Write your name here

Surname	Other names

Pearson Edexcel
International
Advanced Level

Centre Number | | | | | |

Candidate Number | | | | |

Biology

Advanced Subsidiary
Unit 1: Lifestyle, Transport, Genes and Health

Monday 9 January 2017 – Morning
Time: 1 hour 30 minutes

Paper Reference
WBI01/01

You must have:
Calculator, ruler and pencil

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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P 4 8 3 5 4 A 0 1 2 4

Pearson

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 Glycogen is an energy storage molecule in muscle cells. Glycogen is formed from glucose molecules that are taken into muscle cells.

(a) Glucose molecules are taken into muscle cells by facilitated diffusion.

Describe the process of **facilitated diffusion**.

(2)

(b) Glycogen is a source of energy for muscle cells during exercise.

(i) Name the bond between glucose molecules in glycogen.

(1)

(ii) Name the type of reaction that takes place when glycogen is broken down into glucose.

(1)

(iii) Explain why glycogen is a good energy storage molecule in muscle cells.

(3)

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(Total for Question 1 = 7 marks)

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2 Cardiovascular disease (CVD) is a major health problem in both developing and developed countries.

(a) Atherosclerosis may cause CVD.

Place a cross ☒ in the box next to the correct word or words to complete each of the following statements.

(i) Atherosclerosis is initiated by damage to

(1)

☒ **A** endothelial cells

☒ **B** muscle cells

☒ **C** red blood cells

☒ **D** white blood cells

(ii) Atherosclerosis occurs in

(1)

☒ **A** arteries

☒ **B** atria

☒ **C** capillaries

☒ **D** ventricles

(iii) In atherosclerosis, the blood vessels become

(1)

☒ **A** less elastic with a narrow lumen

☒ **B** less elastic with a wider lumen

☒ **C** more elastic with a narrow lumen

☒ **D** more elastic with a wider lumen

(b) Coronary heart disease is one example of CVD.

Explain why atherosclerosis is a risk factor for coronary heart disease.

(3)

(c) A clinical trial was carried out to investigate the effect of reducing blood pressure on the risk of suffering a heart attack or stroke.

The clinical trial was carried out in Finland. A total of 572 patients with high blood pressure and ranging in age from 25 to 66 were included in the trial.

Patients were divided into two groups. One group was treated with a drug called Captopril and the second group was treated with a drug called Propranolol.

The health of these patients was studied for six years. The number of patients experiencing a heart attack or a stroke during this six-year period was recorded.

The results of the clinical trial are shown in the table below.

Drug treatment	Percentage of patients experiencing a heart attack (%)	Percentage of patients experiencing a stroke (%)
Captopril	3.9	7.4
Propranolol	10.3	7.2

(i) Use the information in the table to describe what the results of this trial show.

(2)

(ii) Suggest why this clinical trial did not include a placebo.

(1)

(iii) Give **two** limitations of this clinical trial.

(2)

1 .....

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2 .....

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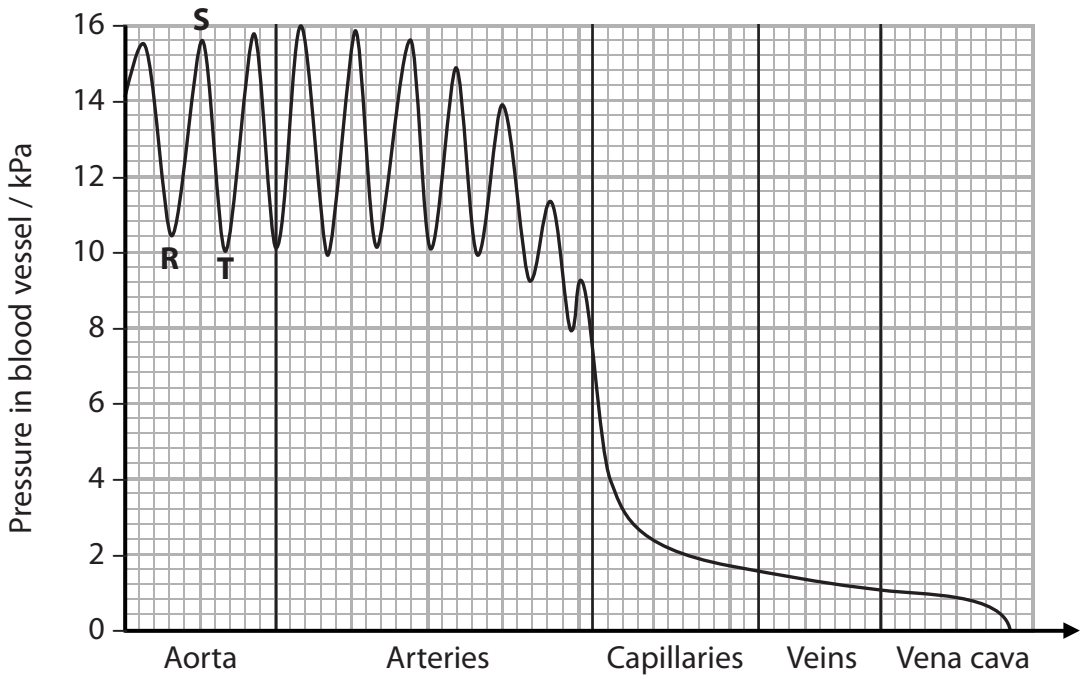
(Total for Question 2 = 11 marks)

3 The circulatory system in mammals has a heart and blood vessels.

(a) The graph below shows the pressure in different blood vessels as blood leaves and returns to the heart.



(i) Place a cross ☒ in the box next to the correct words to complete the following statement.

The change in pressure between **R** and **S** occurs during

(1)

☒ **A** atrial diastole

☒ **B** atrial systole

☒ **C** ventricular diastole

☒ **D** ventricular systole

(ii) Calculate the percentage decrease in pressure between **S** and **T**.

(2)

..... %

(iii) Explain the decrease in pressure between **S** and **T** in the aorta.

(2)

(b) Explain why the human heart is divided into a left side and a right side.

(3)

(c) Explain **one** way in which the structure of a capillary is related to its function.

(2)

(Total for Question 3 = 10 marks)

4 Gas exchange in mammals takes place in the lungs.

(a) Surface area is one factor that affects the rate of gas exchange.

State **two** factors, other than surface area, that affect the rate of gas exchange.

(1)

..... and .....

(b) Scientists investigated the relationship between the mass of different mammals and the surface area of their alveoli.

Some of their results are shown in the table below.

Mammal	Mass / kg	Surface area of alveoli / m^2
African goat	19.9	43.8
Banded mongoose	1.1	3.9
Dik-dik	4.1	14.7
Giraffe	383.0	636.0
Thomson's gazelle	19.5	95.0
Zebu	151.0	313.0

(i) Use the data in the table to calculate the ratio of mass to surface area of the alveoli for the Thomson's gazelle.

(1)

Answer .....

(ii) Suggest an explanation for the relationship between mass and surface area of alveoli.

(2)

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(c) Explain why a gene mutation affects gas exchange in a person with cystic fibrosis.

(4)

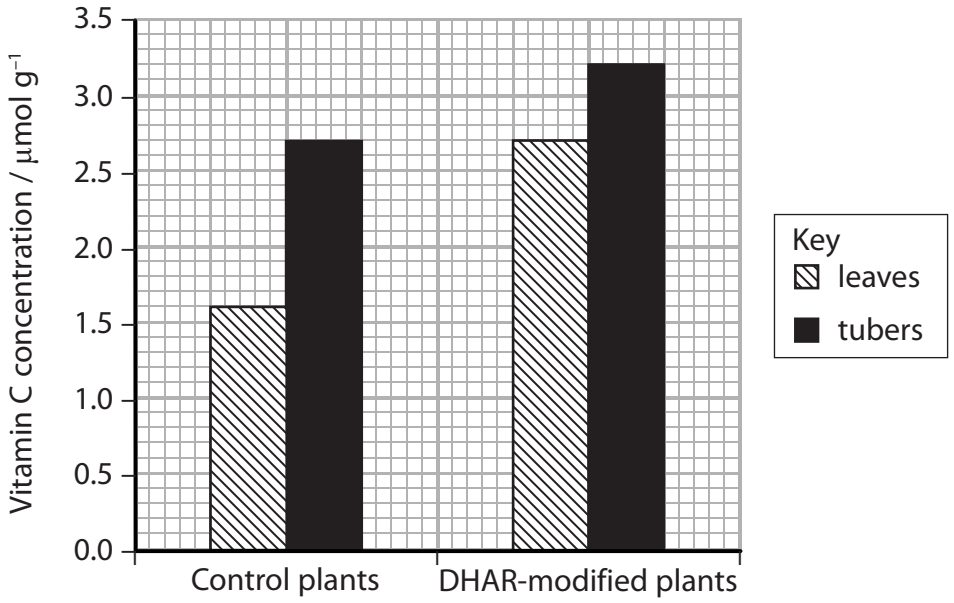
(Total for Question 4 = 8 marks)

5 Vitamin C is an essential nutrient obtained from a variety of foods.

Scientists have genetically modified potato plants to increase their concentration of vitamin C.

(a) In one experiment, the modified plants produced extra quantities of an enzyme called dehydroascorbate reductase (DHAR) in their leaves and tubers.

The graph below shows the vitamin C concentration in the leaves and tubers from control plants and from DHAR-modified plants.



Describe the effect of genetic modification on the vitamin C concentration in these potato plants.

(3)

*(b) In a separate experiment, scientists genetically modified potato plants to produce extra quantities of a different enzyme called GDP.

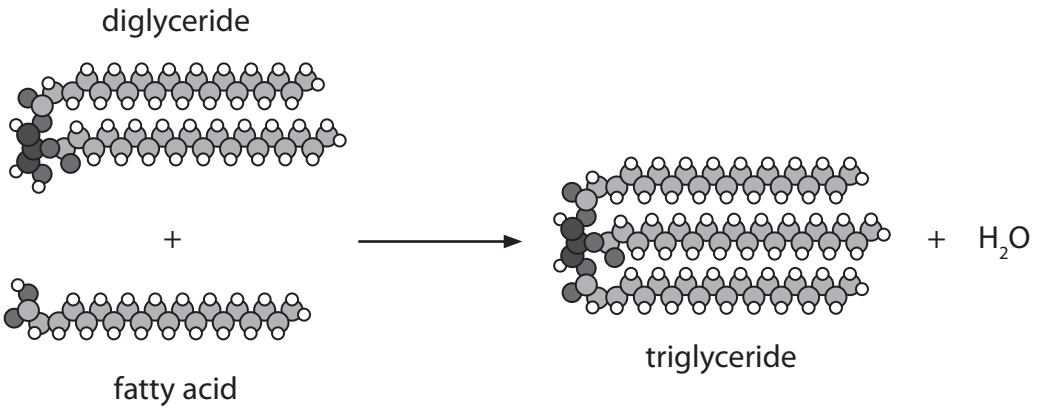
Suggest how an experiment could be carried out to compare the vitamin C concentration in the DHAR-modified plants with that in the GDP-modified plants.

(5)

(Total for Question 5 = 8 marks)

6 Triglycerides are synthesised from fatty acids and glycerol.

One of the reactions involved in the synthesis of triglycerides is shown below.



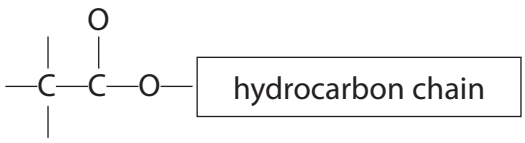
(a) Diglyceride acyltransferase (DGAT) is the enzyme that completes the synthesis of a triglyceride by joining a fatty acid onto a diglyceride.

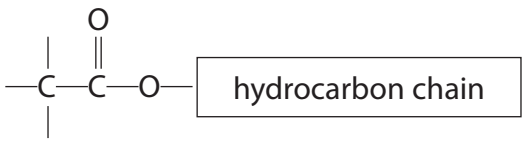
(i) Name the bond that links fatty acids to glycerol.

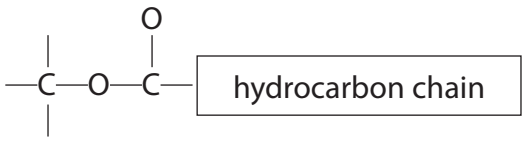
(1)

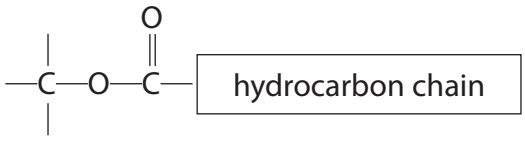
(ii) Which of the following arrangements of atoms links a glycerol molecule to a fatty acid?

(1)

☒ **A** 

☒ **B** 

☒ **C** 

☒ **D** 

(iii) Fatty acids can be saturated or unsaturated.

Distinguish between the structure of a saturated fatty acid and the structure of an unsaturated fatty acid.

(2)

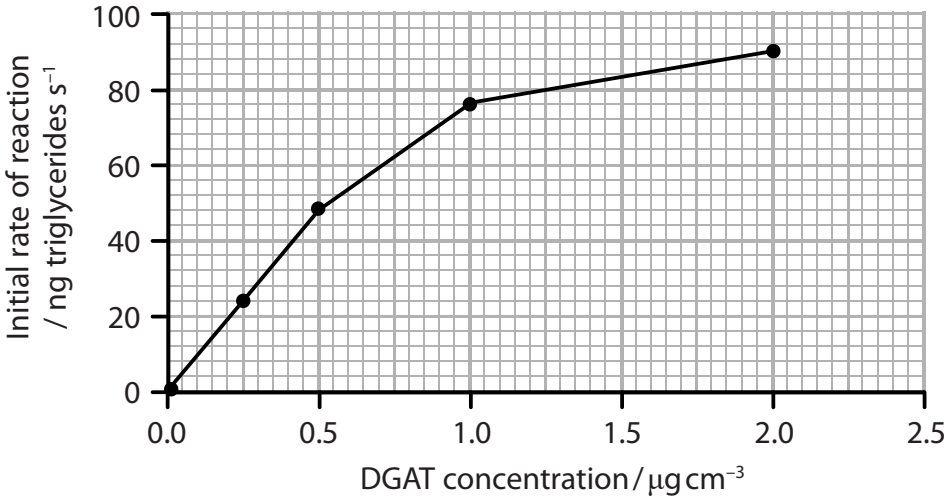
(iv) The enzyme DGAT attaches the third fatty acid to a diglyceride. Other enzymes are involved with the synthesis of the diglyceride.

Suggest why the enzyme DGAT can only catalyse the addition of the third fatty acid to the diglyceride.

(3)

(b) The effect of DGAT concentration on the synthesis of triglycerides was investigated.

The graph below shows the results of this investigation.



(i) Explain why the initial rate of reaction was measured in this investigation.

(2)

(ii) Explain why a buffer solution should be used in this investigation.

(4)

(Total for Question 6 = 13 marks)

7 The fluid mosaic model has been developed from the knowledge of the structure and properties of the cell membrane.

*(a) Describe the structure of the cell membrane.

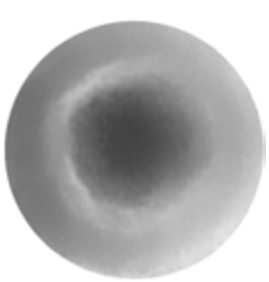
(5)

(b) Molecules can enter and leave a cell through the cell membrane.

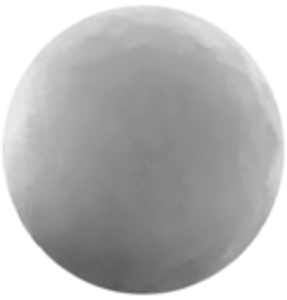
In an experiment, red blood cells were placed in three different sodium chloride solutions, a control solution, solution **P** and solution **Q**.

The control solution had a solute concentration that is the same as the solute concentration in the blood.

The electronmicrographs below show a red blood cell from each of the solutions.



Red blood cell from the control solution



Red blood cell from solution **P**

Red blood cell from solution **Q**

Magnification ×5000

Place a cross ☒ in the box next to the correct words to complete the following statement.

(i) The solute concentration in solution **P** is

(1)

☒ **A** greater than the concentration in solution **Q**

☒ **B** greater than the concentration of the control solution

☒ **C** less than the concentration in the cell in solution **Q**

☒ **D** the same as the concentration in the cell in the control solution

(ii) Suggest an explanation for the appearance of the red blood cell in solution **Q**.

(3)

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(Total for Question 7 = 9 marks)

8 Liver cells synthesise the protein alpha-1-antitrypsin. This protein is secreted into the blood.

Three of the alleles coding for alpha-1-antitrypsin are: **M**, **S** and **Z**.

The table below shows the concentration of alpha-1-antitrypsin in the blood of people with different combinations of these alleles.

Allele combinations	Concentration of alpha-1-antitrypsin in blood (%)
MM	100
MS	80
MZ	60
SS	60
SZ	40
ZZ	10 to 15

(a) Using alpha-1-antitrypsin as an example, explain the terms **genotype** and **phenotype**.

(2)

Genotype.....

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Phenotype.....

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(b) Using your knowledge of dominant and recessive alleles, suggest why the alleles **M**, **S** and **Z** affect the concentration of alpha-1-antitrypsin in the blood.

(3)

(c) The DNA base sequence of a gene codes for the primary structure of a protein.

The table below can be used to find the mRNA codons for some amino acids.

1st base	2nd base				3rd base
A	U	C	A	G	U
	Ile	Thr	Asp	Ser	C
			Lys	Arg	A
	Met				G
G	Val	Ala	Asp	Gly	U
					C
			Glu		A
					G

(i) The alpha-1-antitrypsin **Z** allele has a mutation that results in one amino acid, glutamic acid (Glu), being replaced by another amino acid, lysine (Lys).

The base change in this mutation is

(1)

☒ **A** A to G

☒ **B** A to U

☒ **C** G to A

☒ **D** G to U

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(ii) Complete the diagram below to show the structure of an amino acid.

(2)

(iii) Describe how the primary structure of alpha-1-antitrypsin results in a protein with a three-dimensional structure.

(3)

(d) Two parents with the **MZ** allele combination had a child.

Use a genetic diagram to determine the probability that this child will have a blood concentration of alpha-1-antitrypsin that is lower than its parents'.

(3)

Probability .....

(Total for Question 8 = 14 marks)

TOTAL FOR PAPER = 80 MARKS

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