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— **TUITION** —

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BIOLOGY

FOUNDATIONS IN BIOLOGY

Level & Board	OCR (A-LEVEL)
TOPIC:	NUCLEOTIDES AND NUCLEIC ACIDS
PAPER TYPE:	QUESTION PAPER - 3
TOTAL QUESTIONS	06
TOTAL MARKS	/36

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Nucleotides and Nucleic Acids - 3

1.

A DNA nucleotide is shown in Fig. 24.

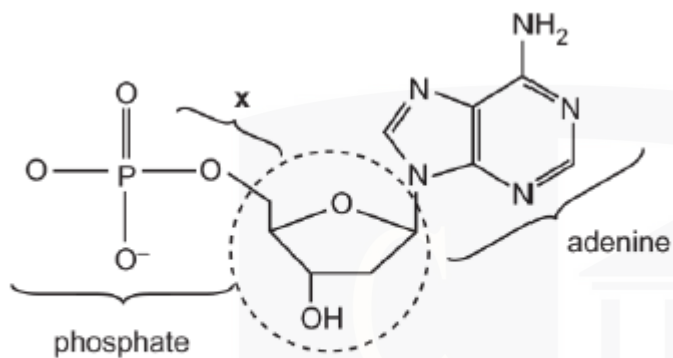


Fig. 24

(a) Identify the part of Fig. 24 that is circled. (2)

(b) Identify the bond in Fig. 24 that is designated with the letter x. (2)

2.

The tiniest DNA molecules are quite lengthy.

- 1000 base pairs make up one kilobase (Kb), the unit of measurement for DNA molecules.
- The length of one Kb of double-stranded DNA is 0.34 μm .

The length of the DNA in a fruit fly (*Drosophila*) cell nucleus is 5.6 cm.

(a) Determine how many Kb are present in the fruit fly's DNA. Display your work. Ascertain the closest whole number in your response. **(2)**

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(b) After the fruit fly's DNA was examined, it was found that 22% of the nucleotides were adenine. How much guanine was there in the bases? Display your work. **(2)**



3.

* In the nucleus of eukaryotic cells, two processes take place: transcription and DNA replication.

(a) Explain the parallels and divergences between the processes of transcription and DNA replication. **(6)**

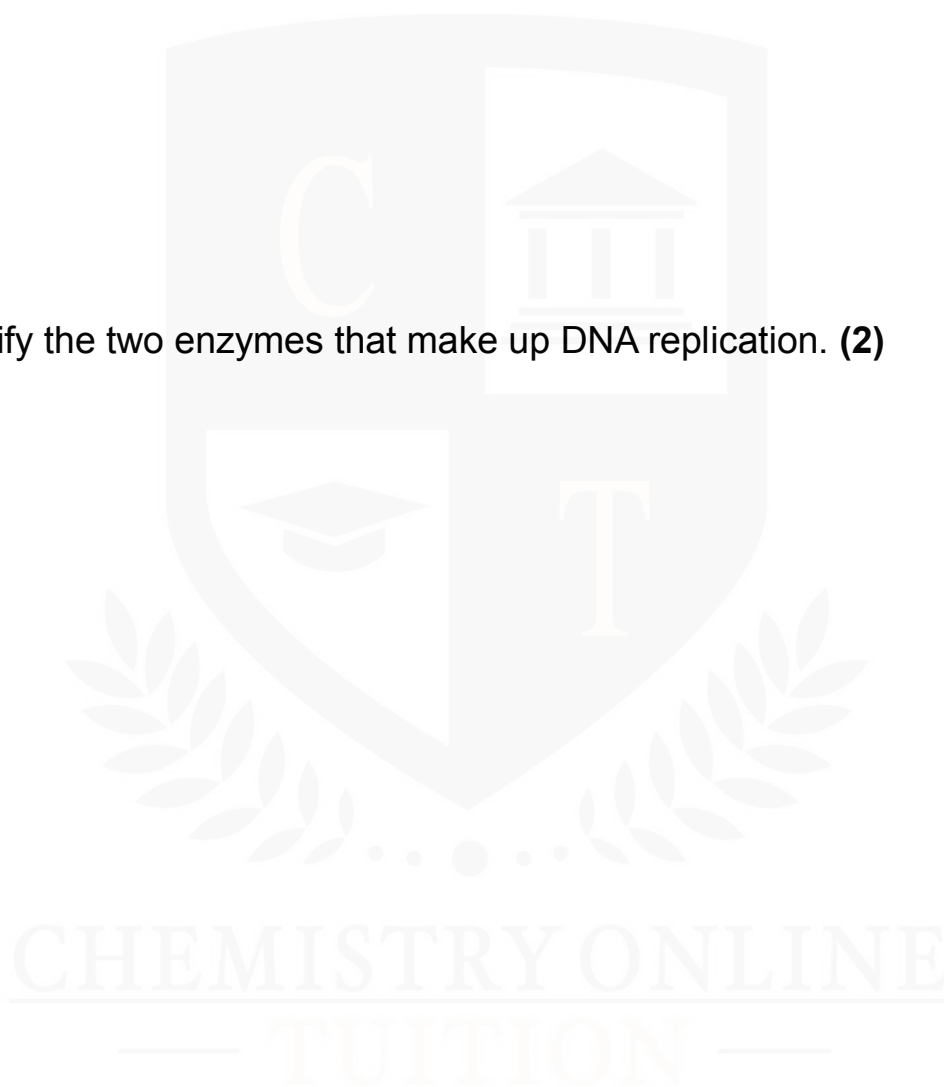


4.

(a) The number of nucleotides in the human genome is 3.0×10^9 . In certain cells, the replication of DNA requires six hours. DNA can be replicated at a rate of 50 nucleotides added per second on each complementary strand by a single eukaryotic enzyme complex. Determine how many eukaryotic enzyme complexes are required in six hours to replicate the DNA in the human genome. Provide a standard response. **(3)**

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(b) Identify the two enzymes that make up DNA replication. (2)



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(c) Justify the necessity of enzymes for all living things. (2)

4.

All living things duplicate their DNA using a mechanism known as semi-conservative replication.

(a) What does the term "semi-conservative replication" mean? **(2)**

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(b) One enzyme that aids in DNA replication is DNA ligase. Name the other two involved enzymes and explain what they do. **(4)**



5.

DNA replication that is semi-conservative was suggested by an experiment conducted in 1958 by Matthew Meselson and Franklin Stahl. Only the heavy isotope of nitrogen, ^{15}N , was present in the growth medium used by Meselson and Stahl to cultivate *E. Coli* bacterium. After transferring the bacterium to a growth medium containing the light ^{14}N isotope, they let the bacteria divide. Following each division, some of the bacteria's DNA was taken out of the culture and separated using centrifugation. The DNA bands in the centrifuge tubes following a predetermined number of divisions are displayed in Fig. 25.

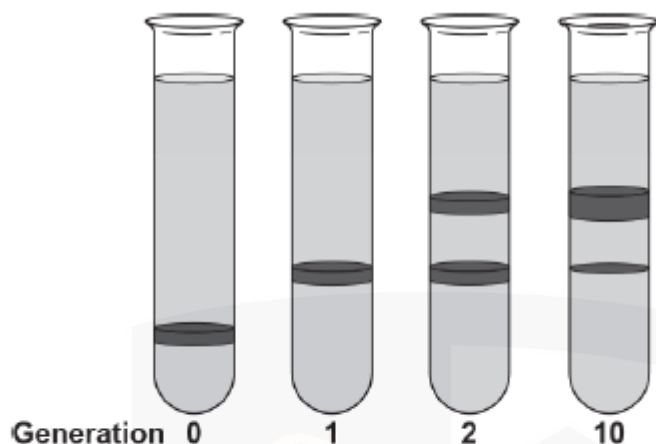


Fig. 25

A single band of DNA having bases that contain just the heavy isotope of nitrogen (^{15}N) is visible in the tube labeled Generation 0 in Figure 25.

(a) Describe how the findings from the other generations provide credence to the semi-conservative theory of DNA replication. **(2)**

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6.

(a) Describe how the pairing of nitrogenous bases results in the completion of the DNA replication process. **(3)**

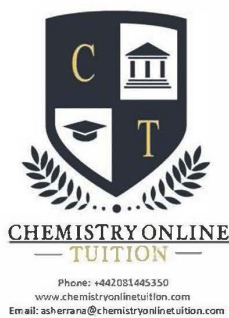


(b) Why is DNA replication described as semi-conservative? **(2)**

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- Chemistry, Physics, and Math's Tutor

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