



ANSWER BOOK

DNA and RNA: four letters and a rule about pairing

Nucleic acids, genomes and protein synthesis · Unit B05

AQA 3.4.1 · OCR A 2.1.3 · Edexcel A Topic 2.4-2.6 · CAIE 6.1

5 questions · 16 marks

NAVY EDITION

SECTION A · Short, 1 to 2 marks

- A1** **B1** a phosphate group, a pentose sugar (deoxyribose) and a nitrogenous base. [2]
B1 a phosphodiester bond, formed by condensation between the phosphate of one nucleotide and the sugar of the next.
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SECTION B · Standard, 3 to 5 marks

- B1** **B1** DNA contains the pentose sugar deoxyribose, whereas mRNA contains ribose. **B1** DNA contains thymine, whereas mRNA carries uracil in its place. **B1** DNA is two antiparallel strands wound into a helix, whereas mRNA is a single strand. **B1** DNA can be hundreds of millions of nucleotides long, whereas an mRNA molecule is tens to a few thousand nucleotides long. [4]
- B2** **B1** in a double-stranded molecule adenine would equal thymine and guanine would equal cytosine, because each base has a fixed partner opposite it. **B1** here adenine at 31% does not equal thymine at 23%, and guanine at 19% does not equal cytosine at 27%. **B1** the molecule cannot therefore be double-stranded; it is single-stranded DNA, since thymine rather than uracil is present. **B1** any one workable further measurement: heat the sample and look for a temperature at which strands separate, since a single-stranded molecule has no paired bases to separate. [4]
- B3** **B1** adenine and guanine are purines, built from two fused rings, while thymine and cytosine are pyrimidines, built from one. **B1** the pairing rule puts a purine opposite a pyrimidine in every pair, so each rung spans the same distance. **B1** the two sugar-phosphate backbones therefore stay a constant distance apart along the whole molecule, whereas two purines would bulge and two pyrimidines would pinch. [3]
- B4** **M1** cytosine equals guanine, so there are 960 cytosine bases, giving 1920 bases in the two of them together. **M1** subtracts from the total to leave the adenine and thymine: $3200 - 1920 = 1280$. **A1** adenine equals thymine, so $1280 \div 2$ gives 640 adenine bases. [3]
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