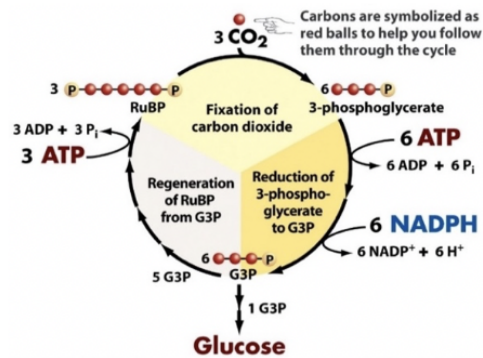


		Second letter					
		U	C	A	G		
First letter	U	UUU } Phe UUC } UUA } Leu UUG }	UCU } UCC } Ser UCA } UCG }	UAU } Tyr UAC } UAA } Stop UAG } Stop	UGU } Cys UGC } UGA } Stop UGG } Trp	U	C
	C	CUU } CUC } Leu CUA } CUG }	CCU } CCC } Pro CCA } CCG }	CAU } His CAC } CAA } Gln CAG }	CGU } Arg CGC } CGA } CGG }	C	A
	A	AUU } Ile AUC } AUA } Met AUG }	ACU } ACC } Thr ACA } ACG }	AAU } Asn AAC } AAA } Lys AAG }	AGU } Ser AGC } AGA } Arg AGG }	A	G
	G	GUU } Val GUC } GUA } GUG }	GCU } Ala GCC } GCA } GCG }	GAU } Asp GAC } GAA } Glu GAG }	GGU } Gly GGC } GGA } GGG }	G	
		Third letter					



Information

You are interested in joining a lab at UCLA to study SARS-CoV-2, the coronavirus that causes COVID. Your lab is hoping to learn more about the virus to develop new treatments. To study this virus in the lab, you plan on infecting cells obtained from mice. You learn from your new lab mates that the mouse genome follows the same rules of DNA base composition and base pairing that you learned about in class. Given this information, what can you conclude about the genome of your mouse cells?

Question 1

Complete

Not graded

Mouse DNA must contain equal amounts of thymine and cytosine.

Select one:

- a. True
 b. False

Question 2

Complete

Not graded

Mouse DNA must contain the same number of purines and pyrimidines.

Select one:

- a. True
 b. False

Question 3

Complete

Not graded

Mouse DNA must contain the same cytosine/thymine ratio as humans.

Select one:

- a. True
 b. False

Question 4

Complete

Not graded

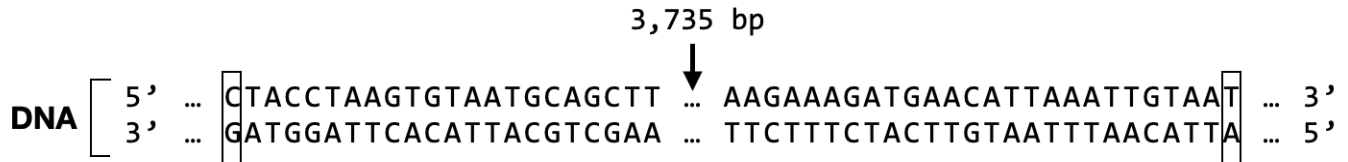
Imagine you have discovered a new species of bacteria. To begin your investigation of this organism, you run an assay on the total nucleotide content of the bacterial DNA. If the thymine content of DNA from the bacterial cells is 40%, what is the guanine content?

- a. 10%
 b. 20%
 c. 30%
 d. 40%
 e. It depends on the bacterial species.

Information

SARS-CoV-2 uses a protein on its surface called "S Protein" to bind to and infect human cells. To study this protein, you create a double stranded DNA sequence that contains the gene for S Protein. Since you learned in LS 7A that a double stranded piece of DNA can contain multiple genes that are transcribed in opposite directions, you also include the sequence for another unrelated gene (Gene X) on the opposite strand. Your double stranded DNA sequence is shown below.

This DNA sequence contains no introns. The three dots in the middle of the sequence indicate that there are an additional 3,735 base pairs in the middle of this DNA sequence that are not shown here, which can be assumed to not contain any stop codons. The boxed base pairs represent the +1 transcription start site for the two genes. The three dots on either side of the DNA sequence indicate that this sequence can be assumed to extend beyond your computer screen on both sides, and the promoter(s) for the S Protein gene and Gene X are located somewhere off of your computer screen. Use this figure and the codon chart below to answer the following questions.



		Second letter					
		U	C	A	G		
First letter	U	UUU } Phe UUC } UUA } Leu UUG }	UCU } UCC } Ser UCA } UCG }	UAU } Tyr UAC } UAA Stop UAG Stop	UGU } Cys UGC } UGA Stop UGG Trp	U C A G	
	C	CUU } CUC } Leu CUA } CUG }	CCU } CCC } Pro CCA } CCG }	CAU } His CAC } CAA } Gln CAG }	CGU } CGC } Arg CGA } CGG }	U C A G	
	A	AUU } AUC } Ile AUA } AUG Met	ACU } ACC } Thr ACA } ACG }	AAU } Asn AAC } AAA } Lys AAG }	AGU } Ser AGC } AGA } Arg AGG }	U C A G	
	G	GUU } GUC } Val GUA } GUG }	GCU } GCC } Ala GCA } GCG }	GAU } Asp GAC } GAA } Glu GAG }	GGU } GGC } Gly GGA } GGG }	U C A G	

Question 5

Complete

Not graded

The amino acid sequence of Protein X begins Met-Gln-Leu. Which strand is the template strand for the Protein X gene?

- a. The top strand shown in the diagram
- b. The bottom strand shown in the diagram

Question 6

Complete

Not graded

What is the second to last amino acid in S Protein?

- a. Ile
- b. Thr
- c. Tyr
- d. Met
- e. None of these

Question 7

Complete

Not graded

T/F: When transcribing Gene X, RNA polymerase will read the DNA sequence from the right side of your computer screen to the left side of your computer screen.

Select one:

- a. True
- b. False

Question 8

Complete

Not graded

The S Protein gene and Gene X most likely have different promoter regions on your DNA sequence.

Select one:

- a. True
- b. False

Question 9

Complete

Not graded

RNA polymerase will read the sequence for the S Protein gene from the 3' end to the 5' end of the template strand.

Select one:

- a. True
- b. False

Question 10

Complete

Not graded

The primary structure of the proteins expressed from each of these genes will be different.

Select one:

- a. True
 b. False

Question 11

Complete

Not graded

The tertiary structure of S Protein and the protein expressed from Gene X will most likely be the same.

Select one:

- a. True
 b. False

Question 12

Complete

Not graded

How many total amino acids would you find in S Protein?

Select one:

- a. 1,253
 b. 1,255
 c. 1,254
 d. 3,765
 e. 3,768
 f. A different number not shown above
 g. Not possible to say without more information

Question 13

Complete

Not graded

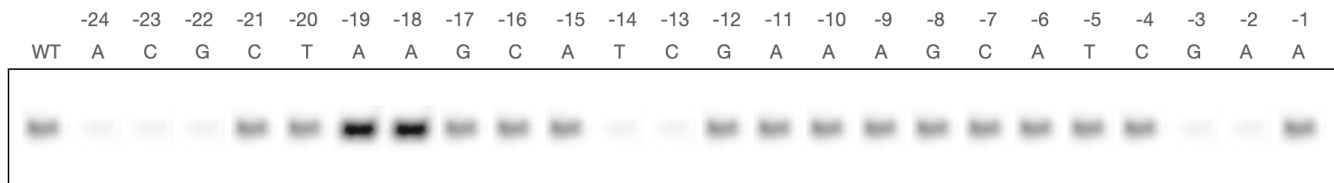
Which of the following changes to a codon would you expect to be LEAST damaging to the resulting protein (all codons are written 5' to 3')?

Select one:

- a. GCC -> CUG
 b. GAG -> AAG
 c. AGC -> AGA
 d. CAA -> GAA

Information

You suspect that regulation of the transcription of the SARS-CoV-2 S Protein gene might play an important role in infection. To identify important regulatory elements for this gene, you isolate a piece of DNA that includes the sequence before the transcribed region of the gene. You first take the wild-type sequence, allow transcription to occur, and run a Northern blot to determine how much RNA is produced. You then change the first nucleotide in this region (labeled -24 to indicate that it is 24 nucleotides upstream from the transcription start site) to a different nucleotide and measure how much RNA is produced. You then change the second nucleotide (-23) and measure how much RNA is produced. You then change the third nucleotide (-22), and so on. The results from your experiment are shown below. Using these data, mark each of the following statements true or false.



Question 14

Complete

Not graded

T/F: The nucleotide at position -22 could be part of a promoter sequence.

Select one:

- a. True
 b. False

Question 15

Complete

Not graded

Nucleotides -21 and -20 do not appear to play a role in transcription.

Select one:

- a. True
 b. False

Question 16

Complete

Not graded

Nucleotides -14 and -13 could be a transcription factor binding site.

Select one:

- a. True
 b. False

Question 17

Complete

Not graded

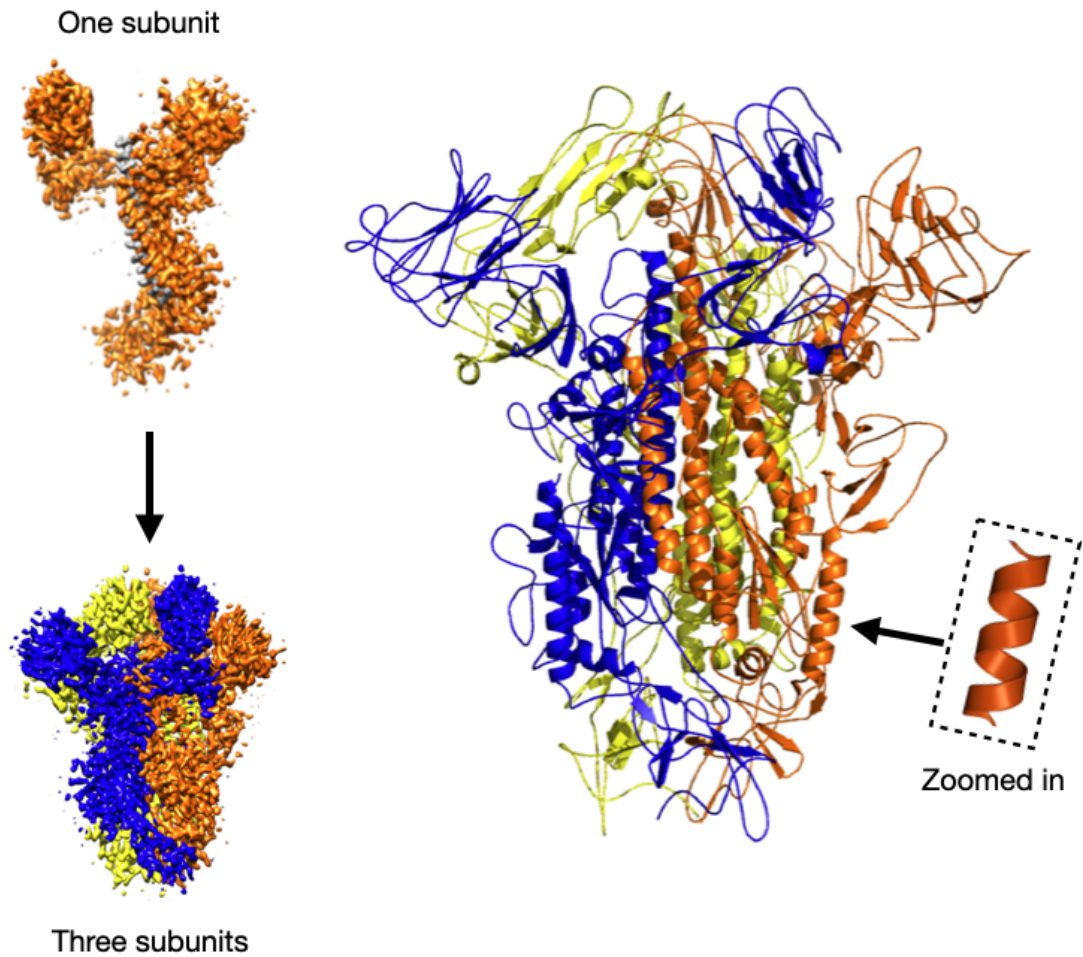
When nucleotide -19 is mutated, transcription of this gene increases.

Select one:

- a. True
- b. False

Information

The image below depicts the structure of the SARS-CoV-2 S Protein. S Protein is made up of three identical polypeptide chains, or subunits, that associate with each other and form a spike-like structure on the surface of SARS-CoV-2. The left side of this image shows the structure of a single subunit (top) and the assembled S Protein spike structure (bottom). The right side of this image is a different model of the same S Protein structure that shows more detail of the protein structure. The arrow on the right side of the image points to a specific part of this structure, and a zoomed in view of that part of the structure is shown to the right of the arrow in a dotted box. Use this information to answer the following questions.



Question 18

Complete

Not graded

What is the highest level of protein structure in S Protein?

Select one:

- a. Primary
- b. Secondary
- c. Tertiary
- d. Quaternary

Question 19

Complete

Not graded

T/F: If heat were added to S Protein, the primary structure would be the first level of structure to be disrupted.

Select one:

- a. True
- b. False

Question 20

Complete

Not graded

What level of protein structure is shown in the boxed zoomed in region?

- a. Primary
- b. Secondary
- c. Tertiary
- d. Quaternary

Question 21

Complete

Not graded

T/F: Disrupting the tertiary structure of S Protein would most likely affect its primary structure.

Select one:

- True
- False

Question 22

Complete

Not graded

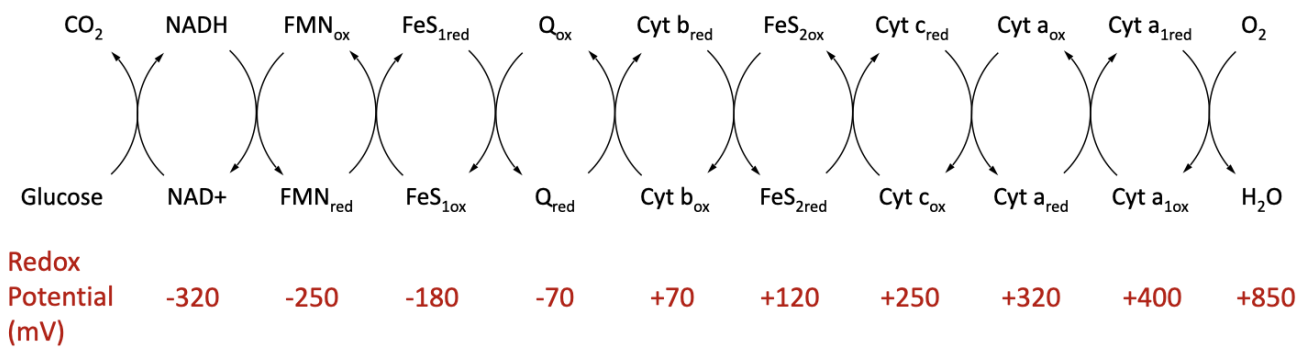
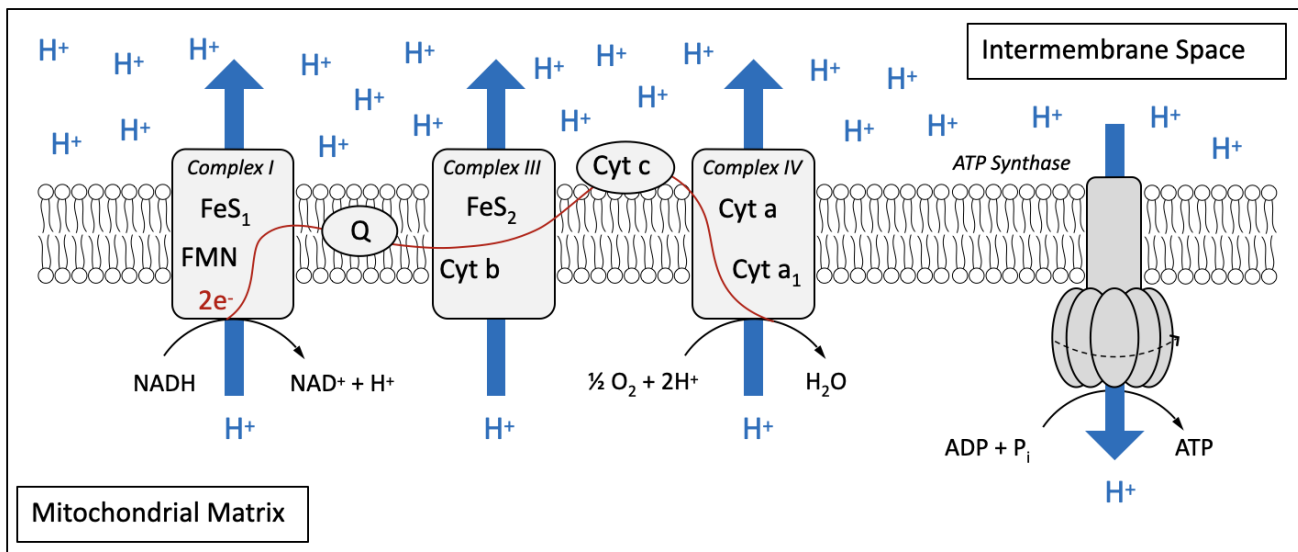
T/F: The tertiary structure of S protein is formed primarily by covalent bonding between amino acids that are not necessarily adjacent to each other in the primary structure.

Select one:

- True
- False

Information

The following image depicts the electron transport chain and oxidative phosphorylation in a eukaryotic cell. Use this diagram to help you answer the following questions.



Question 23

Complete

Not graded

FMN_{ox} is an example of an oxidizing agent.

Select one:

- a. True
- b. False

Question 24

Complete

Not graded

At the same time the total amount of ATP increases in a cell, the total amount of ADP in the cell will increase.

Select one:

- a. True
- b. False

Question 25

Complete

Not graded

Adding a drug that decreases the pH in the intermembrane space of the mitochondrion will cause ATP production to decrease.

Select one:

- a. True
- b. False

Information

Many plants rely on the release of odors into the environment to attract pollinators. To aid in the spread of these odors, these plants often engage in a process called thermogenesis, where they produce heat in the flower (see the image below for one example).



Plants that engage in thermogenesis do so by "decoupling" electron transport from ATP synthesis. Under certain conditions, they produce a protein called alternative oxidase (AOX) that has a redox potential of +90 and acts as an alternate electron acceptor during electron transport. This prevents the normal movement of electrons through the electron transport chain, so fewer H^+ ions are pumped and less ATP is made. The end result is that these plants speed up their metabolism by an enormous amount to make up for the lowered ATP production, producing a great deal of heat in the process.

Use this information to answer the following questions.

Question 26

Complete

Not graded

You determine that the redox potential of AOX is +90. Which molecule in the electron transport chain could AOX be accepting electrons from?

Select one:

- a. FeS1
- b. FeS2
- c. Cyt a
- d. Cyt a1
- e. More than one of these

Question 27

Complete

Not graded

If a plant cell begins producing AOX, the amount of Cyt c_{red} will _____ compared to before AOX was present.

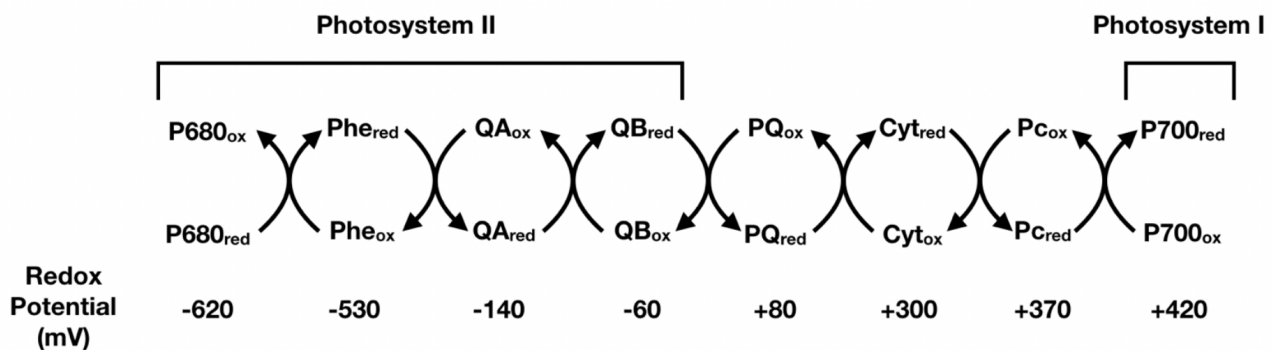
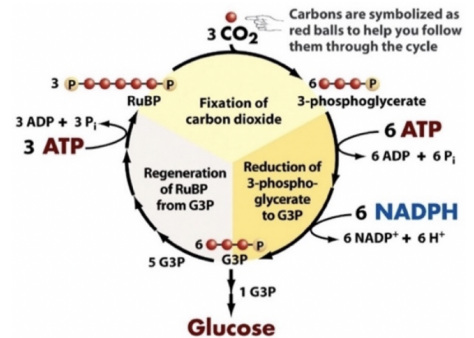
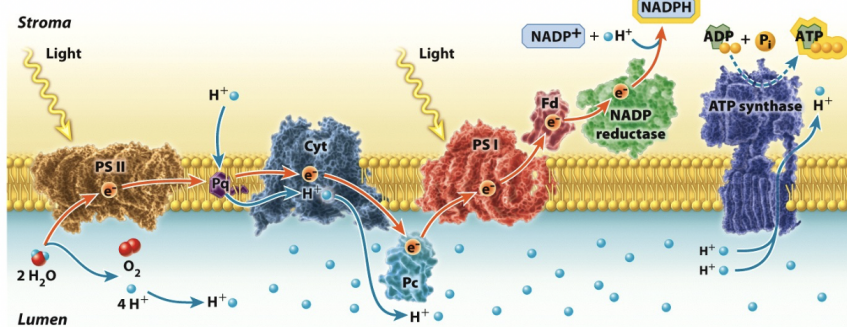
Select one:

- a. Increase
- b. Decrease
- c. Stay the same

Information

The figures below show the light harvesting reactions of photosynthesis and the Calvin Cycle. Beneath the figures is a partial diagram of the redox reactions involved in the light harvesting reactions of photosynthesis, going from photosystem II to photosystem I. Note that photosystem II is made up of multiple smaller components indicated on the redox reaction diagram.

The production of NADPH and ATP by photosynthesis



3-(3,4-dichlorophenyl)-1,1-dimethylurea (DCMU) is a chemical used in the laboratory to block the binding of QB to QA in Photosystem II (PSII). Use this information to answer the following questions.

Question 28

Complete

Not graded

T/F: When a plant is treated with DCMU, NADP+ accumulates in its reduced form.

Select one:

- a. True
- b. False

Question 29

Complete

Not graded

T/F: When a plant is treated with DCMU, Pc accumulates in its oxidized form.

Select one:

- a. True
 b. False

Question 30

Complete

Not graded

T/F: When a plant is treated with DCMU, light energy will no longer be absorbed by chlorophyll molecules in photosystem I.

Select one:

- a. True
 b. False ← correct answer

Question 31

Complete

Not graded

T/F: More oxygen will be produced by the plant when treated with DCMU.

Select one:

- a. True
 b. False

Question 32

Complete

Not graded

T/F: When a plant is treated with DCMU, 3-phosphoglycerate will accumulate in the chloroplast.

Select one:

- a. True
 b. False

Question 33

Complete

Not graded

T/F: Treating a plant with DCMU will cause the plant's mass to decrease over time.

- a. True
 b. False

Question 34

Complete

Not graded

Adding a particular drug changes the redox potential of P700 from +420 to +310. Which of the following would you expect to observe in plant cells treated with this drug?

- a. Phe would accumulate in its reduced form.
- b. ATP would continue to be produced in the chloroplast.
- c. Pc would accumulate in its oxidized form.
- d. Levels of 3-phosphoglycerate would decrease.
- e. More than one of the above

Question 35

Complete

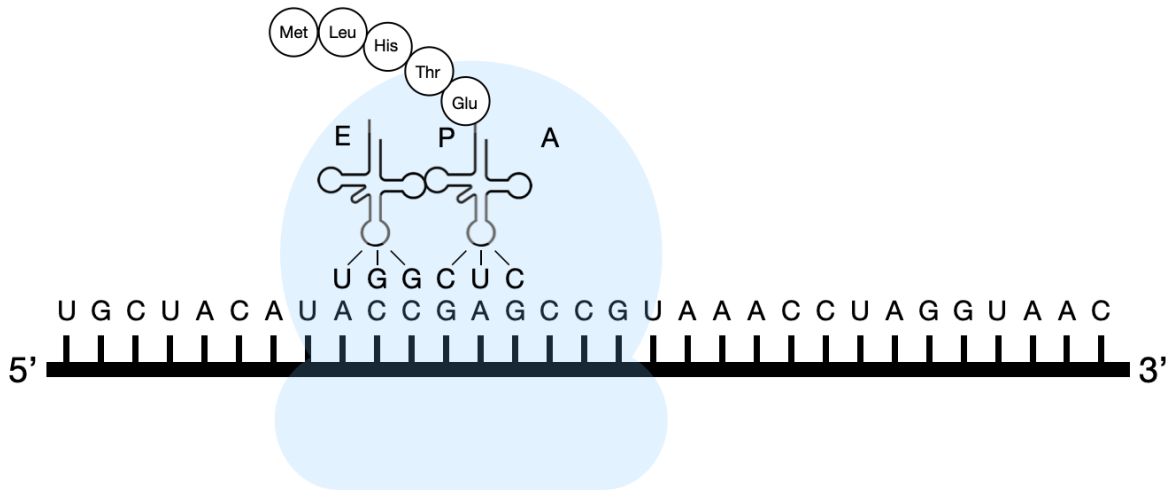
Not graded

Prometryn is an herbicide that acts as a photosystem II inhibitor (it prevents photosystem II from splitting water). If a plant were treated with prometryn, which of the following effects would you NOT expect to observe?

- a. Pc would accumulate in its oxidized form
- b. NADPH would accumulate in the chloroplast
- c. ATP production would decrease in the chloroplast
- d. 3-phosphoglycerate would accumulate in the chloroplast
- e. G3P production would decrease

Information

The figure below represents a ribosome in the process of translating an mRNA molecule (only part of the mRNA molecule is shown - the mRNA can be assumed to extend to the right and left of your screen). What will happen as the ribosome continues to translate the mRNA molecule shown in the diagram? You may find the codon chart below useful.



		Second letter					
		U	C	A	G		
First letter	U	UUU } Phe UUC } UUA } Leu UUG }	UCU } UCC } Ser UCA } UCG }	UAU } Tyr UAC } UAA Stop UAG Stop	UGU } Cys UGC } UGA Stop UGG Trp	U	C
	C	CUU } CUC } Leu CUA } CUG }	CCU } CCC } Pro CCA } CCG }	CAU } His CAC } CAA } Gln CAG }	CGU } CGC } Arg CGA } CGG }	U	C
	A	AUU } AUC } Ile AUA } AUG Met	ACU } ACC } Thr ACA } ACG }	AAU } Asn AAC } AAA } Lys AAG }	AGU } Ser AGC } AGA } Arg AGG }	U	C
	G	GUU } GUC } Val GUA } GUG }	GCU } GCC } Ala GCA } GCG }	GAU } Asp GAC } GAA } Glu GAG }	GGU } GGC } Gly GGA } GGG }	U	C
						Third letter	
						U	C
						A	G
						U	C
						A	G

Question 36

Complete

Not graded

The next amino acid added to the polypeptide will form a peptide bond with the Met amino acid.

Select one:

- a. True
- b. False

Question 37

Complete

Not graded

Refer to the diagram of translation above. What is the anticodon of the tRNA that brought leucine into the growing polypeptide chain?

Select one:

- a. 3'-GAU-5'
- b. 3'-GUA-5'
- c. 3'-AUC-5'
- d. 3'-CAU-5'
- e. None of the above

Question 38

Complete

Not graded

What amino acid will be attached to a tRNA with the anticodon sequence 3'-GUA-5'?

Select one:

- a. Arginine (Arg)
- b. Threonine (Thr)
- c. Methionine (Met)
- d. Serine (Ser)
- e. None of the above

Question 39

Complete

Not graded

Which of the following describes where the ribosome began translating this mRNA molecule?

- a. At the promoter
- b. At the +1 transcription start site
- c. At the 5' cap
- d. At the AUG nearest to the 5' cap
- e. At the beginning of exon 1

Question 40

Complete

Not graded

In a certain mutant strain of bacteria, 10% of the tRNAs with the anticodon 5'-GUA-3' are modified so that they have an anticodon of 5'-UGA-3'. These bacteria will synthesize:

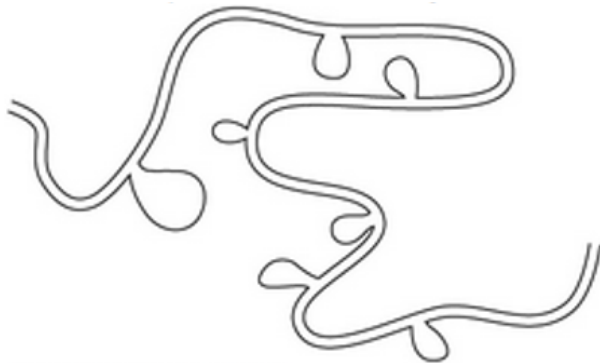
- a. Proteins in which serine is inserted at some positions normally occupied by tyrosine
- b. Shorter proteins on average than the wild-type bacterium
- c. Proteins in which tyrosine is inserted at some positions normally occupied by serine.
- d. Longer proteins on average than the wild-type bacterium

Question 41

Complete

Not graded

You are studying a eukaryotic gene (Gene Z) and want to know how many introns and exons it has. To do this, you hybridize denatured Gene Z DNA with mature Gene Z mRNA. (You may assume that Gene Z only has one possible mature mRNA product.) You look in the microscope and see this result:



What can you conclude from this result?

- a. Gene Z has seven exons
- b. Gene Z has seven introns
- c. Both of the above are true
- d. Neither of the above are true

Question 42

Complete

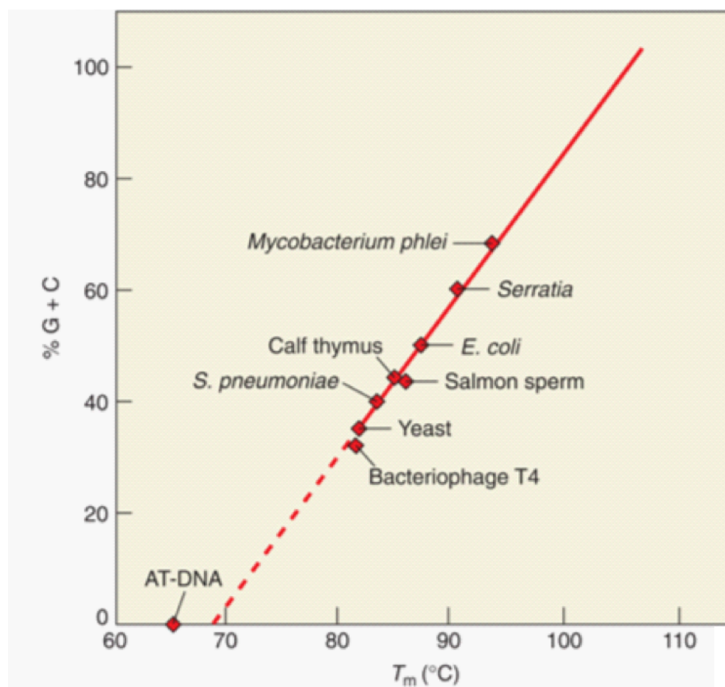
Not graded

The mature Gene Z mRNA is 999 base pairs long. How many amino acids would you expect to see in the protein produced by Gene Z?

- a. 332
- b. 333
- c. 334
- d. No way to tell from the given information

Information

Consider the graph below, which shows the melting temperature of different organism's genomes as a function of nucleotide composition. Use this graph to answer the questions below.



Question 43

Complete

Not graded

The organisms *Mycobacterium phlei* and *E. coli* both have genomes with approximately 5 million base pairs. The number of hydrogen bonds between base pairs in the *Mycobacterium phlei* genome is _____ in the *E. coli* genome.

- a. Greater than
- b. Fewer than
- c. The same as

Question 44

Complete

Not graded

The percentage of adenine in the *E. coli* genome is _____ in the yeast genome.

- a. Greater than
- b. Less than
- c. The same as

Information

A representation of the gene model for a gene (Gene X) as viewed in the genome browser is shown below. The chromosome can be assumed to extend to the left and the right beyond the ends of the diagram. Different regions of the gene model are indicated by arrows and labeled with letters. Use the answer choices [A-F] and the diagram to answer the following questions. Answer choices may be used more than once or not at all.



Question 45

Complete

Not graded

How many introns does Gene X contain?

- a. 2
- b. 4
- c. 5
- d. 6
- e. 7

Question **46**

Complete

Not graded

Where would you expect to find the promoter for Gene X?

- a. A
- b. B
- c. C
- d. D
- e. E
- f. F

Question **47**

Complete

Not graded

Where would you find the stop codon for Gene X?

- a. A
- b. B
- c. C
- d. D
- e. E
- f. F

Question **48**

Complete

Not graded

Where would you find the start codon for gene X?

- a. A
- b. B
- c. C
- d. D
- e. E
- f. F

Information

Even though they are organelles, mitochondria have their own genomes. The mitochondrial genome contains several protein-coding genes that are transcribed and translated inside the mitochondria! Mitochondrial ribosomes and tRNAs use the same genetic code as the rest of the eukaryotic cell with an important difference: one stop codon codes for the amino acid Tyrosine (Tyr) and another stop codon codes for the amino acid Tryptophan (Trp). This information is summarized in the table below.

Codon	Cytosol	Mitochondria
5' – UAA – 3'	STOP	Tyr
5' – UAG – 3'	STOP	STOP
5' – UGA – 3'	STOP	Trp

Use this information to answer the following questions.

Question 49

Complete

Not graded

A tRNA with the anticodon 5'-UCA-3' is present in mitochondria.

Select one:

- a. True
 b. False

Question 50

Complete

Not graded

A tRNA with the anticodon 5'-UCA-3' is present in the cytosol.

Select one:

- a. True
 b. False

Question 51

Complete

Not graded

T/F: A tRNA carrying the amino acid Tyr is present in the cytosol.

Select one:

- True
 False

Question 52

Complete

Not graded

Suppose that all of the tRNAs inside the mitochondria escape and are present in the cytosol of the cell. Assuming that these tRNAs can be used by the ribosomes in the cytosol, the average length of polypeptides synthesized by the cell will most likely _____.

Select one:

- a. Increase
 b. Decrease
 c. Stay the same

Information

You have five samples (#1-5) each with a different RNA molecule. The size of each is given in kilobases (kb) and a small portion of the ribonucleotide sequence is shown. You perform a Northern Blot using the probe shown below. You may assume the probe does not hybridize anywhere on the RNA outside of the sequence shown. Use this information to answer the following questions.

1. 5' – UAGGCCUACAUA – 3' (2.0 kb)
2. 5' – GCACUACAUGGA – 3' (4.5 kb)
3. 5' – ACGAUGUACGAG – 3' (1.5 kb)
4. 5' – UACAUCGACCAU – 3' (2.0 kb)
5. 5' – GCACUACAUCCG – 3' (4.0 kb)

Probe: 5' – AUGUAG – 3'

Question 53

Complete

Not graded

T/F: The probe could hybridize to the RNA molecule in sample 1.

Select one:

- True
 False

Question 54

Complete

Not graded

T/F: The probe could hybridize to the RNA molecule in sample 3.

Select one:

- True
 False

Question 55

Complete

Not graded

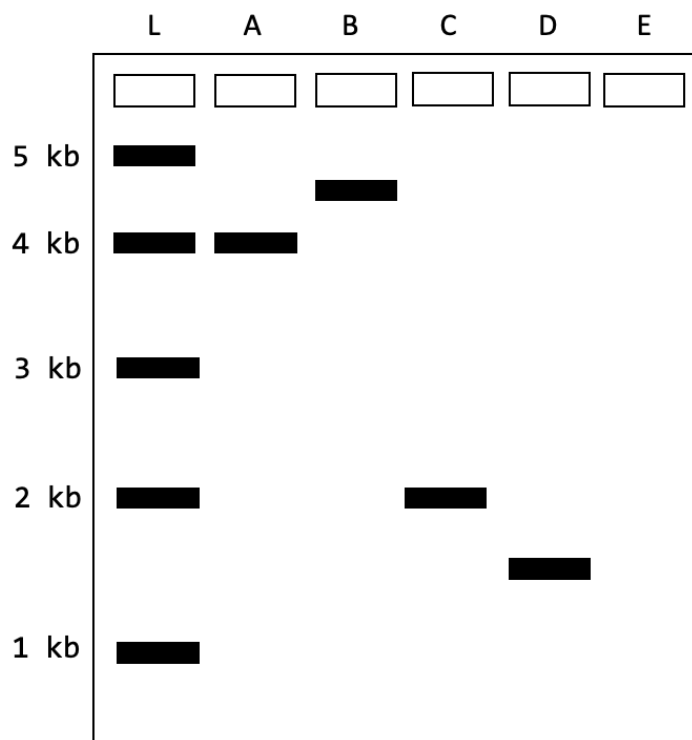
T/F: The probe could hybridize to the RNA molecule in sample 4.

Select one:

- True
 False

Information

The image below is a gel autoradiogram depicting results that you may or may not have observed from your experiment. The lane labeled "L" is a molecular ladder to indicate sizes of different pieces of nucleic acid on the gel. The other lanes are labeled A-E. Use this autoradiogram along with the information above to answer the following questions.



Question 56

Complete

Not graded

Which lane on the autoradiogram above corresponds to the results you would expect to observe for sample 1?

- a. Lane A
 b. Lane B
 c. Lane C
 d. Lane D
 e. Lane E

Question **57**

Complete

Not graded

Which lane on the autoradiogram above corresponds to the results you would expect to observe for sample 2?

- a. Lane A
- b. Lane B
- c. Lane C
- d. Lane D
- e. Lane E

Question **58**

Complete

Not graded

Which lane on the autoradiogram above corresponds to the results you would expect to observe for sample 5?

- a. Lane A
- b. Lane B
- c. Lane C
- d. Lane D
- e. Lane E

Question **59**

Complete

Not graded

This question is a freebie! In the box below, please tell us your favorite thing you have learned in LS 7A this quarter - what was the topic, and what did you learn about that topic that you thought was particularly interesting/fun/cool? This question is worth the equivalent of two multiple choice questions on your exam.

I really enjoyed learning about the different mutations that can occur in DNA/RNA and their effects. I thought that the problems that are associated with this topic are fun to work through. I enjoyed doing the Week 7 discussion worksheet because of the way that this topic is presented.

[◀ LS 7A Spring 2022 Exam 2 ...](#)

Jump to...

