Quiz 2

## Instructions: Absolutely no talking during a quiz. Complete answers as best as you can in the time allowed. If you need additional space, you can write on the back, but space provided should be sufficient so try to be succinct. If there is a problem, please raise your hand for help.

## Note: Answer 5 of 7. If you attempt to answer more than 5 questions, please circle the questions you want me to grade.

## Bonus: Name of the piece playing (1/2 credit) composer (1/2 credit): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. What is PCR (Tell me what the abbreviation stands for, as well as what the technique does)?

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2. Please list and explain (one sentence) 4 of the major chemical /molecular components of the PCR reaction.

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3. What are the three main steps (types of cycles) of the PCR process, briefly explain each step?

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4. Explain the purpose of chelex in the DNA extraction from cheek cells?

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5. Given the following 2 DNA sequences, one original (ancestral) sequence, and a sequence from a distant relative label the following mutations (3 total)

* Transition
* Transversion
* Indel

Original: ACTACGTAGCGGATTAGATTTTTTCGATCGAT

Descendant: ACTACGCAGCGGATTAGATTT- TTCGATCGTT

6) Bracha ordered primers to do a PCR reaction the primers were:

Primer 1 Forward) TAGAGGATCGATCGGGATCG (20 nucleotides)

Primer 2 Reverse) CCGATCTATTTCGATTTCGATC (20 nucleotides)

She has used these same primers in PCR before and they have always worked. However, what she did not know is that this time, the company made a mistake and only partially synthesized the primers. As a result, she accidentally used the following primers which only contained the first four nucleotides:

Forward-truncated) TAGA (4 nucleotides)

Reverse-truncated) CCGA (4 nucleotides)

What effect (if any) might this have on the PCR reaction?

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7) Originally, PCR used DNA Polymerase I (derived from E. coli). What PCR polymerase do we currently used, and why do we use this type of polymerase?

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**BONUS**

As we increase the length of a primer, the chance that it will find a match in the genome by chance decreases:

|  |  |
| --- | --- |
| **Primer Length (n)** | **Probability of match by chance (pM)** |
| 0 | 1 |
| 1 | 0.25 |
| 2 | 0.0625 |
| 3 | 0.015625 |
| 4 | 0.00390625 |
| 5 | 0.000976563 |
| 6 | 0.000244141 |
| 7 | 6.10352E-05 |
| 8 | 1.52588E-05 |
| 9 | 3.8147E-06 |
| 10 | 9.53674E-07 |

When we do PCR, we want to select primers that will only match their target sites in the genome. Given the size of the human genome (~3,200,000,000 bp). What is the minimum length (n) of a primer such the probability of matching by chance is less than 1 in 3.2 billion?

**Hint:** This chart shows how many time a primer of length (x-axis n) will find a match in a genome of a given size (y-axis)

Answer (give a number an explain how you arrived at the number – use the back if necessary:

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