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REDHILL HIGH SCHOOL

GRADE 12

LIFE SCIENCE TEST

DNA and GENETICS MARKING GUIDE

Examiner: Dr Mwaba

Moderator: Mrs M Ho

Time: 60 Min

60 marks

QUESTION 1: MULTIPLE CHOICE

[10 MARKS]

1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8
<u>D</u>	<u>B</u>	D	<u>B</u>	<u>C</u>	<u>D</u>	<u>C</u>	<u>B</u>

QUESTION 2

2.1 A step in protein synthesis is shown in the image below.

2.1.1 Name the process shown in the diagram above. (1)

Protein translation

2.1.2 Where in the cell does this process take place? (1)

Cytoplasm/ribosome

2.1.3 Identify A, B and C. (3)

A: mRNA; B: tRNA; C: polypeptide chain

2.1.4 Outline the importance of B in the stage shown above. (2)

Brings the **correct (SPECIFIC)** amino acid to the ribosome, that corresponds to the mRNA sequence.

2.1.5 If molecule C consisted of 380 amino acids, calculate the number of base sequences on the DNA molecule that codes for molecule C. Show your working. (2)

380X3 ✓ = 1140 nucleotides ✓

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2.1.6 If the base sequence on molecule B was CAU, state the corresponding base sequence that would be found on molecule A. (1)

GUA ✓

QUESTION 3

3.1 A section of mRNA is shown below.

3.1.1 How many codons are there in the mRNA sequence above. (1)

FIVE ✓

3.1.2 Using the codon wheel below, identify the amino acid sequence on this mRNA sequence. (2)

PRO THR ASP LEU TYR ✓ ✓

If all 5 are correct give 2 marks.

Subtract 1 mark for each incorrect amino acid.

3.1.3 Explain FULLY the consequence of a mutation that deletes the first C (underlined) in the mRNA sequence above. (3)

- Frameshift Mutation.
- Different protein will be synthesized.
- to get the third mark, the student must refer to the sequence (see Tatjana's and Alex's response)

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3.1.4 Give a reason why a substitution mutation is more likely less severe than the mutation in answer 3.1.3 above. (2)

- Frameshift can cause the entire sequence of amino acids in the resulting protein to be altered, often leading to a non-functional protein.
- On the other hand, substitution mutations involve the replacement of a single nucleotide, and do not alter the reading frame.
- Redundancy of the genetic code means that a substitution might result in no amino acid change.

3.1.5 Can mutations such as those in question 3.1.3 and 3.1.4 be detected using a Karyotype analysis? Give a reason for your answer. (2)

No. karyotype can be used to screen for chromosomal mutations. ✓ Gene mutations affect a single nucleotide and will not be detectable in a karyotype ✓

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4.1 Read the information below and answer the questions that follow.

4.1.1 The label for the y-axis of the graph is the *DNA content of the cell*. Supply a suitable label for the x-axis of the graph. (1)

Time

4.1.2 Use the descriptions below to match the correct number for labels A and C. You need only write the letter and the corresponding number. (4)

A – 2 ✓ ✓

C – 4 ✓ ✓

4.1.3 Give an alternative name for 2n. (1)

Diploid

4.1.4 What is the significance of the DNA content that is formed at the end of meiosis? (2)

- Half the DNA content in the gametes. When two gametes fuse, the resultant zygote has the full genetic component.
- DNA produced is genetically diverse from parent cell, allowing for diversity.

4.1.5 Interphase only occurs before meiosis I. Using your own knowledge and the information included in the source, explain what the consequence would be, should interphase occur both before the start of meiosis I and meiosis II. (2)

- During interphase, DNA is replicated.
- Should interphase occur before meiosis II, the DNA content in the cell will double.
- the gametes produced will not be haploid.

4.1.6 During Stage B, an important process (shown below) occurs between paired homologous chromosomes.

4.1.6.1 Name this process. (1)

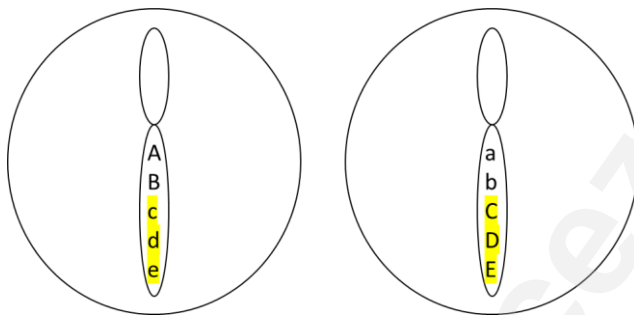
Crossing over

4.1.6.2 Why is this process so important? (2)

- It allows for exchange of alleles between chromosomes from different parents.
- allowing for diversity in gametes.

4.1.6.3 Make a biological drawing of the TWO daughter cells produced at the end of meiosis II that have the new combinations of alleles. Provide any 2 correct labels to your drawing and indicate the correct order of alleles. (6)

- Labels ✓ ✓
- Two cells ✓
- Each cell having one chromosome ✓.
- Correct allele order in each cell ✓ ✓



QUESTION 5

5.1.1 Recessive

5.1.2 heterozygous

(1)

5.1.3 Point mutation

(1)

5.2 was healthy, and the other was affected.

5.2.1 Affected: gg ✓; Healthy Gg ✓; GG ✓

5.2.2

P1 Genotype: Affected Homozygous

dominant

P1 Phenotype: gg

GG

✓

Gametes

g

G

✓

	G
g	Gg

✓ for the grid and ✓ for the correct combination of alleles

F1 Genotype Gg. 100% probability that offspring (F1) will be carriers. ✓

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