BS20001: Spring2022 Midsem exam

Total Marks: 50
25 X 2=50

1

NAME *

Sunanda Mandal

2

ROLL NO. *

19CS10060

3

In an alien species, there are only 2 types of nucleotides (instead of 4 types), but codons are 4 nucleotide long. If each type of codon specifies one unique amino acid, how many possible amino acids can be coded. Also consider that they have two stop codons.
(2 Points)

- 16

- 62
- 64
- 14

4

Which of the following pairs of amino acids might contribute to protein conformation by forming electrostatic interactions?
(2 Points)

(Hints: Nonpolar: Glycine, Phenylalanine and Tyrosine; Positively charged: Lysine and Arginine; Negatively charged: Glutamate and Aspartate; Polar: Asparagine, Glutamine, Serine)

- Lysine and Asparagine
- Glycine and aspartate
- Phenylalanine and tyrosine
- Glutamate and lysine

5

The rate of protein synthesis in prokaryote is limited by the rate of mRNA synthesis. If mRNA synthesis occurs at the rate of 51 nucleotides/sec, then the rate of protein synthesis occurs at:
(2 Points)

- 25 amino acids/sec
- 12 amino acids/sec
- 17 amino acids/sec
- 50 amino acids/sec

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?
(2 Points)

- Each tube will have one type of dNTP and all four types of ddNTP
- 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)
- Each tube will have one type of ddNTP and all four types of dNTP
- All four ddNTPs and four dNTPs in same reaction tube

7

A genetic analysis of an unknown infectious agent reveals that it contains only nucleotides G, A, T and C, in the proportion 30 %, 35 %, 15 % and 20 %, respectively. Based on this information, this infectious agent is most likely
(2 Points)

- Single-stranded DNA virus
- Double-stranded DNA virus
- Not enough information is provided
- Single-stranded RNA virus

8

A new strain of bacteria was isolated from a natural hot water geyser. Comment on the expected DNA base compositions in this thermophilic organism (living in high temperatures).
(2 Points)

- A+T > G+C
- Insufficient data
- Equal A+T and G+C composition
- G+C > A+T

9

What is common feature demonstrated during replication and transcription in *E. coli*?
(2 Points)

- Both require helicase to separate double stranded DNA into single strands
- Both follow the semi-discontinuous mode of synthesis
- Both processes involve making and breaking of hydrogen bonds
- Both require RNA primers for the synthesis of new strands which should be removed later

10

100 template DNA molecules are PCR amplified for 25 cycles in a 100 µl reaction mixture. How many amplified products will be there in 0.01 µl of solution after amplification?
(2 Points)

- 335544320
- 335544
- 3355443200
- 3355443

11

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

5′CACAT**ATG**GCGATACGAAGGGGACGCATGGCGGACAGGGCCGTTGC**TAA**GGTTGT G 3′
(2 Points)

- 13
- 14
- 11
- 10

12

Backbone of DNA and RNA is covalently linked through _____ and is _____ in nature.
(2 Points)

- phosphodiester bond, hydrophilic
- phosphoester, hydrophilic
- phosphodiester bond, hydrophobic
- phosphoester bond, hydrophobic

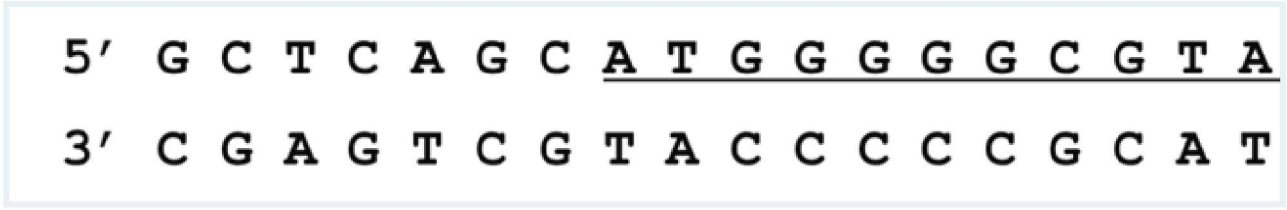
13

We have 64 codons, out of those three are stop codons. On the other hand, we have 20 amino acids that constitute a protein. As a result of that one amino acid can be coded by multiple codons. During translation, tRNA brings correct amino acid at the translation site and recognize codon through its anticodon sequence. Based on the above information, which one of the following statements is most plausible?
(2 Points)

- Should have 64 different types of tRNA
- Should have more than 20 and less than 64 different types of tRNA
- Should have less than 20 different types of tRNA
- Should have 20 different types of tRNA

14

What will be the transcript (i.e. RNA) of this gene (coding strand is underlined)?
(2 Points)



- 5′ A U G G G G G C G U A A 3′
- 3′ U A C C C C C G C A U U 5′
- 5′ U A C C C C C G C A U U 3′
- 3′ A U G G G G G C G U A A 5′

15

One undergrad student is repeating Anfinsen's experiment with an enzyme that has TEN cysteine residues and forms FIVE disulfide bonds. The enzyme is denatured by urea and reduced by BME. What is the expected activity of the enzyme if it is oxidized first and then urea is removed?
(2 Points)

- 1%
- 2%
- 0.1%
- 0.5%

16

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

- DNA is visualized in the gel by staining with ethidium bromide, which fluoresces under UV ligh
- DNA is negatively charged and hence migrates towards the positive terminal in the applied electric field gradient
- DNA molecules get separated according to their size
- Smaller DNA migrates slowly than larger DNA

17

On the ribosome, the mRNA is read from _____, and the polypeptide chain is synthesized from _____.
(2 Points)

- 5' to 3'; C- to N-terminus
- 3' to 5'; C- to N-terminus
- 3' to 5'; N- to C-terminus
- 5' to 3'; N- to C-terminus

18

The coding region of a gene is 132 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 91 in the coding region?
(2 Points)

- There would be no effect on the polypeptide
- There would be changes only after the first 30 amino acids
- There would be change only in the 31st amino acid
- The entire amino acid sequence of the polypeptide would change

19

Which of the following is in correct order:
(2 Points)

- Transcription, Transport of mRNA from nucleus to cytoplasm, Poly-adenylation, mRNA Splicing, Translation, Protein folding
- Transcription, 5'capping of mRNA, Transport of mRNA from nucleus to cytoplasm, mRNA Splicing, Translation, Protein folding
- Transcription, 5'capping of mRNA, mRNA Splicing, Transport of mRNA from nucleus to cytoplasm, Translation, Protein folding
- Transcription, mRNA splicing, Poly-adenylation, translation, Transport of mRNA from nucleus tc cytoplasm, Protein folding

20

Choose the correct one from the following options that indicate the number of molecules present per *E. coli* cell in ascending order
(2 Points)

- DNA<mRNA<protein<rRNA
- DNA<protein<mRNA<tRNA
- DNA<mRNA<tRNA<protein
- DNA<tRNA<mRNA<protein

21

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?
(2 Points)

- $20^{10}\ X\ 10^{20}$
- $20\ X\ 10$
- 20^{10}
- 10^{20}

22

12 amino acids stretch of a protein forms an alpha-helix. What could be the expected phi and psi angles of the amino acids participating in forming alpha-helix?
(2 Points)

- -60, +50

- -60, -50
- +60, +50
- +60, -50

23

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?
(2 Points)

- Lactose metabolizing enzymes will be produced irrespective of the presence or absence of lactose
- Lactose will never be metabolized because the enzymes will never be synthesized
- RNA Polymerase will not be able to bind the promoter
- Glucose metabolism will be hampered

24

A 100 amino acid protein has only polar and charged residues. It has no hydrophobic residues. Which of the following can be expected for its structure?
(2 Points)

- It will be alpha and beta mixed structure.
- It will not fold properly.
- It will be all alpha helical structure.
- It will be all beta stranded structure.

25

Arrange the following options in increasing order of protein structure hierarchy:

A: alpha-helix
B: amino acid sequence
C: quaternary structure
D: a protein domain
(2 Points)

- B, C, A, D
- A, B, C, D
- B, A, D, C
- A, C, B, D

26

Which one of the following statements is INCORRECT?
(2 Points)

- Okazaki fragments are observed during lagging strand synthesis
- Leading strand is synthesized from 5′ to 3′ direction
- Lagging strand requires more primers than leading strand during replication
- Lagging strand is synthesized from 3′ to 5′ direction

27

Peptide backbone has three torsion angles namely omega, phi and psi. However, Ramachandran map ignores one of these and plots only two. Which of the following statements gives the CORRECT reasoning for this?
(2 Points)

- Historically only two torsion angles were discovered at that time. Hence, Ramachandran and hi student used only those two torsion angles for the map.
- It does not matter which two torsion angles are used to create the Ramachandran map. The same map can be created by choosing any two of the three torsion angles.
- One of the torsion angles is part of the peptide plane and in most cases has only one value. Hence, unnecessary to plot.
- A two-dimensional plot can be made using only two variables. Hence one of the angles was ignored.