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VCE Biology ¾

Nucleic Acids & The Structure of Genes [1.2]

Test

34 Marks. 1 Minute Reading. 21 Minutes Writing.

Results:

Test	_____ / 27
Extension	_____ / 7

Section A: Test Questions (5 Marks)

Question 1 (5 marks)

Tick whether the following statements are **true** or **false**.

	True	False
a. DNA is a single-stranded molecule found in the nucleus.		
b. The sugar in RNA nucleotides is ribose, while in DNA nucleotides it is deoxyribose.		
c. Complementary base pairing in DNA involves adenine pairing with thymine and cytosine pairing with guanine.		
d. mRNA is responsible for carrying genetic instructions from the nucleus to the ribosome for protein synthesis.		
e. tRNA is single-stranded but folds into a specific shape to carry amino acids during translation.		
f. Exons are the non-coding regions of a gene that are removed during RNA processing.		
g. The genetic code is universal, meaning all organisms use the same DNA base sequences to encode proteins.		
h. Phosphodiester bonds join nucleotides together in a nucleic acid chain.		
i. In RNA, the base thymine is replaced by uracil.		
j. The promoter region of a gene is responsible for terminating transcription.		

Section B: Multiple Choice Questions (5 Marks)

Question 2 (1 mark)

A student observed a diagram of single-stranded nucleic acid and determined that it was DNA. A piece of evidence that would support this is the presence of:

A. Uracil.

B. A deoxyribose sugar.

C. A methyl cap and a poly A tail.

D. Anticodons.

Question 3 (1 mark)

The genetic code is considered redundant as:

A. All organisms are coded for by the same nucleotides.

B. Multiple codons code for the same amino acid.

C. All nucleotides are double-ringed purines.

D. It is not required for all cell functioning.

Question 4 (1 mark)

A canola crop had a gene coding for an omega-3 fatty acid, derived from bacteria, inserted into it: Genome. Individuals who ate the canola gained the benefit of increased omega-3 fatty acids, such as healthier membranes. The characteristic of DNA that allowed this to occur is that the DNA code is:

A. Universal.

B. Redundant.

C. Degenerate.

D. Transferable.

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Question 5 (1 mark)

A condensation reaction includes:

A. The joining of two nucleotides together.

B. The conversion of ATP into ADP.

C. The digestion of a polypeptide.

D. All of the steps during glycolysis.

Question 6 (1 mark)

Which one of the following statements about biological macromolecules is correct?

A. Nucleic acids are converted into nucleotides by a condensation reaction.

B. Hydrolysis reactions can convert amino acids into proteins.

C. All amino acids contain the elements C, H, O, N and S.

D. There are five naturally occurring nitrogenous bases.

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Section C: Short Answer Questions (17 Marks)

Question 7 (3 marks)

There are structural differences between molecules of DNA and RNA.

a. Outline two of these differences by completing the following table. (2 marks)

	DNA	**RNA**
Difference 1		
Difference 2		

b. Name one kind of RNA and state its function. (1 mark)

Type of RNA_____

Function_____

_____

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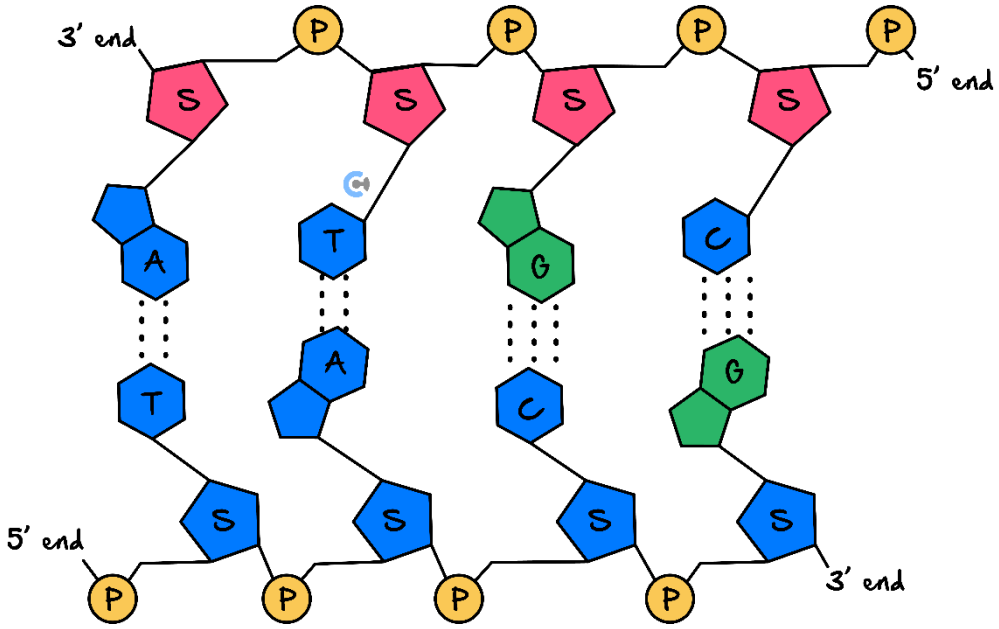
Question 8 (3 marks)

Below is a diagram of part of a DNA molecule.



a. Draw a circle around one nucleotide on the diagram. (1 mark)

b. Complete the table below. (2 marks)

% **of each base**	**A**	**C**	**T**	**G**
Strand 1	25		30	
Strand 2		40		

Question 9 (6 marks)

a. A section of one of the stands of a DNA molecule has a sequence of bases shown.

DNA : C T T A C A T T A C T C

In the spaces below, enter the sequence of bases in the corresponding mRNA, which is complimentary to this DNA. (1 mark)

mRNA												

b. The percentage of base T in a molecule of DNA is 30%. What is the percentage of G bases in the same DNA molecule? (1 mark)

_____

Another type of nucleic acid is tRNA.

c.

i. Where is tRNA found in the cell? (1 mark)

_____

_____

ii. Describe the role of tRNA. (1 mark)

_____

_____

d. The table shows the names of six amino acids together with some of their DNA codes.

Amino acids	DNA triplet(s)
Cysteine	ACA, ACG
Glutamic acid	CTT, CTC
Aspartic acid	CTA, CTG
Asparagine	TTA, TTG
Leucine	GGA, GAG, GAT, GAC
Methionine	TAC

Use the information in the table and write the order of amino acids coded for by the DNA sequence given in **part a.** (1 mark)

_____

Nucleic acids are made up of nucleotides. Each nucleotide consists of three components, sugar (S), phosphate (P) and nitrogen base (B), linked together in a particular way.

e. In the empty box, draw a diagram to show the way the three components are joined to make a nucleotide. (1 mark)

Use the following symbols in your diagram.

Question 10 (5 marks)

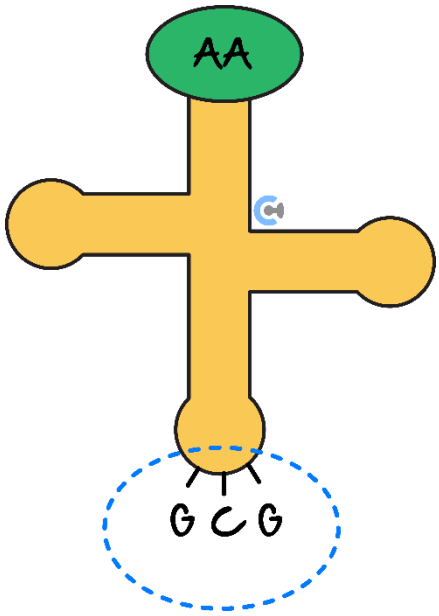
a. In reference to DNA, explain the meaning of the term 'anti-parallel'. (2 marks)

b. Identify three places in a plant cell where DNA can be located. (3 marks)

Section D: Extension (7 Marks)

Question 11 (7 marks)

RNA typically occurs as single-stranded molecules, but tRNA molecules usually take the shape shown in the **figure below**.



a. What does the term tRNA stand for? (1 mark)

_____

_____

b. Name **two** other forms of RNA involved in protein synthesis. (1 mark)

_____

_____

c. Explain what structural features of the tRNA molecule enable it to form the functional shape shown in the **above figure** rather than remaining as a linear strand. (2 marks)

_____

_____

_____

_____

d. What term is given to the three nucleotides that are circled in the **above figure**? (1 mark)

_____

_____

e. Describe the role of tRNA in translation. (2 marks)

_____

_____

_____

_____

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