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| Question | Answer | Associated Misconception(s) |
| 1. All cells on Earth use mRNA to make protein rather than using DNA directly. Why is it more advantageous to make protein from mRNA rather than directly from DNA in prokaryotic cells? | A. It is not possible for protein to be made from DNA directly because DNA cannot leave the nucleus. | Prokaryotes have a nucleus. |
| B. It allows for more levels of control for protein synthesis. | CORRECT ANSWER |
| C. mRNA is more flexible and single-stranded while DNA is double-stranded and helical, and therefore its strands cannot be easily separated. |  |
| D. It allows DNA to be protected from degradation, since if anything ever happened to the RNA, you would at least have the DNA. | This allows DNA to be protected from degradation. |
| Question | **Answer** | **Associated Misconception(s)** |
| 2. If DNA and RNA are so similar in structure, why is it true that in cells one can act as an enzyme and the other cannot? | A. RNA has a linear form, which allows for specific molecules to bind to RNA so that it can function as an enzyme. |  |
| B. RNA has a 2’ OH group on the riboses used in the backbone allowing RNA to be more reactive and therefore function as an enzyme. | RNA can act as an enzyme while DNA cannot because the OH-group on the ribose is very highly reactive. |
| C. DNA’s major and minor grooves can act as active sites so that DNA can function as an enzyme. Being single-stranded, RNA is not capable of this. | The function of DNA’s major and minor grooves is enzymatic in nature. |
| D. RNA can fold into tertiary structures and DNA cannot, allowing RNA to function as an enzyme. | CORRECT ANSWER |
| E. It is not true that only RNA can act as an enzyme since DNA has some enzymatic qualities |  |
| Question | **Answer** | **Associated Misconception(s)** |
| 3 [FIGURE]. The horizontal lines represent DNA strands in a prokaryote while the shaded area represents the open reading frame of a gene. The transcription start site (+1) is shown with the bent arrow. The arrows from I to V pointing to the dashed rectangles indicate either one or both strands of DNA. “I” represents: | A. 3’ end of the non-template (coding) strand. |  |
| B. 5’ end of the template strand. |  |
| C. Ribosome binding site sequence. | Ribosome binding sequence is upstream of the transcription start site. |
| D. Sequence that is downstream of the gene. | The promoter lies downstream of the transcription start site and is transcribed. |
| E. Promoter sequence. | CORRECT ANSWER |
| Question | **Answer** | **Associated Misconception(s)** |
| 4 [FIGURE]. In the same diagram (also shown below), “V” represents: | A. Ribosome binding site sequence. |  |
| B. Sequence that is upstream of the gene. | Downstream of a gene is at the 5’ end of the gene; upstream of a gene is at the 3’ end of the gene. |
| C. 5’ end of the non-template (coding) strand. |  |
| D. Sequence that is downstream of the gene. | CORRECT ANSWER |
| E. 3’ end of the template strand. |  |
| Question | **Answer** | **Associated Misconception(s)** |
| 5 [FIGURE]. In the same diagram (also shown below), “III” represents: | A. 5’ end of the template strand. | The coding strand is transcribed into mRNA |
| B. Ribosome binding sequence. |  |
| C. 3’ end of the template strand. | CORRECT ANSWER |
| D. Promoter sequence. |  |
| E. Sequence that is downstream of the gene. |  |
| Question | **Answer** | **Associated Misconception(s)** |
| 6 [FIGURE]. In the same diagram (also shown below), “IV” represents: | A. 5’ end of the template strand. | CORRECT ANSWER |
| B. Sequence that is upstream of the gene. |  |
| C. 5’ end of the non-template (coding) strand. | The coding strand is transcribed into mRNA. |
| D. Sequence that is downstream of the gene. |  |
| E. 3’ end of the template strand. |  |
| Question | **Answer** | **Associated Misconception(s)** |
| 7 [FIGURE]. In the same diagram (also shown below), “II” represents: | A. Promoter sequence. | The ribosomal binding site is upstream of the transcription start site. |
| B. 3’ end of the non-template (coding) strand. |  |
| C. 5’ end of the template strand. |  |
| D. Sequence that is downstream of the gene. |  |
| E. Ribosome binding sequence. | CORRECT ANSWER |
| Question | **Answer** | **Associated Misconception(s)** |
| 8. During translation, the tRNA molecule carrying the correct amino acid corresponding to its anticodon sequence must base-pair bind with the codon of the mRNA. What would happen in the case where the wrong anticodon successfully binds to a codon? | A. A wrong amino acid will be added to the protein. | CORRECT ANSWER |
| B. The amino acid will not be added to the protein. | During translation, if the wrong anticodon successfully binds the codon, the amino acid will not be added. |
| C. No protein would be made. |  |
| D. The protein could still be made, but at lower levels. | Wrong anticodons affect the level of protein production. |
| E. The protein would be unaffected. |  |
| Question | **Answer** | **Associated Misconception(s)** |
| 9. During translation, what would happen if a defective aminoacyl tRNA synthetase attaches the amino acid tryptophan to the tRNA molecule instead of aspartate? | A. The anticodon for aspartate would no longer bind to the appropriate codon. | The only requirement for the correct anticodon to add the correct amino acid is the sequence of the codon. |
| B. The protein would be made with tryptophan in place of aspartate. | CORRECT ANSWER |
| C. No protein would be made. |  |
| D. The protein could still be made, but at lower levels. |  |
| E. The protein would be unaffected. |  |
| Question | **Answer** | **Associated Misconception(s)** |
| 10. A sequence of DNA is shown below. Hypothetically, *if* both strands could be transcribed, we can state that:    5’ GGCTATCCG 3’ 3’ CCGATAGGC 5’ | A. The two DNA strands are transcribed from left to right. | If either the template or coding strand is transcribed, it would still result in the same polypeptide sequence. |
| B. The two DNA strands are transcribed from right to left. |  |
| C. The upper DNA strand is transcribed from left to right and the lower DNA strand is transcribed from right to left. | The template strand is “read” from 5’ to 3’ and mRNA is made from 3’ to 5’. |
| D. The upper DNA strand is transcribed from right to left and the lower DNA strand is transcribed from left to right. | CORRECT ANSWER |
| Question | **Answer** | **Associated Misconception(s)** |
| 11. With respect to the proteins that could hypothetically be generated from both strands of the DNA sequence shown in the previous question (also shown below), we could make the statement that:  5’ GGCTATCCG 3’ 3’ CCGATAGGC 5’ | A. The two complementary DNA strands produce the same protein. | If either the template or coding strands is transcribed, it would still result in the same polypeptide sequence. |
| B. The two complementary DNA strands produce different proteins. | CORRECT ANSWER |
| C. Only one of the complementary DNA strands has the codons to produce proteins while the other DNA strand does not. |  |
| D. The two complementary DNA strands produce similar proteins. |  |
| Question | **Answer** | **Associated Misconception(s)** |
| 12. Imagine a case in which the ribosome binding site of a gene is deleted. Which of the following processes would subsequently be affected? | A. Replication. | The ribosomal binding site may have a function in processes other than translation. |
| B. Transcription. |  |
| C. Translation. | CORRECT ANSWER |
| D. Transcription, Translation. |  |
| E. Replication, Transcription, Translation. |  |
| Question | **Answer** | **Associated Misconception(s)** |
| 13. In which of the following would you find the *start codon sequence* of a gene? | A. Protein. | Start codon, ribosomal binding site etc. sequences are only found on the RNA. |
| B. RNA. |  |
| C. DNA, RNA. | CORRECT ANSWER |
| D. DNA, Protein. |  |
| E. DNA, RNA, and Protein. |  |
| Question | **Answer** | **Associated Misconception(s)** |
| 14. A *missense* mutation is a change in a nucleotide that changes the amino acid. Which of the following could result from a missense mutation in a gene?  1. a shorter protein  2. a longer protein  3. no change in protein function  4. a protein with a loss of function | A. 4 only. | A missense mutation only results in a loss of protein function. |
| B. 3 and 4. | CORRECT ANSWER |
| C. 1, 2 and 4. | A missense mutation can result in a shorter protein. |
| D. 1, 2 and 3. |  |
| E. All of the above |  |
| Question | **Answer** | **Associated Misconception(s)** |
| 15. A particular sequence of DNA is shown below. Hypothetically, if both strands of DNA could be transcribed, what would be the resulting proteins? A condensed codon table is provided below the sequence to help you. Note: assume that the start codon is not required in this case.  5’ CAGTCC 3’ 3’ GTCAGG 5’ | A. Valine – Arginine; Glutamine – Serine. | The template strand is “read” from 5’ to 3’ and mRNA is made from 3’ to 5’. |
| B. Glyine – Leucine; Proline – Aspartate. |  |
| C. Glutamine – Serine; Glycine – Leucine. | CORRECT ANSWER |
| D. Proline – Aspartate; Valine – Arginine. |  |