

Cambridge International AS & A Level

# BIOLOGY (9700) P1

TOPIC WISE QUESTIONS + ANSWERS | COMPLETE SYLLABUS



## Chapter 6

# Nucleic acids and protein synthesis

### 6.1 Structure and replication of DNA

800. 9700\_m20\_qp\_12 Q: 22

What is correct for cytosine?

	has a single ring structure	is a pyrimidine	joins to its complementary base with 3 hydrogen bonds
<b>A</b>	✓	✓	✓
<b>B</b>	✓	x	✓
<b>C</b>	x	✓	x
<b>D</b>	x	x	✓

key

✓ = correct

x = incorrect

801. 9700\_m20\_qp\_12 Q: 23

Scientists grew bacteria in a medium containing heavy nitrogen,  $^{15}\text{N}$ , as the only source of nitrogen. After many generations, both strands of all of the bacterial DNA molecules contained heavy nitrogen.

These bacteria were then moved from the heavy nitrogen medium into a medium with only light nitrogen,  $^{14}\text{N}$ . The bacteria divided once to form the first generation and once more to form the second generation.

A sample of bacteria was collected from the second generation and the DNA was analysed to find:

- the percentage of DNA strands that contained only light nitrogen
- the percentage of DNA molecules that contained light nitrogen **and** heavy nitrogen.

Which row shows the results of this analysis?

	percentage of DNA strands that contained only light nitrogen	percentage of DNA molecules that contained light nitrogen and heavy nitrogen
<b>A</b>	50	25
<b>B</b>	50	50
<b>C</b>	75	25
<b>D</b>	75	50

802. 9700\_s20\_qp\_11 Q: 20

What is correct for thymine?

	has a single ring structure	is a pyrimidine	joins its complementary base with 3 hydrogen bonds
<b>A</b>	✓	✓	✓
<b>B</b>	✓	✓	✗
<b>C</b>	✓	✗	✗
<b>D</b>	✗	✗	✓

key  
 ✓ = correct  
 ✗ = incorrect

803. 9700\_s20\_qp\_11 Q: 21

A short piece of DNA 15 base pairs long was analysed to find the number of nucleotide bases in each of the polynucleotide strands. Some of the results are shown below.

	number of nucleotide bases			
	A	C	G	T
strand 1		6		3
strand 2				4

How many nucleotides containing guanine were present in strand 1?

- A** 2                      **B** 3                      **C** 4                      **D** 6

804. 9700\_s20\_qp\_11 Q: 22

Scientists grew bacteria in a medium containing heavy nitrogen,  $^{15}\text{N}$ , as the only source of nitrogen.

After many generations, all of the bacterial DNA contained heavy nitrogen.

These bacteria were then moved from the heavy nitrogen medium into a medium with only light nitrogen,  $^{14}\text{N}$ .

Some bacteria were collected from each of the next three generations and their DNA was analysed.

Hybrid DNA contains both heavy and light nitrogen.

Which row shows the correct DNA of the first and third generations?

	DNA of first generation	DNA of third generation
<b>A</b>	all hybrid	half hybrid, half light
<b>B</b>	all hybrid	one quarter hybrid, three quarters light
<b>C</b>	half hybrid, half heavy	half hybrid, one quarter heavy, one quarter light
<b>D</b>	half hybrid, half light	one quarter hybrid, three quarters light

805. 9700\_s20\_qp\_12 Q: 22

Some viruses have single-stranded DNA as their genetic material. This DNA molecule has to be folded to fit in the protein coat.

Which statements about single-stranded DNA are correct?

- 1 Single-stranded DNA cannot replicate semi-conservatively.
- 2 If only the percentage of cytosine is known, then the percentage of guanine can be calculated, but the percentage of adenine and thymine cannot be calculated.
- 3 Hydrogen bonds may be present within the DNA molecule.

**A** 1, 2 and 3    **B** 1 and 2 only    **C** 1 and 3 only    **D** 2 and 3 only

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806. 9700\_s20\_qp\_12 Q: 23

How many statements are true for semi-conservative replication of DNA in a eukaryotic cell?

- 1 The process takes place in the nucleus.
- 2 Adenine will line up against uracil on the complementary strand.
- 3 Each new molecule will contain one strand of the original molecule.
- 4 If the original molecule contained 40% guanine each new molecule will contain 20% guanine.

**A** 1    **B** 2    **C** 3    **D** 4

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807. 9700\_s20\_qp\_13 Q: 20

Which statements about the nucleotide containing uracil are correct?

- 1 Uracil is a pyrimidine.
- 2 The carbohydrate is always ribose.
- 3 Base pairing occurs with 3 hydrogen bonds.

**A** 1, 2 and 3    **B** 1 and 2 only    **C** 1 and 3 only    **D** 2 and 3 only

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808. 9700\_s20\_qp\_13 Q: 21

DNA replication involves several stages.

- 1 Each strand of DNA double helix acts as a template for the opposite strand.
- 2 The enzyme DNA polymerase links bases together.
- 3 Hydrogen bonds between bases A and T and between C and G are broken.

Which statements about DNA replication are correct?

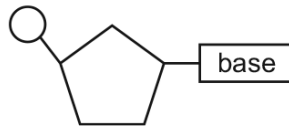
**A** 1, 2 and 3    **B** 1 and 2 only    **C** 1 and 3 only    **D** 3 only

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809. 9700\_w20\_qp\_11 Q: 21

The diagram represents a nucleotide containing cytosine.



Which statements about this nucleotide are correct?

- 1 The carbohydrate could be ribose.
- 2 The organic base contains nitrogen.
- 3 Base pairing occurs with guanine.
- 4 Cytosine is a purine.

**A** 1, 2 and 3      **B** 1, 2 and 4      **C** 1, 3 and 4      **D** 2, 3 and 4

810. 9700\_w20\_qp\_11 Q: 22

A section of DNA contains 73 base pairs.

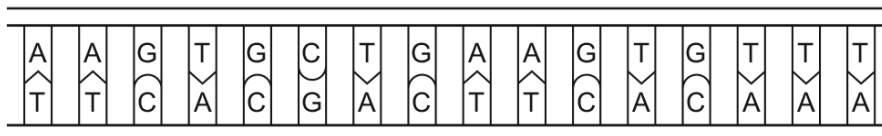
	number of bases on each strand			
	adenine	cytosine	guanine	thymine
strand 1	29	V	14	W
strand 2	21	X	Y	Z

Which row represents the correct number of bases?

	V	W	X	Y	Z
<b>A</b>	9	21	14	9	29
<b>B</b>	14	29	9	9	21
<b>C</b>	21	9	29	9	14
<b>D</b>	29	9	29	14	9

811. 9700\_w20\_qp\_12 Q: 20

How many hydrogen bonds are holding the two strands of this section of a DNA molecule together?



**A** 16      **B** 32      **C** 38      **D** 48

812. 9700\_w20\_qp\_13 Q: 22

Which row represents the correct features of guanine?

	has a single ring structure	is a purine	joins its complementary base via three hydrogen bonds	pairs with thymine
<b>A</b>	✓	✓	✗	✓
<b>B</b>	✓	✗	✓	✗
<b>C</b>	✗	✓	✓	✗
<b>D</b>	✗	✗	✓	✓

key  
✓ = correct  
✗ = not correct

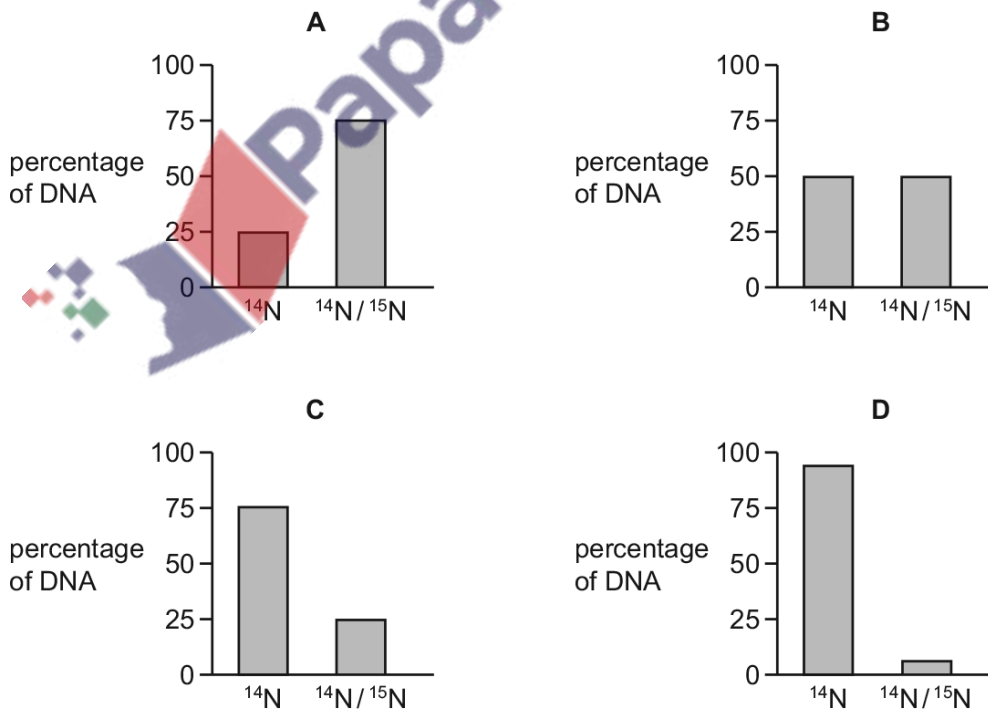
813. 9700\_w20\_qp\_13 Q: 23

Bacteria were grown in a medium containing  $^{15}\text{N}$ . After several generations, all of the DNA contained  $^{15}\text{N}$ .

Some of these bacteria were transferred to a medium containing the common isotope of nitrogen,  $^{14}\text{N}$ . The bacteria were allowed to divide once. The DNA of some of these bacteria was extracted and analysed. This DNA was all hybrid DNA containing equal amounts of  $^{14}\text{N}$  and  $^{15}\text{N}$  ( $^{14}\text{N}/^{15}\text{N}$ ).

In another experiment, some bacteria from the medium with  $^{15}\text{N}$  were transferred into a medium of  $^{14}\text{N}$ . The bacteria were allowed to divide three times. The DNA of some of these bacteria was extracted and analysed.

What is the composition of this DNA?



814. 9700\_m19\_qp\_12 Q: 21

A length of DNA was analysed and sequenced. 24% of its nitrogenous bases were adenine.

Which percentage of the bases will be cytosine?

- A** 24                      **B** 26                      **C** 48                      **D** 76
- 

815. 9700\_s19\_qp\_11 Q: 22

A short piece of DNA, 19 base pairs long, was analysed to find the number of nucleotide bases in each of the polynucleotide strands. Some of the results are shown below.

	number of nucleotide bases			
	A	C	G	T
strand 1				4
strand 2		7		5

How many nucleotide bases containing C were present in strand 1?

- A** 2                      **B** 3                      **C** 5                      **D** 7
- 

816. 9700\_s19\_qp\_11 Q: 23

Which nucleic acid bases are purines?

- A** adenine and cytosine  
**B** cytosine and thymine  
**C** guanine and adenine  
**D** uracil and cytosine
- 

817. 9700\_s19\_qp\_12 Q: 18

Which statement correctly describes the base pairing in a molecule of DNA?

- A** The purine adenine forms bonds with the pyrimidine thymine.  
**B** The purine adenine forms bonds with the pyrimidine uracil.  
**C** The purine cytosine forms bonds with the pyrimidine guanine.  
**D** The purine guanine forms bonds with the pyrimidine thymine.
-



818. 9700\_s19\_qp\_12 Q: 19

Which statements about complementary base pairing are correct?

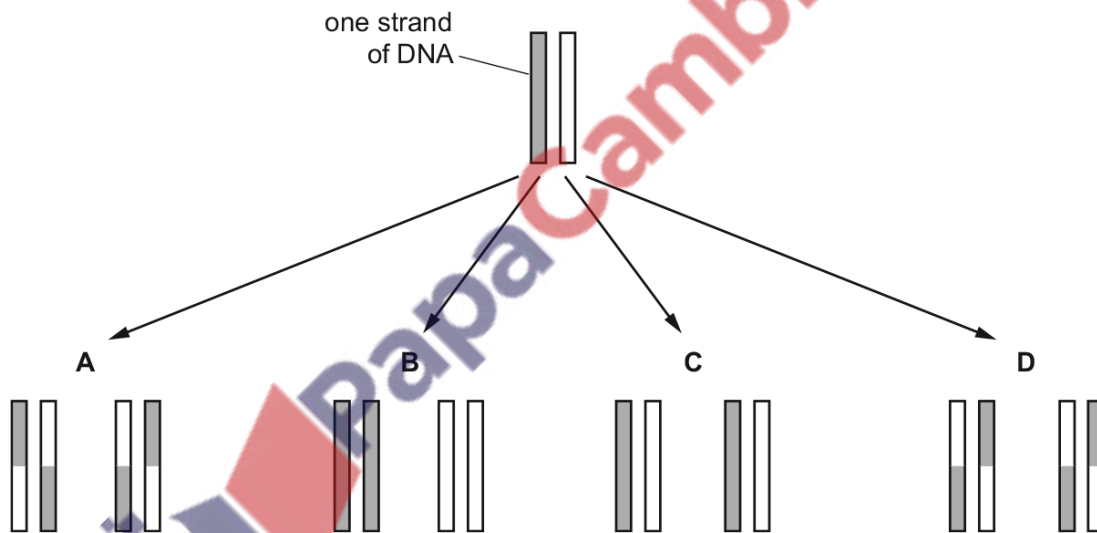
- 1 It allows translation to occur.
- 2 Purines and pyrimidines are the same size.
- 3 The base pairs are of equal length.
- 4 Uracil forms two hydrogen bonds with adenine.

- A** 1, 2, 3 and 4  
**B** 1, 3 and 4 only  
**C** 1 and 4 only  
**D** 2 and 3 only

819. 9700\_s19\_qp\_12 Q: 20

The diagram shows the possible organisation of DNA molecules after one replication.

Which organisation is correct?



820. 9700\_s19\_qp\_12 Q: 21

The diagram shows part of the DNA sequence of a gene and a mutated sequence of the same gene.

normal DNA sequence ...CCG GAT TAT TGC GAG AAA TGG CAT TCT AGG ...

mutated DNA sequence ...CCG GAT GTA TTG CGA GAA ATG CAT TCT AGG ...

What are possible effects of the mutated sequence?

- 1 the presence of mRNA stop codons, UAG, UAA or UGA
- 2 a change in the sequence of amino acids
- 3 a non-functional protein
- 4 ribosomes cannot translate the mRNA

**A** 1, 2 and 3      **B** 1, 3 and 4      **C** 1 and 4 only      **D** 2 and 3 only

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821. 9700\_s19\_qp\_13 Q: 24

A gene codes for the production of a protein, p53, that binds to damaged DNA during interphase and prevents its replication. A carcinogen in cigarette smoke mutates this gene.

Which statement explains why this mutation may cause cancer?

- A** Cells with no p53 are allowed to undergo mitosis.
- B** Cells with no p53 allow their damaged DNA to replicate.
- C** The carcinogen in cigarette smoke increases the rate of cell division.
- D** The p53 causes uncontrolled cell division.

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822. 9700\_s19\_qp\_13 Q: 25

What is the role of DNA polymerase?

- A** condensation reactions to produce DNA nucleotides for replication
  - B** correct alignment of RNA nucleotides along a template strand of DNA
  - C** formation of bonds to complete the sugar-phosphate backbone
  - D** formation of glycosidic bonds between complementary base pairs
-

823. 9700\_s19\_qp\_13 Q: 26

Which row represents the correct features of the nitrogenous base thymine?

	has a single ring structure	is a purine	forms two hydrogen bonds with its complementary base	pairs with cytosine
<b>A</b>	✓	✓	x	x
<b>B</b>	✓	x	✓	x
<b>C</b>	x	✓	x	✓
<b>D</b>	x	x	✓	✓

key  
 ✓ = correct  
 x = not correct

824. 9700\_s19\_qp\_13 Q: 27

Meselson and Stahl investigated DNA in bacteria. They grew bacteria in a medium with only heavy nitrogen, <sup>15</sup>N, until all of the bacterial DNA was heavy.

These bacteria were moved from a heavy nitrogen medium and cultured in a medium with only light nitrogen, <sup>14</sup>N.

A sample of bacteria was collected from the second generation and their DNA analysed.

Hybrid DNA contains both heavy and light DNA.

Which row shows the percentage of heavy DNA strands and the percentage of hybrid DNA molecules in the second generation produced in the medium containing light nitrogen?

	percentage of heavy DNA strands	percentage of hybrid DNA molecules
<b>A</b>	25	25
<b>B</b>	25	50
<b>C</b>	50	25
<b>D</b>	50	50

825. 9700\_s19\_qp\_13 Q: 28

The table shows the DNA triplet codes for some amino acids.

amino acid	DNA triplet code	amino acid	DNA triplet code
arginine	GCA	glycine	CCA
arginine	GCC	glycine	CCG
arginine	GCG	glycine	CCT
asparagine	TTA	lysine	TTC
asparagine	TTG	lysine	TTT
STOP	ATC	proline	GGA
cysteine	ACA	proline	GGC
cysteine	ACG	valine	CAC

The base sequence on the DNA strand coding for a polypeptide is shown.

CCA TTC ACG GCG TTA GCA

Two mutations occur in this sequence during DNA replication.

Which mutated DNA would have **no** effect on the polypeptide synthesised?

- A** CCA ATC ACG GCG TTG GCA
- B** CCA TTC ACA GCA TTA GCA
- C** CCA TTC ACG CCG TTA GCC
- D** CCT TTC ACG GCG TTA GGA

826. 9700\_w19\_qp\_11 Q: 21

Which components could be found in nucleotides of rRNA?

- 1 any one of two different nitrogenous bases with a double ring structure
- 2 any one of two different purine bases
- 3 any one of three different nitrogenous bases with a single ring structure
- 4 any one of three different pyrimidine bases

- A** 1, 2, 3 and 4
- B** 1 and 2 only
- C** 1 and 4 only
- D** 3 and 4 only

827. 9700\_w19\_qp\_11 Q: 22

How many statements are true for semi-conservative replication of DNA in a prokaryotic cell?

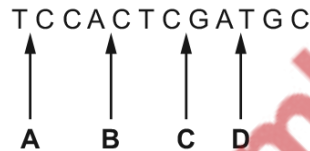
- 1 the process takes place in the cytoplasm
- 2 an adenine nucleotide will line up against a uracil on the template strand
- 3 each new DNA molecule will contain one strand from the parent molecule
- 4 if the parent molecule contained 40% guanine nucleotides each new DNA molecule will contain 20% guanine nucleotides

**A** 1                      **B** 2                      **C** 3                      **D** 4

828. 9700\_w19\_qp\_12 Q: 22

The RNA triplet UAG acts as a stop codon terminating the synthesis of a polypeptide. The diagram shows a strand of DNA which codes for four amino acids.

Where would an insertion mutation of a thymine nucleotide result in the termination of translation?



829. 9700\_w19\_qp\_12 Q: 23

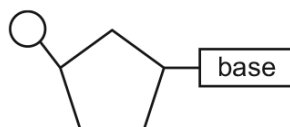
What is correct for uracil?

	It has a single ring structure	It is a purine	It joins its complementary base with 2 hydrogen bonds
<b>A</b>	✓	✓	✓
<b>B</b>	✓	✗	✓
<b>C</b>	✗	✓	✗
<b>D</b>	✗	✗	✓

key  
 ✓ = correct  
 ✗ = not correct

830. 9700\_w19\_qp\_13 Q: 20

The diagram represents a nucleotide containing guanine.



Which statements about this nucleotide are correct?

- 1 The carbohydrate can be ribose or deoxyribose.
- 2 Base pairing occurs with three hydrogen bonds.
- 3 Guanine is a purine.

**A** 1, 2 and 3    **B** 1 and 2 only    **C** 1 and 3 only    **D** 2 and 3 only

831. 9700\_w19\_qp\_13 Q: 22

Meselson and Stahl investigated DNA in bacteria. They grew bacteria in a medium with only heavy nitrogen,  $^{15}\text{N}$ , until all of the bacterial DNA was heavy.

These bacteria were moved from a heavy nitrogen medium and cultured in a medium with only light nitrogen,  $^{14}\text{N}$ .

A sample of bacteria was collected from the first generation and their DNA analysed.

Hybrid DNA contains heavy DNA and light DNA.

Which row shows the percentage of light DNA strands and the percentage of hybrid DNA molecules in the first generation produced in the medium containing light nitrogen?

	percentage of light DNA strands	percentage of hybrid DNA molecules
<b>A</b>	25	50
<b>B</b>	50	50
<b>C</b>	50	100
<b>D</b>	75	100



832. 9700\_m18\_qp\_12 Q: 23

A culture of bacteria was allowed to reproduce using nucleotides containing the heavy isotope of nitrogen ( $^{15}\text{N}$ ). After several generations, all of the bacterial DNA molecules contained heavy nitrogen.

DNA was extracted from a sample of the culture, mixed with caesium chloride solution and spun at high speed in a centrifuge. In this process, DNA molecules of different masses separate into bands at different positions in the centrifuge tube. The heavier the DNA molecules, the closer to the bottom of the centrifuge tube that a band forms.

The diagram shows the position of the DNA molecules containing heavy nitrogen in the centrifuge tube.



The culture of bacteria was then allowed to reproduce using nucleotides containing the light isotope of nitrogen ( $^{14}\text{N}$ ).

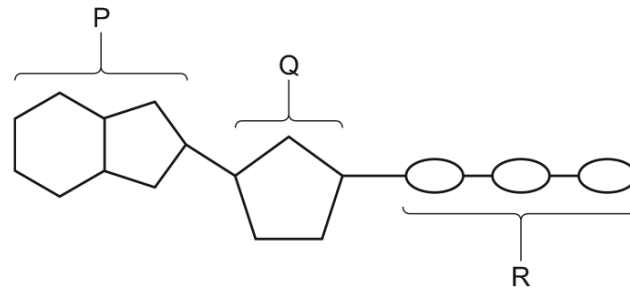
DNA samples were taken and separated by centrifugation after the bacteria had divided once and again after the bacteria had divided twice.

In which positions would the DNA be found after the cells had divided once and after the cells had divided twice?

	after dividing once	after dividing twice
<b>A</b>	half at K and half at L	quarter at K, quarter at M and half at L
<b>B</b>	half at K and half at M	quarter at K, quarter at M and half at L
<b>C</b>	all at L	half at K and half at L
<b>D</b>	all at M	half at L and half at M

833. 9700\_m18\_qp\_12 Q: 24

The diagram represents a molecule of ATP.



What are the components of ATP labelled P, Q and R?

	P	Q	R
<b>A</b>	adenine	deoxyribose	phosphates
<b>B</b>	adenosine	pentose	a phosphate group
<b>C</b>	adenosine	ribose	phosphorus
<b>D</b>	purine	pentose	phosphates

834. 9700\_m18\_qp\_12 Q: 25

The table shows three anticodons for different amino acids.

amino acid	anticodon
alanine	CGU
histidine	GUA
serine	UCA

Which DNA triplet on the DNA template strand codes for the amino acid serine?

- A** AGU      **B** TCA      **C** TGT      **D** UCA

835. 9700\_s18\_qp\_11 Q: 22

Meselson and Stahl investigated DNA in bacteria. They grew bacteria in a medium with only heavy nitrogen,  $^{15}\text{N}$ , until all of the bacterial DNA was heavy.

These bacteria were moved from a heavy nitrogen medium and cultured in a medium with only light nitrogen,  $^{14}\text{N}$ .

A sample of bacteria was collected from the first generation in the medium containing light nitrogen and their DNA was analysed.

Hybrid DNA contains both heavy and light DNA.

Which row shows the percentage of heavy DNA strands and the percentage of hybrid DNA molecules in the first generation produced in the medium containing light nitrogen?

	percentage of heavy DNA strands	percentage of hybrid DNA molecules
<b>A</b>	25	50
<b>B</b>	50	50
<b>C</b>	50	100
<b>D</b>	75	100

836. 9700\_s18\_qp\_11 Q: 23

Which is the correct DNA triplet on the original DNA template that codes for the amino acid histidine (His)?

amino acid	anticodon
Ala	CGU
His	GUA
Ser	UCA

**A** CAU      **B** CGT      **C** GTA      **D** GUA

837. 9700\_s18\_qp\_12 Q: 23

A section of a DNA molecule has the coding sequence: AGGCAATGGC.

Which statements are correct?

- This coding sequence contains 3 pyrimidines.
- The double-stranded DNA of this section contains 26 hydrogen bonds between complementary bases.
- The double-stranded DNA of this section has 20 sugar-phosphate bonds.

**A** 1, 2 and 3      **B** 1 and 2 only      **C** 1 and 3 only      **D** 2 and 3 only

838. 9700\_s18\_qp\_12 Q: 24

XNA is a laboratory-made nucleic acid made of nucleotides in which one component has been replaced by chemical X. The chemical X is not found in nature. The part of the molecule responsible for coding is not changed.

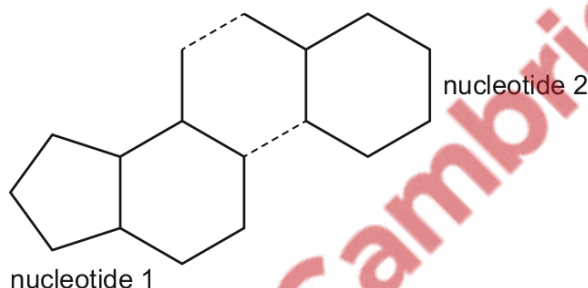
Which organic component of a DNA or RNA nucleotide has been replaced by X?

- A five-carbon sugar
- B phosphate group
- C purine base
- D pyrimidine base

839. 9700\_s18\_qp\_13 Q: 22

The diagram shows the outline structure of two nucleotide bases which occur in DNA.

This pair is held together by two hydrogen bonds, shown as dashed lines.



Which row correctly identifies these two nucleotide bases?

	nucleotide 1	nucleotide 2
<b>A</b>	adenine	thymine
<b>B</b>	cytosine	guanine
<b>C</b>	guanine	cytosine
<b>D</b>	thymine	adenine

840. 9700\_s18\_qp\_13 Q: 23

DNA polymerase catalyses condensation reactions between molecules during semi-conservative replication of DNA.

Which two molecules are joined by DNA polymerase?

- A base and base
- B base and nucleotide
- C nucleotide and nucleotide
- D phosphate and deoxyribose

841. 9700\_w18\_qp\_12 Q: 23

What is the maximum number of hydrogen bonds in a length of DNA containing 700 base pairs?

- A** 350                      **B** 700                      **C** 1400                      **D** 2100
- 

842. 9700\_w18\_qp\_12 Q: 24

What is the common component of the three molecules RNA, DNA, and ATP?

- A** adenosine  
**B** hydrogen bonds  
**C** phosphate  
**D** ribose
- 

843. 9700\_w18\_qp\_13 Q: 22

Which bases found in nucleic acids are purines?

- A** adenine and cytosine  
**B** guanine and adenine  
**C** thymine and cytosine  
**D** uracil and guanine
- 

844. 9700\_m17\_qp\_12 Q: 24

Which statement about nitrogenous bases is correct?

- A** Adenine is a pyrimidine with a double ring structure.  
**B** Cytosine is a purine with a double ring structure.  
**C** Guanine is a purine with a single ring structure.  
**D** Uracil is a pyrimidine with a single ring structure.
- 

845. 9700\_s17\_qp\_11 Q: 13

Bacterial cells divide by a process called binary fission.

Which macromolecules must be synthesised for binary fission?

- 1 cell membrane proteins and RNA
- 2 DNA and peptidoglycan
- 3 enzymes and cellulose

- A** 1, 2 and 3                      **B** 1 and 2 only                      **C** 2 and 3 only                      **D** 3 only
-

846. 9700\_s17\_qp\_11 Q: 24

What is the smallest unit of a DNA molecule that can be altered by a mutation **and** cause a change to the coding of a polypeptide?

- A base
- B codon
- C gene
- D nucleotide

847. 9700\_s17\_qp\_11 Q: 26

The table shows the role of four different proteins involved in DNA replication.

protein	helicase	topoisomerase	single-strand binding protein	DNA polymerase
role	unwinds the parental DNA double helix	breaks and rejoins the DNA strands	binds to separated DNA strands to stabilise them	synthesises strand of DNA

Which shows the function of these proteins?

	helicase	topoisomerase	single-strand binding protein	DNA polymerase
<b>A</b>	adds DNA nucleotides to the 3' end of a growing polynucleotide strand	prevents original strands reforming complementary base pairs	enables tension caused by unwinding to be released	makes strands available as templates
<b>B</b>	enables tension caused by unwinding to be released	prevents original strands reforming complementary base pairs	makes strands available as templates	adds DNA nucleotides to the 3' end of a growing polynucleotide strand
<b>C</b>	enables tension caused by unwinding to be released	makes strands available as templates	adds DNA nucleotides to the 3' end of a growing polynucleotide strand	prevents original strands reforming complementary base pairs
<b>D</b>	makes strands available as templates	enables tension caused by unwinding to be released	prevents original strands reforming complementary base pairs	adds DNA nucleotides to the 3' end of a growing polynucleotide strand



848. 9700\_s17\_qp\_11 Q: 27

Which type of sugar and which type of bond are found in a DNA molecule?

	type of sugar	type of bond
<b>A</b>	non-reducing	glycosidic
<b>B</b>	non-reducing	hydrogen
<b>C</b>	reducing	peptide
<b>D</b>	reducing	hydrogen

849. 9700\_s17\_qp\_12 Q: 18

The bacterium *Escherichia coli* divides once every 50 minutes at 36 °C.

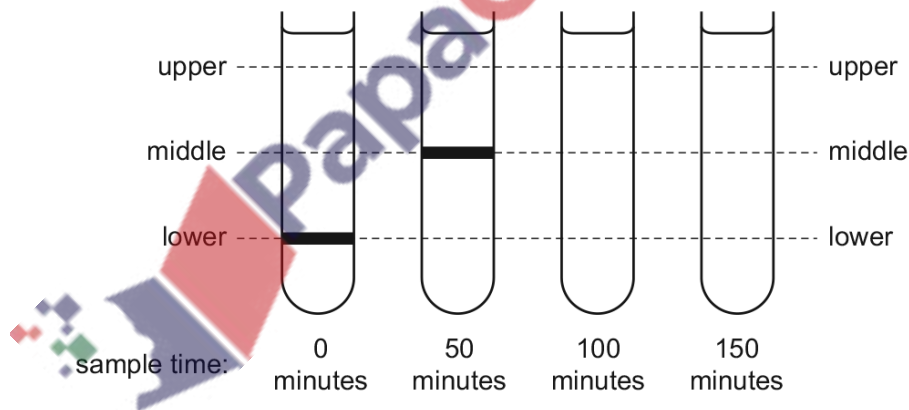
*E. coli* were grown on a medium containing only heavy nitrogen,  $^{15}\text{N}$ , until all of the bacterial DNA contained heavy nitrogen (0 minutes).

Some of the bacteria were moved from a heavy nitrogen medium and cultured in a medium with only light nitrogen,  $^{14}\text{N}$ .

Some bacteria were collected after each of three generations. Their DNA was extracted and centrifuged.

Hybrid DNA contains heavy and light nitrogen.

The diagram shows the possible positions (upper, middle and lower) of the bands of DNA. The actual positions of bands in the first two samples are shown.



Which proportion of the DNA of the sample taken at 150 minutes will be at the upper position?

- A** 25%      **B** 50%      **C** 75%      **D** 100%

850. 9700\_s17\_qp\_12 Q: 21

Which row is correct for adenine?

	has a single ring structure	is a purine	joins to its complementary base with 3 hydrogen bonds
<b>A</b>	✓	✓	✓
<b>B</b>	✓	✗	✗
<b>C</b>	✗	✓	✗
<b>D</b>	✗	✗	✓

key

✓ = correct

✗ = incorrect

851. 9700\_s17\_qp\_13 Q: 18

Which statement about nucleotides is correct?

- A** Adenine and guanine are pyrimidines.
- B** ATP is a phosphorylated nucleotide.
- C** Purines have a single ring structure.
- D** Uracil replaces cytosine in RNA.

852. 9700\_s17\_qp\_13 Q: 19

Scientists have made a nucleic acid (HNA) that has a sugar with the same number of carbon atoms as glucose instead of deoxyribose. Although genetic information can be stored by HNA, naturally occurring DNA polymerase cannot replicate HNA.

Which statements could explain why naturally occurring DNA polymerase cannot replicate HNA?

- 1 DNA polymerase cannot form bonds between the sugars of two HNA nucleotides.
- 2 DNA polymerase cannot form hydrogen bonds between two HNA nucleotides.
- 3 HNA nucleotides do not fit into the active site of DNA polymerase.
- 4 The shape of an HNA nucleotide is slightly larger than that of a DNA nucleotide.

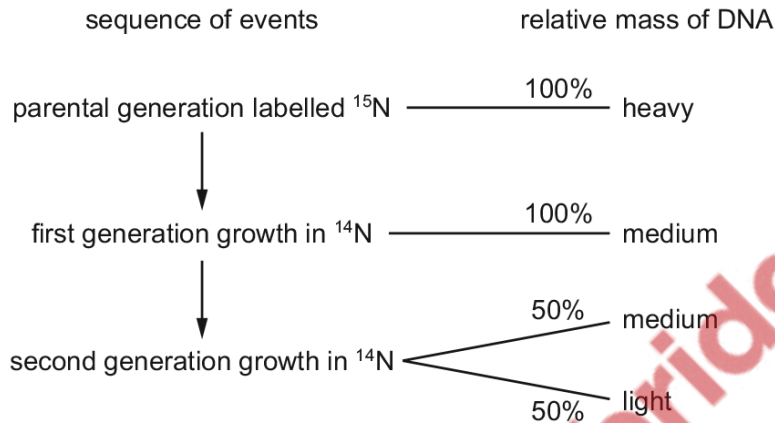
- A** 1, 2, 3 and 4   **B** 1 and 4 only   **C** 2 and 3 only   **D** 3 and 4 only

853. 9700\_s17\_qp\_13 Q: 20

Meselson and Stahl investigated DNA replication by growing bacteria in a culture containing heavy nitrogen,  $^{15}\text{N}$ , until all the DNA was labelled.

These bacteria, the parental generation, were then transferred to a culture containing only light nitrogen,  $^{14}\text{N}$ , and allowed to replicate for two generations.

DNA was extracted from each generation of bacteria and its relative mass estimated. The flow diagram shows the results.



Which row explains the relative mass of the DNA in the second generation grown in  $^{14}\text{N}$ ?

	50% medium DNA molecules		50% light DNA molecules	
	strand 1	strand 2	strand 1	strand 2
<b>A</b>	only $^{15}\text{N}$	only $^{14}\text{N}$	only $^{14}\text{N}$	only $^{14}\text{N}$
<b>B</b>	only $^{15}\text{N}$	only $^{15}\text{N}$	only $^{14}\text{N}$	only $^{14}\text{N}$
<b>C</b>	only $^{15}\text{N}$	only $^{15}\text{N}$	only $^{14}\text{N}$	only $^{15}\text{N}$
<b>D</b>	only $^{15}\text{N}$	half $^{14}\text{N}$ , half $^{15}\text{N}$	only $^{14}\text{N}$	half $^{14}\text{N}$ , half $^{15}\text{N}$

854. 9700\_w17\_qp\_11 Q: 19

Which row represents the correct features of the nitrogenous base adenine?

	has a single ring structure	is a purine	joins its complementary base by three hydrogen bonds	pairs with thymine
<b>A</b>	✓	✓	x	x
<b>B</b>	✓	x	✓	x
<b>C</b>	x	✓	x	✓
<b>D</b>	x	x	x	✓

key  
 ✓ = true  
 x = false

855. 9700\_w17\_qp\_11 Q: 20

The codons UGU and UGC code for the amino acid cysteine, which can form disulfide bonds in a polypeptide.

The codon UGG codes for the amino acid tryptophan, which does not contain a sulfur atom.

The codon UGA is a stop signal.

The DNA triplet code for the 10th amino acid in a particular polypeptide is ACA.

Which single base substitutions in this triplet code will result in **no** disulfide bond being formed with the 10th amino acid in the polypeptide?

- A ACC and ACG
- B ACG and ACT
- C ACT and ACC
- D ACT only

---

856. 9700\_w17\_qp\_12 Q: 22

What is the **maximum** number of hydrogen bonds in a length of DNA containing 700 nucleotides?

- A 350
- B 700
- C 1050
- D 2100

---

857. 9700\_w17\_qp\_12 Q: 23

Which statements concerning DNA and RNA are correct?

- 1 Adenine and guanine are bases that have a double ring structure; cytosine, thymine and uracil are bases with a single ring structure.
- 2 An adenine nucleotide from DNA is the same as an adenine nucleotide from RNA; DNA adenine pairs with thymine and RNA adenine pairs with uracil.
- 3 The base pairing that occurs in a double DNA helix and when RNA is synthesised during transcription is always according to the rule that a purine pairs with a pyrimidine.
- 4 The two polynucleotides on a DNA molecule run in opposite directions so that the double helix formed has two strands that are parallel to each other.

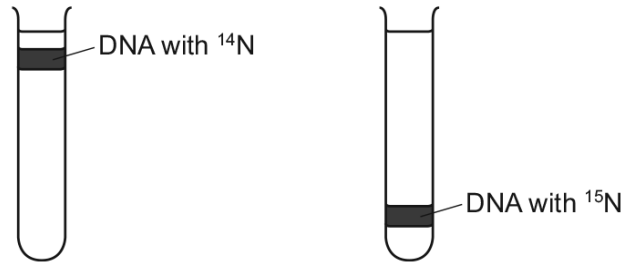
- A 1, 2 and 3
- B 1, 2 and 4
- C 1, 3 and 4
- D 2, 3 and 4

858. 9700\_w17\_qp\_12 Q: 24

Two sets of bacteria were grown using different types of nitrogen-containing growth media.

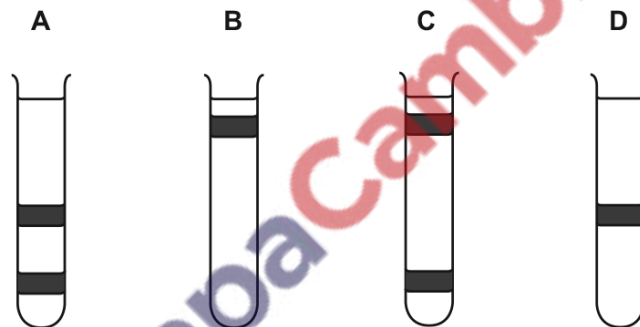
One set was grown in a medium containing the 'heavy' isotope of nitrogen,  $^{15}\text{N}$ , until all the DNA was labelled. The other set was grown in a medium containing the 'light' isotope of nitrogen,  $^{14}\text{N}$ , until all the DNA was labelled.

The DNA from each set of bacteria was extracted and centrifuged. The diagram shows the position in the centrifuge tubes of this DNA.



Bacteria with  $^{15}\text{N}$  labelled DNA were transferred to a medium containing  $^{14}\text{N}$  and allowed to reproduce once. The DNA of the new generation of bacteria was extracted and centrifuged.

Which tube shows the position of DNA from this new generation of bacteria?



859. 9700\_w17\_qp\_12 Q: 25

The diagram shows the nucleotide sequence of a small section of a gene which is transcribed.

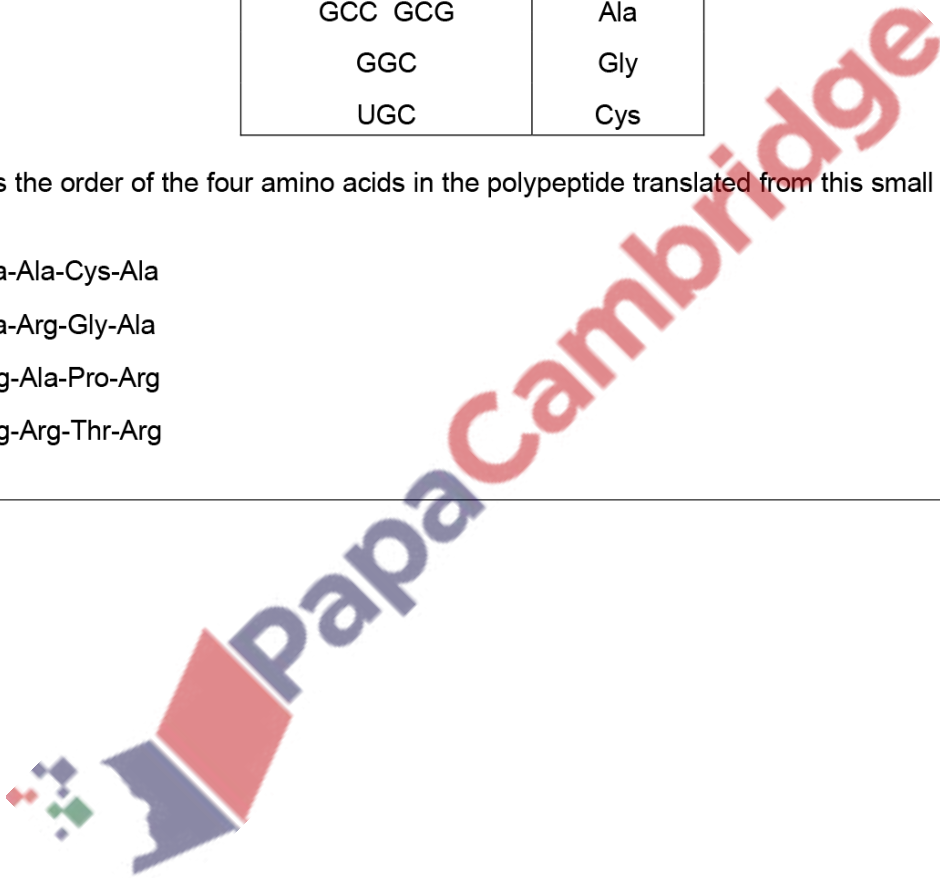
GCGCGCGGCGCG

The table shows the amino acids coded for by 10 mRNA codons.

mRNA codon	amino acid
AAG	Lys
ACG	Thr
CGG CGC CGU	Arg
CCG	Pro
GCC GCG	Ala
GGC	Gly
UGC	Cys

What is the order of the four amino acids in the polypeptide translated from this small section of a gene?

- A Ala-Ala-Cys-Ala
- B Ala-Arg-Gly-Ala
- C Arg-Ala-Pro-Arg
- D Arg-Arg-Thr-Arg





860. 9700\_w17\_qp\_13 Q: 25

A single substitution in an allele of the gene coding for haemoglobin results in sickle cell haemoglobin.

The mRNA sequence for three amino acids for normal haemoglobin is shown.

CCUGAAGAG

The mRNA sequence for sickle cell haemoglobin is shown.

CCUGUAGAG

The table shows some of the triplet codes for two amino acids.

DNA triplet codes	amino acid
CTC	Glu
CTT	Glu
CAT	Val
CAC	Val

Which row is correct for the substituted DNA nucleotide of the allele and the substituted amino acid of the protein?

	DNA nucleotide	new amino acid
<b>A</b>	A	Glu
<b>B</b>	A	Val
<b>C</b>	T	Glu
<b>D</b>	T	Val

861. 9700\_w17\_qp\_13 Q: 26

What is the **minimum** number of hydrogen bonds in a length of DNA containing 700 base pairs?

- A** 350      **B** 700      **C** 1400      **D** 2100

862. 9700\_m16\_qp\_12 Q: 20

21.2% of the bases in a molecule of DNA are cytosine.

What percentage would be adenine?

- A** 21.2%      **B** 28.8%      **C** 42.4%      **D** 57.6%

863. 9700\_s16\_qp\_11 Q: 20

DNA contains the .....X..... base .....Y..... which is joined to adenine with .....Z..... hydrogen bonds.

Which row correctly completes the statement about DNA?

	X	Y	Z
<b>A</b>	purine	thymine	three
<b>B</b>	purine	uracil	three
<b>C</b>	pyrimidine	thymine	two
<b>D</b>	pyrimidine	uracil	two

864. 9700\_s16\_qp\_12 Q: 19

Which statements about complementary base pairing are correct?

- 1 Cytosine forms three hydrogen bonds with guanine.
- 2 Purines and pyrimidines are different sizes.
- 3 It allows transcription to occur.
- 4 The base pairs are of different lengths.

**A** 1, 2 and 3      **B** 1, 2 and 4      **C** 1, 3 and 4      **D** 2, 3 and 4

865. 9700\_s16\_qp\_12 Q: 20

Bacteria were grown in a medium containing  $^{15}\text{N}$ . After several generations, all of the DNA contained  $^{15}\text{N}$ . Some of these bacteria were transferred to a medium containing the common isotope of nitrogen,  $^{14}\text{N}$ . The bacteria were allowed to divide once. The DNA of some of these bacteria was extracted and analysed. This DNA was all hybrid DNA containing equal amounts of  $^{14}\text{N}$  and  $^{15}\text{N}$ .

The remaining bacteria were left in the medium with  $^{14}\text{N}$  and allowed to divide one more time. The DNA of some of these bacteria was extracted and analysed.

What is the composition of this DNA?

- A** 25% hybrid DNA
- B** 50% hybrid DNA
- C** 75% hybrid DNA
- D** 100% hybrid DNA

866. 9700\_s16\_qp\_12 Q: 22

The diagram shows the nucleotide sequence of a small section of a gene which is transcribed.

TTCTTCCCGTTC

The table shows the amino acids coded for by 10 mRNA codons.

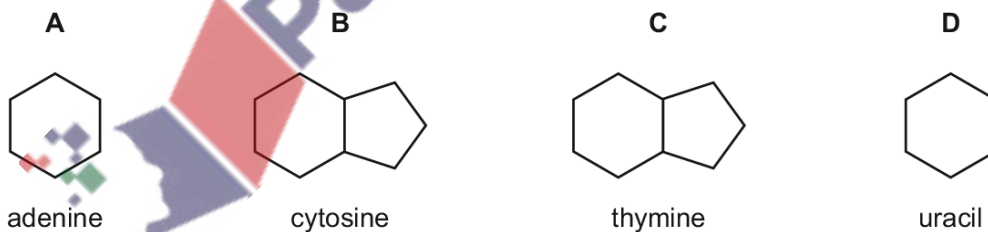
mRNA codon	amino acid
AAG	Lys
ACG	Thr
CGG CGC CGU	Arg
CCG	Pro
GCC GCG	Ala
GGC	Gly
UGC	Cys

What is the order of the four amino acids in the polypeptide translated from this small section of a gene?

- A Cys-Cys-Gly-Cys
- B Lys-Lys-Gly-Lys
- C Lys-Lys-Pro-Lys
- D Thr-Thr-Pro-Thr

867. 9700\_s16\_qp\_13 Q: 19

Which diagram shows a correct ring structure and named nucleic acid base?



868. 9700\_s16\_qp\_13 Q: 20

Which statements are correct?

- 1 Adenine and cytosine are both purines.
- 2 The DNA nucleotide containing adenine is different from the RNA nucleotide containing adenine.
- 3 Purines only form base pairs with pyrimidines.

**A** 1, 2 and 3    **B** 1 and 2 only    **C** 1 and 3 only    **D** 2 and 3 only

869. 9700\_s16\_qp\_13 Q: 21

A short piece of DNA 18 base pairs long was analysed to find the number of nucleotide bases in each of the polynucleotide strands. Some of the results are shown below.

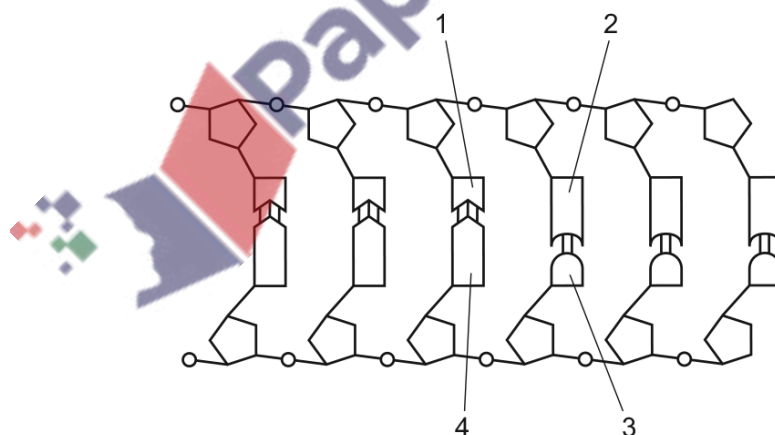
	number of nucleotide bases			
	adenine	cytosine	guanine	thymine
strand 1		4		7
strand 2		5		

How many nucleotides containing thymine were present in strand 2?

**A** 2    **B** 4    **C** 5    **D** 7

870. 9700\_w16\_qp\_11 Q: 19

The diagram shows part of a DNA molecule.



Which labels represent purines?

**A** 1 and 2    **B** 2 and 4    **C** 3 and 1    **D** 4 and 3

871. 9700\_w16\_qp\_11 Q: 20

A double stranded DNA molecule was analysed and 29% of its nucleotide bases were found to be adenine.

What percentage of its nucleotide bases will be cytosine?

- A** 21%                      **B** 29%                      **C** 42%                      **D** 58%

872. 9700\_w16\_qp\_12 Q: 22

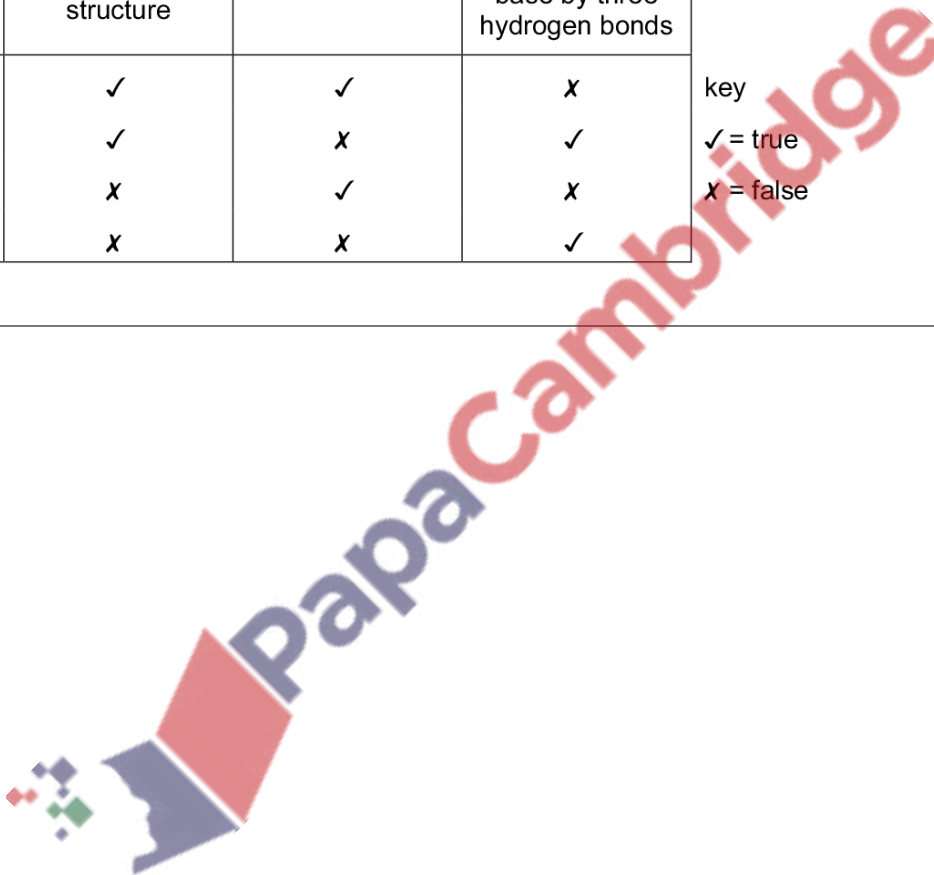
Which row represents the correct features of the nitrogenous base cytosine?

	has a single ring structure	is a purine	joins its complementary base by three hydrogen bonds
<b>A</b>	✓	✓	x
<b>B</b>	✓	x	✓
<b>C</b>	x	✓	x
<b>D</b>	x	x	✓

key

✓ = true

x = false

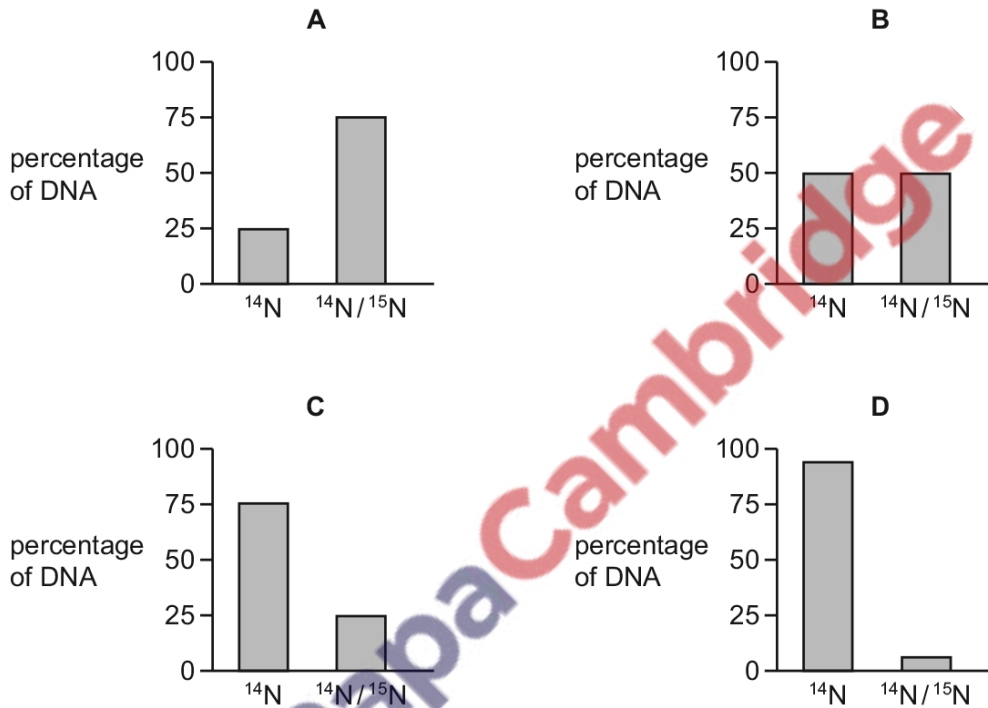


873. 9700\_w16\_qp\_12 Q: 23

Bacteria were grown in a medium containing  $^{15}\text{N}$ . After several generations, all of the DNA contained  $^{15}\text{N}$ . Some of these bacteria were transferred to a medium containing the common isotope of nitrogen,  $^{14}\text{N}$ . The bacteria were allowed to divide once. The DNA of some of these bacteria was extracted and analysed. This DNA was all hybrid DNA containing equal amounts of  $^{14}\text{N}$  and  $^{15}\text{N}$ .

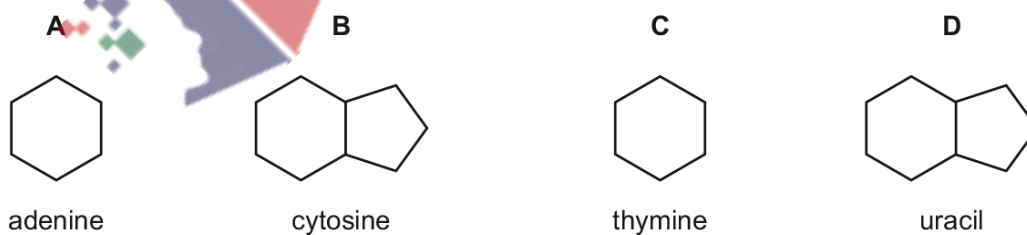
In another experiment, some bacteria from the medium with  $^{15}\text{N}$  were transferred into a medium of  $^{14}\text{N}$ . The bacteria were allowed to divide three times. The DNA of some of these bacteria was extracted and analysed.

What is the composition of this DNA?



874. 9700\_w16\_qp\_13 Q: 20

Which diagram shows a correct ring structure and named nucleic acid base?





875. 9700\_s15\_qp\_11 Q: 20

Which row shows two pairs of nucleotides formed during transcription?

	first base pair transcribed		second base pair transcribed	
	bases	number of hydrogen bonds	bases	number of hydrogen bonds
<b>A</b>	AU	2	CG	2
<b>B</b>	AU	2	CG	3
<b>C</b>	AU	2	TU	2
<b>D</b>	AU	3	CG	2

876. 9700\_s15\_qp\_11 Q: 21

Which row correctly identifies the features of DNA and RNA molecules?

	DNA and RNA contain both purine and pyrimidine bases	DNA and RNA both contain a pentose sugar	hydrogen bonds form between bases in some RNA
<b>A</b>	✓	✓	✓
<b>B</b>	✓	✓	✗
<b>C</b>	✓	✗	✓
<b>D</b>	✗	✓	✗

key

✓ = correct statement

✗ = incorrect statement

877. 9700\_s15\_qp\_11 Q: 22

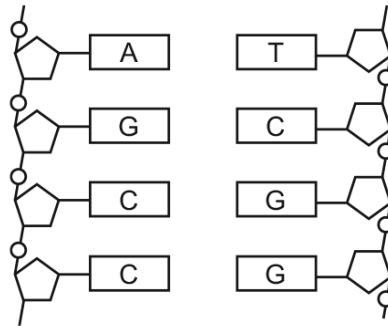
Two polynucleotide strands make up a DNA molecule.

What is a correct description?

- A** The percentage of cytosine is 50% of that of guanine in the whole molecule.
- B** The percentage of cytosine is the same as that of guanine in each strand.
- C** The percentage of cytosine is the same as that of guanine in the whole molecule.
- D** The percentage of cytosine is the same in each strand of the molecule.

878. 9700\_s15\_qp\_12 Q: 22

The diagram shows part of a DNA molecule.



How many hydrogen bonds are involved in holding these strands of DNA together?

- A** 11                      **B** 9                      **C** 8                      **D** 4

879. 9700\_s15\_qp\_13 Q: 20

Which row correctly describes adenine?

	complementary base	component on nucleotide strand it is attached to	ring structure
<b>A</b>	thymine	deoxyribose	double
<b>B</b>	thymine	phosphate	single
<b>C</b>	uracil	phosphate	double
<b>D</b>	uracil	ribose	single

880. 9700\_w15\_qp\_11 Q: 22

Which row shows two pairs of nucleotide bases in a molecule of DNA?

	first base pair		second base pair	
	bases present	number of hydrogen bonds	bases present	number of hydrogen bonds
<b>A</b>	AC	2	GT	3
<b>B</b>	AC	3	GT	2
<b>C</b>	AT	2	GC	3
<b>D</b>	AT	3	GC	2

881. 9700\_w15\_qp\_12 Q: 22

Which row shows two pairs of nucleotide bases in a molecule of DNA?

	first base pair		second base pair	
	bases present	number of hydrogen bonds	bases present	number of hydrogen bonds
<b>A</b>	AT	2	CG	2
<b>B</b>	AT	2	CG	3
<b>C</b>	TA	3	GC	2
<b>D</b>	TA	3	GC	3

882. 9700\_w15\_qp\_13 Q: 22

Which row correctly describes cytosine?

	ring structure	number of hydrogen bonds it forms with its complementary base	type of base
<b>A</b>	double	three	purine
<b>B</b>	double	two	pyrimidine
<b>C</b>	single	three	pyrimidine
<b>D</b>	single	two	purine

## 6.2 Protein synthesis

883. 9700\_m20\_qp\_12 Q: 24

The table shows the tRNA anticodons for four amino acids.

amino acid	tRNA anticodons
asparagine	UUA, UUG
glutamic acid	CUU, CUC
proline	GGA, GGG, GGU, GGC
threonine	UGA, UGG, UGU, UGC

A cell makes a polypeptide containing the amino acid sequence shown.

asparagine – threonine – proline – glutamic acid

Which sequence of bases on the transcribed strand of a DNA molecule could code for this part of the polypeptide?

- A AATACCCCTGAA
- B AATACCCCTCAA
- C TTA CTTGGATGG
- D TTATGGGGACTT

---

884. 9700\_s20\_qp\_11 Q: 23

A population of bacteria is exposed to the antibiotic penicillin. Most of the bacteria die.

However, some bacteria in the population have an allele coding for an enzyme that breaks down penicillin. These bacteria are able to survive.

Which could explain how these bacterial cells acquired this allele?

- 1 An error during DNA replication.
- 2 An error during transcription.
- 3 An error during translation.

- A 1, 2 and 3    B 1 and 3 only    C 1 only    D 2 and 3 only
-

885. 9700\_s20\_qp\_12 Q: 24

Part of the nucleotide sequence of an mRNA molecule is shown, with spaces between the codons.

CAG UAC AGC AAU CUA UAA

The translation of the codons is provided.

codon	amino acid or STOP
AAU	asn
AGC	ser
CAG	gln
CUA	leu
UAA	STOP
UAC	tyr
UAU	tyr

Which events will cause the termination of polypeptide synthesis during translation?

- 1 Deletion of C from the leu codon.
- 2 Deletion of C from the tyr codon.
- 3 The ribosome reaching the UAA codon.

**A** 1, 2 and 3    **B** 1 and 2 only    **C** 1 and 3 only    **D** 2 and 3 only

---



886. 9700\_s20\_qp\_13 Q: 22

The sequence of bases in mRNA for the first eight amino acids in the  $\beta$ -polypeptide of adult haemoglobin is:

GUG–CAC–CUG–ACU–CCU–GAG–GAG–AAG.

In haemoglobin C, which is a cause of haemolytic anaemia, the sequence is:

GUG–CAC–CUG–ACU–CCU–AAG–GAG–AAG.

The coding for seven of the amino acids is listed.

amino acid	DNA triplet
glu	CTC
his	GTG
leu	GAG
lys	TTC
pro	GGA
thr	TGA
phe	AAG

Which change occurs to the amino acid sequence of adult haemoglobin to make haemoglobin C?

- A Histidine is changed to leucine.
- B Proline is changed to threonine.
- C Glutamic acid is changed to lysine.
- D Leucine is changed to phenylalanine.

887. 9700\_s20\_qp\_13 Q: 23

Some antibiotics kill prokaryotes by binding to RNA polymerase.

What effect will this have on protein synthesis?

- A Codons on mRNA will be unable to hydrogen bond to complementary anticodons on tRNA.
- B Condensation reactions joining RNA nucleotides will not take place to form mRNA.
- C DNA will not unwind and unzip to allow for base pairing with RNA nucleotides.
- D Free RNA nucleotides will not base pair to exposed bases on the DNA template strand.

888. 9700\_w20\_qp\_12 Q: 21

Which description of a eukaryotic gene is correct?

- A a sequence of bases that forms part of a DNA molecule and codes for a protein
  - B a sequence of nucleotides that forms part of a DNA molecule and codes for a polypeptide
  - C a sequence of bases that forms part of an RNA molecule and codes for a protein
  - D a sequence of nucleotides that forms part of an RNA molecule and codes for a polypeptide
- 

889. 9700\_w20\_qp\_12 Q: 22

The DNA sequence CCAAGAAGTCGACAAACA is translated to synthesise the amino acid chain gly-ser-ser-ala-val-cys.

As a result of a mutation, the sequence length of the amino acid chain is shortened from six to two amino acids. A stop codon in mRNA is UGA.

Which base in the DNA sequence was changed by the mutation?

- A A
  - B C
  - C G
  - D T
- 

890. 9700\_w20\_qp\_13 Q: 24

A molecule of transfer RNA (tRNA) has the anticodon sequence UAC.

What will be the corresponding nucleotide sequence in the DNA?

- A ATG
  - B AUG
  - C TAC
  - D TUG
- 

891. 9700\_m19\_qp\_12 Q: 22

Rifampicin is an antibiotic used to treat tuberculosis (TB).

It works by inhibiting RNA polymerase in bacteria.

Which processes are directly inhibited by this antibiotic?

- 1 DNA replication
- 2 transcription
- 3 ATP synthesis

- A 1, 2 and 3
  - B 1 and 2 only
  - C 1 and 3 only
  - D 2 only
- 

892. 9700\_s19\_qp\_11 Q: 24

In a genetic engineering experiment a piece of double-stranded DNA containing 6000 nucleotides coding for a specific polypeptide is transcribed and translated.

What is the total number of amino acids in this polypeptide?

- A 500
  - B 1000
  - C 2000
  - D 3000
-



893. 9700\_s19\_qp\_11 Q: 25

Which statements about tRNA are correct?

- 1 Hydrogen bonds between bases temporarily hold tRNA against mRNA.
- 2 The base sequences in the tRNA molecules are the same as the base sequences in the mRNA that is being translated.
- 3 tRNA translates the base sequence in mRNA into the amino acid sequence in a protein.

**A** 1, 2 and 3      **B** 1 and 2 only      **C** 1 and 3 only      **D** 2 and 3 only

894. 9700\_w19\_qp\_11 Q: 23

Sickle cell anaemia is caused by a mutation in an allele of the gene that codes for the  $\beta$ -globin polypeptide of haemoglobin.

The diagram shows the sequence of bases in a small section of the coding strand of DNA for both the  $Hb^A$  (normal) and  $Hb^S$  (sickle cell)  $\beta$ -globin alleles.

$Hb^A$  CTGACTCCTGAGGAGAAGTCT

$Hb^S$  CTGACTCCTGTGGAGAAGTCT

How will the mutation in the allele result in the production of an altered version of the  $\beta$ -globin polypeptide?

- A** A tRNA molecule with the anticodon GUG will hydrogen bond to the altered codon on mRNA.
- B** All the amino acids coded for after the mutation will differ from those in the  $Hb^A$  protein.
- C** mRNA transcribed from the  $Hb^S$  allele will contain the codon CAC instead of the codon CTC.
- D** The ribosome will be unable to continue translation of the  $Hb^S$  mRNA after the altered codon.

895. 9700\_w19\_qp\_13 Q: 21

What is the maximum number of codon-anticodon interactions within one ribosome?

**A** 2      **B** 3      **C** 4      **D** 6

896. 9700\_w19\_qp\_13 Q: 23

Which statements about tRNA structure are correct?

- 1 There is a binding site for the attachment of a specific amino acid and a different binding site for the attachment to the ribosome, so that translation can occur.
- 2 There is a ribose-phosphate backbone with strong phosphodiester bonds and areas within the polynucleotide chain where base pairing occurs.
- 3 There is an anticodon that contains the same triplet of bases as the triplet of DNA bases that has been transcribed to produce the mRNA codon.

**A** 1, 2 and 3      **B** 1 and 2 only      **C** 1 only      **D** 2 and 3 only

---

897. 9700\_s18\_qp\_12 Q: 25

Which statements about tRNA are correct?

- 1 Hydrogen bonds between bases temporarily hold tRNA against mRNA.
- 2 The base sequences in the tRNA molecules are the same as the base sequences in the mRNA that is being translated.
- 3 The specificity of the tRNA molecule for glycine and the specificity of the enzyme that loads glycine are both necessary for correct loading.

**A** 1, 2 and 3      **B** 1 and 2 only      **C** 1 and 3 only      **D** 2 and 3 only

---

898. 9700\_s18\_qp\_13 Q: 24

What occurs during each of DNA replication and transcription and translation?

- 1 ATP provides energy.
- 2 Condensation reactions occur to form a polymer.
- 3 Hydrogen bonds form between purine and pyrimidine bases.

**A** 1, 2 and 3      **B** 1 and 2 only      **C** 2 only      **D** 3 only

---

899. 9700\_s18\_qp\_13 Q: 25

Part of a sequence of DNA from a person with a genetic disease is:

TAGTAACCACAAAGG

The corresponding sequence of DNA from a person without this genetic disease is:

TAGTAAAACACAAAGG

The possible mRNA codons for some amino acids are shown in the table.

amino acid	mRNA codons			
1	GGU	GGC	GGA	GGG
2	AUU	AUC	AUA	
3	UUU	UUC		
4	UCU	UCC	UCA	UCG

Which amino acid is missing from a person with this genetic disease?

- A** 1                      **B** 2                      **C** 3                      **D** 4

900. 9700\_w18\_qp\_11 Q: 23

Following translation, the alpha polypeptide chain of haemoglobin,  $\alpha$ -globin, undergoes modification. During this modification, the first amino acid is removed, leaving 141 amino acid residues.

How many nucleotides does the gene coding for  $\alpha$ -globin contain?

- A** 141                      **B** 142                      **C** 423                      **D** 426

901. 9700\_w18\_qp\_13 Q: 23

A length of double-stranded DNA contains 120 nucleotides and codes for a section of a polypeptide.

What is the maximum length of this section of a polypeptide?

- A** 20 amino acids  
**B** 40 amino acids  
**C** 60 amino acids  
**D** 120 amino acids

902. 9700\_m17\_qp\_12 Q: 25

Rifampicin is an antibiotic used to treat tuberculosis.

It works by inhibiting RNA polymerase in bacteria.

Which of these processes will be **directly** inhibited by this antibiotic?

- 1 ATP synthesis
- 2 transcription
- 3 translation

**A** 1 and 2      **B** 1 and 3      **C** 2 only      **D** 3 only

903. 9700\_m17\_qp\_12 Q: 26

Meselson and Stahl investigated DNA in bacteria. They grew bacteria in a medium with only heavy nitrogen,  $^{15}\text{N}$ , until all of the bacterial DNA contained only heavy nitrogen.

These bacteria were then moved from the heavy nitrogen medium and cultured in a medium with only light nitrogen,  $^{14}\text{N}$ .

Some bacteria were collected from each of the **next** three generations and their DNA was analysed.

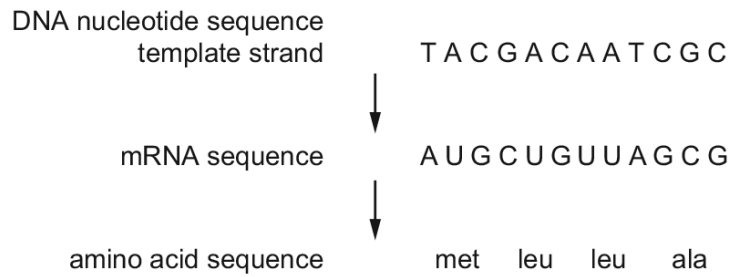
Hybrid DNA contains both heavy and light nitrogen.

Which row shows the correct DNA of the first and third generations?

	DNA of first generation	DNA of third generation
<b>A</b>	all hybrid	half hybrid, half light
<b>B</b>	all hybrid	one quarter hybrid, three quarters light
<b>C</b>	half hybrid, half heavy	half hybrid, one quarter heavy, one quarter light
<b>D</b>	half hybrid, half light	one quarter hybrid, three quarters light

904. 9700\_m17\_qp\_12 Q: 27

The diagram shows the stages in the production of part of a polypeptide.



Which feature of the triplet code is illustrated by the information given?

- A An amino acid can be coded for by more than one triplet.
- B The triplet code is non-overlapping and is only read in one direction.
- C The triplet code is universal for the DNA of all organisms.
- D There are some triplets that code for 'start' and 'stop'.

905. 9700\_s17\_qp\_11 Q: 25

Which statements about tRNA are correct?

- 1 contains base pairing
- 2 contains hydrogen bonds
- 3 is single stranded

- A 1, 2 and 3    B 1 and 2 only    C 1 and 3 only    D 2 and 3 only

906. 9700\_s17\_qp\_12 Q: 19

Different tissues in a plant were supplied with a radioactively labelled substance to identify which tissues were actively synthesising mRNA.

Which radioactively labelled substances would be most suitable for this experiment?

- 1 adenine
- 2 ribose
- 3 inorganic phosphate
- 4 uracil

- A 1, 2, 3 and 4
- B 1, 2 and 3 only
- C 2 and 4 only
- D 4 only

907. 9700\_s17\_qp\_12 Q: 20

Electron micrographs may show large numbers of ribosomes forming chains along mRNA molecules.

What is the advantage of this arrangement, compared to when ribosomes appear singly on the mRNA?

- A Different polypeptides can be produced simultaneously.
- B Fewer tRNA molecules are required to translate the polypeptide.
- C Large polypeptide chains can be produced.
- D Polypeptides can be produced more rapidly.

908. 9700\_s17\_qp\_13 Q: 21

Which statement is correct?

- A During transcription, mRNA is synthesised from DNA nucleotides to have the same sequence of nucleotides as the DNA strand on which it was made.
- B During transcription, tRNA is synthesised from RNA nucleotides and carries codons that are complementary to the sequence of nucleotides on the DNA strand on which it was made.
- C During translation, mRNA is synthesised from RNA nucleotides to have the complementary sequence of nucleotides to that of the DNA strand on which it was made.
- D During translation, ribosomes join amino acids in a sequence determined by mRNA with the complementary sequence of nucleotides to that of the DNA strand on which it was made.

909. 9700\_w17\_qp\_11 Q: 18

The following statements describe the process of translation.

- 1 A peptide bond forms between adjacent amino acids.
- 2 Hydrogen bonds form between the anticodon and the codon.
- 3 mRNA binds to the ribosome.
- 4 tRNA enters the ribosome carrying a specific amino acid.

In which order does this process take place?

- A 3 → 2 → 1 → 4
- B 3 → 4 → 2 → 1
- C 4 → 2 → 1 → 3
- D 4 → 2 → 3 → 1

910. 9700\_w17\_qp\_11 Q: 21

A student produced a table of differences between RNA and DNA. The table contains one mistake.

Which row has the mistake?

	RNA	DNA
<b>A</b>	contains ribose	contains deoxyribose
<b>B</b>	contains uracil	contains thymine
<b>C</b>	found throughout cell	found only in nucleus
<b>D</b>	single polynucleotide per molecule	two polynucleotides per molecule

911. 9700\_w17\_qp\_13 Q: 23

Rifampicin is an antibiotic used to treat tuberculosis.

It works by inhibiting RNA polymerase in bacteria.

Which of these processes are prevented by this antibiotic?

- 1 DNA replication
- 2 transcription
- 3 translation

**A** 1, 2 and 3    **B** 1 and 2 only    **C** 2 and 3 only    **D** 3 only

912. 9700\_w17\_qp\_13 Q: 24

A gene codes for the sequence of amino acids in a single polypeptide. Haemoglobin consists of two  $\alpha$ -globins and two  $\beta$ -globins.

How many genes are needed to code for a single haemoglobin molecule?

**A** 1    **B** 2    **C** 4    **D** 8

913. 9700\_m16\_qp\_12 Q: 19

What does the enzyme DNA polymerase synthesise in a cell?

- A** a polypeptide using DNA as a template
- B** a strand of DNA using a polypeptide as a template
- C** a strand of DNA using DNA as a template
- D** a strand of mRNA using DNA as a template



914. 9700\_m16\_qp\_12 Q: 21

One gene provides the code for the production of which type of molecule?

- A amino acid
- B DNA
- C nucleotide
- D polypeptide

915. 9700\_m16\_qp\_12 Q: 22

The table shows the mode of action of two antibacterial drugs that can affect the synthesis of proteins.

antibacterial drug	rifampicin	streptomycin
mode of action	binds to RNA polymerase	causes errors in translation

If bacteria are treated with **both** drugs, what will be the immediate effects?

- 1 Transcription will stop, but faulty proteins may continue to be synthesised.
- 2 If translation has started, proteins may be faulty.
- 3 Translation will be inhibited.

- A 1, 2 and 3    B 1 and 2 only    C 1 and 3 only    D 2 and 3 only

916. 9700\_s16\_qp\_11 Q: 22

The statements describe the features of some nucleic acids.

- 1 carry an amino acid to a ribosome
- 2 carry a genetic code sequence out of the nucleus
- 3 carry a genetic code sequence to a ribosome
- 4 hold amino acids in position for translation

Which functions are carried out by tRNA?

- A 1 and 2    B 1 and 4    C 2 and 3    D 3 and 4

917. 9700\_s16\_qp\_12 Q: 6

Which biological molecules **always** contain the element nitrogen?

- A amino acids, cellulose, mRNA
  - B amino acids, DNA, lipids
  - C enzymes, mRNA, tRNA
  - D membrane proteins, starch, tRNA
- 

918. 9700\_s16\_qp\_12 Q: 21

Which statements about tRNA are correct?

- 1 It contains base pairing.
- 2 It contains hydrogen bonds.
- 3 It contains uracil.
- 4 It is single stranded.

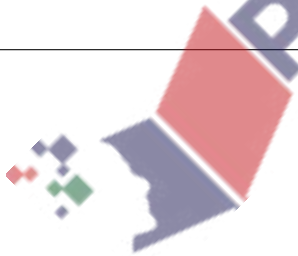
- A 1, 2, 3 and 4    B 1, 3 and 4 only    C 1 and 2 only    D 2 and 3 only
- 

919. 9700\_w16\_qp\_11 Q: 21

When a gene mutation occurs, which of the following may be altered, resulting in the production of a non-functional protein?

- 1 amino acid sequence
- 2 DNA nucleotide sequence
- 3 mRNA nucleotide sequence

- A 1, 2 and 3    B 1 and 2 only    C 2 and 3 only    D 2 only
- 



920. 9700\_w16\_qp\_13 Q: 18

Gene mutations in either the *BRCA1* or the *BRCA2* genes are responsible for the majority of hereditary breast cancer in humans.

The proteins produced by the two genes migrate to the nucleus where they interact with other proteins, such as those produced by the tumour suppressor gene, *p53*, and the DNA repair gene, *RAD51*.

Which combination of gene activity is most likely to result in breast cancer?

	gene		
	<i>BRCA1</i> or <i>BRCA2</i>	<i>p53</i>	<i>RAD51</i>
<b>A</b>	✓	✓	✓
<b>B</b>	✓	✓	✗
<b>C</b>	✓	✗	✓
<b>D</b>	✗	✗	✗

key

✓ = gene produces normal protein

✗ = gene produces abnormal protein or no protein

921. 9700\_w16\_qp\_13 Q: 22

The following events occur during transcription.

- 1 Bonds break between complementary bases.
- 2 Bonds form between complementary bases.
- 3 Sugar-phosphate bonds form.
- 4 Free nucleotides pair with complementary nucleotides.

Before the mRNA molecule leaves the nucleus, which events will have occurred twice?

- A** 1, 2, 3 and 4    **B** 1, 3 and 4 only    **C** 2, 3 and 4 only    **D** 1 and 2 only

922. 9700\_s15\_qp\_12 Q: 20

What is needed to transcribe DNA?

- A** DNA ligase
- B** DNA polymerase
- C** ribosomes
- D** RNA polymerase

923. 9700\_s15\_qp\_12 Q: 21

In a ribosome, which bond holds together two adjacent amino acids?

- A disulfide
- B hydrogen
- C ionic
- D peptide

---

924. 9700\_s15\_qp\_13 Q: 4

Ribosomes exist as separate subunits that bind together during protein synthesis.

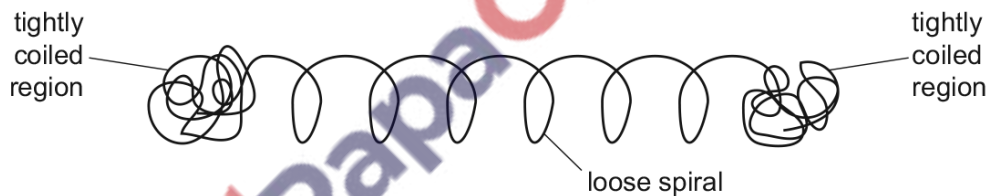
What do these subunits consist of?

- A mRNA and protein
- B mRNA and tRNA
- C rRNA and protein
- D rRNA and tRNA

---

925. 9700\_s15\_qp\_13 Q: 11

The protein glutenin gives bread dough its elasticity. The diagram represents a polypeptide of glutenin.



What describes the structure of glutenin?

- A quaternary structure because there are both globular and fibrous regions
  - B quaternary structure because there are both spiral and tightly coiled regions
  - C secondary structure because the loose spiral is an  $\alpha$ -helix
  - D tertiary structure because the different regions form a 3D shape
-

926. 9700\_s15\_qp\_13 Q: 21

Which row shows two pairs of nucleotides formed when mRNA is translated?

	first base pair translated		second base pair translated	
	bases present	number of hydrogen bonds	bases present	number of hydrogen bonds
<b>A</b>	AT	2	TU	2
<b>B</b>	AU	2	AT	2
<b>C</b>	AU	2	GC	3
<b>D</b>	AU	3	GC	3

927. 9700\_s15\_qp\_13 Q: 22

Sickle cell anaemia is caused by a mutation in an allele of the gene that codes for the  $\beta$ -globin polypeptide of haemoglobin.

The diagram shows the sequence of bases in a small section of the coding strand of DNA for both the HbA (normal) and HbS (sickle cell)  $\beta$ -globin alleles.

HbA CTGACTCCTGAGGAGAAGTCT

HbS CTGACTCCTGTGGAGAAGTCT

How will the mutation in the HbS allele result in the production of an altered version of the  $\beta$ -globin polypeptide?

- A** A tRNA molecule with the anticodon GUG will hydrogen bond to the altered codon on mRNA.
- B** All the amino acids coded for after the mutation will differ from those in the HbA protein.
- C** mRNA transcribed from the HbS allele will contain the codon CAC instead of the codon CTC.
- D** The ribosome will be unable to continue translation of the HbS mRNA after the altered codon.

928. 9700\_w15\_qp\_11 Q: 20

The statements describe the features of some nucleic acids.

- 1 carry an amino acid to a ribosome
- 2 carry a genetic code sequence out of the nucleus
- 3 carry a genetic code sequence to a ribosome

Which functions are carried out **only** by mRNA?

- A** 1, 2 and 3    **B** 1 and 2 only    **C** 1 and 3 only    **D** 2 and 3 only

929. 9700\_w15\_qp\_11 Q: 21

The antibiotic chloramphenicol prevents prokaryotes from reproducing by inhibiting the enzyme which catalyses the formation of peptide bonds during translation.

What will be prevented by the action of this antibiotic?

- A** binding of amino acids to tRNA
  - B** condensation of amino acids
  - C** pairing between codons and anticodons
  - D** positioning of amino acids by tRNA
- 

930. 9700\_w15\_qp\_12 Q: 19

Which metabolic processes will be very active in a cell that has just completed cytokinesis?

- 1 ATP formation
- 2 DNA replication
- 3 protein synthesis

- A** 1, 2 and 3    **B** 1 and 3 only    **C** 2 only    **D** 3 only
- 

931. 9700\_w15\_qp\_12 Q: 20

What occurs during DNA replication and transcription and translation?

- 1 ATP provides energy.
- 2 Condensation reactions occur to form a polymer.
- 3 Hydrogen bonds form between purine and pyrimidine bases.

- A** 1, 2 and 3    **B** 1 and 2 only    **C** 2 only    **D** 3 only
- 

932. 9700\_w15\_qp\_12 Q: 21

Ricin is a toxic protein which inactivates ribosomes.

Which effect will this have on protein synthesis?

- A** Amino acids will be unable to bind to the binding sites on specific tRNA molecules.
  - B** Anticodons on mRNA molecules will not base pair to codons on tRNA molecules.
  - C** Peptide bonds will not form between adjacent amino acids in the growing polypeptide.
  - D** RNA nucleotides will be unable to join by condensation reactions to form rRNA.
-

933. 9700\_w15\_qp\_13 Q: 21

Some antibiotics kill prokaryotes by binding to RNA polymerase.

What effect will this have on protein synthesis?

- A** Codons on mRNA will be unable to hydrogen bond to complementary anticodons on tRNA.
  - B** Condensation reactions joining RNA nucleotides will not take place to form mRNA.
  - C** DNA will not unwind and unzip to allow for base-pairing with RNA nucleotides.
  - D** Free RNA nucleotides will not base-pair to exposed bases on the DNA template strand.
- 

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