

Student name _____ ID # _____

Second Mid Term Exam, Biology 2020, Spring 2002

Scores

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____

15. _____

16. _____

17. _____

18. _____

19. _____

20. _____

21. _____

Total _____

Student name _____ ID # _____

1. Matching (7 pts). Each answer is used exactly once

- | | |
|--------------------------------------|---|
| _____ Helicase | A. Prevent DNA strands from reannealing |
| _____ Topoisomerase | B. Relieves supercoils in DNA |
| _____ DNA polymerase | C. Uses an RNA primer |
| _____ Ligase | D. Oligonucleotide containing ribonucleotides and deoxiribnucleotides |
| _____ Primase | E. Makes RNA from DNA template |
| _____ Single strand binding proteins | F. Unwinds DNA duplex |
| _____ Okazaki fragment | G. Seals nicks in single stranded DNA |

2. (2pts) State 1 difference between DNA replication on the leading and lagging strands. (1 sentence)

3. RNA processing . A few words for each answer

A. (2 pts) Where are the sequences needed for correct RNA splicing?

B. (1 pt) Name the structure of the 5' cap of a mRNA? (don't say 5' cap)

C. (1 pt) State one function of the cap.

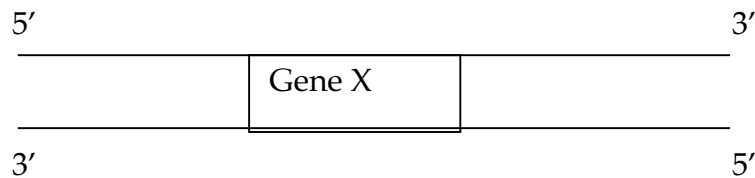
D. (1 pt) Addition of a poly A tail is intimately linked to what other process during transcription?

E. (1 pt) State one function of the poly A tail.

Student name _____ ID # _____

4. (5 pts) What might happen to energy production in a cell that had a mutation in the gene coding for pyruvate dehydrogenase? (Pyruvate dehydrogenase converts pyruvate to acetyl CoA plus CO₂.) Assume that glucose is the only energy source and that no functional enzyme is made in the mutant cell. Explain your answer being as specific as possible. Four or five sentences.

5. Given the following representation of a 4000 base pair piece of double stranded DNA:



Your job is to design a primer pair to amplify the 1000 base pair Gene X using the polymerase chain reaction (PCR).

- A. (4 pts) Draw the primer pair on the diagram at the appropriate locations, indicating the approximate size of the primers relative to gene X
- B. (2 pts) Indicate the polarity of the primers

Student name _____ ID # _____

6. (5 pts) The strands of a DNA double helix can be separated by heating. If you raised the temperature of a solution containing the following 3 DNA molecules, in what order do you suppose they would “melt” (complementary strands separate)? Write ‘first to melt’, ‘second to melt’ or ‘third to melt’ to the right side of each of the three sequences. Explain your answer in a sentence or two.

a) 5' GCGGGCCAGCCCCGAGTGGGTAGCCCAGG 3'
3' CGCCCGGTCGGGCTCACCCATCGGGTCC 5'

b) 5' ATTATGGGATATCTAGATACTATATTTAC 3'
3' TAATACCCTATAGATCTATGATATAAATG 5'

c) 5' ATAATTAAATAT 3'
3' TATTAATTTATA 5'

7. Fermentation

A. (1 pt) When you exercise strenuously your muscles convert pyruvate to what molecule? (1 or 2 words)

B. (1 pt) Under what conditions do muscles produce this molecule? (1 word)

C. (2 pts) What is the purpose of producing this molecule? (1 sentence)

Student name _____ ID # _____

8. Nucleic acids

A. (6 pts) Below is a DNA double helix, a mRNA transcribed from the DNA, and the appropriate anticodon sequence. Fill in the following table:

| | | | | | | |
|---|---|---|---|---|---|-----------------------------------|
| C | | | | | A | DNA Double helix |
| G | | | T | G | T | |
| | C | A | U | | | mRNA transcribed |
| | | | | | | Appropriate tRNA anticodon |

B. (2 pts) Indicate polarity of all 4 strands by writing 5' or 3' to the left of each sequence.

9. (2 pts) Taq and Pfu are two kinds of DNA polymerases used in a PCR reaction. Taq has an error rate that is significantly greater than Pfu. What activity of Pfu do you think makes it less prone to error? 1 word answer.

10. (6 pts) True/False

_____ Loss of the 3'-5' exonuclease activity of DNA polymerase will slow the rate of DNA synthesis but not its fidelity (accuracy).

_____ dATP inhibits the phosphofructokinase whereas ADP stimulates it.

_____ All the nucleotides in a mRNA sequence are translated into protein.

_____ Transcription termination in prokaryotes involves formation of a loop of RNA with the bases hydrogen bonded to one another.

Student name _____ ID # _____

_____ An individual ribosome can make only one type of protein

_____ All tRNAs fold into particular 3D- structures that is important for their function

11. Tryptophan operon.

A. (2 pts) Is the tryptophan operon inducible or repressible?

Based on your answer to A, what effect will the following mutations have on tryptophan biosynthesis (i.e whether tryptophan will be synthesized or not). Assume that all the mutations inactivate function completely. Give one sentence reasons for each answer.

B. (1 pt) Mutation in the promoter region.

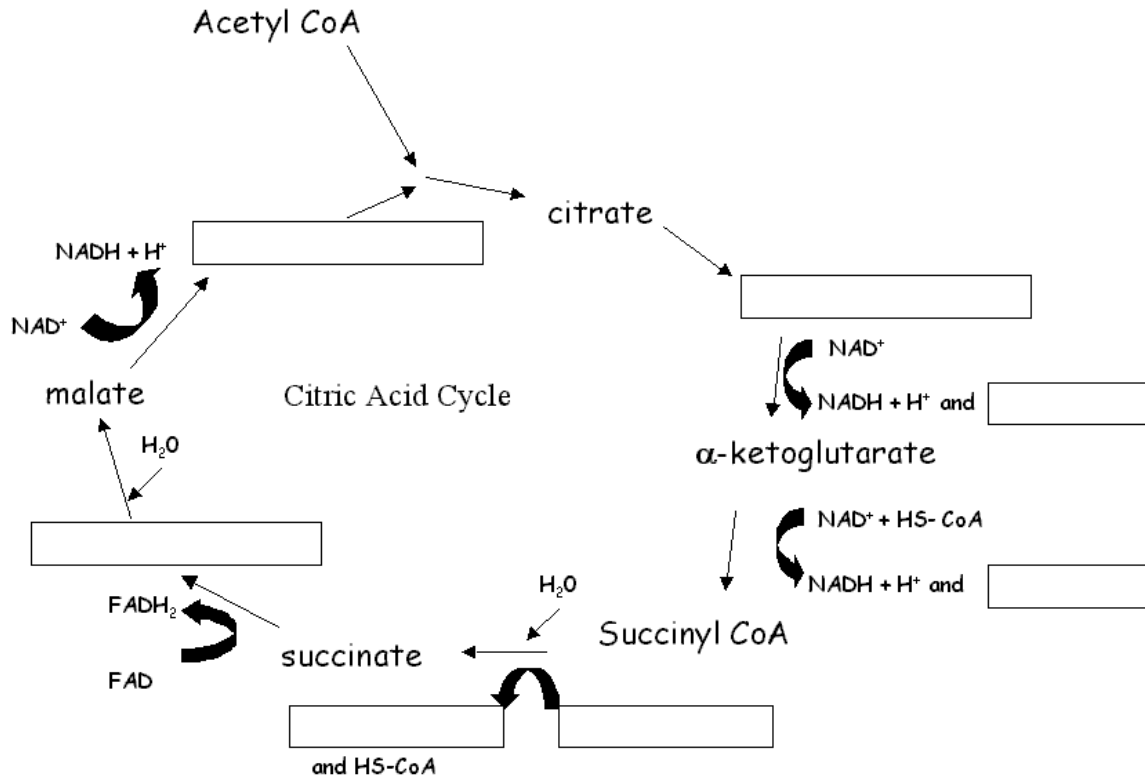
C. (1 pt) Mutation in the operator region

D. (1 pt) Mutation in the gene coding for the repressor protein

E. (1 pt) Mutation in RNA polymerase.

12. (4 pts) During β oxidation _____ are catabolized in a cyclic pathway. Each turn of the cycle produces _____ which feeds directly into the _____ cycle, and the chain length of the starting molecule is decreased by _____ carbons.

13. Citric acid cycle (7 pts). Fill in all boxes with the name of the molecule.



14. (3 pts) Why are the ends of the chromosome difficult to replicate? Hint, think about the mechanism of replication. Three or four sentences.

15. (6 pts) tRNA translates the sequences of ribonucleotides in _____ into the sequence of _____ in proteins. tRNA binds both the large and small subunit of the _____. The two most important regions of the tRNA are the _____ stem at the _____ end of the molecule, and the _____ loop.

16. (4 pts) You are working on a project that requires you to clone a gene coding for protein so you can isolate the protein for study. You try to purify the protein from the bacteria containing the plasmid, but you find that the protein expressed by the bacteria is extremely short (only a few amino acids). You then sequence the gene that was cloned into the bacteria and find that an extra base was added at the +12 position at the 5' end of the gene. Explain why the short protein is produced. (Three or four sentences)

17. (6 pts) Match the terms, each blank has only one correct answer

- A. Prokaryotes
- B. Eukaryotes (ignore mitochondria and chloroplasts)
- C. Both Prokaryotes and Eukaryotes

_____ contains leading and lagging strand during DNA replication

Student name _____ ID # _____

_____ -35 and -10 sequences in the promoter are involved in binding RNA polymerase

_____ chromosome is linear, double stranded DNA

_____ contains enhancer sequences

_____ UGA is a stop codon

_____ transcription and translation occur in the same compartment

_____ alternative splicing

_____ during initiation, mRNA binds to the small ribosomal subunit prior to tRNA binding

_____ initiator tRNA binds to the small ribosomal subunit prior to mRNA binding

_____ contains snRNP

_____ sigma subunit

_____ TFIID

18. (4 pts) Fill in each blank with a number (1, 2, 3 etc)

The energy stored in NADH molecules produced during the citric acid cycle is used to make ATP. NADH donates _____ electron(s) to the electron transport chain, and as the electron(s) move down the chain _____ H^+ are moved outward across the inner mitochondrial membrane. If we assume that _____ H^+ must flow across membranes to make one ATP molecule, it is possible to make _____ ATP(s) from one NADH molecule.

19. (3 pts) State three differences between DNA and RNA. One sentence each.

20. (4 pts) Plasmids used in cloning have specific DNA sequences designed into them to facilitate cloning. Give the names and function of two such sequences in a typical cloning plasmid. One sentence each.

21. (2 pts) What would happen to transcription if you inject 3' deoxyadenosine into the nucleus of a eukaryotic cell? Explain your answer in 1 sentence.