

Write your name here

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Other names

Pearson
Edexcel GCE

Centre Number

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Candidate Number

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Biology

Advanced Subsidiary

Unit 1: Lifestyle, Transport, Genes and Health

Thursday 26 May 2016 – Afternoon

Time: 1 hour 30 minutes

Paper Reference

6BI01/01

You do not need any other materials.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*

Information

- The total mark for this paper is 80.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
– *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*
- Candidates may use a calculator.

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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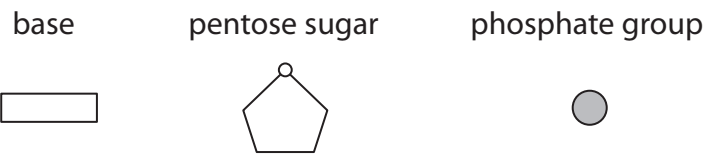


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Answer ALL questions.

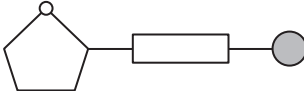
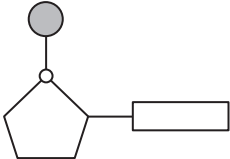
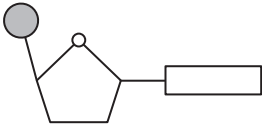
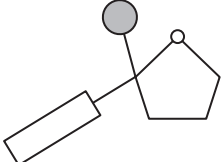
Some questions must be answered with a cross in a box ☐. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☐.

- 1 The polynucleotides, DNA and RNA, are involved in the process of protein synthesis.
- (a) For each of the statements below, put a cross ☐ in the box that corresponds to the correct statement.
- (i) A mononucleotide consists of three components represented by the diagrams below.



The diagram that shows the correct arrangement of these components in a mononucleotide is

(1)

- ☐ **A** 
- ☐ **B** 
- ☐ **C** 
- ☐ **D** 



- (ii) During transcription of the section of DNA shown below, **a single base** is paired **incorrectly**.

C - T - A - A - C - T - G - C - A

This transcription error results in an mRNA molecule with the following sequence.

(1)

☐ **A** C - A - T - T - G - A - C - G - T

☐ **B** G - A - U - U - C - A - C - G - U

☐ **C** G - A - U - U - G - A - C - G - U

☐ **D** G - T - U - U - G - U - C - G - U

- (iii) The following stages occur in the production of a protein from a section of DNA:

1. the mRNA molecule leaves the nucleus
2. peptide bonds form between adjacent amino acids
3. the base sequence is transcribed
4. the tRNA anticodons pair with the mRNA codons.

The sequence of events occurs in the following order.

(1)

☐ **A** 1 3 4 2

☐ **B** 2 4 1 3

☐ **C** 3 1 4 2

☐ **D** 3 4 1 2

- (b) The diagram below shows the sequence of bases in part of a messenger RNA molecule that codes for the amino acids in a polypeptide chain.

A - U - G - G - C - C - U - C - G - A - U - A - A - C - G - G - C - C - A - C - C - A - C - C

- (i) State the maximum number of amino acids in the polypeptide chain produced from this part of the messenger RNA molecule.

(1)

- (ii) State the number of different tRNA molecules that would be used to produce the polypeptide chain from this part of the messenger RNA molecule.

(1)



(c) State **three** differences between the structure of DNA and the structure of RNA.

(3)

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(Total for Question 1 = 8 marks)



- 2 Ascorbic acid (vitamin C) is named from the Latin word for scurvy, *scorbutus*.

Scurvy is caused by vitamin C deficiency and used to be a serious concern for sailors. These sailors had no access to fresh fruit and vegetables during long sea voyages.

Sauerkraut (fermented cabbage) contains vitamin C. Ships stored sauerkraut because it does not decompose easily.

Vitamin C is water soluble and is found in cabbage cells. These cells also contain an enzyme, ascorbic acid oxidase, that can oxidise vitamin C.

The table below shows the vitamin C content of sauerkraut and cabbage, treated in different ways.

Food	Treatment	Vitamin C content / mg per 100 g
Sauerkraut	freshly made	41.4
Sauerkraut	stored for 3 months	10.2
Cabbage	raw	32.2
Cabbage	added to cold water and then boiled for 5 minutes	7.6
Cabbage	added to boiling water and boiled for 5 minutes	14.3
Cabbage	stored for 3 months	not possible to measure

- (a) Using the information in the table, calculate the percentage loss of vitamin C when raw cabbage was added to cold water and then boiled for 5 minutes.

(2)

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(b) Describe an experimental technique for measuring the vitamin C content of raw cabbage.

(4)

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(c) (i) Suggest why the vitamin C content is reduced by boiling cabbage in water.

(2)

(ii) Suggest why less vitamin C is lost when the cabbage is added to boiling water rather than cold water before being boiled for 5 minutes.

(1)

(d) Suggest why sauerkraut was more useful than cabbage on a long sea voyage.

(1)

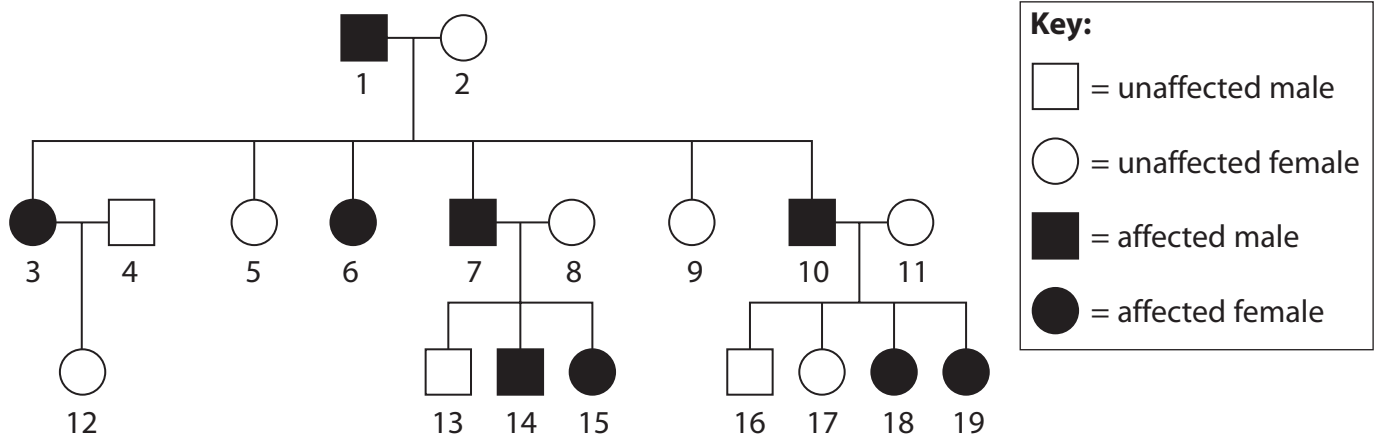
(Total for Question 2 = 10 marks)



- 3 Moyamoya is a **rare** disorder caused by a dominant allele. This disorder progressively damages the arteries supplying the brain.

(a) Inherited factors may contribute to the development of moyamoya.

The pedigree diagram below shows a family affected by moyamoya.



- (i) Explain how the information in the pedigree diagram suggests that this disorder is due to a dominant allele.

(3)

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- (ii) Using a genetic diagram, find the probability that the next child born to parents 3 and 4 would be affected by moyamoya.

(3)

Probability.....

- (b) One way of treating moyamoya is to transplant an artery from a suitable donor to bypass the affected arteries supplying the brain.

Explain how the structure of an artery is adapted for its function.

(4)

(Total for Question 3 = 10 marks)



4 Triglycerides, amylose and glycogen are used to store energy in many living organisms.

(a) Triglycerides contain fatty acids. Fatty acids are classified as saturated or unsaturated.

The formula for a saturated fatty acid is $C_nH_{2n}O_2$

The formula for an unsaturated fatty acid, with one double bond, is $C_nH_{(2n-2)}O_2$

The table below shows the melting points of some common fatty acids.

Fatty acid	Formula of fatty acid	Melting point / °C
P	$C_{16}H_{30}O_2$	-11.0
Q	$C_{18}H_{34}O_2$	13.4
R	$C_{20}H_{40}O_2$	76.5
S	$C_{24}H_{48}O_2$	86.0

For each of the statements below, put a cross ☒ in the box that corresponds to the correct statement.

(i) The saturated fatty acid(s) in the table

(1)

- ☒ **A** are P and Q
- ☒ **B** are R and S
- ☒ **C** is P only
- ☒ **D** is Q only

(ii) The fatty acid(s) liquid at 5 °C

(1)

- ☒ **A** are P and R
- ☒ **B** are Q and S
- ☒ **C** is P only
- ☒ **D** is Q only

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(b) Use a labelled diagram to show how a triglyceride is formed.

(3)

(c) Amylose and glycogen are polysaccharides.

(i) Name the type of chemical reaction that joins monosaccharides together to form an amylose molecule.

(1)

(ii) Name the chemical bond that is formed between the monosaccharides in an amylose molecule.

(1)

(iii) Describe **one** structural difference between amylose and glycogen.

(1)

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(iv) Explain **two** ways in which the structures of amylose and glycogen make them suitable for energy storage.

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(Total for Question 4 = 10 marks)

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P 4 6 6 4 0 A 0 1 3 2 8

- 5 Blood clots can form if the lining of an artery becomes damaged and affected by atherosclerosis.

One cause of a myocardial infarction (heart attack) is a blood clot in a coronary artery that supplies the muscle of the heart with blood.

- (a) Read through the following passage about the blood clotting process then write on the dotted lines the most appropriate words to complete the passage.

(3)

The cell fragments called stick to the site of damaged tissue.

This causes thromboplastin to be released, resulting in

being converted into an enzyme. This enzyme catalyses the conversion of a soluble plasma protein into long, insoluble strands of

This insoluble protein traps red blood cells to form a clot.

- (b) Explain how a blood clot can cause a heart attack.

(3)

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(c) One risk factor for cardiovascular disease (CVD) is a high concentration of blood cholesterol.

- (i) The table below shows the death rate due to CVD and the ratio of fatty acids in the diet for four countries.

Country	Death rate from CVD / deaths per 100 000	Ratio of unsaturated to saturated fatty acids in diet
Finland	503	0.175
USA	408	0.275
Italy	235	0.350
Japan	115	1.000

Using the information in the table, describe the relationship between the ratio of fatty acids in the diet and the death rate from CVD.

(3)

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- (ii) The table below shows information about four fatty acids found in some foods.

Fatty acid	Number of carbon double bonds	Effect on blood cholesterol concentration	Percentage of fatty acid in each food (%)			
			Beef	Butter	Olive oil	Corn oil
Palmitic	0	raises	25	30	9	13
Stearic	0	raises	29	11	3	3
Oleic	1	no effect	34	19	77	31
Linoleic	2	lowers	2	2	11	53

Using information from both tables, explain what changes a person could make to their diet to reduce their risk of developing CVD.

(3)

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- (d) Studies of CVD patterns between different countries suggest that there is a link between CVD and diet.

Suggest why such studies may **not** prove the link between CVD and diet.

(2)

(Total for Question 5 = 14 marks)

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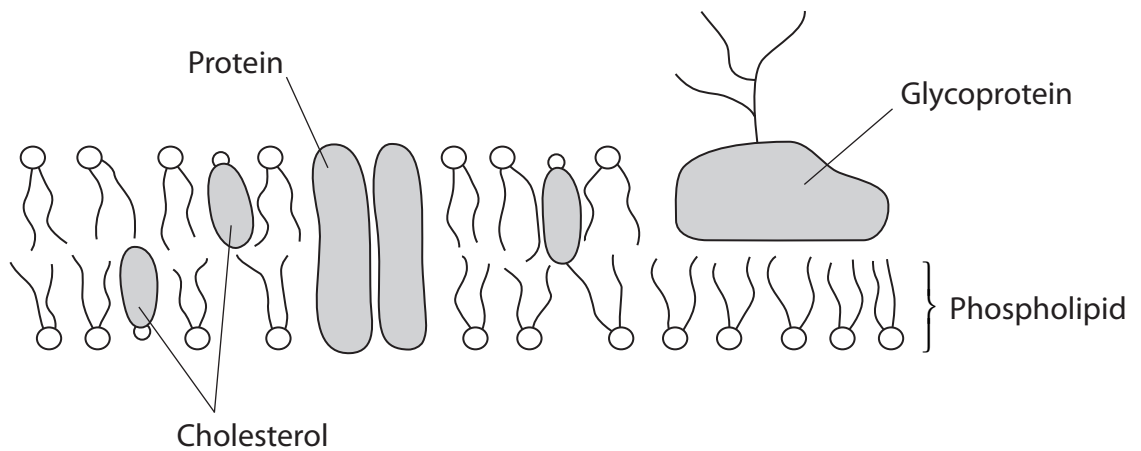
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- 6 The fluid mosaic model explains our current knowledge of the structure of cell membranes and the movement of molecules in and out of cells.

The diagram below illustrates some of the components of the fluid mosaic model.



- (a) For each of the statements below, put a cross ☒ in the box that corresponds to the correct sentence.

(i) Osmosis is an example of

(1)

- ☐ A active transport
☐ B mass transport
☐ C movement of a solute down a concentration gradient
☐ D passive transport

(ii) During facilitated diffusion

(1)

- ☐ A ATP is used to move ions
☐ B ions move against a concentration gradient
☐ C ions move down a concentration gradient
☐ D ions move directly through the phospholipid bilayer with no other molecules involved

(iii) Endocytosis

(1)

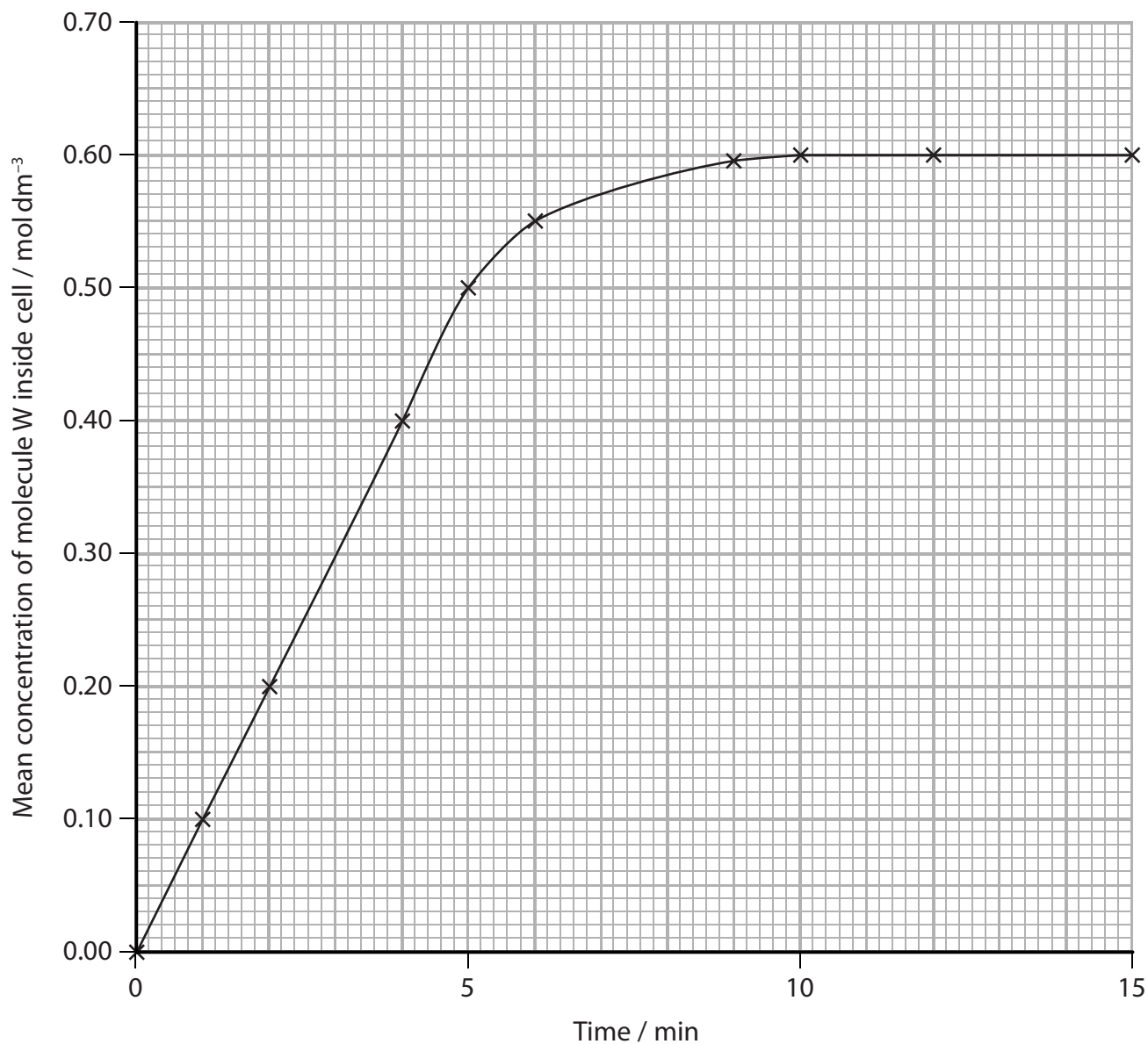
- ☐ A involves the bulk release of molecules from a cell
☐ B involves the production of a vacuole or vesicle
☐ C is a passive process
☐ D is involved in gas exchange



- (b) A student investigated the movement of molecules into red blood cells. He placed red blood cells into a solution of molecule W.

He then measured the concentration of W inside the cells over a period of 15 minutes.

The graph below shows the results of this investigation.



- (i) Using the information in the graph, describe the uptake of molecule W into the red blood cells during the 15 minutes of this investigation.

(3)

- (ii) From his results, the student concluded that molecule W was taken up by diffusion.

Using the information in the graph, give an explanation for his conclusion.

(2)

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(c) The student then left the red blood cells in distilled water.

After 2 minutes, he observed that some of the red blood cells had a larger volume and some had burst.

Suggest an explanation for his observations.

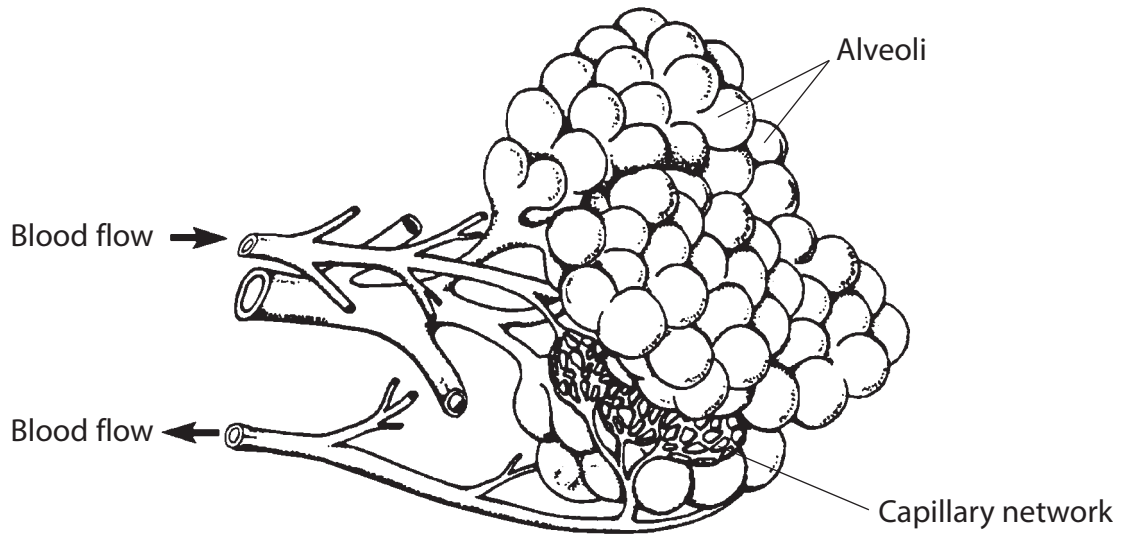
(3)

(Total for Question 6 = 11 marks)



7 The lungs in a mammal are adapted for efficient gas exchange.

- (a) The diagram below illustrates a small part of the lung responsible for gas exchange.



- (i) On the diagram, add a line labelled P to a branch of the pulmonary vein. (1)

- (ii) Give **one** difference between the structure of a capillary and the structure of a vein. (1)

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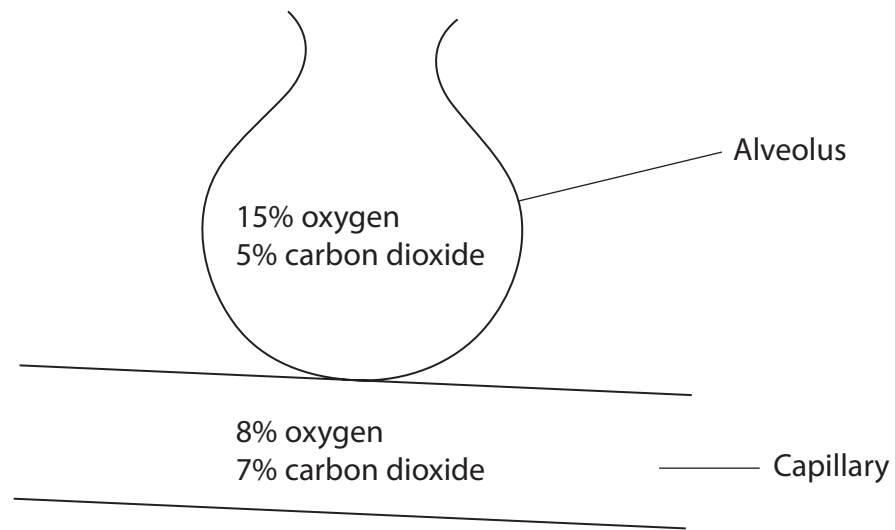
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- (b) The diagram below represents the approximate concentrations of oxygen and carbon dioxide inside an alveolus and a capillary in the lungs.

These gases will diffuse at different rates.



Using the information in the diagram, explain the difference in the rate of diffusion of these gases.

(2)



- (c) Fick's law of diffusion states that the rate of diffusion is proportional to the surface area, the difference in concentration and the length of the diffusion pathway.

This law is represented by the following formula.

Rate of diffusion is proportional to $\frac{\text{surface area} \times \text{difference in concentration}}{\text{length of diffusion pathway}}$

*Using the information given in the question and your own knowledge, explain how rapid gaseous exchange takes place in a mammal.

(5)

(Total for Question 7 = 9 marks)



- 8 Haemoglobin is a protein found in red blood cells that helps transport oxygen in the blood.

In sickle cell anaemia, the presence of the allele (**a**) in place of the normal allele (**A**) results in a change of one amino acid in the haemoglobin molecule.

This mutation changes the properties of haemoglobin and can result in red blood cells becoming less flexible and blocking small blood vessels.

The frequency of the recessive allele (**a**) is much higher in populations in West Africa than in populations in Northern Europe.

People in West Africa have a much higher risk of being infected with malaria parasites and developing severe anaemia than people in Northern Europe.

People who are heterozygous for sickle cell anaemia have sufficient amounts of normal haemoglobin to prevent severe anaemia.

One theory suggests that the malaria parasite (*Plasmodium sp.*) causes red blood cells with any modified haemoglobin to rupture. This occurs before the parasite can reproduce.

- *(a) In West Africa, the average life expectancies of people with genotypes **AA**, **Aa** or **aa** are different.

- (i) Using the information above, give an explanation for the difference in life expectancy of people who do not have the recessive allele.

(2)

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- (ii) Using the information above, give an explanation for the difference in life expectancy of people in West Africa who have the genotype **Aa**.

(2)

- *(b) Explain how a change of one amino acid can lead to a change in the structure and properties of the haemoglobin protein.

(4)

(Total for Question 8 = 8 marks)

TOTAL FOR PAPER = 80 MARKS



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