BS20001_Spring21_Test1

Date of Exam: 17th Feb, 2021
Time: 1hr (2:30 pm to 3:30 pm)
Total marks: 40
ONLY ONE correct answer. NO NEGATIVE marking. Choose the BEST possible answer.

1

Backbone of DNA and RNA is covalently linked through ----------- and is ------------------ in nature.
(1 Point)

○ phosphodiester bond, hydrophobic

◉ phosphodiester bond, hydrophilic

○ phosphoester bond, hydrophobic

○ phosphoester, hydrophilic

2

Hemoglobin and RNA polymerase are examples of
(1 Point)

○ Two of the most complex proteins present in our body.

◉ Quaternary structures of protein

○ Proteins that are available in all of our cells

○ Tertiary structures of protein

3

A 990 nucleotide long Eukaryotic nascent mRNA has a 60 nucleotide long intron. But the mature mRNA available for translation is found to be 1100 nucleotide long. What may have caused the increased length of the mature mRNA?
(1 Point)

○ 5' capping

○ Reverse transcription

◉ Splicing

○ Poly-A tailing

4

What is a protein domain?
(1 Point)

○ A multi-subunit protein complex

○ An unfolded part of a protein

○ The α-helical or β-pleated sheet portion of a protein

◉ Part of a protein folded into a self-contained 3D structure

5

During transcription, RNA polymerase reads the template DNA strand in:
(1 Point)

○ does not require a DNA template

○ in both directions

○ 5'- 3' direction

◉ 3'- 5' direction

6

Which sugar is found in RNA?
(1 Point)

○ Deoxyribose

◉ Pentose

○ Lactose

○ Fructose

7

Which of the following best describes a promoter:
(1 Point)

○ A specific DNA sequence that promotes termination of transcription

○ A specific DNA sequence to which RNA polymerase binds

○ An extracellular inducer that controls genes expression

◉ A specific DNA sequence from where transcription starts

8

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

○ double-stranded DNA virus

○ single-stranded DNA virus

◉ single-stranded RNA virus

○ not enough information is provided

9

A tripeptide has
(1 Point)

○ 6 amino acids and 3 peptide bonds

○ 3 amino acids and 2 peptide bonds

○ 4 amino acids and 3 peptide bonds

◉ 3 amino acids and 3 peptide bonds

10

The nucleotides in DNA and RNA have three components: a sugar group, a nitrogenous base, and a phosphate group. Adjacent nucleotides in a nucleic acid are joined by a phosphodiester bond. This bond links the phosphate group of one nucleotide to which one of the following components of a neighbouring nucleotide?
(1 Point)

○ Others

○ Base

○ Phosphate

◉ Sugar

11

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?
(1 Point)

○ $10 \, x \, 2^{25}$

◉ $0.01 \, x \, 2^{25}$

○ $100 \, x \, 2^{25}$

○ $0.1 \, x \, 2^{25}$

12

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).
(1 Point)

○ Insufficient data

○ A+T > G+C

○ Equal A+T and G+C composition

◉ G+C > A+T

13

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

○ ddNTPs are positively charged

◉ In ddNTPs 3'OH group is changed to –H group

○ ddNTPs are bulky molecules

○ ddNTPs have ribose sugar instead of deoxyribose

14

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?
(1 Point)

○ There would be changes only in the first 25 amino acids

○ There would be no effect on the polypeptide

◉ There would be changes only after the first 25 amino acids

○ The entire amino acid sequence of the polypeptide would change

15

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.
(1 Point)

○ 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.

○ Historically only two torsion angles were discovered at that time. Hence, Ramachandran and his student used only those two torsion angles for the map.

◉ 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.

16

In an experiment, it was found that the value of Tm for a DNA sample is = 70° C. If that DNA sample has 45% GC at the above Tm, then what will be the value of 'Tm' if the GC% increases to 55%?
(1 Point)

◉ Increases

○ Remains same

○ Decreases

○ Can't be predicted

17

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

5' G C T C A G C A T G G G G G C G T A A 3'
3' C G A G T C G T A C C C C C G C A T T 5'

◉ 5' A U G G G G G C G U A A 3'

○ 3' A U G G G G G C G U A A 5'

○ 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'

18

One undergrad student is repeating Anfinsen's experiment with an enzyme that has TEN cysteine residues and forms FIVE disulfide bonds. What is the total number of possible disulfide bond combinations that can be formed randomly in the denatured protein?
(1 Point)

○ 105

○ 225

◉ 945

○ 45

19

Which one of the following statements is correct?
(1 Point)

○ Poly-A tailing of mRNA is a template dependent synthesis

○ 5' end of nascent eukaryotic mRNA acquires a poly A tail

○ Transcription and translation occurs in the same cellular compartment in eukaryotes

◉ Splicing removes introns from eukaryotic transcripts

20

Which of the following is in correct order of sequence as they happen in a cell:
(1 Point)

◉ Transcription, mRNA Splicing, Translation, Protein folding

○ Transcription, Translation, poly-adenylation Protein folding

○ Transcription, Translation, mRNA Splicing, Protein folding

○ Transcription, Translation, 5' capping of mRNA, Protein folding

21

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?
(1 Point)

○ RNA Polymerase will not be able to bind the promoter

○ Glucose metabolism will be blocked

◉ 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

22

Choose the enzyme that is not composed of protein:
(1 Point)

○ DNA polymerase

◉ Peptidyl transferase

○ DNA ligase

○ RNA polymerase

23

Glycine and alanine contain _____ and_____ chiral centre(s) respectively
(1 Point)

○ 1, 1

○ 1, 2

◉ 0, 1

○ 1, 0

24

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?
(1 Point)

○ $20^{10} X 10^{20}$

○ 10^{20}

◉ 20^{10}

○ $20 \, X \, 10$

25

In a folded protein, the nonpolar (hydrophobic) amino acids tend to be
(1 Point)

○ hidden inside the protein

○ cannot be predicted

○ distributed randomly throughout the protein

◉ exposed on the outside of the protein

26

In an alien species, there are only 2 types of nucleotides (instead of 4 types in humans) 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 only one stop codon.
(1 Point)

○ 31

◉ 15

○ 63

○ 7

27

Which one of the following statements is incorrect?
(1 Point)

◉ Lagging strand is synthesized from 3' to 5' direction

○ Lagging strand requires more primers than leading strand during replication

○ Okazaki fragments are observed during lagging strand synthesis

○ Leading strand is synthesized from 5' to 3' direction

28

Which of the following amino acids often participate in covalent bond formation through its side chain?
(1 Point)

○ Valine

◉ Cysteine

○ Glycine

○ Alanine

29

Anfinsen's experiment showed that
(1 Point)

○ Right combination of disulfide bonds dictate the three-dimensional structure of a protein

○ It is easier to win the Nobel Prize in Chemistry by Biochemists

○ The primary sequence of a protein can be predicted from its three-dimensional structure

◉ The three-dimensional structure of a protein is encoded in its primary sequence

30

Formation of peptide bond is a
(1 Point)

◉ condensation reaction

○ hydrolysis reaction

○ ligation reaction

○ oxidation reaction

31

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?
(1 Point)

○ 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

32

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 first
codon from ATG into TTG.
(1 Point)

○ Protein length will be unaffected

○ Protein will be shorter in length

◉ No protein will be synthesized

○ Protein will be produced but its amino acid composition will be changed

33

Metal ions such as Na+, K+ and Mg2+ interact with the following of DNA
(1 Point)

◉ Sugar group

○ Nitrogenous base

○ All of the above

○ Phosphate group

34

DNA present in E. coli is
(1 Point)

◉ double stranded, right-handed, circular

○ double stranded, right-handed, linear

○ single-stranded, left-handed, linear

○ single stranded, right-handed, circular

35

RNA is chemically less stable than DNA, because of
(1 Point)

◉ the presence of the 2'-OH group

○ All of the above

○ the extra carbon atom

○ the uracil base instead of the thymine

36

Arrange the following options in increasing order of protein structure hierarchy:
A: alpha-helix
B: amino acid sequence
C: quaternary structure
D: folded structure
(1 Point)

○ A, C, B, D

◉ B, A, D, C

○ A, B, C, D

○ B, C, A, D

37

What is the nature of the interaction between tRNAs and mRNAs at the translation site?
(1 Point)

○ Hydrophobic interaction

○ Covalent bond

◉ Hydrogen bond

○ Electrostatic interaction

38

Protein secondary structures are stabilized primarily by (chose the best answer)
(1 Point)

○ amino acid sidechains

○ van der Waal's forces

◉ hydrogen bonds