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ST BENEDICT'S COLLEGE

SUBJECT	LIFE SCIENCES	DATE	4 JUNE 2024
GRADE	12	MARKS	50
EXAMINER	MRS S. STEGMANN	MODERATOR	MRS B. ZAJAC
NAME		DURATION	50 MINUTES
CLASS			

INSTRUCTIONS:

1. This paper consists of 10 pages- 9 pages of questions and 1 page of additional writing space. Please check that your question paper is complete.
2. Answer all questions on the question paper.
3. Write in blue or black pen only.
4. Read all questions carefully and answer in as much detail as possible.
5. All diagrams should have a clear heading unless otherwise stated.
6. It is in your own interest to write legibly and to present your work neatly.

QUESTION	POSSIBLE MARK	MARK ACHIEVED
1	15	
2	15	
3	13	
4	7	
TOTAL: 50		

Question 1:

- 1.1. Four multiple choice questions are asked below. Choose the most correct answer to each question and write the letter of your choice in the table below. (4)

1.1.1.	1.1.2.	1.1.3.	1.1.4.

- 1.1.1. Independent assortment occurs during:

- A. anaphase 1
- B. prophase 1
- C. metaphase 1
- D. metaphase 2

- 1.1.2. if meiosis did not occur in sexually reproducing organisms,

- A. growth of the zygote would be halted.
- B. mitosis would be sufficient.
- C. the chromosome number would double in each generation.
- D. Gametes would be haploid.

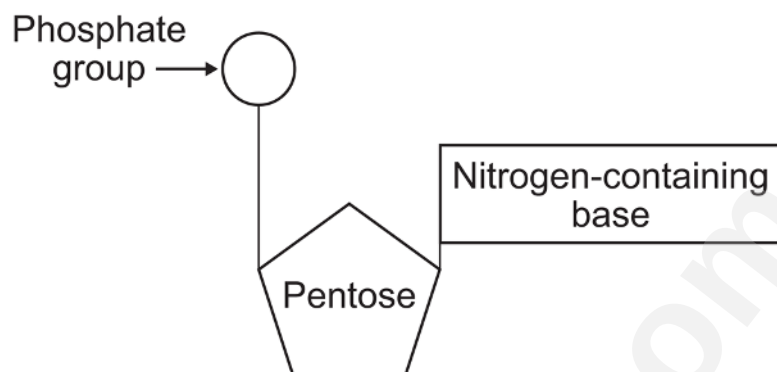
- 1.1.3. Sister chromatids are separated from each other during:

- A. metaphase I
- B. anaphase I
- C. telophase II
- D. anaphase II

- 1.1.4. If a diploid organism has a genome consisting of four chromosomes, how many different combinations of maternal and paternal chromosomes can be produced disregarding crossing over.

- A. 4
- B. 8
- C. 12
- D. 16

1.2. The diagram below shows the basic structure of a DNA subunit.



1.2.1. Provide the correct term for the DNA subunit. (1)

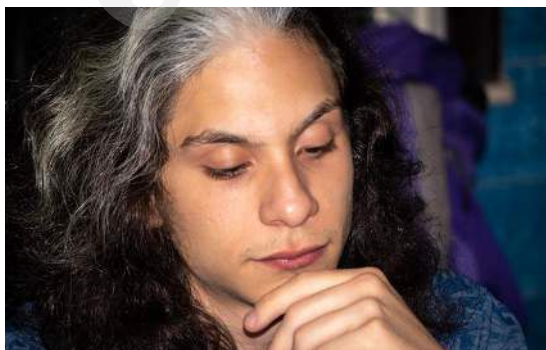
1.2.2. Name the pentose sugar molecule that would be found in the DNA molecule. (1)

1.2.3. If the nitrogenous base indicated above was a purine, name the possible bases it could be. (2)

1.2.4. Which base in RNA substitutes thymine? (1)

1.3. Read the following information and answer the questions that follow.

A boy's mother in grade 12 had a patch of white hair called 'white forelock' which is caused by a dominant allele H. Her other allele is h. She therefore has the genotype Hh. The boy's father does not have a white forelock. He has the genotype hh.



LIFE SCIENCES- LIFE AT A MOLECULAR LEVEL

Use the information on the previous page to help you fill in the table below.

Put a tick in the box if the gametes shown at the left-hand side can carry the allele or alleles shown at the top of the columns. Put a cross if the gametes cannot carry the allele or alleles shown.

1.3.1.

	H	h	Hh	Hh
Mother's gametes				
Father's gametes				

(2)

1.3.2. (i) Which combinations of alleles could the boy inherit?

(1)

(ii) Show, by filling in the table below, how you worked out your answer.

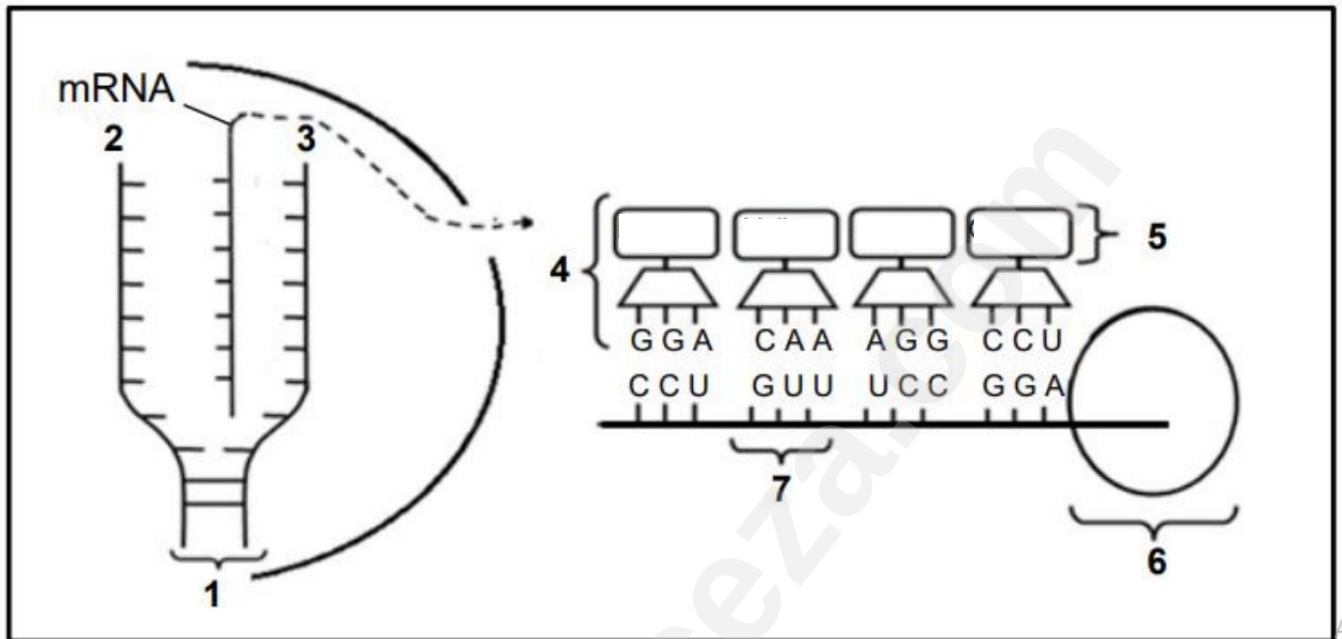
	Mother	Father
Parental genotypes	Hh	
Parental gametes		h
Possible genotypes of boy		
Possible phenotype of boy	Normal	

(3)

[15]

Question 2

Study the diagram below and answer the questions that follow.



2.1. What process is occurring in the diagram? (1)

2.2. Provide the:

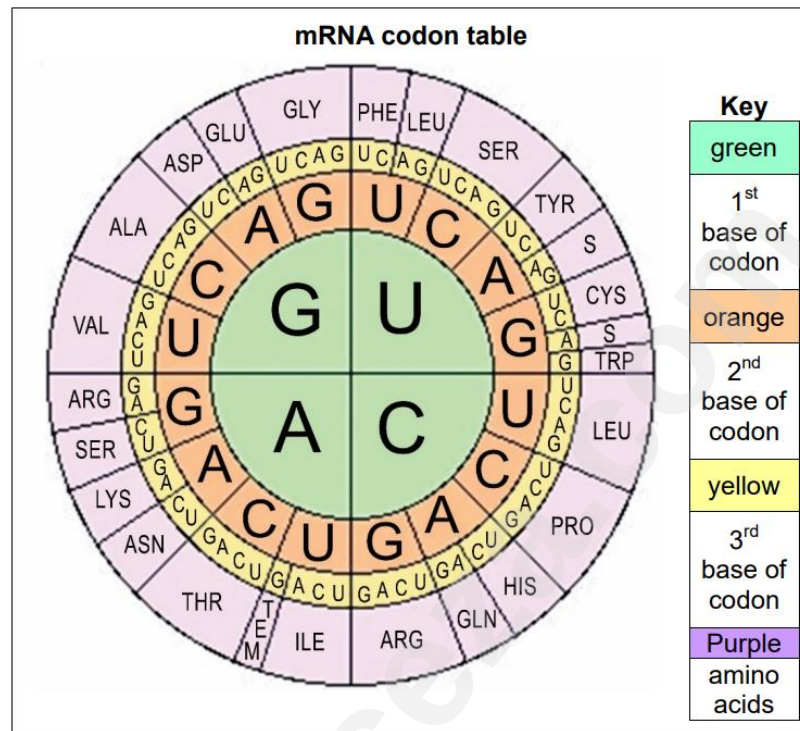
- (i) Name of molecule 1: _____
- (ii) Name of organelle 6: _____
- (iii) Number of the DNA template strand: _____
- (iv) Number representing a codon: _____ (4)

2.3. Give the sequence of the DNA template strand. (2)

2.4. Explain the process of translation. (4)

2.5. Using the mRNA codon wheel below give the sequence of amino acids at 4.

(4)

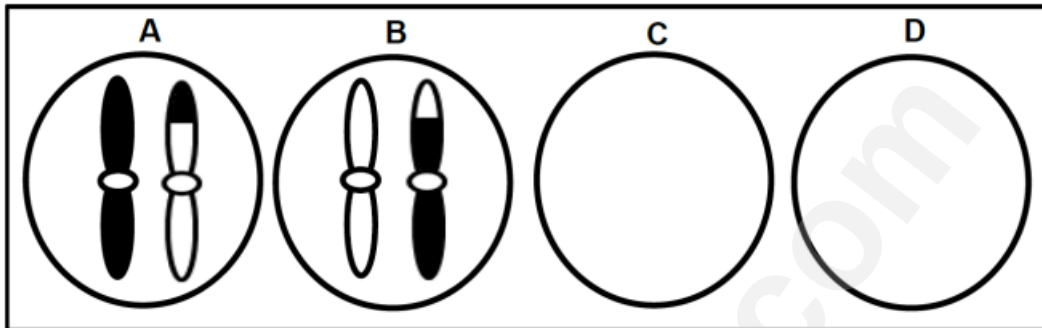


[Adapted: <<https://slideplayer.com>>]

[15]

Question 3

The diagrams below show the distribution of chromosome pair 21 at the **end of meiosis II** in four gametes.



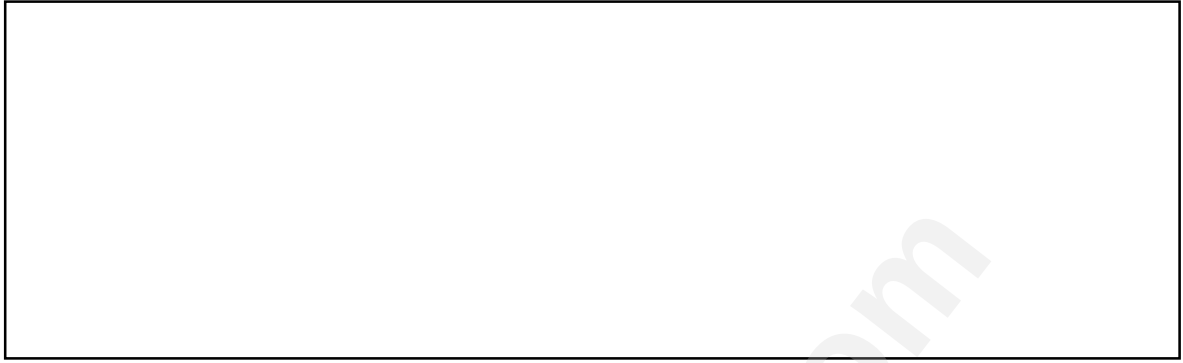
3.1. Explain why gametes C and D not contain a copy of chromosome 21? (3)

3.2. Gamete A is involved in fertilisation.
What is the end result of the organism formed? (2)

3.3. Due to the process of crossing over the chromosomes in A and B look different.
i. In which phase of meiosis does crossing over occur? (1)

ii. What is the importance of crossing over in living organisms? (2)

iii. In the space on the next page sketch gamete A if crossing over did not occur.
No heading required. (3)



3.4. What is the importance of meiosis?

(2)

[13]

Question 4

DNA profiling may be used in forensic science to solve crimes. Read the information below and answer the following questions.

The first step to making a genetic profile requires getting a sample of DNA. This sample can come from blood, semen, hair or saliva, and may be an extremely small sample. A blood sample contains white blood cells which are broken open using detergent, and the DNA is extracted.

Next, restriction enzymes are used to cut the non-coding DNA into many pieces of different lengths. This non-coding DNA consists of short sequences of bases that are repeated. The number of times the non-coding segments are repeated varies from individual to individual.

4.1. How are enzymes used in the process described above? (1)

4.2. What process is used to amplify DNA before DNA profiles are created? (1)

4.3. Suggest why white blood cells and not red blood cells are used to extract DNA. (1)

4.4. What is meant by the term 'non-coding DNA' and explain how it is different to 'coding DNA'. (2)

4.5. Other than solving crimes, name TWO other uses of DNA profiling? (2)

[7]

TOTAL: 50 MARKS

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