Write your name here

Surname	Other names

Pearson Edexcel GCE

Centre Number	Candidate Number

Biology

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

Wednesday 21 May 2014 – Morning
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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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 Transcription and translation are processes involved in the synthesis of proteins.

(a) Put a cross ☒ in the box to complete each of the following statements.

(i) Individual mononucleotides in a molecule of mRNA are joined together by

(1)

☒ **A** glycosidic bonds

☒ **B** hydrogen bonds

☒ **C** peptide bonds

☒ **D** phosphodiester bonds

(ii) The maximum number of amino acids coded for by a molecule of mRNA that is 600 mononucleotides long is

(1)

☒ **A** 100

☒ **B** 200

☒ **C** 300

☒ **D** 600

(iii) When a gene that contains 22% adenine is transcribed, the mRNA produced will have

(1)

☒ **A** 22% adenine

☒ **B** 0% cytosine

☒ **C** 0% thymine

☒ **D** 28% uracil

(b) Describe the structure of a mononucleotide found in RNA.

(2)

*(c) Describe the process of protein synthesis that occurs in the cytoplasm.

(5)

(Total for Question 1 = 10 marks)

2 The cell vacuoles of beetroot (*Beta vulgaris*) contain the red pigment betalain.

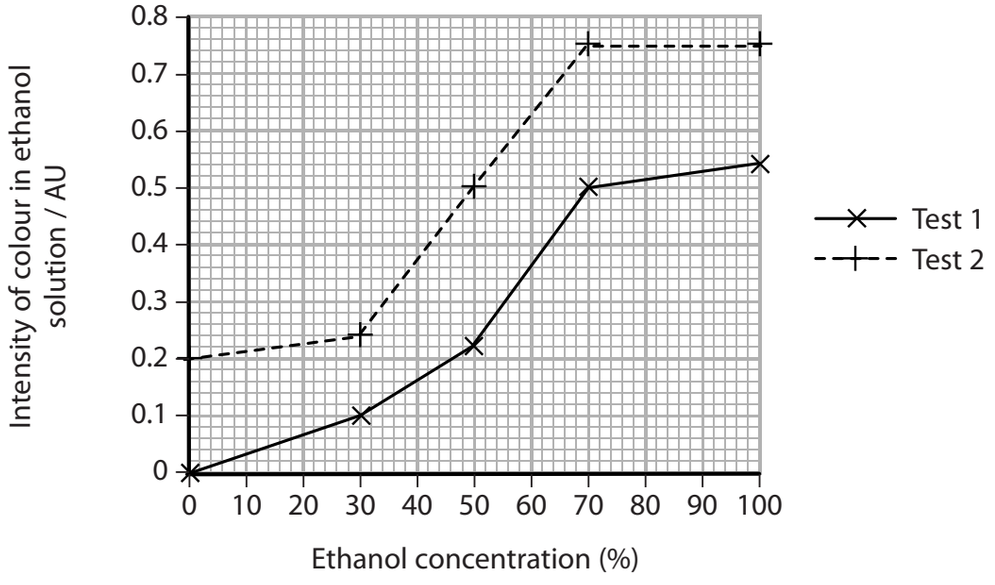
A student investigated the effect of ethanol on the permeability of beetroot cell membranes.

In this investigation, 10 identical pieces were cut from one beetroot. One piece of beetroot was left in 10 cm^3 of 30% ethanol for 20 minutes at 20 °C.

After 20 minutes, the piece of beetroot was removed and the intensity of the colour of the ethanol solution was measured using a colorimeter.

This was repeated with other pieces of beetroot that were left in ethanol concentrations of 0%, 50%, 70% and 100%, at 20 °C.

The student repeated this investigation with the other five pieces of beetroot at the same temperature of 20 °C. The graph below shows the results of these investigations.



(a) Using the information in the graph, describe the effect of ethanol concentration on the intensity of colour.

(3)

(b) Using the information in the graph and your knowledge of membrane structure, explain the effect of ethanol on the permeability of beetroot cell membranes.

(4)

(c) Suggest why the results for these two investigations are different.

(2)

(Total for Question 2 = 9 marks)

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3 Metachromatic leukodystrophy (MLD) is an inherited disorder. This disorder, due to brain damage during the first two years of life, can prevent a child learning how to walk and talk.

In one of the first gene therapy treatments approved in Europe, one child from each of three families with a history of MLD, was treated.

As a result of this treatment the children were able to talk at an age when some of their untreated brothers and sisters were unable to talk.

MLD is associated with a recessive allele.

(a) Two parents, who are physically unaffected by the disorder, have already had one child with the disorder.

Using a suitable genetic diagram, calculate the probability that the next child of these parents will also be affected by this disorder.

(4)

probability .....

(b) Suggest how a newborn baby could be tested for MLD before brain damage develops.

(2)

(c) The gene therapy involved taking bone marrow stem cells from the child to be treated. A virus was then used to transfer DNA with the dominant allele into the stem cells. These modified stem cells were then injected into this child.

(i) Suggest how these modified stem cells can result in the prevention of MLD.

(3)

(ii) Suggest why the development of the treated children was compared with the development of their untreated brothers and sisters.

(2)

(d) There are some risks associated with somatic gene therapy.

Suggest why the parents of these children gave consent for their children to be involved in the gene therapy treatment for MLD.

(2)

(Total for Question 3 = 13 marks)

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4 All mammals, such as harp seals, feed their young on milk produced by mammary glands. This continues until the young are old enough to eat the same diet as their parents.

The photograph below shows a female harp seal feeding her pup.

magnification ×0.002

(a) The table below shows the composition of human milk and harp seal milk.

Milk	Protein (%)	Lipid (%)	Lactose (%)
Human	1.4	3.8	7.0
Harp seal	13.8	36.5	0.0

(i) Suggest **two** substances (other than protein, lipid and lactose) that milk should contain for the development of the harp seal pups.

(2)

1 .....

2 .....

(ii) Harp seal pups are born in the Arctic where it is extremely cold and there is little shelter.

After nine days of feeding, the mass of a harp seal pup can increase by about 300%.

Using information from the table, suggest why a harp seal pup increases in mass more quickly than a human baby.

(4)

(b) The composition of human milk can be affected by the diet of the mother.

The table below shows the concentration of eight fatty acids found in milk from two different groups of women.

One group of women were vegans who ate food obtained only from plants. The other control group had a mixed diet of food from plants and animals.

Fatty acid	Number of double bonds in the hydrocarbon chain	Concentration of fatty acid / mg per g of milk	
		Vegans	Control group
lauric	0	39	33
myristic	0	68	80
palmitic	0	166	276
stearic	0	52	108
palmitoleic	1	12	36
oleic	1	313	353
linoleic	2	317	69
linolenic	3	15	8

(i) State the difference between the structure of a saturated fatty acid and an unsaturated fatty acid.

(1)

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(ii) Complete the table below by calculating the total concentration of unsaturated fatty acids in the milk from the women in the vegan and control groups.

(1)

Group	Total concentration of saturated fatty acids / mg per g milk	Total concentration of unsaturated fatty acids / mg per g milk
Vegan	325	
Control	497	

(iii) Using the information given, suggest why there are differences in the concentrations of saturated and unsaturated fatty acids in the milk from the women in the vegan and control groups.

(2)

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(Total for Question 4 = 10 marks)

5 (a) Read through the following passage about the structure of the heart. Write on the dotted lines the most appropriate word or words to complete the passage.

(5)

The heart muscle in the walls of the heart is called ..... muscle.

The ..... valves control the flow of blood between the chambers of the heart.

The chamber of the heart that receives oxygenated blood from the lungs is named the

..... .

Deoxygenated blood is transported back to the lungs in the ..... .

Backflow of blood into the heart is prevented by ..... valves.

(b) Arteries and capillaries are blood vessel adapted for specific roles in the circulatory system.

Give **two** differences between the structure of an artery and a capillary.

(2)

1 .....

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2 .....

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.....

(c) Anticoagulants, such as warfarin, are used to treat cardiovascular disease (CVD).

(i) Explain how anticoagulants can help reduce the effects of CVD.

(2)

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(ii) State **one** risk associated with the use of anticoagulants.

(1)

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(Total for Question 5 = 10 marks)

6 Scientists investigated the BMI (Body Mass Index) of male office workers aged 40 and the type of breakfast they ate most regularly.

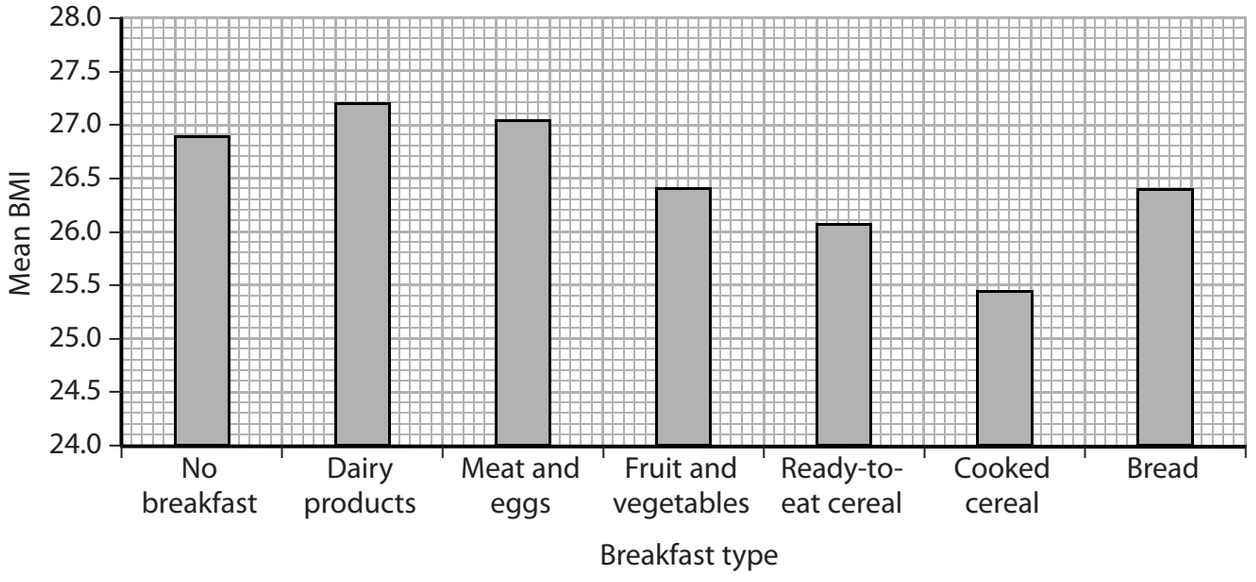
BMI is calculated using the formula below.

$$\text{BMI} = \frac{\text{mass in kilograms}}{(\text{height in metres})^2}$$

BMI can be used to indicate the category, shown in the table below, to which a person belongs.

Category	BMI range
underweight	less than 18.5
healthy weight	from 18.5 to 25
overweight	from 25 to 30
obese	over 30

The graph below shows the results of their investigation.



(a) Put a cross ☒ in the box to complete each of the following statements.

(i) The graph shows that people who ate

(1)

☒ **A** dairy products have a lower mean BMI than those people who ate bread.

☒ **B** fruit and vegetables have the lowest mean BMI

☒ **C** no breakfast have a higher mean BMI than those people who ate meat and eggs

☒ **D** ready-to-eat cereal have a higher mean BMI than those people who ate cooked cereal

(ii) The graph shows that the mean BMI for

(1)

- ☒ **A** every group sampled in the investigation indicates that they were overweight
- ☒ **B** those who ate bread for breakfast indicates that they were a healthy weight
- ☒ **C** those who ate cooked cereals for breakfast indicates that they were underweight
- ☒ **D** those who ate dairy products for breakfast indicates that they were obese

(iii) The units for mean BMI are

(1)

- ☒ **A** kg m^2
- ☒ **B** kg m^{-2}
- ☒ **C** m^2 kg
- ☒ **D** m kg^{-2}

(iv) The scientists ensured that their data were reliable by repeating the investigation with

(1)

- ☒ **A** a larger sample size
- ☒ **B** female office workers aged 40
- ☒ **C** more types of breakfast
- ☒ **D** male footballers

(b) Suggest how the scientists ensured that their investigation was valid.

(2)

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(c) Some people avoid eating breakfast in an attempt to lose weight.

Using information from the graph, suggest why eating no breakfast is unlikely to lead to weight loss.

(2)

(d) Cooked cereal, such as porridge, contain a high proportion of dietary fibre. This helps to lower blood cholesterol levels.

Using the information in the graph and your knowledge of blood cholesterol, suggest why a breakfast of cooked cereal could reduce the chances of developing cardiovascular disease (CVD).

(3)

(Total for Question 6 = 11 marks)

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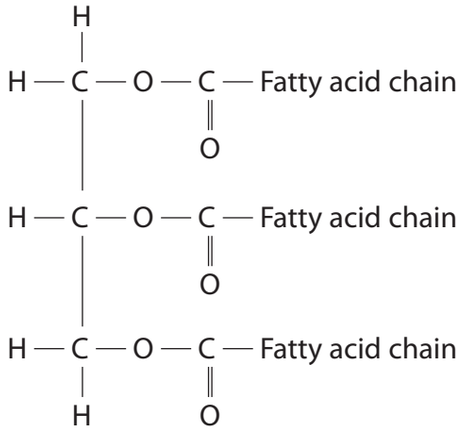
7 Triglycerides are lipids that are an important source of energy for the body. Triglycerides are broken down and reassembled in the body.

(a) The diagram below shows the structure of a triglyceride.



In the space below, draw a diagram to show the molecules produced from the complete hydrolysis of the triglyceride.

(3)

(b) Suggest the possible consequence of a very low fat diet for someone who has a very active lifestyle.

(2)

*(c) Groups of enzymes help the body to break down and process triglycerides. Abnormalities in these enzymes can lead to the build-up of lipids that would have been broken down.

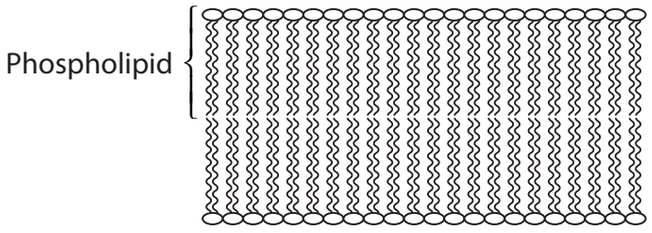
Explain why a gene mutation can result in an enzyme that is unable to break down lipids.

(5)

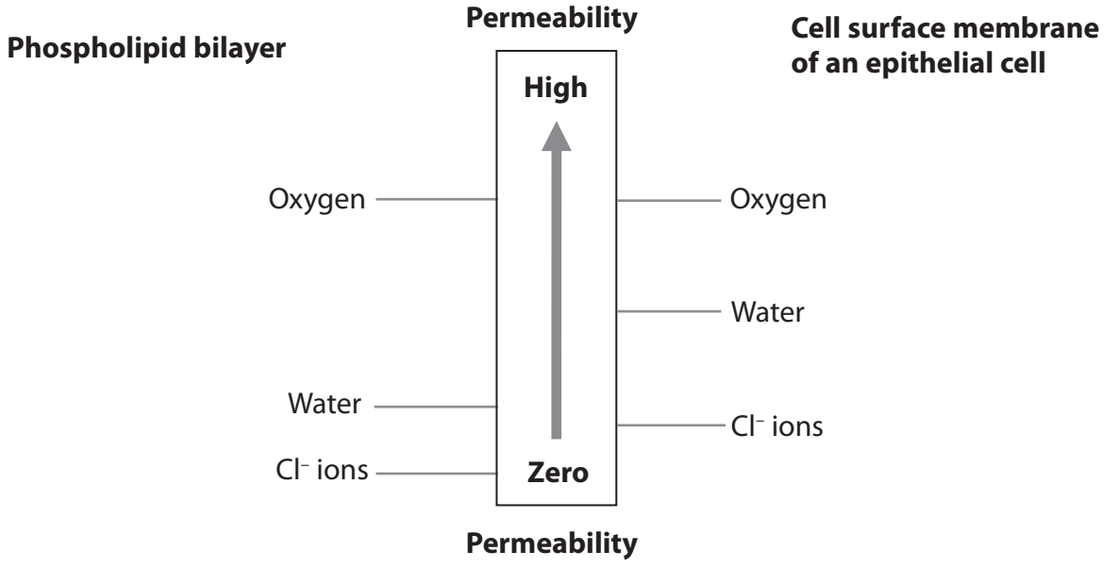
(Total for Question 7 = 10 marks)

8 Artificial membranes have a variety of medical applications.

It is possible to make an artificial membrane consisting of a phospholipid bilayer only, as shown in the diagram below.



The diagram below represents the relative permeability to oxygen, water and chloride ions (Cl^-) of a phospholipid bilayer and a cell surface membrane of an epithelial cell of the trachea.



Using the information in the diagram and your knowledge of membrane structure, suggest an explanation for each of the following.

(a) The permeability to oxygen is the same for a phospholipid bilayer and a cell surface membrane.

(2)

(b) The permeability to chloride ions (Cl^-) is different in the two membranes.

(3)

(c) The rates of osmosis will be different in the two membranes.

(2)

(Total for Question 8 = 7 marks)

TOTAL FOR PAPER = 80 MARKS

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