutation
 - (d) mRNA sequences undergoing attenuation
21. Proteins at the time of degradation becomes joined to
 - (a) Ubiquitin
 - (b) Peptidase
 - (c) Clathrin
 - (d) SRP
22. Amino acid sequences of H₃ and H₄ is

- (a) Same in some plants and animals and different in some
 (b) Same in all plants and animals
 (c) Different in plants and animals
 (d) Different in animals and same in all plants
23. Example of isoprenylated protein is
 (a) Lamins (b) G protein
 (c) Proto-oncogenes (d) All of the above
24. Eukaryotic proteins are isoprenylated *i.e.*
 (a) A thioester bond is formed between the isoprenyl group and cys residue of the protein
 (b) Isoprenyl group is deleted from the protein
 (c) Isoprenyl group is attached at the 3rd end of the polypeptide chain
 (d) As ester bond is formed between isoprenyl group and ser residue of the protein
25. The DNA of which of the following organism is non methylated ?
 (a) *E. coli* (b) Yeast
 (c) *Xenopus* (d) *Drosophila*
26. The percentage of mammalian DNA coding for protein is
 (a) 2% only (b) 4% only
 (c) 3% only (d) 1% only
27. "Clustering is not essential for coordinated gene expression". This statement is verified by
 (a) Histone genes are dispersed and scattered but expressed together
 (b) Immunoglobulins are arranged distantly but expressed simultaneously
 (c) Different subunits of ribosomes are scattered but expressed together
 (d) All of these
28. Choose the correct statement.
 (a) mRNA for histones do not have poly A chain
 (b) Repetitive genes for ribosomal RNAs and histones are exceptions
 (c) Most genes of eukaryotic proteins are encoded by single copy genes
 (d) All of the above
29. During translocation the signal for attachment (a sequence of amino acid residues are attached) is at
 (a) Sometimes at carboxy I and sometimes amino terminus
 (b) Amino terminus
 (c) Carboxyl terminus (d) All of these
30. Clathrin is a protein that forms
 (a) Hexagonal lattices (b) Tetrahedral lattices
 (c) Polyhedral lattices (d) Forms no lattices
31. All protein transport except the outer membrane transport is driven by
 (a) Proton motive force (b) GTP hydrolysis

- (c) ATP hydrolysis (d) All of the above
32. The acid nature of the endosome leads to
 (a) Separating the microbes from surface proteins
 (b) Inactivating the interferons
 (c) Killing of the microbes
 (d) Conformational change that is necessary for infection
33. The pH of the lysosomes is endosomes
 (a) Lower than (b) Equal to
 (c) Higher than
 (d) All of the above depending on the situation
34. The clathrin unit (triskelion) is a
 (a) Tetrahedral structure (b) 4 legged structure
 (c) 3 legged structure (d) Beaded structure

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1. (d) 2. (c) 3. (a) 4. (c) 5. (c) 6. (c) 7. (c) 8. (a)
 9. (b) 10. (d) 11. (b) 12. (a) 13. (c) 14. (a) 15. (a) 16. (d)
 17. (b) 18. (a) 19. (c) 20. (b) 21. (a) 22. (b) 23. (d) 24. (a)
 25. (d) 26. (a) 27. (a) 28. (d) 29. (b) 30. (c) 31. (a) 32. (d)
 33. (a) 34. (c)

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EXERCISE - 3

1. Amino acids that are degraded to acetyl CoA or acetoacetyl CoA are termed as
 - (a) Gluconeogenic
 - (b) Glucogenic
 - (c) Ketogenic
 - (d) Microorganisms
2. Synthesis of urea requires
 - (a) 2 ATPs
 - (b) 3 ATPs
 - (c) 4 ATPs
 - (d) 12 ATPs
3. Amino acid degradation occurs in
 - (a) Intestine
 - (b) Stomach
 - (c) Mouth
 - (d) Liver
4. Amylose is
 - (a) Is a branched starch
 - (b) Is a starch
 - (c) Not a starch
 - (d) Is an unbranched starch
5. Phosphorylation helps in making the sugar
 - (a) Neutral
 - (b) Cationic
 - (c) Anionic
 - (d) None of these
6. In Mucoproteins N-acetyl glucosamine is linked to
 - (a) Serine or threonine
 - (b) Threonine only
 - (c) Serine only
 - (d) All of these
7. The most important polysaccharides in living organisms are
 - (a) Cellulose
 - (b) Starch and glycogen
 - (c) Starch
 - (d) All of the above
8. In glycoproteins the proteins is linked to the carbohydrate moiety by way of
 - (a) Aspartate
 - (b) Arganine
 - (c) Glutamine
 - (d) Asparagine
9. Most secreted proteins are
 - (a) Mucoproteins
 - (b) Glycoproteins
 - (c) Phosphoproteins
 - (d) Sphingolipids
10. Disaccharides and polysaccharides are formed from monosaccharides by
 - (a) Decarboxylation
 - (b) Hydrolysis
 - (c) Condensation
 - (d) None of these
11. Mass of nitrogenase enzyme involved in nitrogen fixation has a mass of
 - (a) 225 kd
 - (b) 220 kd
 - (c) 210 kd
 - (d) 10 kd
12. The enzyme involved in nitrogen fixation is
 - (a) Nitrogenase & reductase
 - (b) Nitrogenylase only
 - (c) Oxidase & reductase
 - (d) Reductase only
13. A family of protein cleaving enzymes that includes the digestive enzymes is
 - (a) Elastase proteases
 - (b) Trypsin proteases
 - (c) Threonine proteases
 - (d) Serine proteases
14. Collagen protein consists of
 - (a) Three separate chain
 - (b) Three linked chain
 - (c) Two linked chain
 - (d) Three disulphide linked chain
15. Codons are degenerate *i.e.*
 - (a) One amino acid is specified by one codons
 - (b) One codon specifies several amino acid
 - (c) One amino acid is specified by several codons
 - (d) None of the above
16. Oligosaccharides and Polysaccharides are
 - (a) Slightly different
 - (b) Different altogether
 - (c) Same
 - (d) Differ in chain length
17. The committed step for the fatty acid synthesis is the formation of
 - (a) Ketoacyl CoA
 - (b) Succiny1 CoA
 - (c) Malonyl CoA
 - (d) Enoyl CoA
18. The oxidation of fatty acid is
 - (a) Slightly different for saturated and unsaturated fatty acid
 - (b) Different for saturated and unsaturated fatty acid
 - (c) Similar for both saturated and unsaturated fatty acid
 - (d) None of the above
19. The compound which is most highly hydrated is
 - (a) Triacylglycerols
 - (b) Carbohydrates
 - (c) Proteins
 - (d) Glycogen
20. Cobalamin is a vitamin synthesized by
 - (a) Animals only
 - (b) Plants only
 - (c) Animals and plants both
 - (d) Microorganisms
21. The amino acid often found in the active sites of enzymes is
 - (a) Threonine
 - (b) Lysine
 - (c) Methionine
 - (d) Histidine
22. Glycine is unique in the sense
 - (a) It is optically inactive
 - (b) It is optically actives
 - (c) It is an unreactive amino acid
 - (d) It has aromatic side chain
23. Sulphydryl group is present in
 - (a) Tyrosine
 - (b) Phenylalanine
 - (c) Methionine
 - (d) Cysteine
24. The proteins are constituted by
 - (a) L-amino acids only
 - (b) D-amino acids only
 - (c) Both L & D amino acids
 - (d) Depends on the type of protein
25. Water has usually high dielectric constant because
 - (a) Of its polarity and capacity to form oriented solvent shells around ions
 - (b) Of its bond angle
 - (c) Of its polarity
 - (d) Of its electrostatic force

26. In human the final product of purine degradation is
 (a) Urate (b) Urea
 (c) Thymidylate (d) Xanthine
27. Azidothymidine (AZT) is used to treat
 (a) Alzheimer's (b) AIDS
 (c) Cancer (d) Thalassemia
28. Methotrexate is a/an
 (a) Inhibitor
 (b) Intermediate in lipid biosynthesis
 (c) Precursor of Glycine (d) Vitamin
29. Amino acids can be modified to yield
 (a) Glucose (b) Ketone bodies
 (c) Fatty acid (d) All of these
30. An enzyme not involved in nitrogen fixation is
 (a) Dehydrogenase (b) Synthetase
 (c) Reductase (d) Oxyhydrogenase
31. Ultra centrifugation separates proteins according to
 (a) Charge (b) Shape
 (c) Size (d) Geometry
32. The amino acids with longest side chains is
 (a) Arginine & Lysine (b) Lysine & Leucine
 (c) Arginine (d) Asparagine
33. Paramercaptoethanol
 (a) Breaks all disulfide bonds (b) Breaks all bonds
 (c) Breaks all non covalent bonds
 (d) Breaks Vander Waal bonds
34. Proteins contain regulatory sites called
 (a) Clefts (b) Complementary surfaces
 (c) Folding sites (d) Allosteric sites
35. α -helix is stabilized by hydrogen bonds between the
 (a) NH and COOH groups of all chain
 (b) NH and NH groups of the same chain
 (c) NH and CO groups of the side chain
 (d) NH and CO groups of the main chain



1. (b) 2. (d) 3. (a) 4. (c) 5. (c) 6. (a) 7. (b) 8. (d)
 9. (b) 10. (c) 11. (b) 12. (c) 13. (d) 14. (a) 15. (c) 16. (d)
 17. (c) 18. (b) 19. (a) 20. (c) 21. (d) 22. (a) 23. (d) 24. (a)
 25. (a) 26. (a) 27. (b) 28. (a) 29. (d) 30. (d) 31. (c) 32. (a)
 33. (a) 34. (d) 35. (d)



EXERCISE-4

1. The frequency of recombination is
 (a) Lowest for genes that first entered the recipient cells
 (b) Highest for genes that first entered the recipient cells
 (c) Same for all genes (d) None of these
2. Plasmids replication
 (a) Needs an initiator (b) Is depends on the genomic DNA
 (c) Is autonomous (d) Does not replicate
3. The plasmid which is largest in size is
 (a) F (b) G
 (c) R (d) λ
4. During SOS response the bond in *lex A* protein broken is
 (a) Ala-Met (b) Ala-Alu
 (c) Ala-Gly (d) None of these
5. SOS response is initiated by the
 (a) Cleavage of *rec A* protein (b) Bidirectional
 (c) Single stranded DNA (d) Cleavage of *lex A* protein
6. *Rec A* protein moves in
 (a) 5'-3' direction in DNA (b) Bidirection
 (c) 3'-5' direction (d) 3'-5' direction in RNA
7. *Rec A* protein binds to
 (a) Bases (b) Nucleotides
 (c) Single stranded DNA (d) Double stranded DNA
8. Bacterial cells treated with chloramphenicol
 (a) Becomes filled with both plasmids & genomic DNA
 (b) Becomes filled with genomic DNA
 (c) Becomes filled with plasmids
 (d) None
9. The following are the essential requirements for recombination
 (a) DNA polymerase I (b) DNA ligase
 (c) Single standard DNA (d) All of the above
10. Transposons are
 (a) Mobile genetic elements between non homologous chromosomes
 (b) None mobile genetic elements
 (c) Mobile genetic elements between homologous chromosomes
 (d) Recombination genetic elements
11. Recombination in eukaryotic cells can occur during meiosis by ion exchange process called

- (a) Chiasma (b) Crossing over
(c) Linkage (d) Diakinesis
12. In an $F^+ \times F^-$ cross
(a) The F^+ cell becomes an F^- cell
(b) The F^- cell becomes an Hfr cell
(c) The F^+ cell becomes an Hfr cell
(d) The F^- cell becomes an F^+ cell
13. Hfr cells are those that
(a) Show high frequency of conjugation
(b) Show high frequency of division
(c) Exhibit a high frequency of recombination
(d) Show high frequency of transformation
14. Plasmid are naturally occurring
(a) Linear duplex DNA (b) Linear single stranded RNA
(c) Linear single stranded DNA (d) Circular duplex DNA
15. Ti-Plasmid naturally occurs in
(a) *Staphylococcus* (b) *Corynebacterium*
(c) *Agrobacterium* (d) *Vibrio*
16. Ideal host for the amplification DNA molecules is
(a) Bacteria (b) Plants
(c) Viruses (d) Animals
17. Ti-plasmid transfer works with
(a) All plants (b) Dicots only
(c) Monocots only (d) All of these
18. Ti plasmid is useful in
(a) Bringing tumour cells into plant cells
(b) Bringing new genes into plant cells
(c) Bringing new genes into animal cells
(d) All of the above
19. The RTF region enables the plasmid to
(a) Replicate in the host cell
(b) Undergo transformation
(c) Be transmitted to other bacteria by conjugation
(d) Code for enzymes that inactivate specific drugs
20. The insertion sequence with greatest length is
(a) IS_4 (b) IS_2
(c) IS_1 (d) IS_5
21. The plasmid resist to ampicillin is
(a) PUC (b) pBR 322
(c) pBR 327 (d) All

22. Polylinker DNA is one which
(a) Is used for DNA transfer
(b) Has restriction sites for several enzymes
(c) Do not code for any protein
(d) Is seen in single stranded DNA only
23. Transposon tagging is used to
(a) Study the sequence of genes (b) Isolate a transposon
(c) Isolate a gene (d) Study the characters coded by genes
24. Transposon tagging depicts
(a) Crossing over (b) Loading with radioactive elements
(c) Linkage (d) Mutation
25. The mating type locus of yeast genes is called
(a) MAL (b) MLY
(c) MTL (d) MAT
26. Due to transposition in yeast its changes.
(a) Sex (b) Life cycle
(c) Shape (d) Mode of division
27. Small pieces of DNA that can insert themselves into chromosomes at numerous locations and mutations are called
(a) Transposons (b) Wild type genes
(c) Carcinogens (d) Frame shift genes
28. Plasmids have been classified into various groups on the basis of their ability to coexist in the same cell with other plasmids. The group is called
(a) Incompatibility (b) Classical
(c) Major (d) Constitutive
29. A bacterial cell treated so that it is freed of plasmids is said to be
(a) Hyper cell (b) Depleted cell
(c) Cured (d) Hypo cell
30. The plasmids associated with resistance to antibiotics are
(a) D plasmids (b) Hfr plasmids
(c) R plasmids (d) All plasmids
31. The recipient site becomes.....during transposition .
(a) Halved (b) Duplicate
(c) Short by few sequences (d) Non-coding
32. Antisense RNA molecules have a sequence.....to normal RNA transcripts.
(a) Opposite (b) Non-complementary
(c) Complementary (d) Similar
33. Reverse genetics follows the sequence
(a) mRNA \rightarrow DNA (b) Genes \rightarrow proteins
(c) Proteins \rightarrow DNA (d) Proteins \rightarrow genes

34. A type of DNA cloning that is carried outside cells is
 (a) PCR (b) Genomic
 (c) cDNA (d) Positional
35. Genomic DNA clones of all cells are
 (a) Same with few exceptions (b) Different
 (c) Same
 (d) Dependent on the cell type use to prepare clones
36. Which of the following viruses contain DNA with two segments.
 (a) Tobacco mosaic virus (b) Gemini viruses
 (c) Cauliflower mosaic virus (d) Yeast artificial chromosomes
37. The enzyme responsible for transposition is
 (a) Transpase (b) Recombinase
 (c) Transposase (d) Recombase
38. The plasmid with largest base pairs are
 (a) P elements (b) Bacteriophage
 (c) Phage (d) YAC
39. pBR 322 vector was produced by
 (a) Bolivar (b) Rodriguez
 (c) Both (d) None
40. The plasmid derived from *E.coli* is
 (a) pBR 327 (b) pBR 322
 (c) All (d) None
41. Which of the following enzymes prevents tissue damage from reactive oxygen species ?
 (a) Superoxide dismutase (b) Interleukins
 (c) Vaccines (d) Erythropoietin
42. Plasmids can be introduced into bacterial cells by a process called
 (a) Transfusion (b) Conjugation
 (c) Transformation (d) Recombination
43. Erythropoietin is a protein hormone that stimulates production of
 (a) Thrombocytes (b) Leucocytes
 (c) Erythrocyte (d) All of the above
44. During infection of a bacterial cell phage sheath
 (a) Expands (b) Breaks into two pieces
 (c) Withers away (d) Contracts
45. The process of Lysogeny is carried out only by phages containing DNA
 (a) cDNA (b) d DNA
 (c) ds DNA (d) sDNA
46. Which term is not descriptive of bacteriophage types
 (a) Lysogenic (b) Temperate
 (c) Lytic (d) Virulent
47. The word bacteriophage means
 (a) Fungi infection (b) Bacteria eater
 (c) Infected virus (d) Phage in a bacterial life cycle
48. The transposition of transposons is aided by protein called
 (a) Transaminase (b) Transposases
 (c) Transposes (d) Transaminidase
49. In case of site specific recombination the enzyme recombinase gets linked to the DNA through
 (a) Ionic linkage (b) Van der Waal bonds
 (c) Phosphodiester bonds (d) Phosphotyrosine bonds
50. By the transposition of an insertion sequence into their midst most genes are
 (a) Depleted (b) Inactivated
 (c) Activated
 (d) All of the above depending upon the situation



1. (b) 2. (c) 3. (c) 4. (c) 5. (d) 6. (a) 7. (c) 8. (c)
 9. (d) 10. (a) 11. (b) 12. (d) 13. (c) 14. (a) 15. (c) 16. (a)
 17. (b) 18. (b) 19. (c) 20. (d) 21. (d) 22. (b) 23. (c) 24. (d)
 25. (d) 26. (a) 27. (a) 28. (a) 29. (c) 30. (c) 31. (b) 32. (c)
 33. (d) 34. (a) 35. (a) 36. (a) 37. (c) 38. (d) 39. (c) 40. (c)
 41. (a) 42. (c) 43. (c) 44. (d) 45. (c) 46. (a) 47. (b) 48. (b)
 49. (d) 50. (b)



**NATIONWIDE BIOTECHNOLOGY
OLYMPIAD (NBTO)
SAMPLE PAPER**

Total duration : 60 Minutes

Total Marks : 50

SECTION A : GENERAL KNOWLEDGE

- The massive hole in the ozone layer over the Antarctica was first discovered in
(a) 1905 (b) 1950 (c) 1985 (d) 2000
- Environmental friendliness of a vehicle could be measured by the amount of pollutants it emits per passenger per kilometre travelled. Rate the environmental friendliness (1=best & 4 = worst) of the following vehicles as per this criterion:
Car : scooter : bus : bicycle
(a) 4:3:2:1 (b) 2:3:4:1 (c) 3:2:4:1 (d) 4:2:3:1
- A device is fitted to motor vehicles to chemically reduce some gases produced by internal combustion engines like NO_x, CO, and HC into less harmful products. Name this device.
(a) 2-stroke engines (b) Carburetor
(c) Catalytic converter (d) Tail pipe
- CFCs (chloro-fluoro-carbons) are greenhouse gases that have caused a rise of 0.3 °C in the global temperatures in the past century. Name the CFC that is used in refrigerators.
(a) Methane (b) Freon (c) Carbon dioxide (d) Ammonia
- One of the most harmful consequences of run-off pollution is eutrophication. Eutrophication...
I. is initiated by too many nutrients in the water which causes algal blooms to occur.
II. causes less sunlight to reach the bottom of the bay, resulting in dead of marine life.
III. results in a decrease in dissolved oxygen and water clarity.
(a) I and II (b) II and III (c) I and III (d) I,II and III
- The number of drowned polar bears is rising. Why?
(a) Due to evolutionary changes caused by global warming, they have lost the capacity to swim.
(b) Polar bears get caught in huge fishing nets causing them to drown.
(c) Due to the loss of ice. As ice melts, the swimming distance between the remaining ice islands increase.
(d) All the above
- What country is the largest source of global warming pollution?
(a) Japan (b) India (c) United states (d) China
- The Kyoto Protocol is an agreement countries make to help slow down global warming? Which two countries have not entered into this agreement?
(a) The United States and Australia (b) Japan and Australia
(c) Canada and the United States (d) Canada and Japan

Class - 12

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- One of the most severe threats from global warming is catastrophic coastal flooding due to the melting of ice caps. The melting of which ice cap(s) would cause the worst flooding problems?
(a) The ice caps of the Rocky Mountains
(b) The Arctic ice cap (c) The Antarctic ice cap
(d) The ice caps of the Andes Mountains
- Scientists predict that if the Greenland ice sheet completely melts, sea level will rise by about how many feet?
(a) 15 feet (b) 20 feet (c) 30 feet (d) 35 feet

SECTION B : PHYSICS & CHEMISTRY

- A projectile can have the same range R for two angles of projection. If T_1 and T_2 be the time of flights in the two cases, then the product of the two times of flights is directly proportional to
(a) $\frac{1}{R^2}$ (b) $\frac{1}{R}$ (c) R (d) R^2
- A satellite of mass m revolves around the earth of radius R at the height x from its surface. If g is a acceleration due to gravity on the surface of the earth, the orbital speed of the satellite is
(a) gx (b) $\frac{gR}{R-x}$ (c) $\frac{gR^2}{R+x}$ (d) $\left(\frac{gR^2}{R+x}\right)^{1/2}$
- The angle of incidence at which reflected light is totally polarized for reflection from air to glass (refractive index n), is
(a) $\sin^{-1}(n)$ (b) $\sin^{-1}(1/n)$ (c) $\tan^{-1}(1/n)$ (d) $\tan^{-1}(n)$
- When $n-p-n$ transistor is used as an amplifier
(a) electrons move from base to collector
(b) holes move from emitter to base
(c) electrons move from collector to base
(d) holes move from base to emitter
- The manifestation of band structure in solids is due to
(a) Heisenberg's uncertainty principle
(b) Pauli's exclusion principle
(c) Bohr's correspondence principle
(d) Boltzmann's law
- Laissagne's test for the detection of nitrogen will fail in case of
(a) hydrazine (b) phenyl hydrazine
(c) urea (d) $\text{NH}_2\text{CONHNH}_2 \cdot \text{HCl}$
- Identify C in the following
$$\text{C}_3\text{H}_7\text{I} \xrightarrow[\text{alc.}]{\text{KOH}} \text{A} \xrightarrow[\Delta]{\text{NBS}} \text{B} \xrightarrow[\text{alc.}]{\text{KCN}} \text{C}$$

(a) $(\text{CH}_3)_2\text{CHCN}$ (b) $\text{CH}_2 = \text{CH} - \text{CH}_2\text{CN}$
(c) $\text{Br} - \text{CH} = \text{CH} - \text{CN}$ (d) $\text{CH}_2 = \text{CH} - \underset{\text{Br}}{\text{C}}\text{H} - \text{CN}$

18. Caustic soda is
 (a) efflorescent (b) deliquescent (c) hygroscopic (d) oxidant
19. $\text{BrCH}_2\text{CH}_2\text{COCl} \xrightarrow{\text{LiAlH}_4} \text{A}$
 $\xrightarrow{\text{LiAlH}_4/\text{AlCl}_3} \text{B}$ Identify A & B
 (a) A = $\text{BrCH}_2\text{CH}_2\text{CH}_2\text{OH}$ B = $\text{BrCH}_2\text{CH}_2\text{CH}_2\text{OH}$
 (b) A = $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ B = $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
 (c) A = $\text{BrCH}_2\text{CH}_2\text{CH}_2\text{OH}$ B = $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
 (d) A = $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ B = $\text{BrCH}_2\text{CH}_2\text{CH}_2\text{OH}$
20. The difference between n th $(n+1)$ th Bohr's radius of H-atom is equal to the $(n-1)$ th Bohr's radius. The value of n is
 (a) 1 (b) 4 (c) 3 (d) 2

SECTION C : MATHEMATICS

21. To a man running at a speed of 20 km/hr, the rain drops appear to be falling at an angle of 30° from the vertical. If the rain drops are actually falling vertically downwards, their velocity in km/hr is
 (a) $10\sqrt{3}$ (b) $10\sqrt{2}$ (c) $20\sqrt{3}$ (d) $40\sqrt{3}$.
22. If $f(x) = 3x + 10$, $g(x) = x^2 - 1$, then $(f \circ g)^{-1}$ is equal to
 (a) $\left(\frac{x+7}{3}\right)^{1/2}$ (b) $\left(\frac{x+7}{3}\right)^{1/2}$ (c) $\left(\frac{x-3}{7}\right)^{1/2}$ (d) $\left(\frac{x-7}{3}\right)^{1/2}$.
23. Let $[x]$ denotes the greatest integer less than or equal to x . If $f(x) = x \sin \pi x$, then $f(x)$ is
 (a) not continuous at $x = 0$ (b) differentiable at $x = 1$
 (c) continuous in $(-1, 0)$ (d) none of these.
24. If $I = \int_0^{\pi/2} \frac{\cos \theta}{\sin \theta + \cos \theta} d\theta$, then $I =$
 (a) $\pi/8$ (b) $\pi/4$ (c) $\pi/6$ (d) $\pi/2$.
25. Let A and B be two events such that $P(A) = 0.3$ and $P(A \cup B) = 0.8$. If A and B are independent, then $P(B) =$
 (a) $7/5$ (b) $4/3$ (c) $3/4$ (d) $5/7$
26. The coefficient of the term independent of x in the expansion of $\left(\sqrt{\frac{x}{3}} + \frac{3}{2x^2}\right)^{10}$ is
 (a) $9/4$ (b) $7/4$ (c) $5/4$ (d) $3/7$
27. If $\vec{a} \times \vec{b} = 0$ and $\vec{a} \cdot \vec{b} = 0$, then
 (a) \vec{a} is parallel to \vec{b} (b) \vec{a} is perpendicular to \vec{b}
 (c) $\vec{a} = 0$ (d) either $\vec{a} = 0$ or $\vec{b} = 0$.

Section C is optional. Non-medical (non-Biology) students will have option for Mathematics. Biology students will have option for Biotechnology.

28. In two events $P(A \cup B) = 5/6$, $P(\bar{A}) = 5/6$, $P(B) = 2/3$, then A and B are
 (a) mutually exclusive (b) independent
 (c) mutually exhaustive (d) dependent.
29. Four boys and three girls stand in queue for an interview, probability that they will in alternate position is
 (a) $1/35$ (b) $1/34$ (c) $1/17$ (d) $1/68$.
30. If $A + B = 45^\circ$, then the value of $(1 + \tan A)(1 + \tan B)$ is
 (a) 1 (b) 2 (c) 0 (d) 5
31. If $z = x + iy$ and $\omega = \frac{1-iz}{z-i}$, then $|\omega| = 1$ implies that in the complex plane
 (a) z lies on imaginary axis (b) z lies on unit circle
 (c) z lies on real axis (d) none of these.
32. The value of $10^3 + 11^3 + 12^3 + \dots + 100^3$ is equal to
 (a) 25500475 (b) 25500000
 (c) 25000000 (d) none of these.
33. Fifteen coupons are numbered 1 to 15. Seven coupons are selected at random, one at a time with replacement. The probability that the largest number appearing on a selected coupon be 9 is
 (a) $\left(\frac{1}{15}\right)^7$ (b) $\left(\frac{3}{5}\right)^7$ (c) $\left(\frac{8}{15}\right)^7$ (d) none of these.
34. If α and β be the roots of $ax^2 + bx + c = 0$, then $\lim_{x \rightarrow \alpha} (1 + ax^2 + bx + c)^{1/(x-\alpha)}$ is
 (a) $a(\alpha - \beta)$ (b) $\ln |a(\alpha - \beta)|$
 (c) $e^{a|\alpha - \beta|}$ (d) $e^{a(\alpha - \beta)}$
35. If $f(x) = \cos x - \int_0^x (x-t)f(t)dt$, then $f''(x) + f(x)$ equals
 (a) $\int_0^x (x-t)f(t)dt$ (b) 0
 (c) $-\cos x$ (d) $-\int_0^{-x} (x-t)f(t)dt$.
36. If $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$, then $\text{adj}(\text{adj } A)$ is equal to
 (a) $\begin{bmatrix} 1 & -2 \\ -3 & 4 \end{bmatrix}$ (b) $\begin{bmatrix} 1 & -3 \\ -2 & 4 \end{bmatrix}$ (c) $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ (d) none of these.
37. The largest area of rectangle which has one side on x axis and two vertices on $y = e^{-x^2}$ is

(a) $\frac{1}{\sqrt{2}}e^{-1/2}$ (b) $\frac{1}{2}e^{-2}$ (c) $2e^{-2}$ (d) $\sqrt{2}e^{-1/2}$

38. If $y = \tan^{-1}\left(\sqrt{\frac{a-b}{a+b}} \tan \frac{x}{2}\right)$ then $\frac{d^2y}{dx^2}$ at $x = \frac{\pi}{2}$ is

(a) $\frac{b\sqrt{a^2-b^2}}{2a^2}$ (b) $\frac{b\sqrt{a^2-b^2}}{a^2}$ (c) $\frac{b\sqrt{a^2-b^2}}{2a}$ (d) $\frac{a\sqrt{a^2-b^2}}{2b^2}$.

39. a , b , c and d are positive real numbers and $a+b+c+d=2$ then minimum

value of expression $\frac{(1+a)(1+b)(1+c)(1+d)}{(1-a)(1-b)(1-c)(1-d)}$ is

(a) 80 (b) 81 (c) 72 (d) 100.

40. In a triangle OAB , E is midpoint of OB and D is a point on AB such that $AD : DB = 2 : 1$. If OD and AE intersect at P then $OP : PD =$

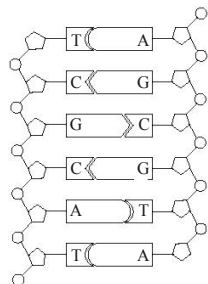
(a) 2 : 3 (b) 3 : 2 (c) 1 : 3 (d) 3 : 1.

SECTION C : BIOTECHNOLOGY

21. In one variety of corn, the kernels turn red when exposed to sunlight. In the absence of sunlight, the kernels remain yellow. Based on this information, it can be concluded that the color of these corn kernels is due to the

- process of selective breeding
- rate of photosynthesis
- effect of environment on gene expression
- composition of the soil

22. The diagram below represents a portion of an organic molecule. This molecule controls cellular activity by directing the synthesis of



- (a) carbohydrates (b) fats (c) minerals (d) proteins

23. In the body of a human, the types of chemical activities occurring within cells are most dependent on the

- biological catalysts present
- size of the cell
- number of chromosomes in the cell
- kind of sugar found on each chromosome

24. The enzyme pepsin is produced in the cells of the stomach but not in the cells of the small intestine. The small intestine produces a different

enzyme, trypsin. The reason that the stomach and small intestine produce different enzymes is that the gene that codes for pepsin is

- in the cells of the stomach, but not in the cells of the small intestine
- expressed in the stomach but not expressed in the small intestine
- mutated in the small intestine
- digested by the trypsin in the small intestine

25. The presence of some similar structures in all vertebrates suggests that these vertebrates

- all develop at the same rate
- evolved from different animals that appeared on Earth at the same time
- all develop internally and rely on nutrients supplied by the mother
- may have an evolutionary relationship

26. A mutation occurs in the liver cells of a certain field mouse. Which statement concerning the spread of this mutation through the mouse population is correct?

- It will spread because it is beneficial.
- It will spread because it is a dominant gene.
- It will not spread because it is not in a gamete.
- It will not spread because it is a recessive gene.

27. Which factor is least likely to contribute to an increase in the rate of evolution?

- presence of genetic variations in a population
- environmental selection of organisms best adapted to survive
- chromosomal recombinations
- a long period of environmental stability

28. Some researchers transferred a gene from an African clawed frog into a bacterium. To accomplish this, these scientists had to use

- enzymes to cut out and insert the gene
- hereditary information located in amino acids
- radiation to increase the gene mutation rate of the bacterial cells
- cancer cells to promote rapid cell division

29. The human brain, kidney, and liver all develop from the same zygote. This fact indicates that cells formed by divisions of the zygote are able to

- differentiate
- mutate
- undergo cloning
- be fertilized

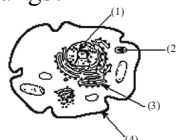
30. The reproductive cycle of a human is usually regulated by

- gametes
- hormones
- natural selection
- immune responses

31. Toxins can harm a developing fetus. They usually enter the fetus by the process of

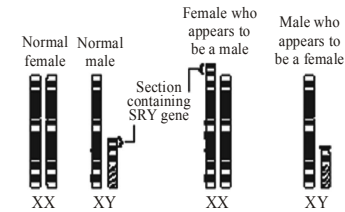
- blood flow from the mother to the fetus

- (b) active transport from the ovary
 (c) diffusion across placental membranes
 (d) recombination of genes from the fetus and mother
32. Which statement best describes cellular respiration?
 (a) It occurs in animal cells but not in plant cells.
 (b) It converts energy in food into a more usable form.
 (c) It uses carbon dioxide and produces oxygen.
 (d) It stores energy in food molecules.
33. Antibody molecules and receptor molecules are similar in that they both
 (a) control transport through the cell membrane
 (b) have a specific shape related to their specific function
 (c) remove wastes from the body
 (d) speed up chemical reactions in cells
34. Feedback interactions in the human body are important because they
 (a) determine the diversity necessary for evolution to occur
 (b) direct the synthesis of altered genes that are passed on to every cell in the body
 (c) regulate the shape of molecules involved in cellular communication
 (d) keep the internal body environment within its normal range
35. The purpose of introducing weakened microbes into the body of an organism is to stimulate the
 (a) production of living microbes that will protect the organism from future attacks
 (b) production of antigens that will prevent infections from occurring
 (c) immune system to react and prepare the organism to fight future invasions by these microbes
 (d) replication of genes that direct the synthesis of hormones that regulate the number of microbes
36. Humans have altered ecosystems in many ways. The most positive impact on an ecosystem would result from
 (a) planting a single economically valuable crop in a 25-acre area
 (b) seeding an area with valuable plants that are from another ecosystem
 (c) planting many different plants that are native to the area in a vacant lot
 (d) filling in a swamp and planting grass and trees for a community park
37. In the diagram below, which structure performs a function similar to a function of the human lungs?



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

38. The Y-chromosome carries the SRY gene that codes for the production of testosterone in humans. Occasionally a mutation occurs resulting in the SRY gene being lost from the Y-chromosome and added to the X-chromosome, as shown in the diagram below.



Based on the diagram, which statement is correct?

- (a) The production of testosterone influences the development of male characteristics.
 (b) Reproductive technology has had an important influence on human development.
 (c) Normal female characteristics develop from a single X-chromosome.
 (d) Male characteristics only develop in the absence of X-chromosomes.
39. Even though the finches on the various Galapagos Islands require different biotic and abiotic factors for their survival, these finches would most likely be grouped in the same
 (a) species, but found in different habitats
 (b) kingdom, but found in different ecological niches
 (c) species and found in the same biosphere
 (d) population, but found in different ecosystems

Base your answer to question 40 on the portion of the mRNA codon chart and information below.

AUU } AUC } ILE AUA } (Isoleucine)	ACU } ACC } THR ACA } (Threonine) ACG }	AAU } ASN AAC } (Asparagine)	AGU } SER AGC } (Serine)
AUG } MET (Methionine)	AAA } LYS AAG } (Lysine)	AGA } ARG AGG } (Arginine)	

Series I represents three mRNA codons. Series II includes a mutation of series I.

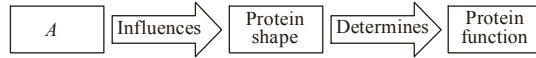
Series I AGAUCGAGU

Series II ACAUCGAGU

40. How would the amino acid sequence produced by the mutant strand (series II) compare to the amino acid sequence produced by series I?
 (a) The amino acid sequence would be shorter.
 (b) One amino acid in the sequence would change.
 (c) The amino acid sequence would remain unchanged.
 (d) More than one amino acid in the sequence would change.

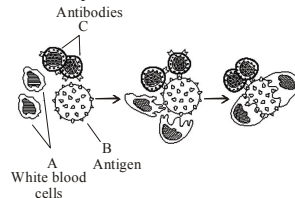
SECTION D : INTERACTIVE QUESTIONS

41. The diagram below provides some information concerning proteins.



Which phrase is represented by A?

- (a) sequence of amino acids (b) sequence of simple sugars
(c) sequence of starch molecules
(d) sequence of ATP molecules
42. The diagram below represents one possible immune response that can occur in the human body. The structures that are part of the immune system are represented by



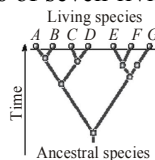
The structure that are part of the immune system are represented by

- (a) A, only (b) B and C, only
(c) A and C, only (d) A, B, and C

Base your answers to questions 43 on the table below, which represents the DNA codes for several amino acids.

Amino Acid	DNA Code Sequence
Cysteine	ACA or ACG
Tryptophan	ACC
Valine	CAA or CAC or CAG or CAT
Proline	GGA or GGC or GGG or GGT
Asparagine	TTA or TTG
Methionine	TAC

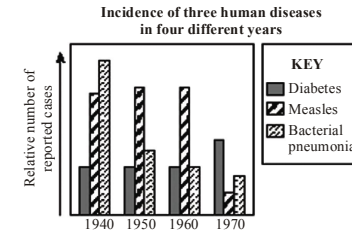
43. A certain DNA strand has the base sequence: TACACACAAACGGGG. In the space provided below, write the sequence of amino acids synthesized from this code if it is read from left to right.
- (a) Asparagine → Methionine → Valine → Proline → Tryptophan
(b) Methionine → Cysteine → Proline → Cysteine → Proline
(c) Methionine → Cysteine → Valine → Cysteine → Proline
(d) None of these
44. The evolutionary pathways of seven living species are shown in the diagram below.



Which two species are likely to have the most similar DNA base sequences?

- (a) B and G (b) B and C (c) E and G (d) C and D

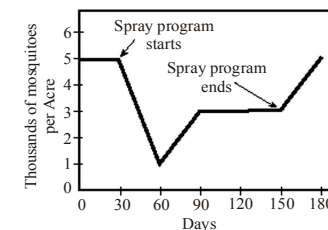
Base your answers to questions 45 through 47 on the graph below and on your knowledge of biology.



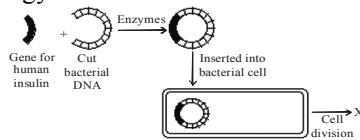
45. The greatest difference between the incidence of measles and the incidence of bacterial pneumonia occurred in
(a) 1940 (b) 1950 (c) 1960 (d) 1970
46. Which statement best explains a change in the incidence of disease in 1970?
(a) Children were vaccinated against measles.
(b) New drugs cured diabetes.
(c) The bacteria that cause pneumonia developed a resistance to drugs.
(d) New technology helped to reduce the incidence of all three diseases.
47. Which statement provides the best possible reason for the decrease in number of cases of bacterial pneumonia from 1940 to 1970?
(a) As a result of genetic engineering, humans became immune to the bacteria.
(b) Antibiotics were made available for the treatment of bacterial infections.
(c) The bacteria did not respond to medical treatments.
(d) As a result of sexual reproduction, the bacteria evolved into a harmless form.

Base your answers to questions 48 and 49 of the information below.

A small village was heavily infested with mosquitoes. The village was sprayed weekly with an insecticide for a period of several months. The results of daily counts of the mosquito population are shown in the graph below.



48. Which statement best explains why some mosquitoes survived after the first spraying?
- Some mosquitoes were adapted to the climatic change that occurred over the several-month period of spraying.
 - All of the mosquitoes contained DNA unique to the species.
 - The spraying of the insecticide represented a change in the environment to which all adult mosquitoes were adapted.
 - A natural variation existed within the mosquito population.
49. Which statement best explains the decreased effectiveness of the insecticide?
- The insecticide caused mutations that resulted in immunity in the mosquito.
 - Mosquitoes resistant to the insecticide lived and produced offspring.
 - The insecticide reacted chemically with the DNA of the mosquitoes and was destroyed.
 - All of the mosquitoes produced antibodies that activated the insecticide.
50. The diagram below illustrates some key steps of a procedure in one area of biotechnology.



The letter X most likely represents

- Bacterial cells that are unable to synthesize insulin
- Human cells that are able to synthesize antibodies
- Bacterial cells that are able to synthesize insulin
- human cells that are unable to resist antibiotics



ANSWERS

- | | | | | |
|---------|---------|---------|---------|---------|
| 1. (c) | 2. (a) | 3. (c) | 4. (b) | 5. (d) |
| 6. (c) | 7. (c) | 8. (c) | 9. (c) | 10. (b) |
| 11. (c) | 12. (d) | 13. (d) | 14. (d) | 15. (b) |
| 16. (a) | 17. (b) | 18. (b) | 19. (d) | 20. (b) |
| 21. (c) | 22. (d) | 23. (a) | 24. (b) | 25. (d) |
| 26. (c) | 27. (d) | 28. (a) | 29. (b) | 30. (b) |
| 31. (c) | 32. (b) | 33. (b) | 34. (d) | 35. (c) |
| 36. (c) | 37. (d) | 38. (a) | 39. (b) | 40. (b) |
| 41. (a) | 42. (c) | 43. (c) | 44. (d) | 45. (c) |
| 46. (a) | 47. (b) | 48. (d) | 49. (b) | 50. (c) |

