Cambridge International AS & A Level

BIOLOGY (9700) PAPER 2

Past Paper Questions By Topic
+ Answer Scheme

2015 - 2020

Complete Syllabus

PapaCambridge

Chapter 6

Nucleic acids and protein synthesis

6.1 Structure and replication of DNA

66. 9700_s20_qp_22 Q: 1

Picornaviruses are small viruses that are 30 nm in diameter. Picornaviruses are able to enter the cells of mammals and birds and can replicate within these cells.

Fig. 1.1 shows the entry of a picornavirus into its host cell.

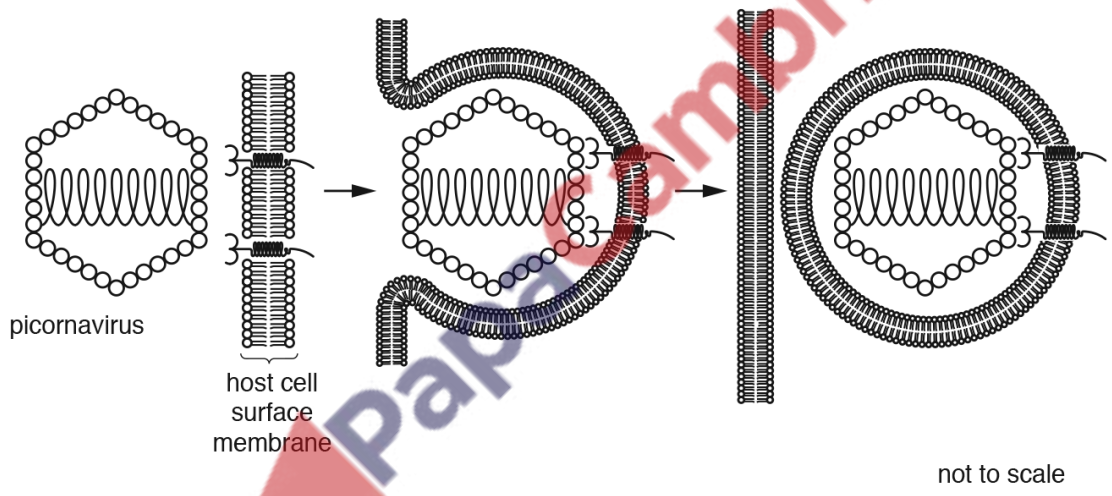

Fig. 1.1

(a) State the key features of a virus, such as picornavirus.

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..... [2]

(b) State, with reasons, whether a picornavirus can be seen using the light microscope.

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..... [3]

(c) With reference to Fig. 1.1, describe how the picornavirus enters the host cell.

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..... [3]

[Total: 8]

67. 9700_m19_qp_22 Q: 6

Plant and animal cells carry out mitosis to form two genetically identical cells from one original cell.

(a) State **other** reasons why mitosis is important in **both** plants and animals.

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..... [2]

(b) Plant cells require microtubules to form structures that are needed for mitosis.

Name **one** of these structures.

..... [1]

(c) During the mitotic cell cycle, free nucleotides are used for the synthesis of both types of nucleic acid: RNA and DNA.

Complete sentences **A**, **B**, **C** and **D** to provide information about nucleotides and the synthesis of nucleic acids.

Write the correct term in the spaces provided in each sentence.

A Each nucleotide has three main components: a ..... group, a ..... (5 carbon) sugar and a nitrogenous organic base.

B The nitrogenous organic base of a nucleotide is either a purine or a ..... .

C In a DNA nucleotide, the sugar is deoxyribose and in an RNA nucleotide the sugar is ..... .

D The synthesis of RNA from a template strand of DNA is known as ..... .

[5]

(d) A virus named *Pandoravirus salinus* was discovered in 2013 by French scientists.

The virus was so large that the scientists initially thought that *P. salinus* was a bacterium.

P. salinus was confirmed to be a virus after further research.

(i) List **three** key features of viruses.

1 .....

2 .....

3 .....

[3]

(ii) The dimensions of viruses are usually stated in nanometres (nm).

As *P. salinus* is so big, it has been described as 1 μm long and 0.5 μm wide.

Convert the **width** of *P. salinus* to nanometres.

width = ... nm [1]

[Total: 12]

68. 9700_s19_qp_23 Q: 1

Fig. 1.1 is a diagram showing the structure of a section of a DNA molecule.

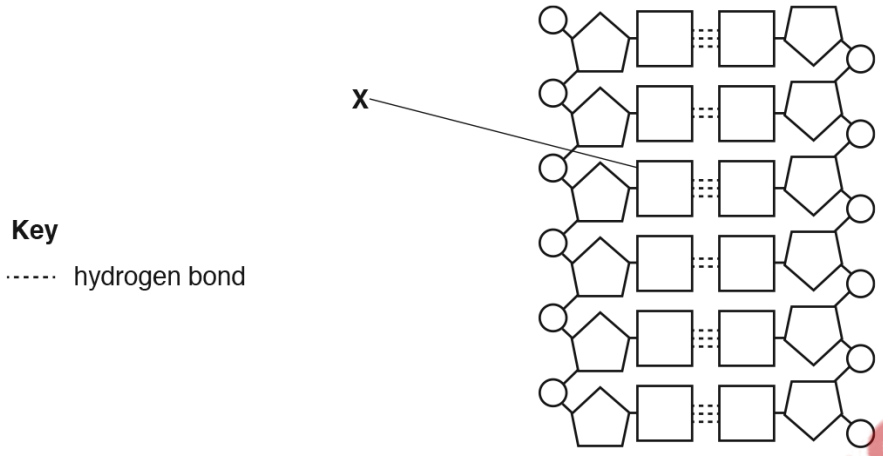

Fig. 1.1

(a) Draw a circle around **one** monomer of DNA in Fig. 1.1. [1]

(b) Name the two bases forming the base pair at **X** in Fig. 1.1 **and** give a reason for your answer.

bases .....

reason .....

.....

.....

..... [2]

(c) The statements 1–5 describe events that occur during DNA replication.

1 DNA polymerase forms a phosphodiester bond
2 DNA double helix forms
3 hydrogen bonds break
4 hydrogen bonds form
5 two strands of the double helix separate

Write the numbers 1 to 5 in the spaces below to show the order in which these events occur.
The first one has been done for you.

3 .... [1]

(d) The telomere is a region found at the end of a chromosome.

Outline the function of telomeres.

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..... [2]

[Total: 6]

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69. 9700_w19_qp_22 Q: 4

Carbohydrates, proteins and nucleic acids are types of biological molecule. Within each type, there are examples of molecules that can be described as polymers.

(a) A polymer is a large molecule composed of smaller repeating molecules known as monomers.

Complete Table 4.1 to produce a summary of some named biological polymers.

Table 4.1

polymer	constituent monomer	type of bond between monomers
amylose	glucose	
cellulose	glucose	
collagen		peptide
DNA	DNA nucleotide	
glycogen		glycosidic

[4]

(b) Explain why an amylose molecule and a cellulose molecule have very different structures, even though they both have glucose as the constituent monomer.

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..... [2]

(c) Polymerisation of DNA nucleotides occurs during the semi-conservative replication of a molecule of DNA during interphase.

Describe the semi-conservative replication of DNA.

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..... [5]

[Total: 11]

70. 9700_m18_qp_22 Q: 6

In a dividing cell, DNA replication occurs before mitosis.

(a) Steps in DNA replication are outlined in Fig. 6.1.

Complete Fig. 6.1 by filling in the gaps using the most appropriate terms.

1	Helicase enzyme allows the DNA double helix to unwind and the hydrogen bonds between the two strands to break, exposing the four bases, ... (A), ... (T), ... (C) and ..... (G).
2	An enzyme molecule attaches to each of the two separated parental strands. The two enzyme molecules move in opposite directions, each catalysing the formation of a new strand of DNA. This enzyme is known as ..... .
3	DNA ..... , the monomers of DNA, are activated with two additional phosphates and are free in the nucleus for the synthesis of the new strands.
4	The bases of the DNA monomers form hydrogen bonds with the bases on each separated parental strand of DNA, according to the rules of ..... .
5	One DNA strand is synthesised continuously and the other is synthesised in sections known as Okazaki fragments. The fragments are joined by an enzyme, ... , which catalyses the formation of phosphodiester bonds.
6	The result of replication is two DNA molecules, each one containing an original parental strand and a newly synthesised strand. This type of replication is described as ..... .

Fig. 6.1

[6]

(b) Fig. 6.2 is a photomicrograph of root tip cells at different stages in the cell cycle. A cell in interphase is labelled.

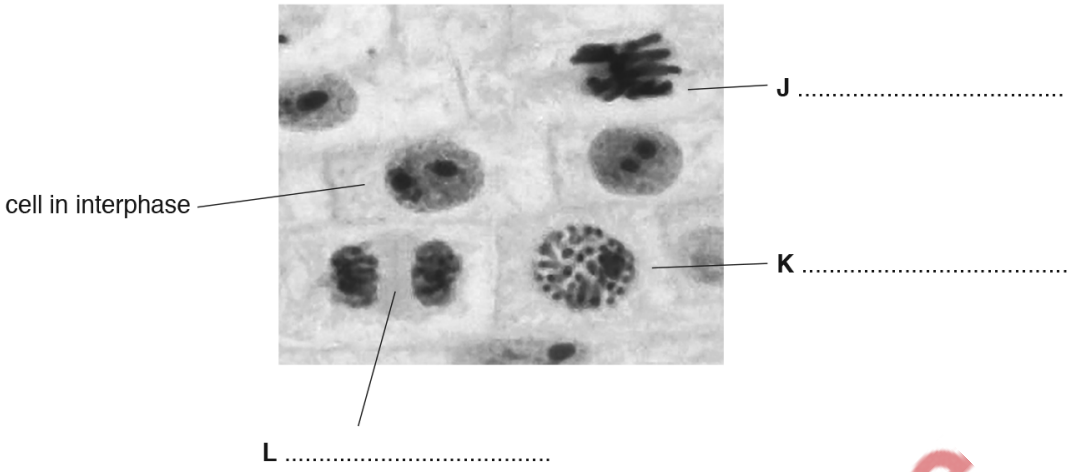

Fig. 6.2

(i) Name the stage of mitosis shown in each of cells **J**, **K** and **L** in Fig. 6.2.

Write your answer in the space next to each letter on Fig. 6.2. [3]

(ii) Explain how it is possible to deduce that the labelled cell in interphase shown in Fig. 6.2 is in late, rather than early, interphase.

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.....

..... [1]

(iii) Describe the stage of mitosis shown in cell **J**.

.....

.....

.....

..... [2]

[Total: 12]

71. 9700_s17_qp_23 Q: 5

(a) Describe the process of DNA replication.

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.....[5]

(b) State the name of the part of the chromosome that prevents the loss of genes during DNA replication.

.....[1]

(c) During DNA replication, the use of an incorrect base in the newly synthesised strand can lead to a mutation.

(i) A transversion event is where a pyrimidine is used in the newly synthesised strand instead of a purine, or the other way round.

Name the **two** possible bases that could be used instead of cytosine in a transversion event.

.....[1]

(ii) A transition event is where an incorrect purine is used or an incorrect pyrimidine is used.

Suggest why transversion events are **less** likely to occur than transition events.

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.....[2]

(d) Outline how mutations can cause healthy cells to become tumour cells.

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.....[3]

[Total: 12]

72. 9700_w16_qp_22 Q: 3

High fructose corn syrup, made from maize, can be used as a replacement for sucrose to sweeten food and drink products.

Commercial production of high fructose corn syrup involves the enzyme glucose isomerase, extracted from bacteria.

(a) Fructose and sucrose are both sugars.

State two structural differences between fructose and sucrose.

1 .....

.....

.....

2 .....

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.....[2]

(b) The glucose isomerase used in the production of high fructose corn syrup is extracted from a strain of a bacterium, *Thermus thermophilus*, which is found in hot springs. The enzyme has an optimum temperature of 95 °C.

Suggest **and** explain the advantages of using glucose isomerase from *T. thermophilus* to produce high fructose corn syrup, rather than using glucose isomerase that has an optimum temperature of 37 °C.

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.....[3]

(c) The commercial production of high fructose corn syrup uses immobilised glucose isomerase.

Fig. 3.1 shows the effect of pH on the activity of immobilised glucose isomerase compared to glucose isomerase free in solution.

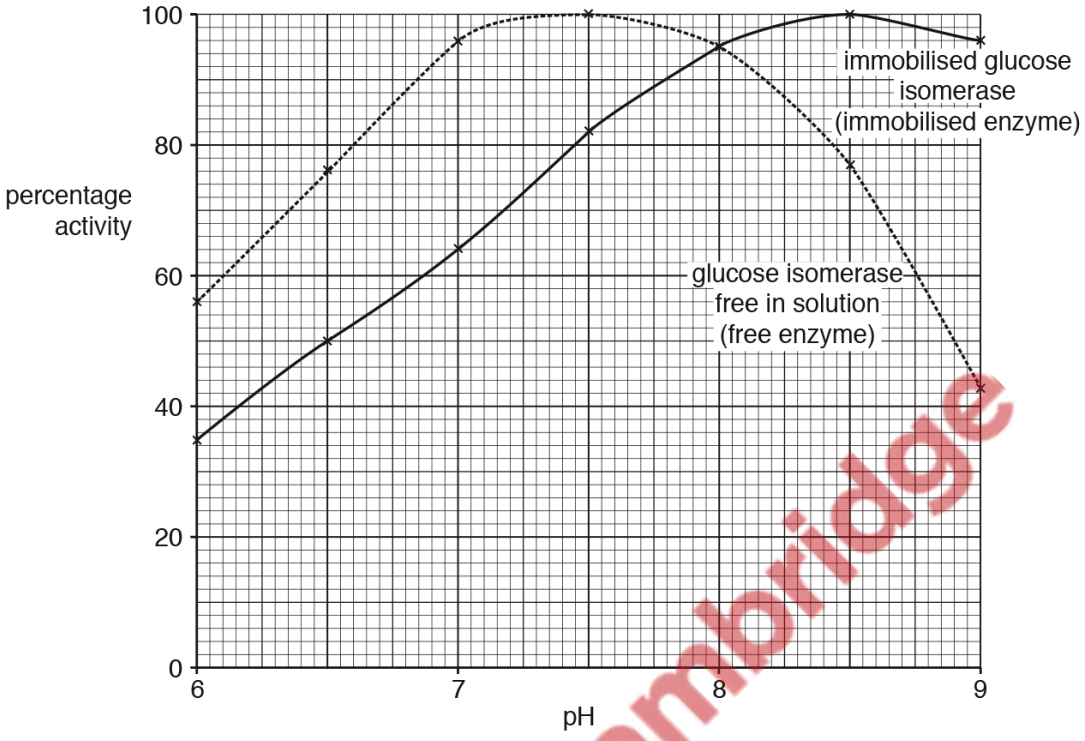

Fig. 3.1

With reference to Fig. 3.1, describe the differences shown between the immobilised enzyme and the free enzyme as pH changes.

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.....[3]

(d) The amino acid sequence of the enzyme glucose isomerase has been determined. The first five amino acids of this sequence are shown in Table 3.1.

Table 3.2 (on page 11) shows the genetic code (mRNA codons).

A student was asked to use Table 3.2 to work out an mRNA nucleotide sequence that would correspond to the first five amino acids of glucose isomerase. The student's sequence is shown in Table 3.1.

Table 3.1

amino acid sequence	met	tyr	glu	pro	lys
student's nucleotide sequence	AUG	UAU	GAC	CCU	UGU
correct = ✓ incorrect = ✗					

(i) Complete Table 3.1 using a ✓ or a ✗ to indicate whether the student has used Table 3.2 correctly to identify the codons for each amino acid in the nucleotide sequence. [1]

(ii) Discuss, with reasons, how an mRNA nucleotide sequence worked out to correspond to the first five amino acids using Table 3.2 may not be the same as the mRNA nucleotide sequence for those amino acids present in the bacterial cell.

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.....[3]

Table 3.2

first position	second position				third position
	U	C	A	G	
U	phe	ser	tyr	cys	U
	phe	ser	tyr	cys	C
	leu	ser	STOP	STOP	A
	leu	ser	STOP	trp	G
C	leu	pro	his	arg	U
	leu	pro	his	arg	C
	leu	pro	gln	arg	A
	leu	pro	gln	arg	G
A	ile	thr	asn	ser	U
	ile	thr	asn	ser	C
	ile	thr	lys	arg	A
	met	thr	lys	arg	G
G	val	ala	asp	gly	U
	val	ala	asp	gly	C
	val	ala	glu	gly	A
	val	ala	glu	gly	G

[Total: 12]

73. 9700_w15_qp_21 Q: 3

Fig. 3.1 is a light micrograph of cells in the root tip of the garlic plant *Allium sativum*. It has a diploid number (2n) of 16.

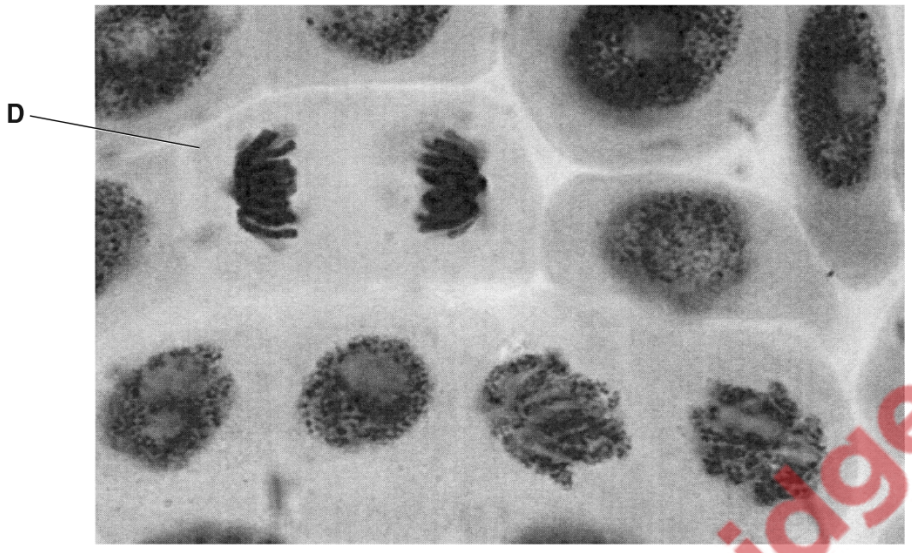

Fig. 3.1

(a) Name the stage of mitosis shown in cell **D**.

..... [1]

(b) Explain why mitosis occurs in a plant such as *A. sativum*.

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..... [2]

(c) **(i)** State the haploid number of *A. sativum*.

..... [1]

(ii) Explain why a plant such as *A. sativum* produces haploid cells.

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..... [3]

(d) DNA replication must occur before cell division.

Describe the process of DNA replication.

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..... [5]

[Total: 12]

6.2 Protein synthesis

74. 9700_s20_qp_21 Q: 6

Fig. 6.1 shows the formation of a polypeptide during translation in a eukaryotic cell.

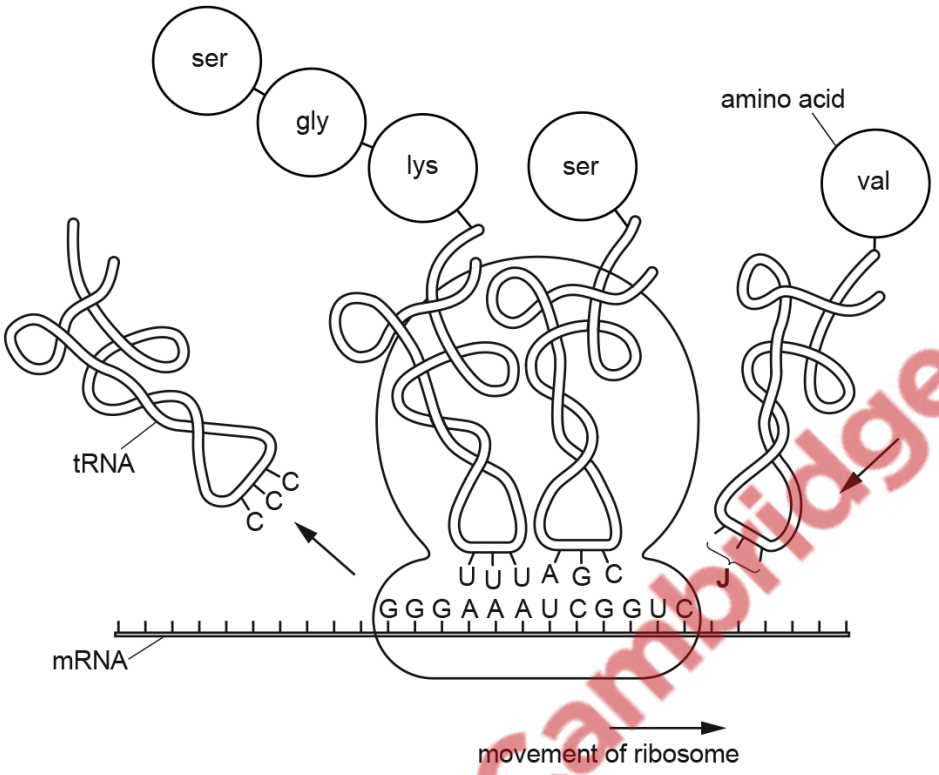

Fig. 6.1

(a) Name the purine bases shown in Fig. 6.1.

..... [1]

(b) State the name given to the group of three bases found at **J** on the tRNA molecule.

..... [1]

(c) Identify the three bases at **J**.

..... [1]

(d) State how the three bases at **J** on tRNA interact with the bases on mRNA.

..... [1]

[Total: 4]

75. 9700_s20_qp_23 Q: 5

Blood cells are formed from tissue stem cells in the bone marrow. These bone marrow stem cells go through a number of mitotic cell cycles to form the fully functioning blood cell.

Fig. 5.1 shows the three main stages of the cell cycle.

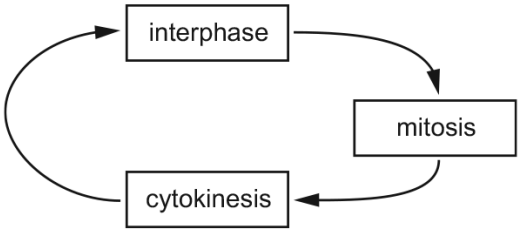

Fig. 5.1

The activity of genes changes during the mitotic cell cycle.

When genes are being expressed, the cell produces many messenger RNA (mRNA) molecules and ATP molecules.

(a) Explain what is meant by a gene.

.....

.....

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..... [2]

(b) Name the main stage of the cell cycle in Fig. 5.1 during which most mRNA and ATP is formed.

..... [1]

(c) Fig. 5.2 is an incomplete diagram of an ATP molecule.

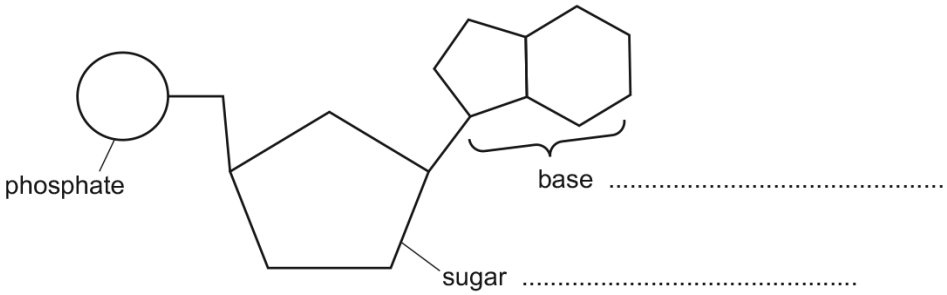

Fig. 5.2

(i) On Fig. 5.2:

- complete the diagram of the ATP molecule
- write the name of the base in the space provided
- write the name of the sugar in the space provided.

[3]

(ii) The base shown in Fig. 5.2 has a double ring structure.

State the term for a base that has a double ring structure.

..... [1]

(d) Suggest **and** explain the role of mitosis in the formation of blood cells by the bone marrow stem cells.

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..... [3]

[Total: 10]

76. 9700_w20_qp_21 Q: 6

(a) Mutations in body cells can sometimes result in a tumour. Some tumours are cancerous.

(i) Outline how mutations can result in the development of a tumour.

.....

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..... [2]

(ii) Tumour cells have antigens on their cell surface that are not present on non-tumour cells.

These antigens are the result of gene mutations and are known as tumour specific antigens (TSA).

One type of TSA differs in structure from the protein found on the cell surface of non-tumour cells by a single amino acid.

Explain how a gene mutation could result in the production of this TSA.

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..... [2]

(b) Immunotherapy is a form of treatment for cancer which aims to stimulate the immune system to destroy tumour cells.

One form of immunotherapy for cancer uses a vaccine which contains one specific type of TSA.

(i) Describe how vaccination with a specific type of TSA could lead to the destruction of tumour cells by T-lymphocytes in the body.

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.....

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..... [3]

(ii) Vaccines that contain tumour cells instead of a TSA are being developed for use during immunotherapy. Tumour cells are removed from a patient's body and used in a vaccine for the patient.

Suggest **one** advantage and **one** disadvantage of using a patient's tumour cells in a vaccine rather than a TSA.

advantage .....

.....

.....

disadvantage .....

.....

.....

[2]

[Total: 9]

77. 9700_w20_qp_23 Q: 5

A molecule of collagen consists of three identical polypeptides that form a triple helix.

The amino acid glycine forms one third of the amino acids in a collagen molecule.

Fig. 5.1**A** shows a polypeptide molecule during protein synthesis. A molecule of glycine is shown just before it is added to the polypeptide.

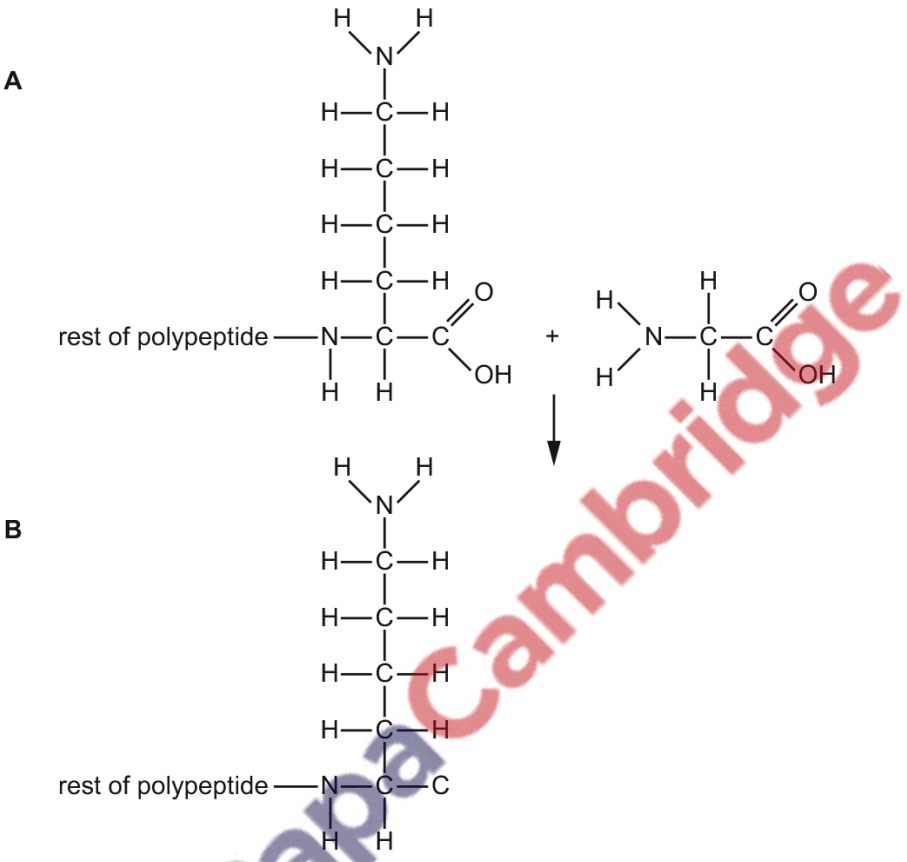

Fig. 5.1

(a) (i) Complete Fig. 5.1**B** to show the molecule of glycine added to the end of the polypeptide. [2]

(ii) State the type of reaction that occurs when glycine is added to the end of the polypeptide.

..... [1]

(iii) Explain the importance of glycine in a collagen molecule.

.....

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.....

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..... [2]

(b) Collagen is a fibrous protein.

Explain how the structure of collagen is related to its functions within the mammalian body.

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..... [4]

(c) The enzyme collagenase catalyses the breakdown of collagen molecules. This enzyme acts by using an induced fit mechanism.

Describe the mode of action of collagenase.

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..... [5]

(d) Students investigated the effect of pH on the activity of collagenase extracted from the bacterium *Bacillus licheniformis* at 50 °C.

The results are shown in Fig. 5.2.

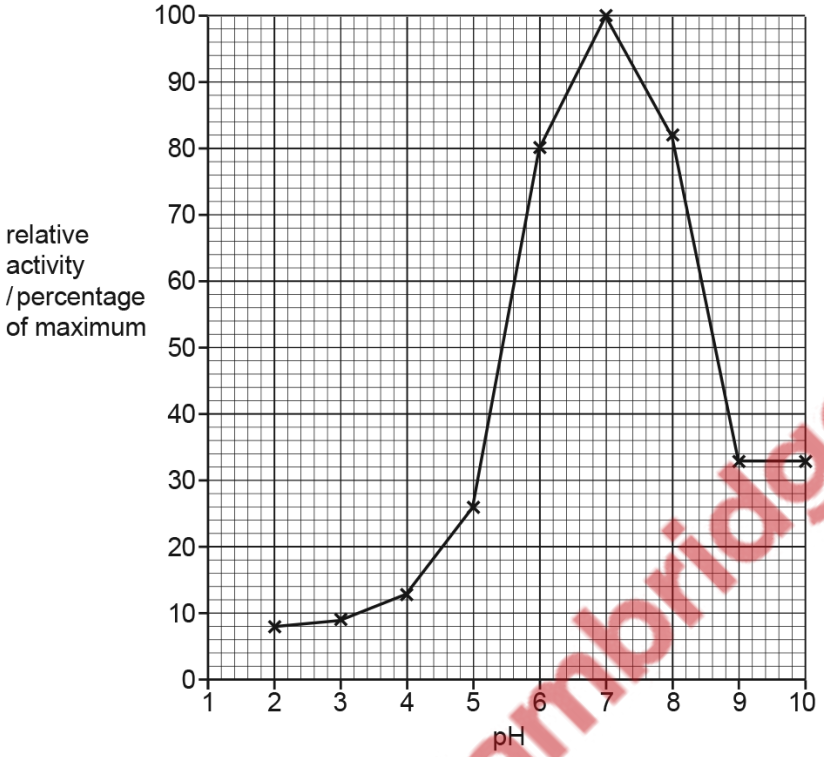

Fig. 5.2

With reference to Fig. 5.2, describe **and** explain the effect of pH on the activity of collagenase.

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..... [4]

[Total: 18]

78. 9700_s19_qp_21 Q: 6

(a) The DNA in the nucleus is known as nuclear DNA.

(i) In the cells of the grasshopper, *Chorthippus brunneus*, 20% of the nucleotides in nuclear DNA contain thymine.

Calculate the percentage of nucleotides in the nuclear DNA of *C. brunneus* that contain guanine **and** explain your answer in terms of the structure of DNA.

percentage .....

explanation .....

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..... [3]

(ii) State another location, **other than** the nucleus, where DNA occurs in cells of *C. brunneus*.

..... [1]

(b) Fig. 6.1 is a diagram of a molecule of tRNA.

The region labelled **R** shows detail of part of the tRNA molecule.

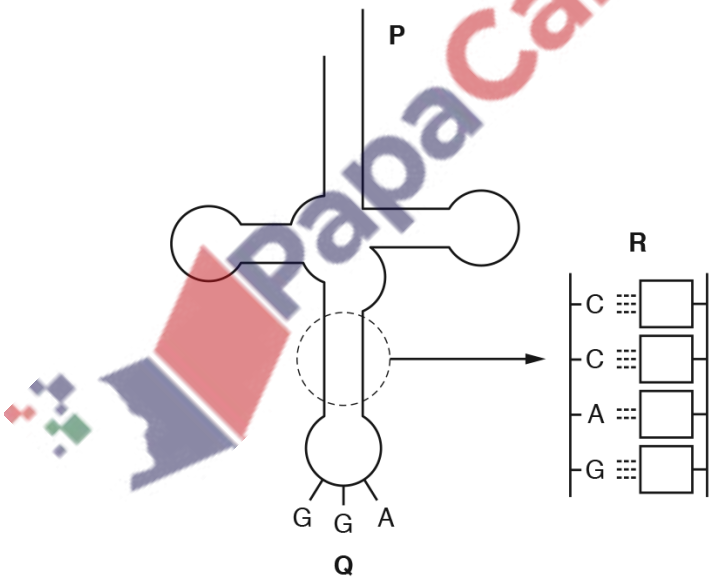

Fig. 6.1

(i) Complete Fig. 6.1 by writing the sequence of bases in the region labelled **R**. [1]

(ii) State the name of region **Q and** explain the role of region **Q** in translation.

name .....

explanation .....

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.....

..... [3]

(iii) State the function of region **P**.

.....

.....

..... [1]

[Total: 9]

79. 9700_s18_qp_22 Q: 2

In 1953, James Watson and Francis Crick published details about the structure of DNA. They used experimental results from other scientists to help them work out the structure and then built a model of a section of a DNA molecule, using pieces of wire and metal, with clamp stands to hold the model in place. This is shown in Fig. 2.1.

Fig. 2.1

(a) Watson and Crick used results from work carried out by Erwin Chargaff. He found that the proportions of the bases A, T, C and G were different in different species, but **within** each species:

- the proportion of A was equal to the proportion of T
- the proportion of G was equal to the proportion of C.

(i) Name the bases A, T, G and C.

A .....

T .....

G .....

C .....

[2]

(ii) Suggest **and** explain how Chargaff's findings helped Watson and Crick work out the structure of DNA.

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.....[3]

(b) Phoebus Levene isolated the nucleotides of DNA and identified the carbohydrate component of each nucleotide.

State the name of this carbohydrate component.

.....[1]

(c) Before the discovery of the structure of DNA as the molecule of inheritance, scientists thought that proteins were most likely to be the molecules that carried information.

Suggest how the structure of proteins made scientists think that these were the molecules that carried information.

.....

.....

.....

.....

.....[2]

[Total: 8]

80. 9700_w18_qp_22 Q: 5

DNA and RNA are nucleic acids.

(a) Explain why RNA can be described as a polymer **and** as a macromolecule.

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..... [2]

(b) The sugar component of DNA is a reducing sugar.

Outline the test for reducing sugars **and** describe the observations for a positive result.

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..... [2]

(c) Nucleotides are structural components of nucleic acids. Each nucleotide consists of a pentose sugar, a phosphate group and a nitrogenous organic base.

Complete Table 5.1 to compare DNA nucleotides with RNA nucleotides as structural components of nucleic acids.

Table 5.1

feature	DNA nucleotides	RNA nucleotides
pentose sugar component		
purine bases		
pyrimidine bases		

[3]

[Total: 7]

81. 9700_w18_qp_23 Q: 3

(a) Fig. 3.1 is a diagram of a monomer of the nucleic acid, messenger RNA.

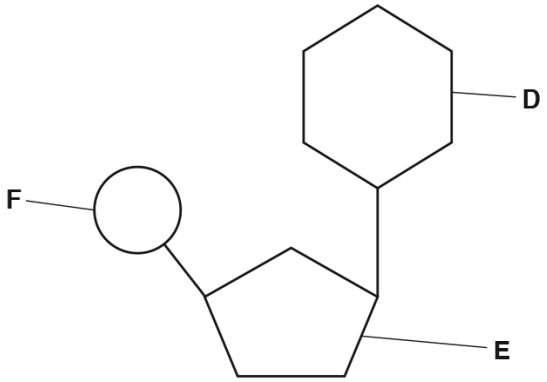


Fig. 3.1

(i) Name **D**, **E** and **F** in Fig. 3.1.

D .....

E .....

F .....

[3]

(ii) State **one** way in which the **structure** of DNA differs from the structure of messenger RNA.

.....

..... [1]

(b) Telomeres are repeating sequences of bases located at the ends of DNA molecules. These repeating sequences do not code for proteins.

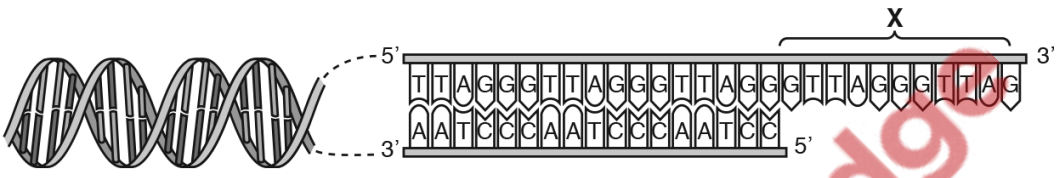
The enzyme telomerase ensures that telomeres do not shorten each time DNA is replicated.

Fig. 3.2**A** shows the end of a DNA molecule during replication. DNA polymerase cannot attach to the region labelled **X**, so it cannot complete the synthesis of the new strand without the action of telomerase.

Telomerase synthesises additional lengths of DNA that are added to the telomere. These additional lengths are used by DNA polymerase to complete the process of replication.

Fig. 3.2**B** is an enlarged view of region **X** to show the action of the enzyme telomerase.

A



B

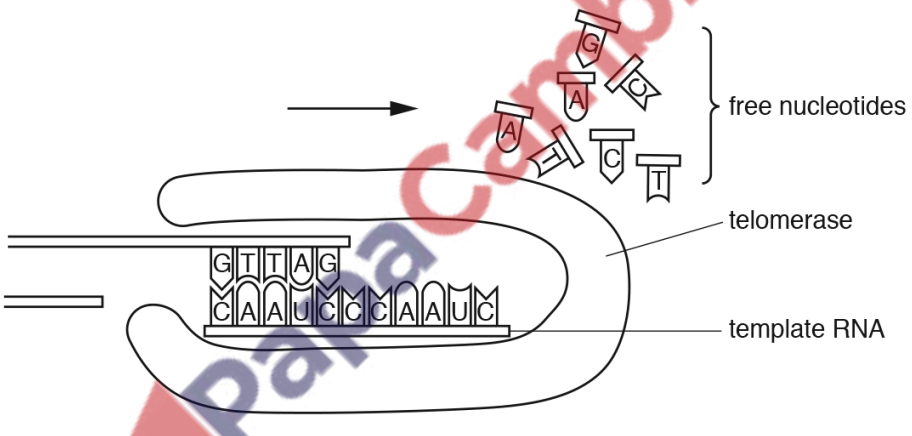


Fig. 3.2

Telomerase contains a short length of RNA that acts as a template for the synthesis of DNA as shown in Fig. 3.2**B**.

Explain how a molecule of telomerase synthesises additional lengths of DNA.

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..... [4]

(c) Telomerase is not present in prokaryotic cells.

Suggest why prokaryotes do not have telomerase.

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..... [1]

(d) One of the ways to diagnose lung cancer is to determine the concentration of telomerase in cells from the lining of the bronchus.

Explain why determining the activity of telomerase may be useful in the diagnosis of lung cancer.

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..... [2]

[Total: 11]

82. 9700_s17_qp_21 Q: 4

(a) Fig. 4.1 shows part of a DNA molecule.

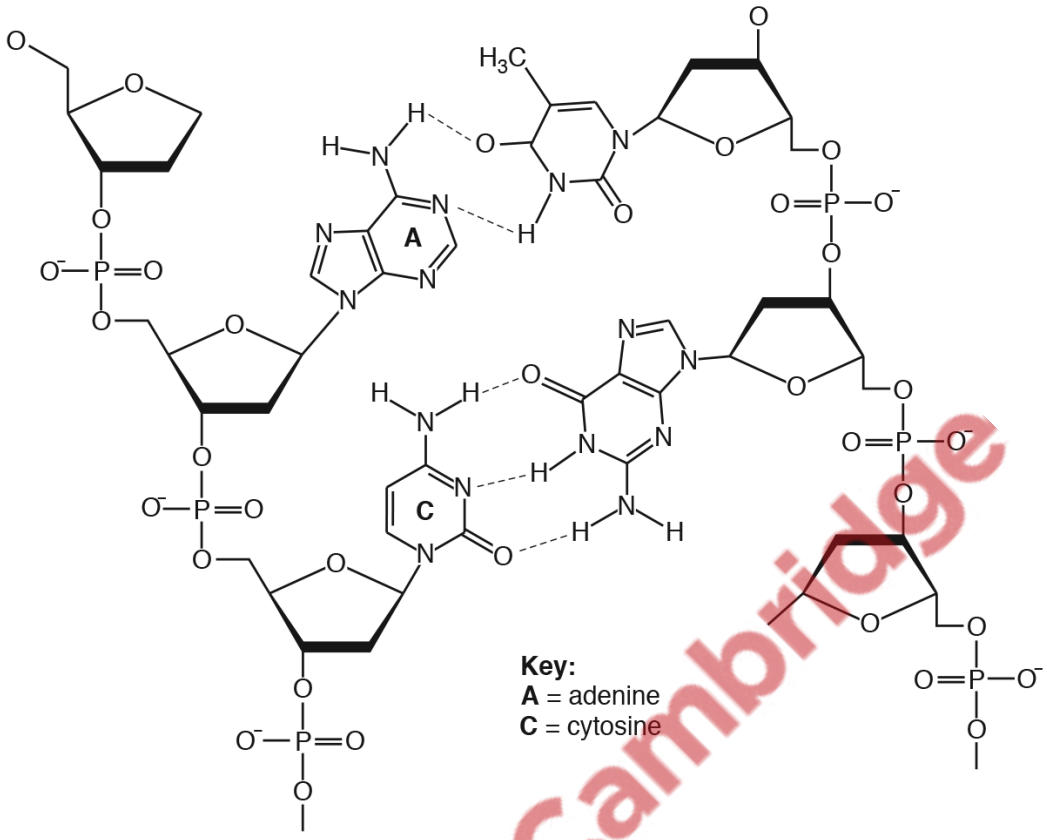

Fig. 4.1

Use Fig. 4.1 to explain how the structure of mRNA differs from the structure of DNA.

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.....[4]

(b) Fig. 4.2 shows:

- the first seven amino acids of the β chain of haemoglobin
- the first amino acid in the sequence is valine (Val)
- the 21 base pairs in the sequence of DNA that code for these seven amino acids.

amino acid sequence	Val	His	Leu	Thr	Pro	Glu	Glu
base sequence in DNA	CAC	GTG	GAC	TGA	GGA	CTC	CTC
	GTG	CAC	CTG	ACT	CCT	GAG	GAG

Fig. 4.2

Table 4.1 shows the triplets of bases that code for seven amino acids.

Using Fig. 4.2 and Table 4.1, state what will happen to the sequence of amino acids in the first part of the β chain of haemoglobin:

(i) if the base pair at position 6 is deleted

.....

.....[1]

(ii) if the three base pairs at positions 7, 8 and 9 are deleted.

.....

.....[1]

Table 4.1

amino acid		DNA triplets
cysteine	(Cys)	TGT TGC
glutamic acid	(Glu)	GAA GAG
histidine	(His)	CAT CAC
leucine	(Leu)	CTT CTC CTA CTG
proline	(Pro)	CCT CCC CCA CCG
threonine	(Thr)	ACT ACC ACA ACG
valine	(Val)	GTT GTC GTA GTG
no amino acid	STOP	TAA TAG TGA

(c) DNA is involved in the processes of replication and transcription.

Complete Table 4.2 by using a tick (✓) to indicate which features apply to each of the processes. Use a cross (✗) for features that do **not** apply.

The first row has been completed for you.

Table 4.2

feature	replication	transcription
a single-stranded molecule is produced	✗	✓
hydrogen bonds are broken		
both strands of DNA act as templates		
phosphodiester bonds are formed		
DNA polymerase is used		

[4]

(d) Telomeres are parts of chromosomes. Describe the function of telomeres.

.....

.....

.....

.....

.....

.....[2]

(e) Describe the function of ribosomes in protein synthesis.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....[4]

[Total: 16]

83. 9700_s17_qp_23 Q: 2

Fig. 2.1 is a transmission electron micrograph of a cell from a leaf.

Fig. 2.1

(a) Use the scale bar to calculate the magnification of the image in Fig. 2.1.

Write down the formula that you will use and show your working.

formula

magnification × .....[3]

(b) Name structure **X** and state **one** function of this structure.

name .....

function .....

.....[2]

(c) Name two structures, **visible** in the cell in Fig. 2.1, that contain DNA.

1 .....

2 .....[2]

(d) Plant cells can be infected with viruses.

Fig. 2.2 shows the key features of a plant virus.

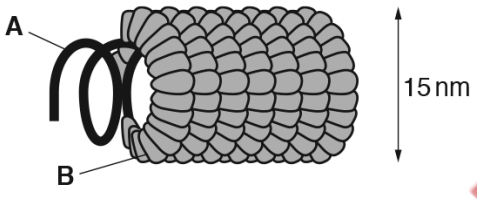

Fig. 2.2

Identify the structures labelled **A** and **B** in Fig. 2.2.

A .....

B .....[2]

(e) Some plant cells produce a polypeptide called systemin.

(i) Describe the role of DNA in the production of systemin.

.....

.....

.....

.....

.....[2]

(ii) Systemin stimulates plant cells to produce enzyme inhibitors known as serpins.

One of these serpins is a competitive inhibitor of some protease enzymes. It inhibits the protease enzymes found in herbivores, but does **not** inhibit the proteases in plants.

Suggest how this serpin inhibits **only** the protease enzymes in herbivores but **not** those in plants.

.....

.....

.....

.....

.....

.....

.....[3]

(iii) The presence of competitive inhibitors, such as serpins, increases the Michaelis-Menten constant (K_m) for the enzymes they inhibit.

Explain why the K_m value increases.

.....

.....[1]

[Total: 15]

84. 9700_w16_qp_23 Q: 4

Protein synthesis requires ribosomes, mRNA, tRNA, amino acids and enzymes.

Fig. 4.1 is a diagram of a molecule of tRNA.

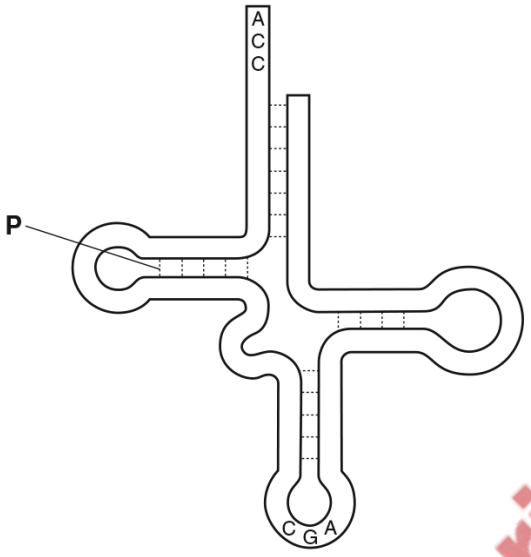

Fig. 4.1

(a) Name the bond labelled **P**.

.....[1]

(b) Use Fig. 4.1 to describe the role of tRNA in protein synthesis.

You may annotate Fig. 4.1 to help your answer.

.....

.....

.....

.....

.....

.....

.....[3]

(c) tRNA molecules are synthesised inside the nucleus of eukaryotic cells.

Outline the process by which tRNA molecules are synthesised in the nucleus.

.....

.....

.....

.....

.....

.....

.....[3]

[Total: 7]

85. 9700_s15_qp_21 Q: 6

Red blood cells are formed from cells called reticulocytes. Stem cells in the bone marrow produce reticulocytes which differentiate into red blood cells. During differentiation haemoglobin is produced.

Fig. 6.1 shows the structure of small sections of DNA and messenger RNA (mRNA) in the nucleus of a reticulocyte during transcription.

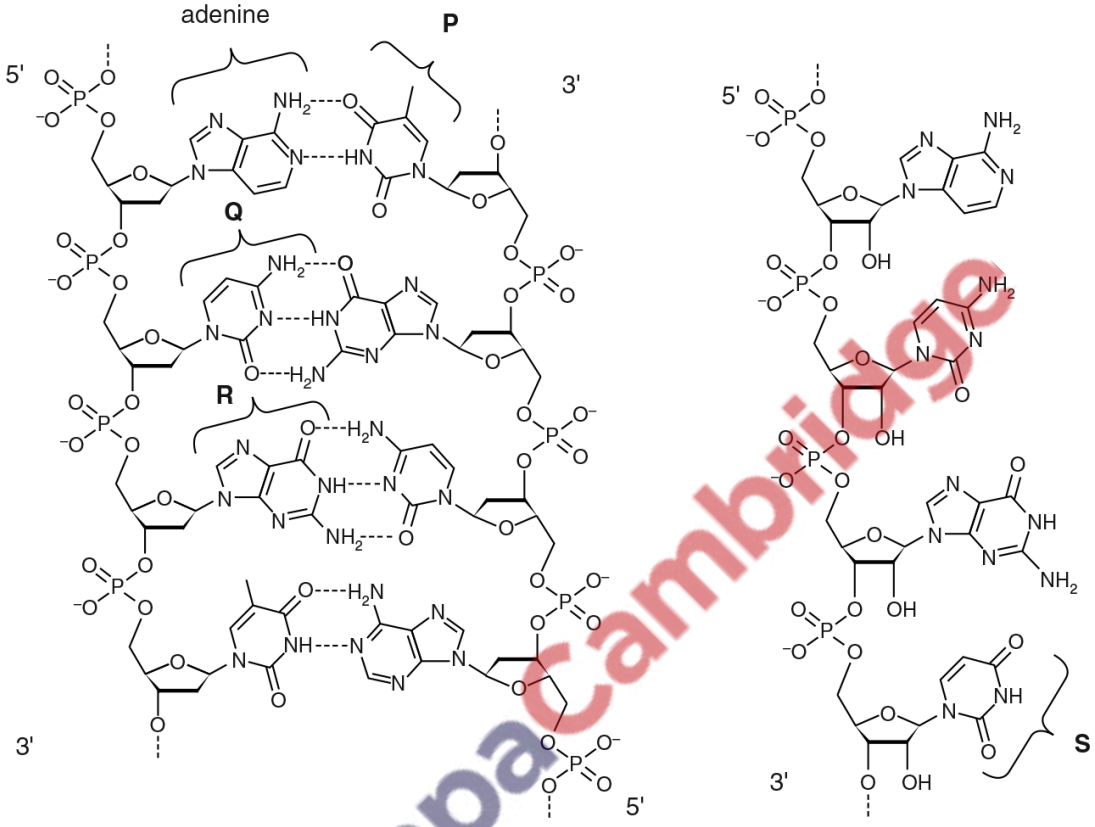

Fig. 6.1

(a) Name the bases **P** to **S**.

P .....

Q .....

R .....

S .....[4]

(b) Describe the role of the mRNA molecule shown in Fig. 6.1.

.....

.....

.....

.....

.....

.....

.....[3]

[Total: 7]

86. 9700_s15_qp_23 Q: 2

DNA replication is an important event in the cell cycle.

(a) State when, during the cell cycle, DNA replication occurs.

.....[1]

(b) Fig. 2.1 shows pairing between two bases, **X** and **Y**, in a DNA molecule.

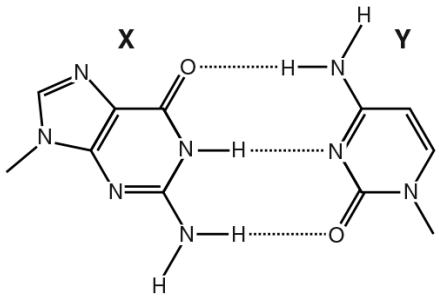

Fig. 2.1

(i) Name the type of bond shown by the dotted lines between the bases.

.....[1]

(ii) State which base, **X** or **Y**, is a pyrimidine **and** explain your answer.

.....

.....[1]

(c) The compound benzopyrene, found in tar from tobacco smoke, can become chemically changed in cells and interferes with DNA replication, causing gene mutations.

(i) State what is meant by the term *gene mutation*.

.....

.....

.....

.....

.....[2]

(ii) Mutations that occur in dividing cells of the gas exchange system may result in lung cancer.

Suggest the differences in the cell cycle of a cancer cell compared with that of a normal cell of the same type.

.....

.....

.....

.....

.....[2]

[Total: 7]