

Sub: Science of Living Systems

Sub No: BS20001

Full Marks: 20

Session: Spring, 2018-19

Date: 13-02-2019

Time: 30 minutes

NAME:

ROLLNO:

DEPT:

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

1. 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

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

- (A) DNA is positively charged and 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

3. Griffith's experiment proving DNA as the genetic material was based on the principle of

- (A) Termination
(B) Transformation
(C) Transcription
(D) Translation

4. The accepted theory for DNA replication is

- (A) conservative theory
(B) dispersive theory
(C) semi-conservative theory
(D) evolutionary theory

5. Write True/False against each statement:

- (A) If the GC content of a single stranded DNA is 60%, the AT content of its complementary strand will be 60%. **F**
(B) If we replace the DNA polymerase of our body with Taq polymerase, it can work just fine. **F**

6. In classic Sanger DNA sequencing technique, four types of ddNTPs are used along with the normal dNTPs. Which of the following is the correct combination?

- (A) All four ddNTPs and four dNTPs in same reaction tube
(B) Each tube with one type of ddNTP and one type of dNTP (e.g., ddATP + dATP in tube 1, ddGTP + dGTP in tube 2 and so on)
(C) Each tube will have one type of dNTP and all four types of ddNTP
(D) Each tube will have one type of ddNTP and all four types of dNTP

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

5' **ATG** GCC CAA TAC TGG TGC ACG ACG TGC GAA GTC TGC ATA TTT **TAA** 3'

What will happen to the protein product of the gene if you mutate (change) the 10th codon from GAA into TAA?

- (A) Protein length will be unaffected
(B) Protein will be shorter in length
(C) Amino acid composition will be changed
(D) No protein will be synthesized

8. Estimate the length of the protein coded by the following DNA sequence. Start and stop codons are in bold letters; introns are underlined.

5' GCACAT**ATG**CGATACGAAGGGGACGCGGTTGAGGCCGTTGTGTT**TAA**GGTTGT 3'

- (A) 10
(B) 11
(C) 13
(D) 14

9. 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) $20^{10} \times 10^{20}$

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. Anticodon is present in

- (A) mRNA
- ☒ (B) tRNA
- (C) rRNA
- (D) amino acid

12. Tetracycline 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 30S ribosome
- (D) blocking bacterial DNA replication by binding to DNA polymerase

13. 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

14. Write True/False against the following statements:

- (A) The σ subunit is not a permanent component of the RNA polymerase from *E. coli*. ☒ T
- (B) Ribosomal RNA (rRNA) is used as a template for protein synthesis. ☒ F

15. Which of the following can be an example of tertiary structure of a protein?

- (A) A multi-subunit protein
- (B) An α -helix
- (C) A β -pleated sheet
- ☒ (D) A globular domain

16. How are secondary structures stabilized in proteins?

- (A) Through ionic bonds between oppositely charged amino acid side chains
- (B) Through covalent bonds joining different parts of the peptide backbone
- (C) Through hydrogen bonds between different amino acid side chains
- ☒ (D) Through hydrogen bonds joining different parts of the peptide backbone

17. What is a protein domain?

- (A) The α -helical or β -pleated sheet portion of a protein
- (B) A multi-subunit protein complex
- ☒ (C) Part of a protein folded into a self-contained 3D structure
- (D) An unfolded part of a protein

18. Hydrogen bonds in α -helices are

- (A) more numerous than Van der Waals interactions
- (B) not present at Phe residues
- (C) analogous to the steps in a spiral staircase
- ☒ (D) roughly parallel to the helix axis

19. 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

20. Peptidyl transferase enzyme

- (A) is rRNA
- (B) forms peptide bonds
- (C) component of ribosome
- ☒ (D) all of the above