Write your name here

Surname	Other names

Centre Number | Candidate Number

Edexcel GCE

Biology

Advanced Subsidiary

Unit 1: Lifestyle, Transport, Genes and Health

Monday 16 May 2011 – 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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P 3 8 1 7 0 A 0 1 2 8

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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 Molecules are transported into and out of cells by several mechanisms.

(a) Read through the following passage that describes some of these mechanisms, then write on the dotted lines the most appropriate word or words to complete the passage.

(4)

Some molecules move across a cell surface membrane by passing down a concentration gradient, through the phospholipid bilayer. The movement of some polar molecules across the membrane involves carrier and channel ..... molecules. When this movement occurs down a concentration gradient, the process is called ..... and when it occurs against a concentration gradient the process is called ..... .

Energy in the form of ..... is used in the movement of molecules against a concentration gradient.

(b) A student wanted to sweeten some strawberries, so she sprinkled some sugar on top of them, one hour before eating them. The student noticed that the sugar that she had sprinkled on them was no longer visible and that there was some juice at the bottom of the bowl.

Appearance on adding sugar

Appearance one hour after adding sugar

The student thought that the juice was the sugar dissolved in water and that the water had come from the fruit.

In order to test this hypothesis, she weighed some fresh strawberries and sprinkled them with sugar. One hour later she rinsed off the juice and reweighed the strawberries. The mass of the strawberries before adding the sugar was 77 g. The mass after rinsing off the juice was 70 g.

(i) Calculate the percentage decrease in the mass of the strawberries.

Show your working.

(2)

Answer ..... %

(ii) Suggest **one** possible source of error in the student's procedure that could make this value for the percentage decrease in the mass of the strawberries inaccurate.

Explain how this source of error would affect the value for the percentage decrease in the mass of the strawberries.

(3)

Source of error .....

.....

.....

Effect on value and explanation .....

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(iii) Using your knowledge of cell transport mechanisms and the properties of water, explain how the juice is formed from the water that came from the fruit.

(3)

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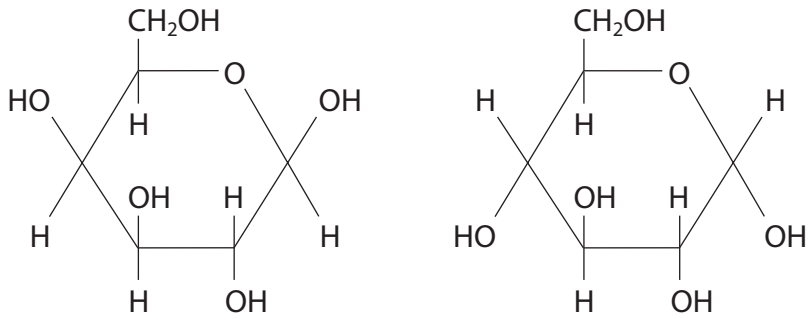
(Total for Question 1 = 12 marks)

2 Galactosaemia is a genetic disorder that affects an individual's ability to metabolise the monosaccharide galactose.

Dairy products contain the disaccharide lactose, which is broken down into galactose and glucose during digestion. If the galactose is not broken down further this may result in damage to the brain, kidneys or liver.

(a) The diagram below shows the structure of a galactose molecule and a glucose molecule.



(i) In the space below, draw a diagram to show the products formed when these two molecules join together to form lactose.

(3)

(ii) Name the chemical reaction that joins the galactose and glucose molecules together.

(1)

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(iii) Name the bond that joins the galactose and glucose molecules together.

(1)

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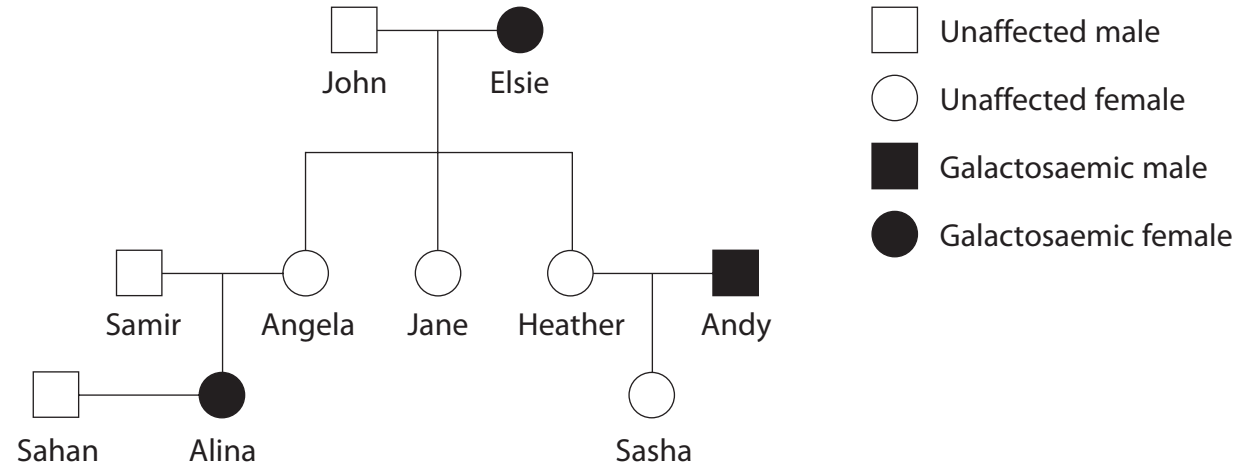
(b) The pedigree diagram below shows the inheritance of galactosaemia in a family.



The normal allele is represented by G and the defective recessive allele by g.

Place a cross ☒ in the box next to the correct letter that completes each of the following statements.

(i) An allele is a

(1)

☒ **A** form of a gene

☒ **B** length of DNA

☒ **C** part of a gene

☒ **D** protein

(ii) If John is heterozygous for galactosaemia, Jane's genotype must be

(1)

☒ **A** GG

☒ **B** Gg

☒ **C** gg

☒ **D** impossible to tell

(iii) Samir's genotype must be

(1)

☒ **A** GG

☒ **B** Gg

☒ **C** gg

☒ **D** impossible to tell

(c) (i) Use a genetic diagram to calculate the probability that Sahan and Alina's first child will be heterozygous (a carrier) if Sahan is heterozygous.

(4)

Answer .....

(ii) What is the probability that their second child would also be a carrier?

(1)

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(Total for Question 2 = 13 marks)

3 Cystic fibrosis is a genetic disease that can affect many body systems, including the digestive system. In a carrier of this disorder, preimplantation genetic diagnosis can be used to detect the presence of an allele for cystic fibrosis.

*(a) Explain how cystic fibrosis affects the digestive system.

(4)

(b) Explain how **preimplantation** genetic diagnosis is performed to detect cystic fibrosis.

(3)

(c) Discuss either **one** ethical issue or **one** social issue relating to the use of preimplantation genetic diagnosis.

(2)

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(Total for Question 3 = 9 marks)

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4 In the late 1950s, Meselson and Stahl performed some important experiments. These experiments provided evidence to support the idea that new DNA was synthesised by semi-conservative replication.

(a) Name an enzyme involved in DNA replication.

(1)

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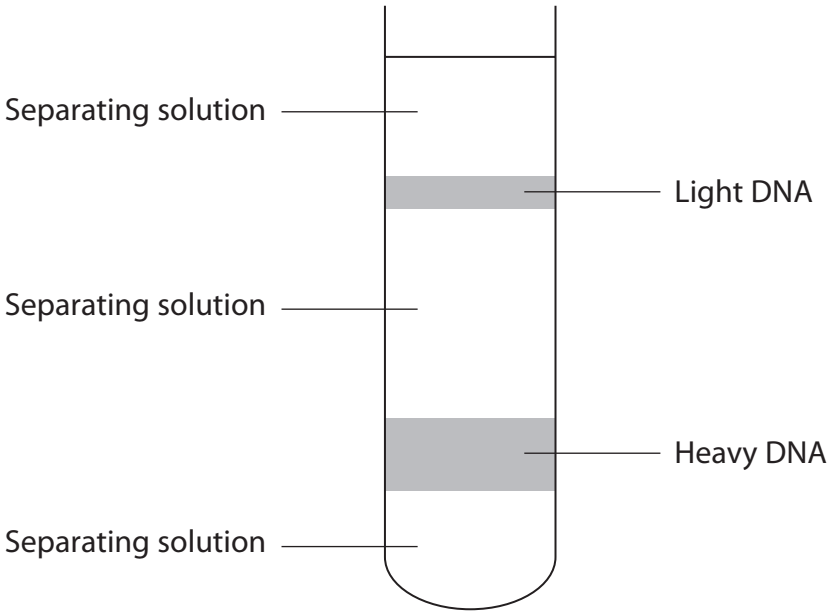
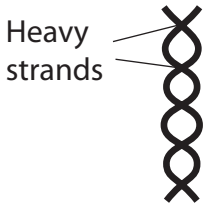
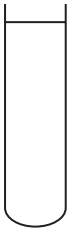
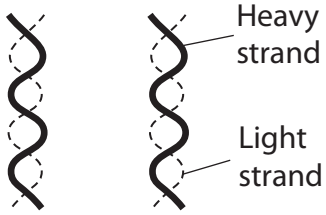
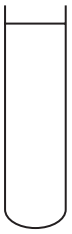
(b) Meselson and Stahl's experiments involved growing bacteria in culture media containing either heavy nitrogen (^{15}N) or light nitrogen (^{14}N). The DNA was then extracted from the bacteria. The DNA was analysed as shown in the diagram below.



The table below summarises the three stages of Meselson and Stahl's experiment and their results.

Complete the table by drawing, in the appropriate boxes, diagrams of the DNA molecules and mark the position and size of the DNA bands in the tubes.

(6)

Experimental stage	Diagram to show the strands in the DNA molecules of the bacteria	Position and size of DNA bands in the tube of separating solution
Stage 1 Bacteria grown for several generations in culture medium containing heavy nitrogen		
Stage 2 The bacteria from the end of stage 1 were grown for another generation in culture medium containing light nitrogen		
Stage 3 The bacteria from the end of stage 2 were grown for one more generation in culture medium containing light nitrogen		

(Total for Question 4 = 7 marks)

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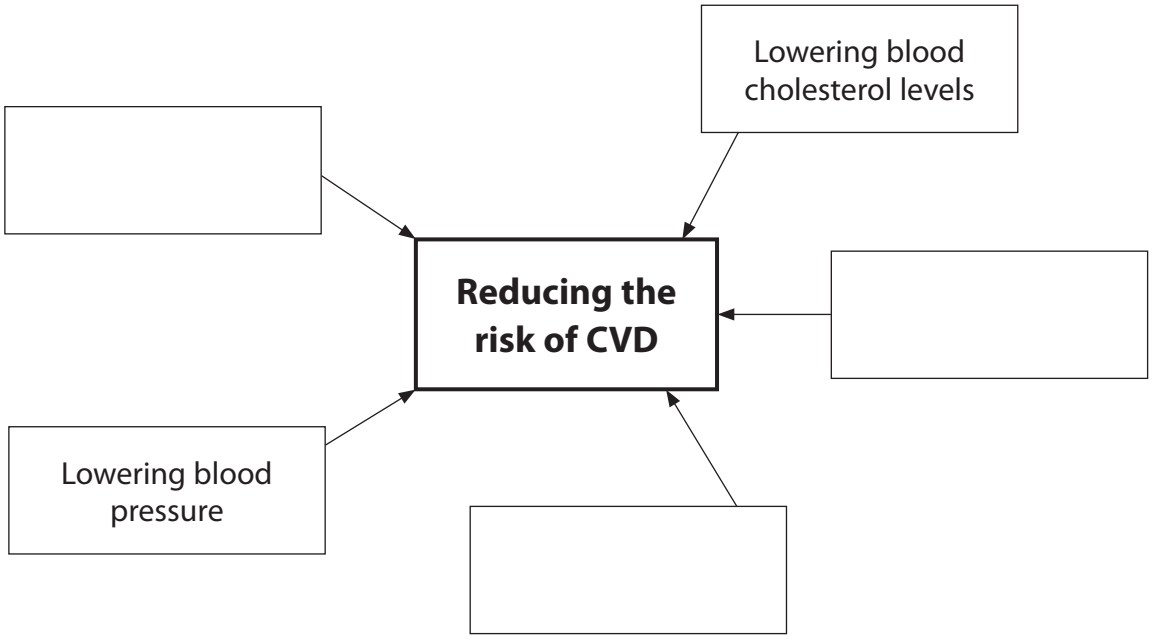
5 The risk of developing cardiovascular disease (CVD) can be reduced in several ways. Lowering blood cholesterol levels and lowering blood pressure are two ways of reducing CVD.

(a) (i) Complete the diagram below by giving three other ways in which the risk of CVD may be reduced. Write your answers in the empty boxes.

(3)



(ii) Explain how lowering blood cholesterol levels can reduce the risk of CVD.

(2)

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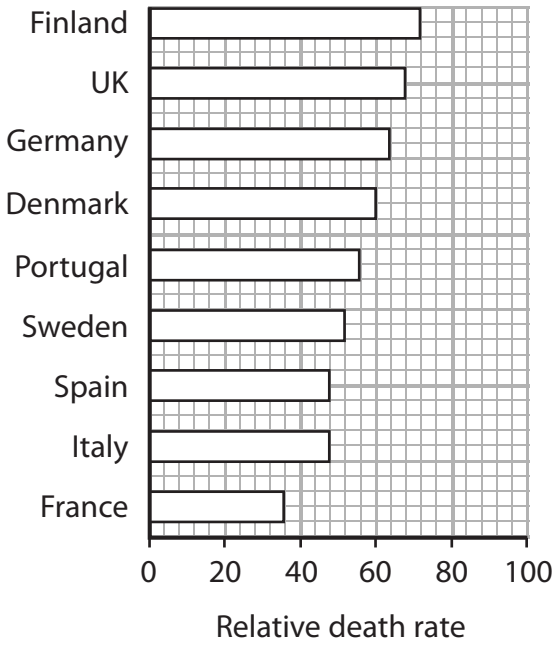
(b) Risk calculators can be used to estimate the probability that a person will develop CVD. Many of these calculators start by asking for the age and gender of the person using them. Explain why information about age and gender is important in estimating the risk of developing CVD.

(2)

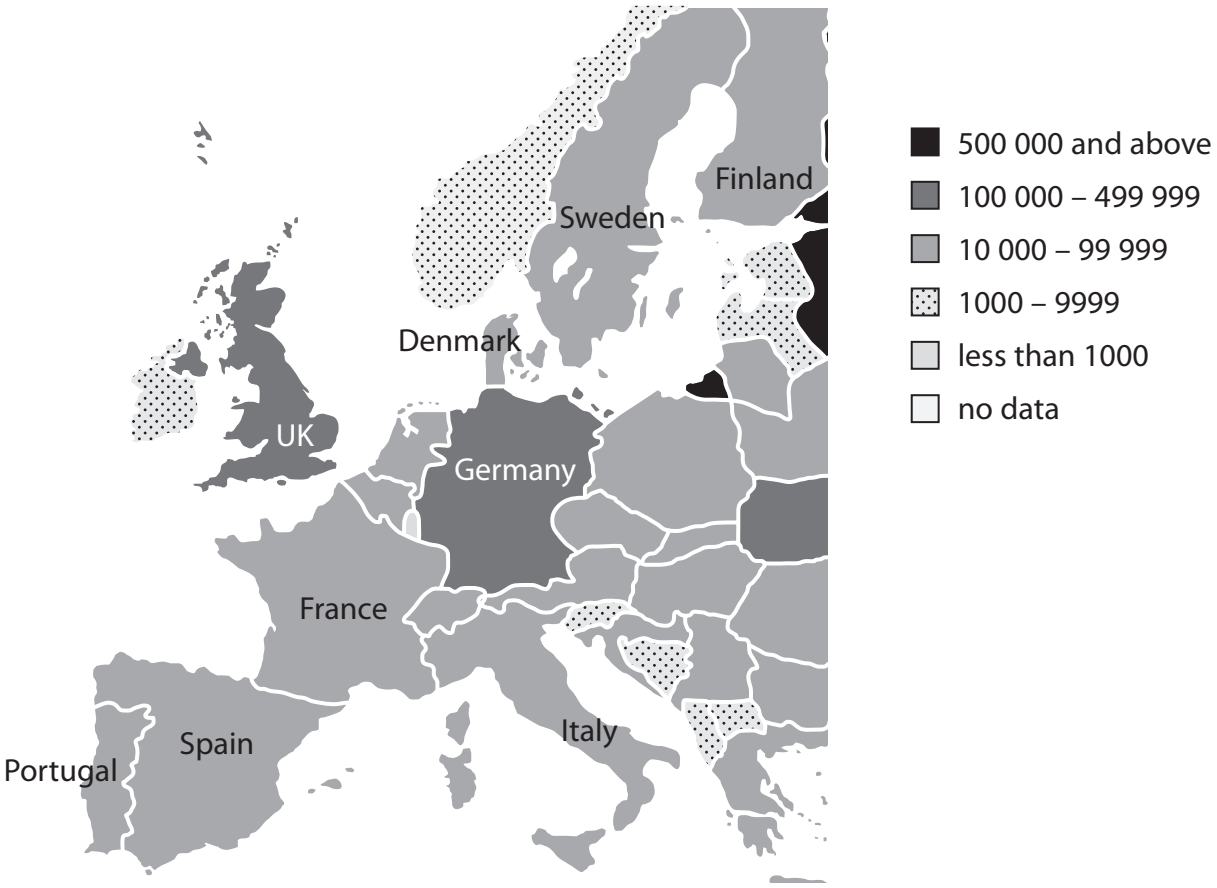
(c) The graph below shows the relative death rate from CVD in some countries in Western Europe.



(i) Compare the relative death rates from CVD in Finland, Denmark and Sweden.

(3)

(ii) The map below shows the number of deaths from CVD in one year in Western Europe.



Describe **two** differences between the data presented in the map and the data shown in the graph.

(2)

1 .....

.....

2 .....

.....

(iii) Suggest **one** reason for the differences between the data presented in the map and the data shown in the graph.

(1)

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(Total for Question 5 = 13 marks)

6 The sequence of amino acids in a polypeptide chain is determined by the sequence of bases in DNA. This sequence of bases is used as a template to synthesise messenger RNA (mRNA).

(a) Describe the structure of an amino acid.

(2)

(b) Describe how mRNA is synthesised.

(4)

(c) The table below shows the amino acids coded for by the codons on **mRNA**.

Three-letter codons of mRNA and the amino acids specified by the codons			
AAU, AAC — Asparagine	CAU, CAC — Histidine	GAU, GAC — Asparatic acid	UAU, UAC — Tyrosine
AAA, AAG — Lysine	CAA, CAG — Glutamine	GAA, GAG — Glutamate	UAA, UAG — Stop
ACU, ACC, ACA, ACG — Threonine	CCU, CCC, CCA, CCG — Proline	GCU, GCC, GCA, GCG — Alanine	UCU, UCC, UCA, UCG — Serine
AGU, AGC — Serine AGA, AGG — Arginine	CGU, CGC, CGA, CGG — Arginine	GGU, GGC, GGA, GGG — Glycine	UGU, UGC — Cysteine UGA — Stop UGG — Tryptophan
AUU, AUC, AUA — Isoleucine AUG — Methionine	CUU, CUC, CUA, CUG — Leucine	GUU, GUC, GUA, GUG — Valine	UUU, UUC — Phenylalanine UUA, UUG — Leucine

The diagram below shows part of a messenger RNA molecule.

(i) Place a cross ☒ in the box next to the complementary sequence of bases found on the strand of the **DNA** molecule, from which part of this mRNA molecule was synthesised.

(1)

☒ **A** G G T A A G C G C C T T

☒ **B** G G U A A C G C G G A A

☒ **C** A A C G G A U A U U G G

☒ **D** A A C G G A T A T T G G

(ii) Place a cross ☒ in the box next to the sequence of amino acids found in the polypeptide chain that is coded for by this part of the **mRNA** molecule.

(1)

☒ **A** proline lysine alanine valine

☒ **B** proline phenylalanine alanine valine

☒ **C** glycine lysine arginine glutamine

☒ **D** proline lysine alanine glutamine

(iii) Place a cross ☒ in the box next to the final codon on this **mRNA** molecule if GUU is the last codon for an amino acid.

(1)

☒ **A** AGU

☒ **B** ACU

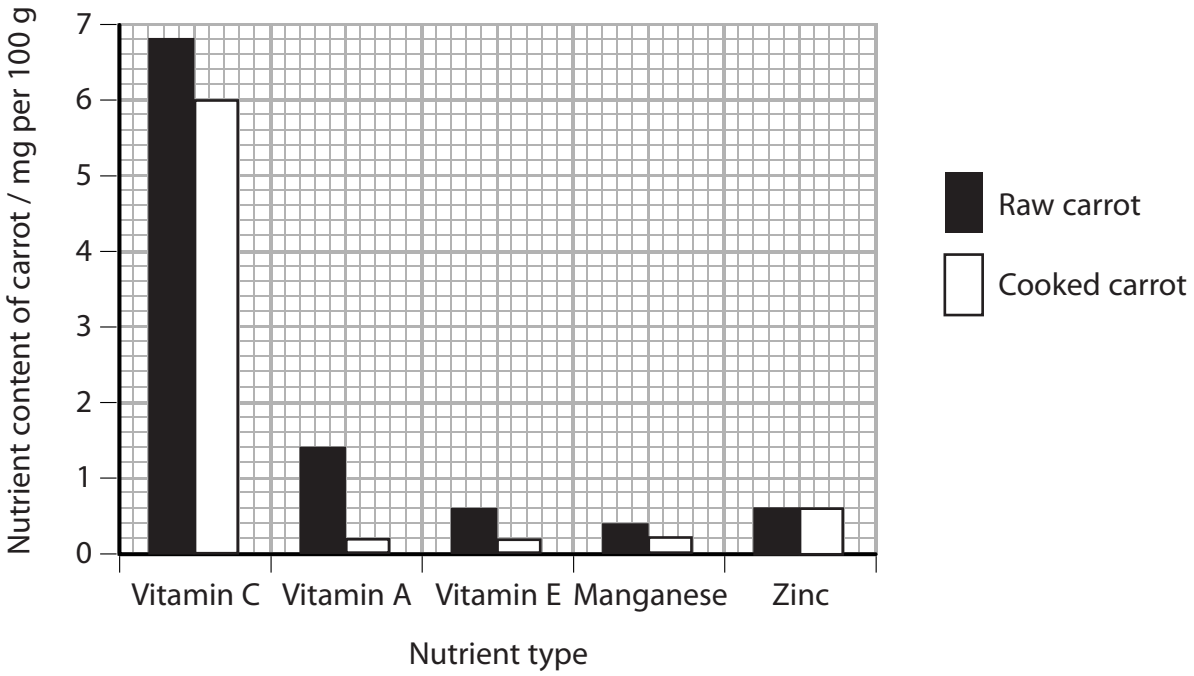
☒ **C** UCA

☒ **D** UGA

(Total for Question 6 = 9 marks)

7 When vegetables are cooked in boiling water, they may lose some of their nutrients.

The graph below shows the effect of cooking on the content of three vitamins and two minerals found in carrots.



(a) Using the information in the graph, compare the effects of cooking on the content of vitamins and minerals found in carrots.

(3)

*(b) It has been suggested that cooking food in a microwave oven does not reduce the nutrient content of foods by as much as cooking in boiling water.

A student wanted to test this idea on the vitamin C content of carrots.

Describe an investigation that the student could carry out to compare these two methods of cooking on the vitamin C content of carrots.

(5)

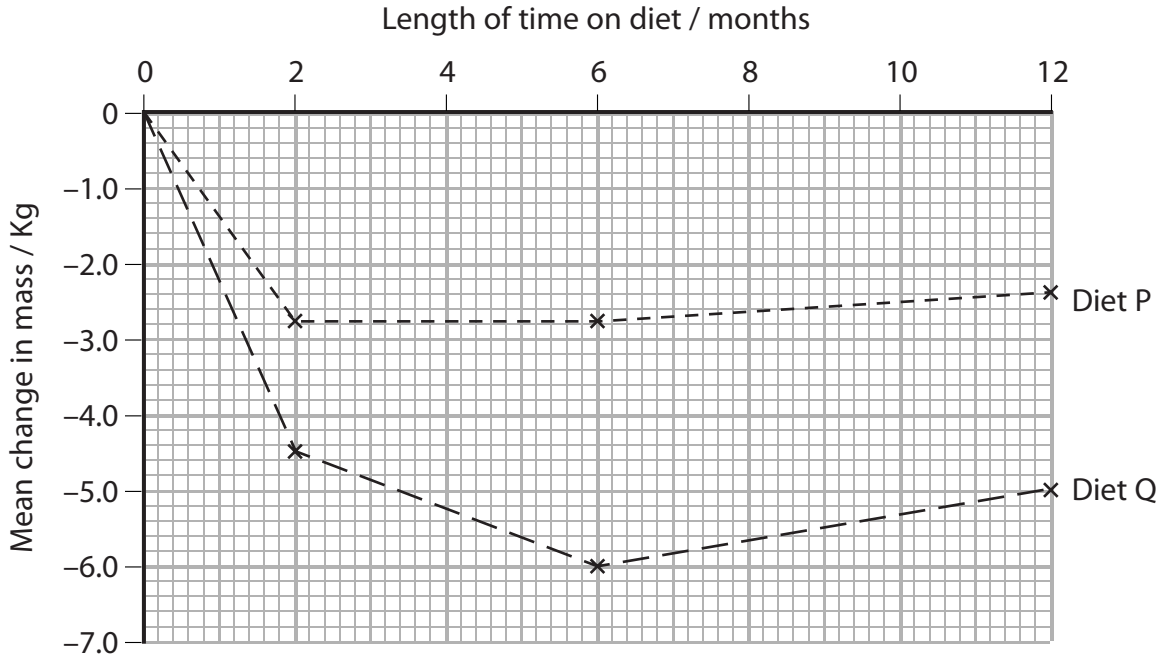
(Total for Question 7 = 8 marks)

8 Many different diets are available for people who want to lose weight. There is a lot of confusion over the merits of each one.

A scientist carried out an investigation to compare the effects of diet P and diet Q, on volunteers.

The changes in mass of two groups of volunteers on each of these diets were monitored over a 12-month period.

The graph below shows the mean changes in mass for each group of volunteers.



(a) (i) Compare the mean change in mass, over the first 6 months, for these two groups of volunteers.

(3)

(ii) Suggest why there was an increase in the mean mass of the volunteers on both diets between 6 months and 12 months.

(1)

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(iii) State **two** variables that the scientist needed to control in this investigation.

(2)

1 .....

2 .....

(b) Suggest why exercise is usually included as part of a weight loss programme.

(3)

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(Total for Question 8 = 9 marks)

TOTAL FOR PAPER = 80 MARKS

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