

**2025 Matric Helpline: DNA and Meiosis**

**5 May 2025**

1.2 Give the correct biological term for EACH of the following descriptions.

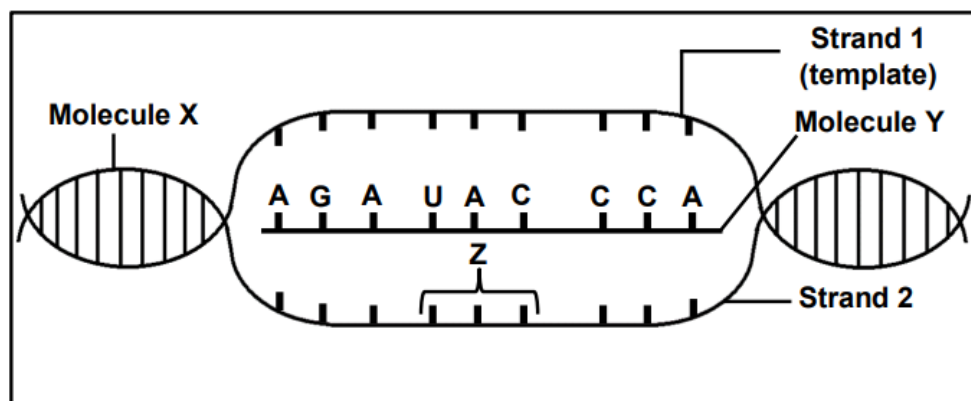
- 1.2.1 A nucleic acid that carries hereditary information
- 1.2.2 The chromosome condition of a cell that has a single set of chromosomes
- 1.2.3 The structure that holds the two chromatids of a chromosome together
- 1.2.4 The type of RNA that carries specific amino acids to the site of protein synthesis
- 1.2.5 The analysis of DNA samples to identify individuals or relationships between individuals
- 1.2.6 A representation of the number and structure of all the chromosomes that occur in the nucleus of a somatic cell
- 1.2.7 A group of similar organisms that are able to interbreed to produce fertile offspring
- 1.2.8 The phase of meiosis where paired chromosomes are arranged at the equator
- 1.2.9 The biotechnological process that produces genetically identical organisms (9 x 1) (9)

1.3 Indicate whether each of the descriptions in COLUMN I apply to **A ONLY**, **B ONLY**, **BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B** or **none** next to the question numbers (1.3.1 to 1.3.3) in the ANSWER BOOK.

COLUMN I	COLUMN II
1.3.1 A source of variation in populations	A: Random fertilisation B: Random mating
1.3.2 Discovery of the structure of the DNA molecule	A: Franklin and Wilkins B: Lamarck and Darwin
1.3.3 Occurs during meiosis	A: Karyokinesis B: Cytokinesis

(3 x 2) (6)

2.1 The diagram below represents a certain stage of protein synthesis. (The sequence of bases is read from left to right.)



2.1.1 Identify molecule Y. (1)

2.1.2 Describe the process that resulted in the formation of molecule Y (6)

2.1.3 Give ONE structural difference between molecule X and molecule Y. (2)

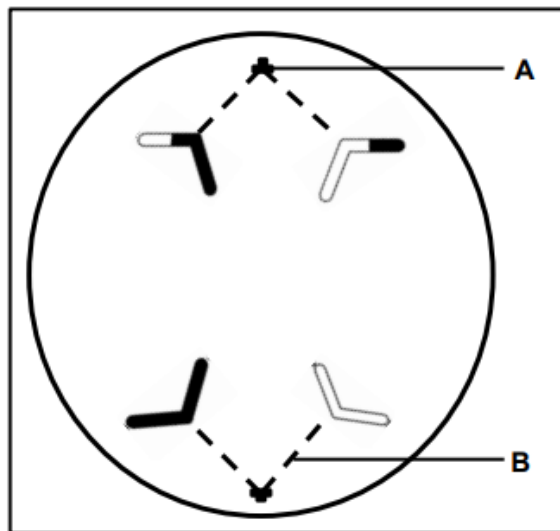
2.1.4 Give the sequence of bases at triplet Z on strand 2 (1)

2.1.5 The table below shows some amino acids coded for by codons on molecule Y.

CODON	AMINO ACID
AGA	Arginine
UCU	Serine
CCA	Proline
UAC	Tyrosine
GGU	Glycine

Identify the first and last amino acids coded for by this section of molecule Y. (2)

2.2 The diagram below represents a phase of meiosis II.



2.2.1 Identify the phase of meiosis shown. (1)

2.2.2 State ONE difference between the phase shown in the diagram above and the same phase in meiosis I. (2)

2.2.3 Identify structure:

(a) **A** (1)

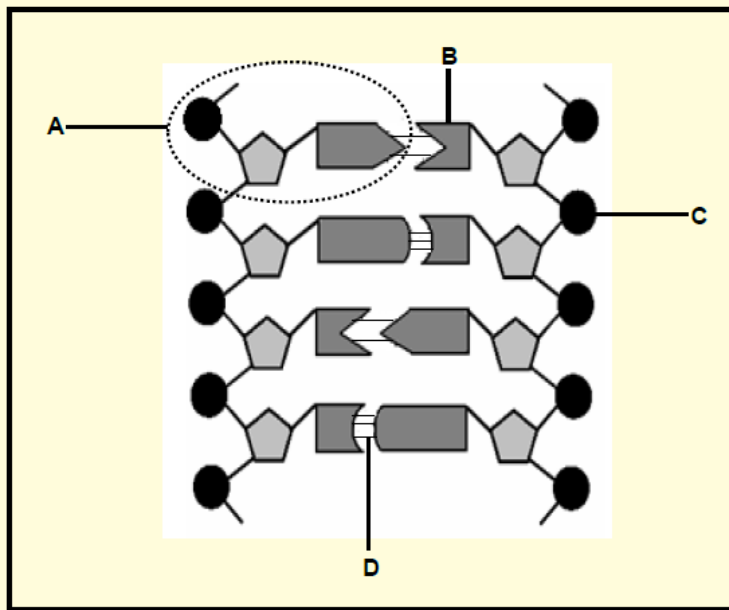
(b) **B** (1)

2.2.4 Describe the role of structure **B** during cell division. (2)

2.2.5 Draw a labelled diagram representing the cell above as it would have appeared in metaphase II.

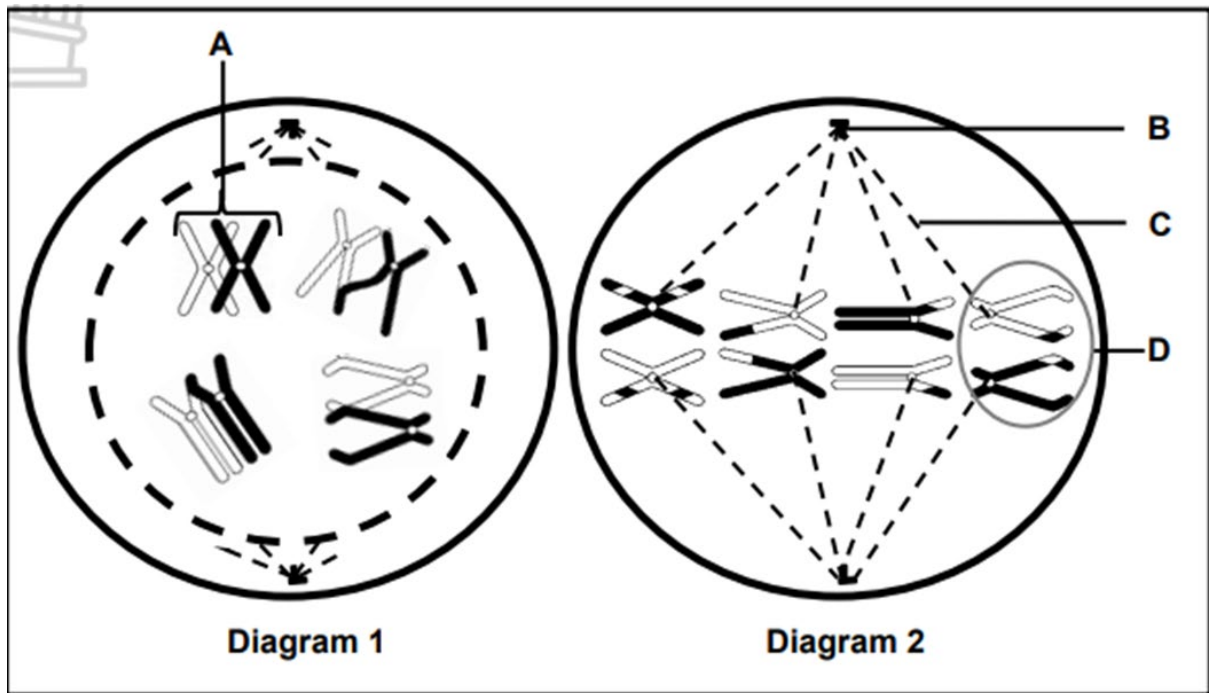
**NOTE:** The diagram should show the correct shading and include labels (exclude labels for **A** and **B**). (5)

2.1 The diagram below represents a portion of a DNA molecule.



- 2.1.1 Identify **B** and **C**. (2)
- 2.1.2 Name: (1)
- (a) Monomer **A** (1)
- (b) TWO scientists who received a Nobel prize for discovering the DNA molecule (2)
- (c) ONE organelle in a cell where DNA is located (1)
- 2.1.3 Describe how a mutation on DNA may change the structure of a protein. (4)
- 2.1.4 Tabulate TWO structural differences between a monomer of RNA and a monomer of DNA. (5)
- (15)

1. Identify: (1)
- (a) Process Z (1)
- (b) Molecule R (1)
- (c) Organelle Q (1)
2. Give the collective name of nitrogenous bases O. (1)
3. Determine the sequence of the nitrogenous bases at area S. (1)
4. Which strand (1 or 2) was used as a template for the formation of molecule R? (1)
5. Which amino acid (3, 4 or 5) will be brought to area P? (1)
6. Name the type of sugar that forms part of the structure of molecule R. (1)



1. Name structure:
  - (a) B (1)
  - (b) C (1)
2. Identify the phase represented in Diagram 1. (1)
3. Give THREE reasons for your answer to QUESTION 2. (3)
4. Describe the process taking place at A. (3)
5. (a) Identify the phase represented in Diagram 2. (1)
- (b) Describe the difference in the events that take place in the phase mentioned in (a) and the same phase during mitosis. (2)
6. Describe the results at the end of meiosis if the chromosomes at D failed to separate. (3)
7. Describe the process of DNA Replication. (6)

A gene, VKORC1, codes for a blood-clotting factor in humans. This gene is made up of 163 amino acids.

A mutation occurred that affected amino acid 128 and 139, the sequence CTG changed to CAG and the TAT became TCT. This mutation has been transmitted as an autosomal dominant characteristic through the generations.

The mutation has resulted in resistance to Warfarin drugs in humans. Warfarin is used in the treatment of thrombosis. Thrombosis results in the formation of a blood clot in the artery. Warfarin causes the thinning of blood to break down the blood clot.

1. Give ONE piece of evidence from the information that shows that the mutation for this gene occurred in the DNA molecule. (1)
2. How many nitrogenous bases code for the VKORC1 gene? (2)
3. Describe what is meant by an autosomal dominant allele. (3)

The table below shows the amino acids and their corresponding codons.

<b>CODONS</b>	<b>AMINO ACID</b>
GAC	Leu
UCU	Ser
AUA	Try
GUC	Gln
AGA	Arg
ACA	Trp
CAG	Gln
UAU	Phe

Explain:

- (a) How the mutation on the VKORC1 gene resulted in resistance to Warfarin in humans (5)
- (b) The effect of this mutation on humans with thrombosis (3)