6.1 Structure of Nucleic Acids & Replication of DNA

Question Paper

Course	CIE A Level Biology (9700) exams from 2022
Section	6. Nucleic Acids & Protein Synthesis
Topic	6.1 Structure of Nucleic Acids & Replication of DNA
Difficulty	Hard

Time allowed: **10**

Score: **/10**

Percentage: **/100**

Question 1

A piece of DNA 153 base pairs long was analysed to find the number of nucleotide bases in each of the polynucleotide strands. Some of the results are shown below

	number of nucleotide bases			
	A	T	G	C
strand 1		31	22	52
strand 2				

How many nucleotides containing Thymine (T) were present in strand 2?

A 22

B 29

C 34

D 48

[1 mark]

Question 2

What would be the result of analysing a DNA molecule 14 000 base pairs in length?

A 28 000 pentose sugars, 14 000 phosphates, an equal ratio of cytosine to thymine bases and an equal ratio of guanine to adenine bases

B 28 000 pentose sugars, 28 000 phosphates, an equal ratio of cytosine to guanine bases and an equal ratio of thymine to adenine bases

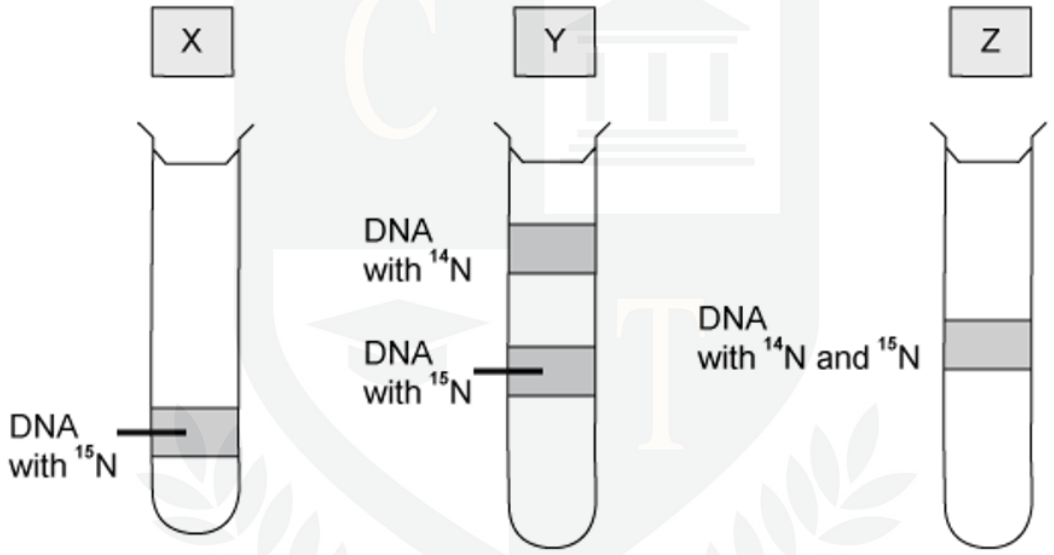
C 14 000 pentose sugars, 28 000 phosphates, an equal ratio of cytosine to thymine bases and an equal ratio of guanine to adenine bases

D 28 000 pentose sugars, 28 000 phosphates, an equal ratio of cytosine to thymine bases and an equal ratio of guanine to adenine bases

[1 mark]

Question 3

Meselson and Stahl proved that DNA replication was semi-conservative. Bacteria were grown for many generations in a medium containing ^{15}N (a heavy isotope of nitrogen). They were then transferred to a medium containing ^{14}N (a lighter isotope of nitrogen). They were given time to replicate DNA and divide once. Their DNA was extracted, spun in a centrifuge and observed using ultraviolet light. They then repeated this experiment, this time allowing the bacteria to replicate DNA and divide twice. Again, the DNA was extracted, spun in a centrifuge and observed using ultraviolet light.



Which shows the predicted results after zero, one and two generations of replication in the medium with the light isotope?

A X = 0 Y = 1 Z = 2

B X = 0 Y = 2 Z = 1

C X = 2 Y = 1 Z = 0

D X = 2 Y = 0 Z = 1

[1 mark]

Question 4

The table shows the percentages of bases in DNA from various types of cell.

source of DNA	adenine	cytosine	guanine	thymine
human hair	30	20	21	29
human liver	9	40	40	11
dog liver	24	26	24	26
mouse bone marrow	23	26	27	24
sunflower leaf	11	41	38	10

What is a valid deduction from this data?

A Larger organisms have a greater thymine abundance.

B All cells have roughly the same amount of DNA.

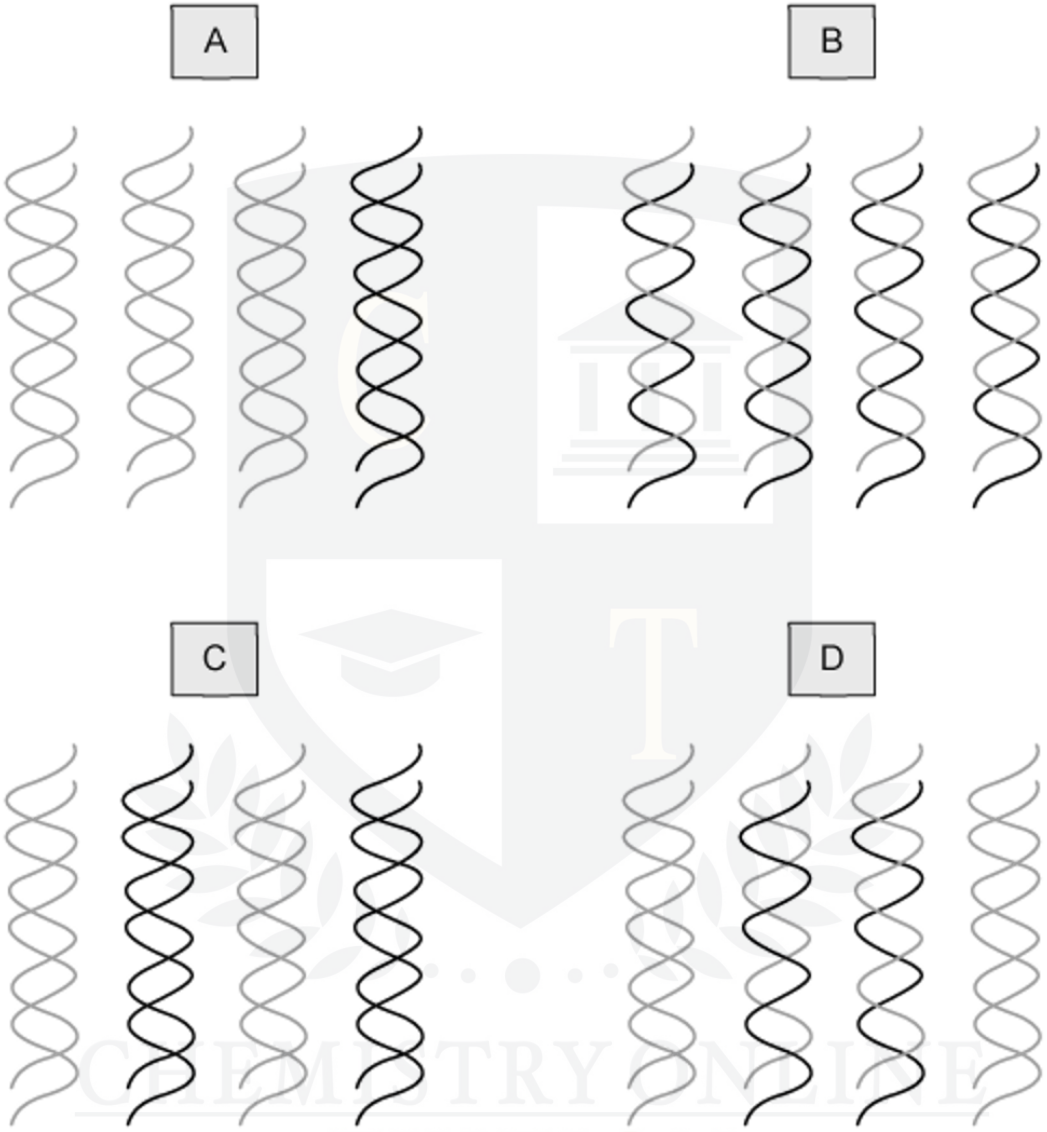
C The structure of DNA in sunflower leaves and human liver is similar.

D The four bases exhibit complementary base pairing.

[1 mark]

Question 5

The diagram shows DNA strands that have undergone replication. The parent DNA is shown in black and the newly synthesised DNA is shown in grey.



Which would be the resulting DNA strands formed after two cycles of semi-conservative replication?

[1 mark]

Question 6

Which enzymes are needed for DNA replication?

1 Helicase

2 DNA ligase

3 RNA polymerase

4 DNA polymerase

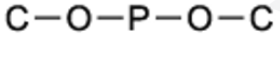
A 1 and 2 only **B** 2, 3 and 4 only **C** 1, 2 and 4 only **D** 1 and 4 only

[1 mark]

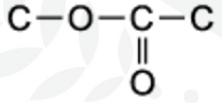
Question 7

Which diagram shows the bond linking the individual units of a nucleic acid?

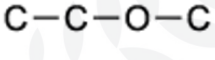
A



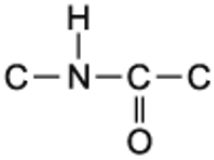
B



C



D



[1 mark]

Question 8

The following events occur in the replication of DNA.

Here are the steps in their experiment in a mixed-up order

1 opposite strands are separated

2 free DNA nucleotides pair with complementary nucleotides on each strand

3 bonds between complementary based are formed

4 bonds between complementary based are broken

5 phosphodiester bonds are formed

Which is the correct order of the processes?

A 1 → 3 → 4 → 2 → 5

B 3 → 1 → 2 → 4 → 5

C 2 → 1 → 3 → 4 → 5

D 4 → 1 → 2 → 3 → 5

[1 mark]

Question 9

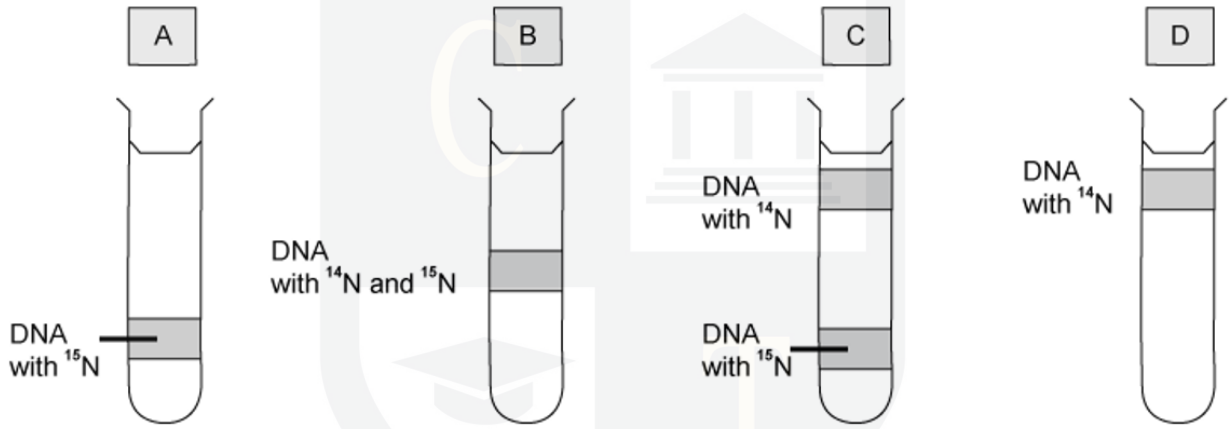
Which type of sugar and types of bonds are found in a DNA molecule?

	type of sugar	nucleotides in strand joined by	adjacent strands joined by
A	non-reducing	phosphodiester bonds	hydrogen bonds
B	reducing	phosphodiester bonds	hydrogen bonds
C	non-reducing	ester bonds	covalent and hydrogen
D	reducing	ester bonds	covalent and hydrogen

[1 mark]

Question 10

In 1957, Meselson and Stahl conducted an experiment that proved that DNA replication was semi-conservative. They took bacteria containing only ^{15}N in their DNA and transferred them to a medium only containing ^{14}N. They allowed the bacteria to divide once then centrifuged the DNA to reveal the following results



Which shows the predicted results after one generation in the medium with the light isotope?

[1 mark]