

Sub: Science of Living Systems

Sub No: BS20001

Full Marks: 20

Session: Autumn, 2018-2019

Date: 05-09-2018

Time: 30 minutes

NAME:

ROLLNO:

DEPT:

Choose (tick) the (ONE) correct answer OR write in a few words

1. Write True/False against each statement:

- (A) If the GC content of a single stranded DNA is 65%, the AT content of its complementary strand will be 65%. **F**
 (B) If we replace the DNA polymerase of human cells with Taq polymerase, there will be no adverse effect. **F**

2. Ligase enzyme is required during DNA replication for

- ☒ (A) sealing the gaps between newly synthesized DNA fragments
 (B) synthesis of Okazaki fragments
 (C) stabilizing single stranded DNA
 (D) sealing the gaps between RNA primers and newly synthesized DNA

3. In gel electrophoresis different sized DNA migrate at different rate. Which of the following statements is FALSE?

- ☒ (A) DNA is positively charged, hence migrates towards the negative terminal in the applied electric field gradient
 (B) Different DNA molecules separate according to mass
 (C) Smaller molecules migrate faster
 (D) DNA is visualized in the gel by staining with ethidium bromide, which fluoresces under UV light

4. The overall conclusion of the Griffith's experiment was that

- ☒ (A) DNA is the genetic material
 (B) proteins and DNA both are genetic material
 (C) the ratio of Adenine to thymine was always the same
 (D) Phage DNA was similar to bacterial DNA

5. Which of the following enzymes adds complementary bases during replication?

- (A) Helicase (B) Synthetase (C) Replicase ☒ (D) Polymerase

6. Automated DNA sequencing is an improved version of Sanger's method where

- (A) ddNTPs are used for chain termination
 (B) PCR is used for making sequencing templates
 (C) Fluorescently labelled dNTPs are used to track DNA fragments
☒ (D) Fluorescently labelled ddNTPs are used for chain termination

7. Which part of DNA sequence dictates RNA polymerase where to start transcription?

- (A) Operator (B) Enhancer ☒ (C) Promoter (D) Initiator

8. Write True/False against the following statements:

- (A) Poly-A tailing is a template independent synthesis. **T**
 (B) Transcription and translation occurs in same cellular compartment in both Eukaryotes and Prokaryotes. **F**

9. If the genetic code is constructed following a new rule where 4 consecutive nucleotides are used as codons, instead of triplets. How many different amino acids could such a code specify?

- ☒ (A) 256 (B) 32 (C) 64 (D) 32

10. In lac operon, if you remove the lac operator (the repressor binding site) what will be the effect on the metabolic state of the bacteria?
- ☒ (A) Lactose metabolizing enzymes will be produced irrespective of the presence or absence of lactose
 - (B) Glucose metabolism will be hampered
 - (C) Lactose will never be metabolized because the enzymes will never be synthesized
 - (D) RNA Polymerase will not be able to bind the promoter
11. During transcription, RNA polymerase reads the template DNA strand in:
- ☒ (A) 3' - 5' direction
 - (B) 5' - 3' direction
 - (C) in both directions
 - (D) does not require a DNA template
12. Which of the following is in correct order of sequence as they happen in a cell:
- (A) Transcription, Translation, mRNA Splicing, Protein folding
 - ☒ (B) Transcription, mRNA Splicing, Translation, Protein folding
 - (C) Transcription, Translation, poly-adenylation Protein folding
 - (D) Transcription, Translation, 5' capping of mRNA, Protein folding
13. The coding region of a gene is 102 nucleotides long, including both start and stop codons. Which of the following would be the most likely effect of a single nucleotide deletion at position 76 in the coding region?
- (A) There would be no effect on the polypeptide
 - (B) The entire amino acid sequence of the polypeptide would change
 - (C) There would be changes only in the first 25 amino acids
 - ☒ (D) There would be changes only after the first 25 amino acids
14. A quaternary structure of a protein signifies
- (A) a highly-supercoiled protein
 - (B) multiple α -helices and β -sheets are present in a polypeptide chain
 - (C) folded 3D conformation of a multi-domain polypeptide chain
 - ☒ (D) arrangement of multiple folded polypeptide subunits in a multi-subunit protein complex
15. Which type of bond is formed between two adjacent β -strands?
- (A) Covalent bond
 - (B) Hydrophobic interaction
 - ☒ (C) Hydrogen bond
 - (D) Electrostatic interaction
16. In a helical wheel plot what is the angular distance between two amino acids?
- (A) 90°
 - ☒ (B) 100°
 - (C) 150°
 - (D) 360°
17. In a folded protein, the nonpolar (hydrophobic) amino acids tend to be
- ☒ (A) hidden inside the protein
 - (B) exposed on the outside of the protein
 - (C) distributed randomly throughout the protein
 - (D) cannot be predicted
18. What provides the information necessary to specify the three-dimensional shape of a protein?
- (A) The protein's peptide bonds
 - (B) The protein's interactions with other polypeptides
 - (C) The protein's interaction with molecular chaperones
 - ☒ (D) The protein's amino acid sequence
19. Name the amino acid without a chiral carbon atom:
- (A) Cysteine
 - (B) Alanine
 - ☒ (C) Glycine
 - (D) Histidine
20. Which of the following is an example of tertiary structure in a protein?
- (A) A multimeric (multi subunit) protein
 - (B) An α -helix
 - (C) A β -pleated sheet
 - ☒ (D) A globular domain

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1. In DNA, hydrogen bonds are formed between

(A) Sugar and Phosphate

(B) Adenine and Cytosine

(C) Two polynucleotide chains

(D) Sugar and Nitrogenous bases

2. During DNA replication, Helicase enzyme unwinds the double stranded DNA to produce localized single stranded DNA. In a PCR reaction, we use an alternative mechanism for DNA unwinding, what is that?

(A) A special buffer with high salt concentration

(B) High temperature

(C) A special DNA polymerase that can denature DNA

(D) very low pH

3. In Sanger DNA sequencing technique, ddNTP (analogue of dNTP) is used that can terminate DNA synthesis when they get incorporated. How does that happen?

(A) ddNTPs are bulky molecules

(B) In ddNTPs 3'OH group is changed to -H group

(C) ddNTPs are positively charged

(D) ddNTPs have ribose sugar instead of deoxyribose

4. The accepted theory for DNA replication is

(A) conservative theory

(B) dispersive theory

(C) semi-conservative theory

(D) evolutionary theory

5. RNA is chemically less stable than DNA, because of

(A) the uracil base instead of the thymine

(B) the presence of the 2'-OH group

(C) the extra carbon atom

(D) All of the above

6. The function of the sigma factor of RNA polymerase is to

(A) assure that transcription begins at the proper point

(B) assure that transcription ends at the proper point

(C) assure that translation begins at the proper point

(D) assure that translation ends at the proper point

7. Metal ions such as Mg^{2+} , Na^+ typically interact with the _____ group of DNA.

(A) sugar

(B) nitrogenous base

(C) hydroxyl

(D) phosphate

8. Following is the protein coding part of the DNA sequence of a hypothetical gene:

5' ATG GCC TAA TAC TGG TGC ACG ACG TGC GGT GTC TGC ATA TTT TAA 3'

Predict what will happen to the protein product of the gene if you mutate (change) the start codon from ATG into TTG.

(A) Protein length will be unaffected

(B) Protein will be shorter in length

(C) Protein will be produced but its amino acid composition will be changed

(D) No protein will be synthesized

9. Anticodon is present in

(A) mRNA

(B) tRNA

(C) rRNA

(D) amino acid

10. The lac operon is turned ON
 (A) in the presence of lactose.
 (B) in the presence of glucose.
 (C) in the presence of lactose and presence of glucose.
 (D) in the presence of lactose and absence of glucose.
11. State true or false for the following statements:
 (A) 3' end of nascent Prokaryotic mRNA acquires a poly A tail F
 (B) Splicing removes introns from Eukaryotic transcripts T
12. Erythromycin is an antibiotic that kills bacteria by
 (A) lysing the bacterial cell wall
 (B) interfering with bacterial transcription by binding to RNA polymerase
 (C) blocking bacterial translation by binding to 50S ribosome
 (D) blocking bacterial DNA replication by binding to DNA polymerase
13. Which of the following is a hydrophobic amino acid?
 (A) Valine (B) Serine (C) Arginine (D) Aspartic acid
14. The amino acid that can form a disulfide linkage is
 (A) methionine (B) cysteine (C) histidine (D) proline
15. In a helical wheel plot what is the angular distance between two amino acids?
 (A) 90° (B) 100° (C) 150° (D) 360°
16. Which part of an amino acid gives unique properties to each of the 20 amino acids?
 (A) The amino group (B) The carboxyl group (C) The side chain (D) The peptide backbone
17. Theoretically, a vast number of different proteins can be assembled from 20 different amino acids. How many polypeptide chains are possible that are 10 amino acids long?
 (A) 20×10 (B) 20^{10} (C) 10^{20} (D) $20^{10} \times 10^{20}$
18. Choose the enzyme that is not composed of protein:
 (A) RNA polymerase (B) DNA polymerase (C) DNA ligase (D) Peptidyl transferase
19. State True or False for the following statements:
 (a) By-product of forming a peptide bond from two amino acids is water. T
 (b) Proteins fold with their hydrophobic amino acids in the core and hydrophilic amino acids on the surface. T
20. Arrange the following in the increasing order of protein structure hierarchy:
 A: α -helix B: amino acid sequence C: quaternary structure D: folded structure
 (a) A, D, C, B (b) A, D, B, C (c) B, A, D, C (d) B, A, C, D