

APOLLO

Nucleic acids

SL

Biology

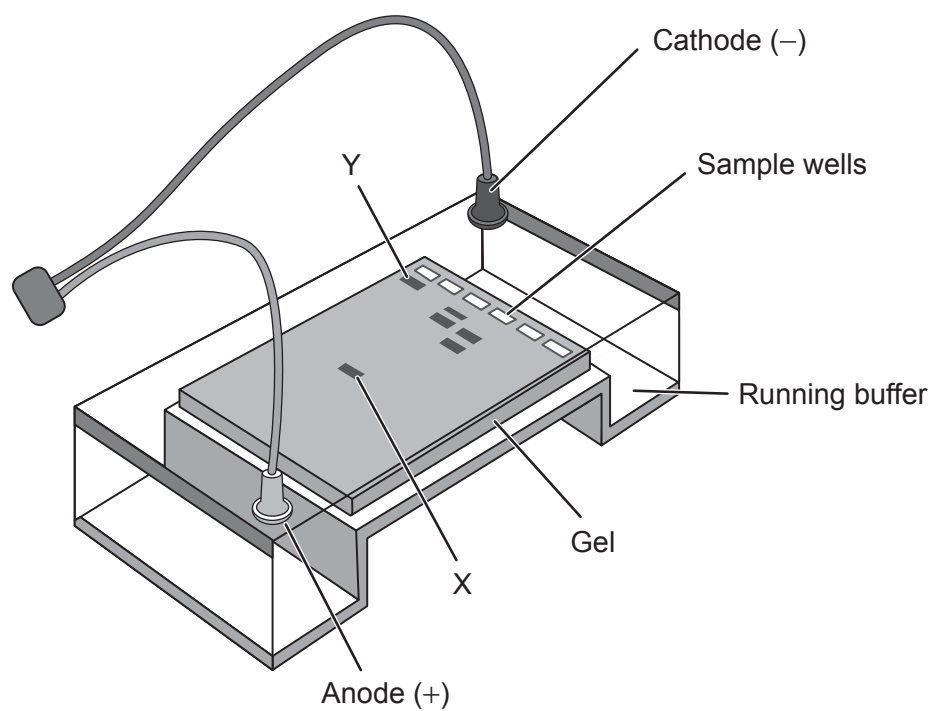
First assessment 2025

9 questions | questions

2. What allows DNA to store very large amounts of data?

- A. Two strands of DNA
- B. Base sequence
- C. Complementary base pairing
- D. Sugar–phosphate backbone

7. The diagram shows a gel electrophoresis apparatus.



What can be deduced from the diagram?

- A. X is the smallest fragment.
- B. Y is positively charged.
- C. X is moving towards the cathode.
- D. Y travels at the greatest rate.

4. The table shows the nuclear DNA content of some plant and animal species.

Species scientific name	Common name	Chromosome number	Genome size / DNA million base pairs
<i>Apis mellifera</i>	honey bee	16	215
<i>Homo sapiens</i>	human	46	3080
<i>Ailurus fulgens</i>	red panda	36	2340
<i>Pinus sylvestris</i>	Scots pine	22	20 000
<i>Paris japonica</i>	canopy plant	40	150 000

- (a) Suggest, giving a reason, whether gametes or somatic cells have been used to provide the information in the table. [1]

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- (b) State **one** way in which chromosomes are classified to construct the karyotype of an individual. [1]

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- (c) Outline the role of histones in plant and animal chromosomes. [1]

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(Question 4 continued)

(d) Using the data provided in the table, discuss whether genome size positively correlates to organism complexity. [2]

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References:

1. tonaquatic, 2021. [*Leaf epidermis under light microscope view*]. [image online] Available at: <https://www.gettyimages.co.uk/detail/photo/the-leaf-epidermis-under-light-microscope-view-has-royalty-free-image/1323853398> [Accessed 14 June 2024]. Reference redacted. Source adapted.
2. Golemansky, V. and Todorov, M., 2006. New Data to the Shell Ultrastructure and the Biometry of the Marine Interstitial Testate Amoebae (Rhizopoda: Testaceafilosia). *Acta Protozoologica* 45(3), pp. 301–312. Source adapted.
3. Drakesmith, M., Harms, R., Rudrapatna, U., Parker, G. D., Evans, J. and Jones, D. K., 2019. Estimating axon conduction velocity in vivo from microstructural MRI. *NeuroImage* 203, 116186. <https://doi.org/10.1016/j.neuroimage.2019.116186>. Source adapted. Licensed under CC BY 4.0: <https://creativecommons.org/licenses/by/4.0/>.



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1. Whole genome sequencing has allowed scientists to compare the genetic content of different organisms. The table shows the genome sizes of some plants and animals.

Organism	Scientific name	Genome size in million base pairs (mbp)
Nematode worm	<i>Caenorhabditis elegans</i>	100
Thale cress plant	<i>Arabidopsis thaliana</i>	160
Fruit fly	<i>Drosophila melanogaster</i>	180
Tiger pufferfish	<i>Takifugu rubripes</i>	400
Rice plant	<i>Oryza sativa</i>	490

(a) There are 64 million adenine–thymine base pairs in the genome of the nematode worm. Deduce the number of cytosine–guanine base pairs in the genome. [1]

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(b) State **one** organelle in which a base pair could be found. [1]

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(c) Discuss the current and potential future uses of whole genome sequencing. [3]

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Section A

Answer **all** questions. Answers must be written within the answer boxes provided.

5. Watson and Crick’s discovery of the double helical structure of DNA gave rise to our current understanding of genes.

(a) State the name of the monomers that make up DNA. [1]

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(b) Distinguish between the structure of DNA and RNA. [2]

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(c) From experiments, it was concluded that pea (*Pisum sativum*) plants have a recessive allele (t) for short stems. Explain the reason that recessive alleles are not always expressed in the phenotype. [3]

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Turn over

Section A

Answer **all** questions. Answers must be written within the answer boxes provided.

2. The percentage of cytosine in the genome of the common octopus (*Octopus vulgaris*) is 17.6%.

(a) Explain the reasons for expecting a thymine percentage of 32.4%. [2]

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Scientists can amplify DNA molecules and separate mixtures of DNA molecules in the laboratory for analysis.

(b) State the laboratory method used to amplify DNA. [1]

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(c) Distinguish between the structure of the nucleotides in DNA and RNA. [2]

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14. What is a function of histones?

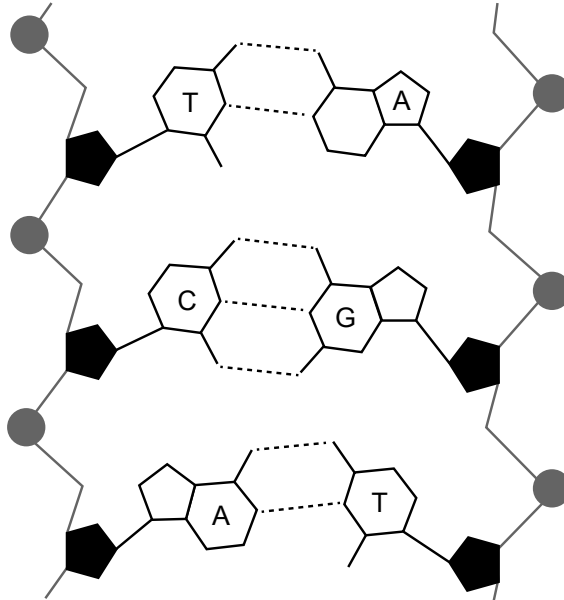
- A. Supercoiling of DNA during binary fission in prokaryotes
- B. Synthesis of proteins
- C. Formation of microtubules during mitosis
- D. Condensation of DNA

- 16.** Which term describes the whole of the genetic information of an organism?
- A. Genome
 - B. DNA
 - C. Gene pool
 - D. Allele frequency

Section A

Answer **all** questions. Answers must be written within the answer boxes provided.

3. The diagram shows a short stretch of DNA with complementary base pairing.



- (a) Identify **two** features of DNA shown in this diagram that distinguish it from RNA. [2]

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- (b) Explain the significance of complementary base pairing in DNA. [3]

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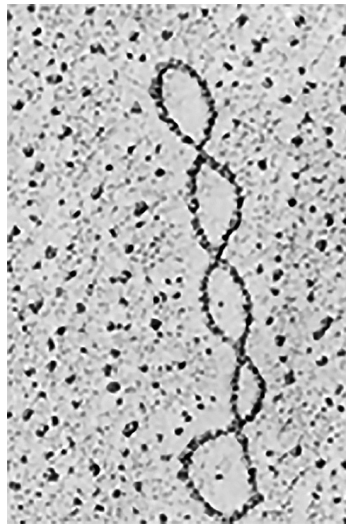
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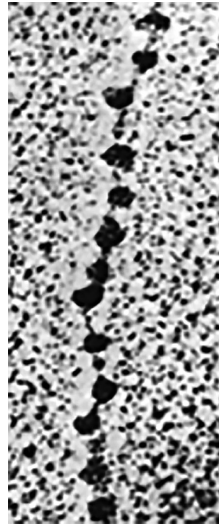


(Question 3 continued)

The images are electron micrographs of DNA from a prokaryote and from a eukaryote.



Prokaryote DNA



Eukaryote DNA

(c) Distinguish between the structure of DNA in prokaryotes and eukaryotes.

[2]

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Turn over