

Nucleic acids: practice questions

5 questions · 18 marks · mark scheme at the back

For IB Diploma Biology SL undefined. **HL only** is additional higher level content, for HL students only.

Name

Total / 18

1 PAPER 1A STYLE

[1 mark]

Which combination is found in RNA but not in DNA?

- A. ☐ Deoxyribose and thymine
- B. ☐ Ribose and thymine
- C. ☐ Ribose and uracil
- D. ☐ Deoxyribose and uracil

2 PAPER 1B STYLE

[5 marks]

The table shows the percentage of each base in the nucleic acid from four sources. Some values are missing. (a) Calculate the percentage of guanine in human DNA. [2] (b) Deduce the percentage of cytosine in wheat DNA, giving a reason. [1] (c) Identify which sample is RNA and explain one piece of evidence for your answer. [2]

Base composition of nucleic acids (percentage of bases, practice data)					
Source	Adenine	Thymine	Guanine	Cytosine	Uracil
Human DNA	30	30	?	?	0
Wheat DNA	27	27	23	?	0
Bacterial DNA	25	25	25	25	0
Sample X	29	0	22	18	31

Answer =

3 PAPER 2A STYLE

[2 marks]

Calculate the number of different base sequences possible for a DNA strand 8 nucleotides long, and state what this shows about the capacity of DNA for storing information.

Answer =

4 PAPER 2A STYLE

[4 marks]

Draw a labelled diagram of a section of RNA consisting of two nucleotides, and outline how they are joined.

5 PAPER 2B STYLE

[6 marks]

Explain the role of complementary base pairing in allowing genetic information to be replicated and expressed.

Mark scheme

One mark for each point unless a maximum is given. Words in brackets are not needed for the mark.

1. [1]

C C [1]

2. [5]

- (a) $A + T = 60\%$, so $G + C = 100 - 60 = 40\%$ [1]
- (a) $G = C$, so guanine = 20% [1]
- (b) 23% because cytosine pairs with guanine / $G = C$ in double-stranded DNA [1]
- (c) sample X is RNA [1]
- (c) contains uracil and no thymine [1]
- (c) $A \neq U$ and $G \neq C$, so it is single-stranded / has no complementary base pairing between strands [1]
- [max 5]: ECF in (a) for $G = \text{half of } (100 - A - T)$

3. [2]

- $4^8 = 65\,536$ [1]
- any length and any base sequence is possible so the capacity for storing information is (effectively) limitless / very large [1]

4. [4]

- each nucleotide drawn as circle (phosphate), pentagon (sugar) and rectangle (base) with base and phosphate on different corners of the sugar [1]
- labels: phosphate, ribose / pentose sugar, base [1]
- bases named as RNA bases (A, U, G or C), not T [1]
- phosphate of one nucleotide bonded to the sugar of the next, forming a sugar-phosphate backbone [1]
- joined by condensation / water released [1]
- the bond is covalent [1]
- [max 4]

5. [6]

- A pairs with T (or U in RNA) and G pairs with C [1]
- complementarity is based on hydrogen bonding between bases [1]
- in replication the two DNA strands separate and each acts as a template [1]
- free nucleotides pair with complementary bases on the template [1]
- producing two identical DNA molecules / the base sequence is copied accurately [1]
- in transcription mRNA is built with bases complementary to the template strand of DNA [1]
- uracil pairs with adenine in transcription [1]
- in translation tRNA anticodons pair with complementary mRNA codons [1]
- so amino acids are linked in the sequence coded by the gene [1]
- the genetic code is shared by (almost) all organisms, so base sequences are translated the same way [1]
- [max 6]