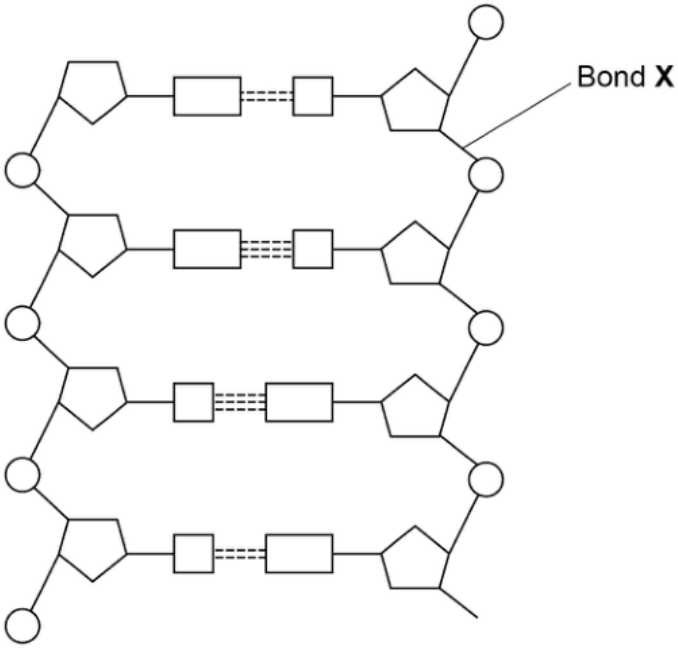
Structure of DNA and RNA: AQA A Level Biology Exam Questions by Top

15 questions · 36 marks · about 47 minutes. Answer in the spaces, then check the mark schemes at the end.

Question 1 · AS Paper 1 · June 2017 · Q01.1 · 1 mark

0 1 **Figure 1** shows part of a DNA molecule.

Figure 1



0 1 . 1 How many nucleotides are shown in **Figure 1**?

[1 mark]

_____

Question 2 · AS Paper 1 · June 2017 · Q01.2 · 1 mark

0 1 . 2 Name the type of bond labelled **X** in **Figure 1**.

[1 mark]

_____

Question 3 · AS Paper 1 · June 2018 · Q03.1 · 2 marks

0 3 . 1 Draw **and** label a single DNA nucleotide.

[2 marks]

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Question 4 · AS Paper 2 · November 2020 · Q02.1 · 2 marks

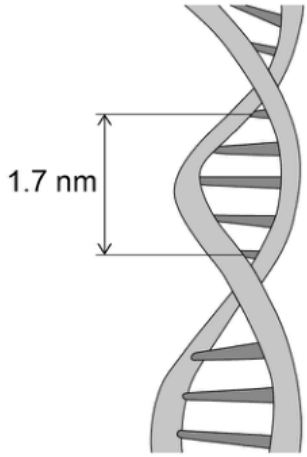
0 2 . 1 Describe how a phosphodiester bond is formed between two nucleotides within a DNA molecule.

[2 marks]

Question 5 · AS Paper 1 · November 2021 · Q01.1 · 2 marks

0 1 **Figure 1** shows part of a DNA molecule.

Figure 1



0 1 . 1 Name the type of bond between:

[2 marks]

complementary base pairs _____

adjacent nucleotides in a DNA strand _____

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Question 6 · A level Paper 1 · June 2023 · Q10.2 · 6 marks

10.2 Describe the structure of DNA and the structure of a chromosome.

[6 marks]

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Question 7 · AS Paper 1 · June 2024 · Q09.1 · 1 mark

0 9 Read the following passage.

DNA is a stable molecule but, even under normal cell conditions, spontaneous changes occur to the DNA nucleotide sequence. One example of a spontaneous change occurs when a cytosine base in a guanine–cytosine nucleotide pair is changed to a uracil base. This produces a guanine–uracil nucleotide pair in the DNA molecule. Scientists estimate this type of spontaneous change occurs to 100 guanine–cytosine nucleotide pairs in the genome of healthy human cells every day.

In healthy cells, enzyme-controlled processes repair these spontaneous changes in the DNA molecule by changing uracil bases back to cytosine bases. If these repairs do **not** happen, the uracil DNA nucleotide attracts an adenine DNA nucleotide when the DNA is replicated in the cell cycle. A mutation of the original DNA has now occurred.

Healthy cells with damaged DNA produce enzyme **X**. This enzyme slows the cell cycle by delaying the start of DNA replication. People with the disease ataxia telangiectasia (AT) do not produce functional enzyme **X**. Mutations occur at a higher rate in people with AT.

Use the information in the passage and your own knowledge to answer the following questions.

0 9 . 1 Give **one** similarity in structure between a guanine–cytosine nucleotide pair and a guanine–uracil nucleotide pair in a DNA molecule (lines 3–5).

Do **not** refer to guanine in your answer.

[1 mark]

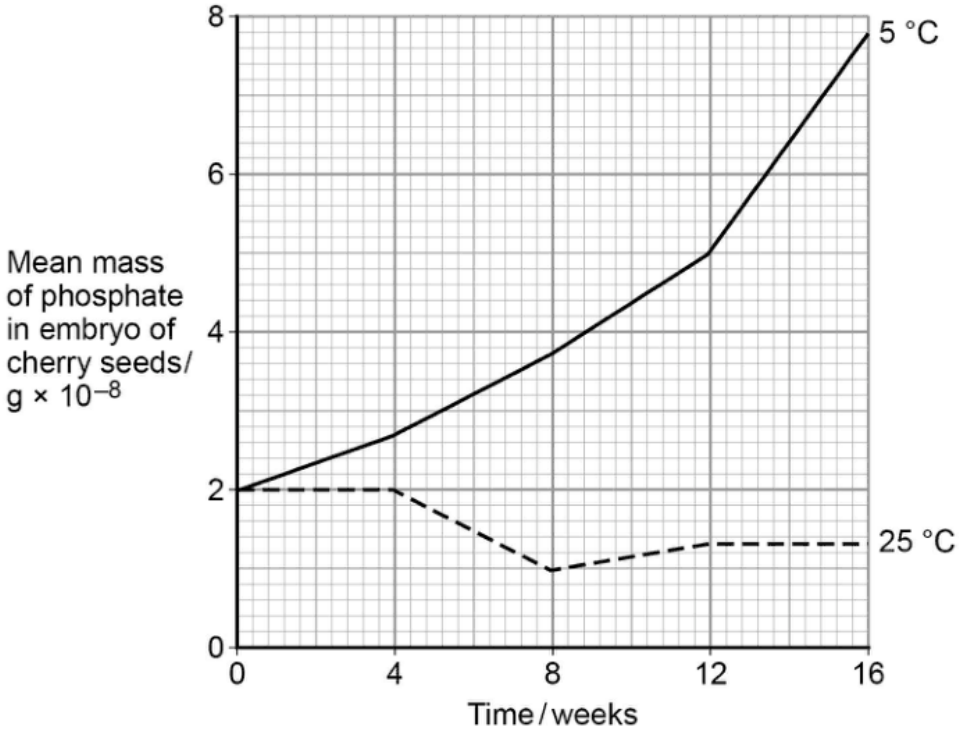
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Question 8 · information from earlier in the question

0 5 The seeds of some plant species require chilling (exposure to low temperatures) before the embryos they contain grow into plants. During chilling, storage molecules in the seed that contain phosphate are broken down and phosphates are transported to the embryo. Scientists investigated the change in the mass of phosphate in the embryos of cherry seeds exposed to two different temperatures for 16 weeks.

Figure 6 shows their results.

Figure 6



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Question 8 · AS Paper 2 · June 2016 · Q05.2 · 2 marks

0 5 . 2 The scientists concluded that an increase in phosphate in the embryo was linked to growth of the embryo.

Suggest **two** reasons why an increase in phosphate can be linked to growth of the embryo.

[2 marks]

1 _____

_____

_____

2 _____

_____

_____

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Question 9 · AS Paper 2 · June 2023 · Q10.1 · 6 marks

1 0 . 1 Outline the similarities in, and the differences between, the structures of DNA and RNA molecules.

[6 marks]

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Question 10 · AS Paper 1 · June 2016 · Q01.3 · 3 marks

0 1 . 3 Contrast the structures of DNA and mRNA molecules to give **three** differences.

[3 marks]

1 _____

_____

2 _____

_____

3 _____

_____

Question 11 · A level Paper 1 · June 2022 · Q07.1 · 3 marks

0 7 . 1 Complete **Table 3** to give **three** differences between DNA molecules and tRNA molecules.

[3 marks]

Table 3

DNA molecules	tRNA molecules

Question 12 · AS Paper 1 · June 2022 · Q02.1 · 2 marks

0 2 . 1 Give the **two** types of molecule from which a ribosome is made.

[2 marks]

1 _____

2 _____

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Question 13 · AS Paper 2 · June 2024 · Q05.2 · 1 mark

0 5 . 2 Suggest **one** reason why analysing genes coding for ribosomal RNA allows phylogenetic relationships to be studied between all cellular organisms.

[1 mark]

Question 14 · AS Paper 2 · November 2020 · Q02.2 · 2 marks

0 2 . 2 The two DNA strands of a particular gene contain 168 guanine bases between them. The relationship between the numbers of guanine bases (G), adenine bases (A), thymine bases (T) and cytosine bases (C) in these two strands of DNA is shown in the following equation.

$$G = 4(A + T) - C$$

Use this information and your understanding of DNA structure to calculate the maximum number of amino acids coded by this gene.

Show your working.

[2 marks]

Answer

Question 15 · A level Paper 2 · June 2019 · Q05.2 · 2 marks

0 5 . 2 The gene that codes for glucagon is 9.531 kilobases in length. The DNA helix makes one complete turn every 10 base pairs. Every complete turn is 3.4 nm in length.

Use this information to calculate the length in micrometres (μm) of the gene for glucagon. Give your answer to 3 significant figures.

[2 marks]

Answer = μm

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Mark schemes

Question 1 · AS Paper 1 · June 2017 · Q01.1 · 1 mark

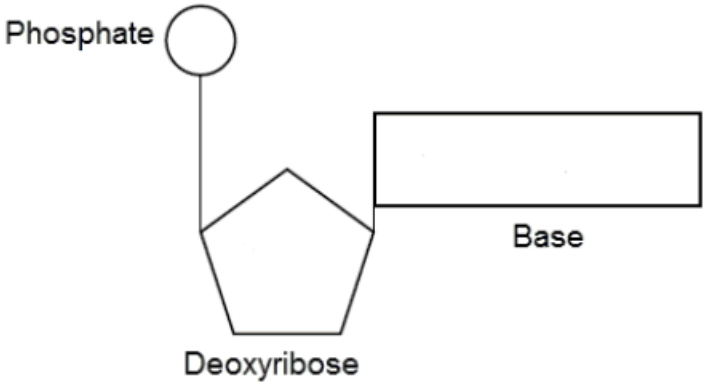
01.1	8; 1	Accept eight

Question 2 · AS Paper 1 · June 2017 · Q01.2 · 1 mark

01.2	Phosphodiester (bond); 1	Accept phonetic spellings

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Question 3 · AS Paper 1 · June 2018 · Q03.1 · 2 marks

03.1	1. Phosphate, deoxyribose and base correctly labelled; 2 2. Correct shapes **and** bonds in the correct positions (as shown below);  	1. Accept P in a circle / P_i / PO_4^{3-} for phosphate. 1. Do not accept phosphorus for phosphate. 1. Do not accept **only** pentose for deoxyribose. 1. Ignore references to sugar. 1. Accept a named base, (eg adenine, thymine, guanine, cytosine). 1. Do not accept uracil or **only** letters (eg A, T, G or C). 1. Ignore labelled bonds 2. Accept correct shapes with incorrect labels 2. Accept any orientation of diagram, eg inverted / mirror image 2. Accept any pentagon for deoxyribose

Question 4 · AS Paper 2 · November 2020 · Q02.1 · 2 marks

02.1	2 max 1. Condensation (reaction)/loss of water; 2. (Between) phosphate **and** deoxyribose; 3. (Catalysed by) DNA polymerase;	3. Reject if DNA polymerase joins AT/GC OR complementary nucleotides/bases OR forms hydrogen bonds

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Question 5 · AS Paper 1 · November 2021 · Q01.1 · 2 marks

01.1	1. Hydrogen (bonds); 2. Phosphodiester (bonds);	2	2. Accept ester/covalent bond

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Question 6 · A level Paper 1 · June 2023 · Q10.2 · 6 marks

10.2	1. Polymer of nucleotides; 2. (Nucleotide) consists of deoxyribose, phosphate and an organic/nitrogenous base; 3. Phosphodiester bonds (between nucleotides); 4. DNA double helix held by H bonds **OR** 2 strands held by H bonds; 5. (Hydrogen bonds/pairing) between adenine, thymine **and** cytosine, guanine; 6. DNA is associated with histones/proteins; 7. (During mitosis/when visible) chromosome consists of two chromatids joined at a centromere;	6 max (6 x AO1)

1. Accept 'polynucleotide'

2. Accept 'phosphoric acid' for phosphate

5. Ignore bases identified with letters (A, T, G, C)

5. Reject adenosine and cysteine

Accept correctly annotated diagram(s) for equivalent marking points

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09.1	(Has) phosphate **OR** (Has) deoxyribose **OR** (Has) hydrogen bonds;	1 (1 x AO2)	Ignore the number of hydrogen bonds Accept both contain a pyrimidine/single ring (structure) Accept ‘H bonds’

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Question 8 · AS Paper 2 · June 2016 · Q05.2 · 2 marks

05.2	1. (Phosphate required) to make RNA; 2. (Phosphate required) to make DNA; 3. (Phosphate required) to make ATP/ADP; 4. (Phosphate required) to make membranes; 5. (Phosphates required) for phosphorylation;	2 max

1 and 2. If neither DNA or RNA are named allow one mark for nucleotide/nucleic acid/phosphodiester bonds/sugar-phosphate backbone.

4. Ignore: phospholipids without reference to membranes.

Accept: as additional mark points any named biological molecule containing phosphate e.g. NADP, AMP, RuBP.

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10.1	Similarities 1. Polymers of nucleotides; 2. (Nucleotide has) pentose, (nitrogen-containing organic) base and a phosphate (group); 3. Cytosine, guanine and adenine (as bases); 4. Have phosphodiester bonds; Differences 5. Deoxyribose v ribose; 6. Thymine v uracil; 7. Long v short; 8. Double helix/stranded v single stranded;

6 max (6 x AO1)	1. Accept 'chain' for polymer 2. Accept in correct context 'ribose/deoxyribose' for pentose 7. Accept DNA longer 7. Ignore 'large' and 'small'

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Question 10 · AS Paper 1 · June 2016 · Q01.3 · 3 marks

01.3	1. DNA double stranded/double helix **and** mRNA single-stranded; 2. DNA (very) long **and** RNA short; 3. Thymine/T in DNA **and** uracil/U in RNA; 4. Deoxyribose in DNA **and** ribose in RNA; 5. DNA has base pairing **and** mRNA doesn't/ DNA has hydrogen bonding **and** mRNA doesn't; 6. DNA has introns/non-coding sequences **and** mRNA doesn't;	3 max

Contrast requires both parts of the statement

2. Accept 'RNA short**er**' or 'DNA bigg**er**/long**er**'

4. **R** Deoxyribonucleic/ ribonucleic acid

Ignore ref. to histones

Ignore ref. to helix and straight chain alone

6.**Ignore** ref to splicing

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Question 11 · A level Paper 1 · June 2022 · Q07.1 · 3 marks

07.1	**DNA v tRNA** 1. Deoxyribose v ribose; 2. Double-stranded v single-stranded; 3. Many nucleotides v few ; 4. Thymine v uracil; 5. Linear v clover leaf (structure) **OR** Double helix v clover (leaf structure); 6. Does not bind to amino acid v does bind to amino acid; 7. No exposed bases v anticodon;	3 max (3 x AO1)	Apply list rule 2. Accept double helix for double stranded 3 Accept longer v shorter 4. Ignore T and U 5. Accept description of clover leaf structure. 5. Accept straight for linear 6. Accept attach/carry/have binding site for 'bind to'

Question 12 · AS Paper 1 · June 2022 · Q02.1 · 2 marks

02.1	1. RNA/rRNA; 2. Protein;	2 (2 x AO1)	Reject tRNA and mRNA Ignore amino acids

Question 13 · AS Paper 2 · June 2024 · Q05.2 · 1 mark

05.2	All (cellular organisms) have ribosomes **OR** All (cellular organisms) have ribosomal RNA/rRNA;	1 (1 x AO2)	

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Question 14 · AS Paper 2 · November 2020 · Q02.2 · 2 marks

02.2	Correct answer for 2 marks = 70;; Accept for 1 mark, A = 42 **and** T = 42 **OR** 420 (total bases in gene) **OR** 210 (bases in template strand)	2

Question 15 · A level Paper 2 · June 2019 · Q05.2 · 2 marks

05.2	1. Correct answer of 3.24 = **2 marks**;; 2. Incorrect but multiplies by 34 (with decimal point in any position) = **1 mark** **OR** Incorrect but shows sequence 324 = **1 mark** **OR** 3.2 = **1 mark**;	2

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