

1 One role of the skin is to protect the body from infection.

(a) (i) Explain how skin flora protect the body from infection.

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(ii) The skin produces lipids that protect the body from infection.

Place a cross in the box next to the correct explanation of how these lipids protect the body from infection.

(1)

- A** they are alkalis that kill bacteria
- B** they have antimicrobial properties that inhibit the growth of bacteria
- C** they are enzymes that destroy viruses
- D** they are water soluble and prevent viruses from replicating

(b) The skin contains a fibrous protein. This protein forms a barrier to the entry of microorganisms.

(i) Place a cross in the box next to the name of this protein.

(1)

- A** cytokine
- B** interferon
- C** keratin
- D** lysozyme

- (ii) The primary structure of a protein is important in determining its final structure and properties.

Describe the structure and properties of fibrous proteins.

(4)

- (iii) Describe the roles of the template (antisense) DNA strand and mRNA in determining the primary structure of a protein.

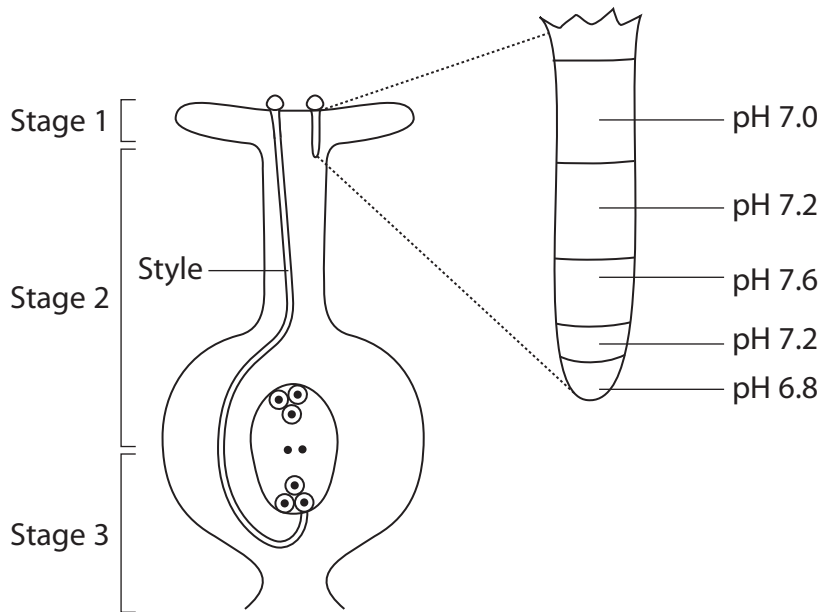
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(Total for Question 1 = 12 marks)

2 Sexual reproduction in plants includes the transfer and fusion of gametes.

The diagram below shows part of a flower with two pollen grains and their pollen tubes.

The diagram also shows an enlargement of one of the pollen tubes and the pH of the cytoplasm in each region of this tube.



(a) At stage 1, the pollen grain contains the haploid generative nucleus.
Explain what is meant by the term **haploid nucleus**.

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(b) Describe the changes in the pH of the pollen tube shown in the diagram.

(2)

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*(c) At stage 2, amino acids are absorbed into the cytoplasm of the pollen tube. These amino acids are used to synthesise proteins such as enzymes. These enzymes are transported through the cytoplasm and then secreted into the style.

Suggest what happens to the amino acids from when they are absorbed into the cytoplasm until they are secreted as enzymes into the style.

(5)

(d) During stage 3, the generative nucleus divides to form two male nuclei and the pollen tube fuses with the embryo sac.

Describe what happens to each of these two male nuclei.

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(Total for Question 2 = 11 marks)

3 Human immunodeficiency virus (HIV) causes the condition known as acquired immunodeficiency syndrome (AIDS) in humans.

(a) Complete the following table by placing a tick (✓) in the correct column next to each statement to show whether it is true or false.

(3)

Statement	True	False
HIV infects b-lymphocytes in the human immune system		
The genetic material in HIV is a form of RNA		
The enzyme, reverse transcriptase, is used by HIV		

(b) Following infection by HIV, the genetic material will be copied as the virus reproduces. A single virus reproduces at a very fast rate giving rise to billions of viruses in just one day.

During reproduction of HIV, many genetic mutations are produced. This means that many new strains of HIV can develop quickly within an infected person.

(i) Explain what is meant by the term **genetic mutation**.

(2)

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(ii) Suggest why effective treatment of HIV in human populations will require the continual development of a mixture of many new drugs.

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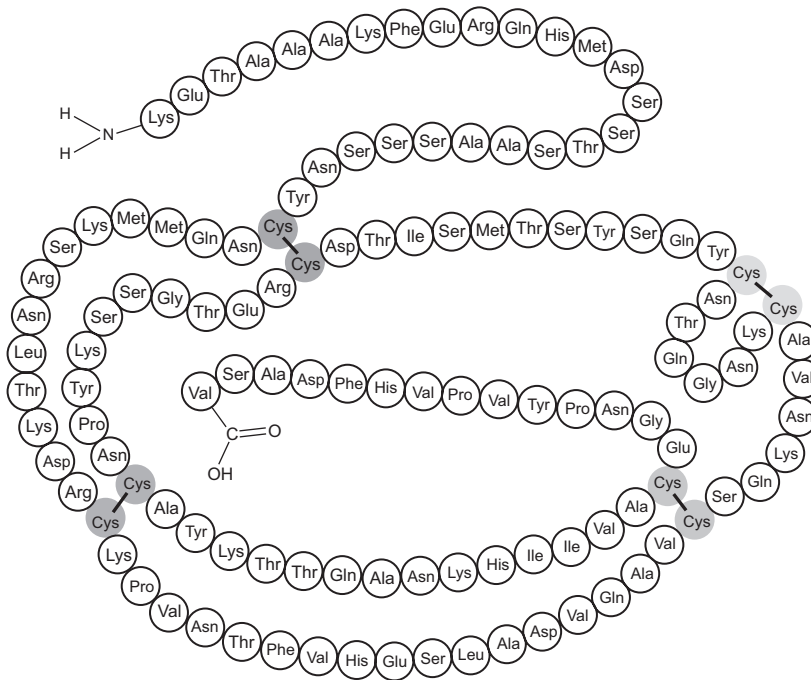
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(Total for Question 3 = 9 marks)

4 Enzymes, messenger RNA (mRNA) and transfer RNA (tRNA) are involved in the synthesis of proteins.

(a) The diagram below represents the structure of an enzyme.
Each circle represents an amino acid.



(i) An enzyme is a protein and has a primary structure.
Explain the meaning of the term **primary structure**.

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(ii) Using the diagram and your own knowledge of enzymes, explain the importance of the primary structure of an enzyme to its function.

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(b) Describe the roles of messenger RNA (mRNA) and transfer RNA (tRNA) in protein synthesis.

(i) Messenger RNA

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(ii) Transfer RNA

(3)

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(Total for Question 4 = 13 marks)

5 DNA and lipids are important molecules found in living organisms.

(a) A triglyceride is one type of lipid.

For each of the descriptions below, put a cross (☒) in the box that corresponds to the correct statement about lipids or triglycerides.

(i) Triglycerides are composed of:

(1)

3 glycerol molecules and 3 fatty acid molecules

1 glycerol molecule and 3 fatty acid molecules

1 glycerol molecule and 1 fatty acid molecule

3 glycerol molecules and 1 fatty acid molecule

(ii) The bond between a glycerol molecule and a fatty acid molecule is:

(1)

A glycosidic bond

A peptide bond

A phosphodiester bond

An ester bond

(iii) This bond is formed by:

(1)

Hydrolysis

Condensation

A chain reaction

An automatic reaction

(iv) Unsaturated lipids:

(1)

Do not have any double bonds

Have double bonds only between carbon atoms

Have double bonds between carbon atoms and between carbon and oxygen atoms

Have double bonds only between carbon and oxygen atoms

(v) Saturated lipids have:

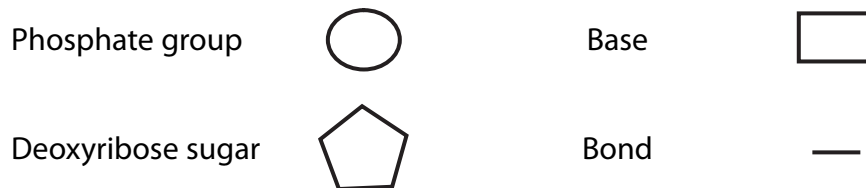
(1)

- More hydrogen atoms than unsaturated lipids
- Fewer hydrogen atoms than unsaturated lipids
- The same number of hydrogen atoms as unsaturated lipids
- No hydrogen atoms

(b) DNA is a double-stranded molecule composed of mononucleotides.

(i) In the space below, draw a diagram to show **two** mononucleotides joined together in a **single** strand of DNA (polynucleotide). Use the symbols shown below for each component in your diagram.

(3)



(ii) Name an enzyme involved in DNA replication.

(1)