EDEXCEL A-LEVEL BIOLOGY

BIOLOGY



EXAM QUESTION PACK

UNIT 1 OLD SPECIFICATION PAPERS

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Write your name here

Surname	Other names

Pearson Edexcel GCE

Centre Number	Candidate Number

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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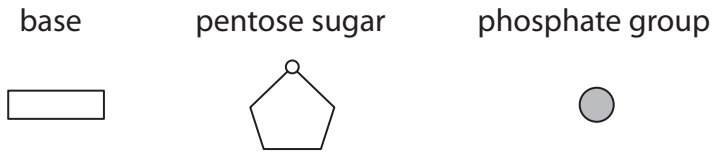
Answer ALL questions.

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.

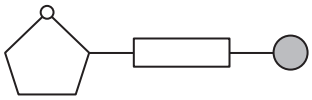
(i) A mononucleotide consists of three components represented by the diagrams below.



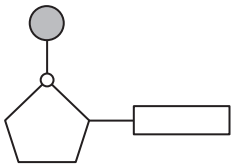
The diagram that shows the correct arrangement of these components in a mononucleotide is

(1)

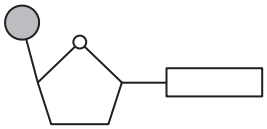
☒ **A**



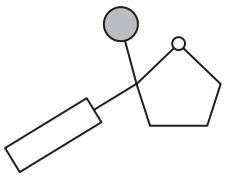
☒ **B**



☒ **C**



☒ **D**



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(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)

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(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)

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(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)

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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)

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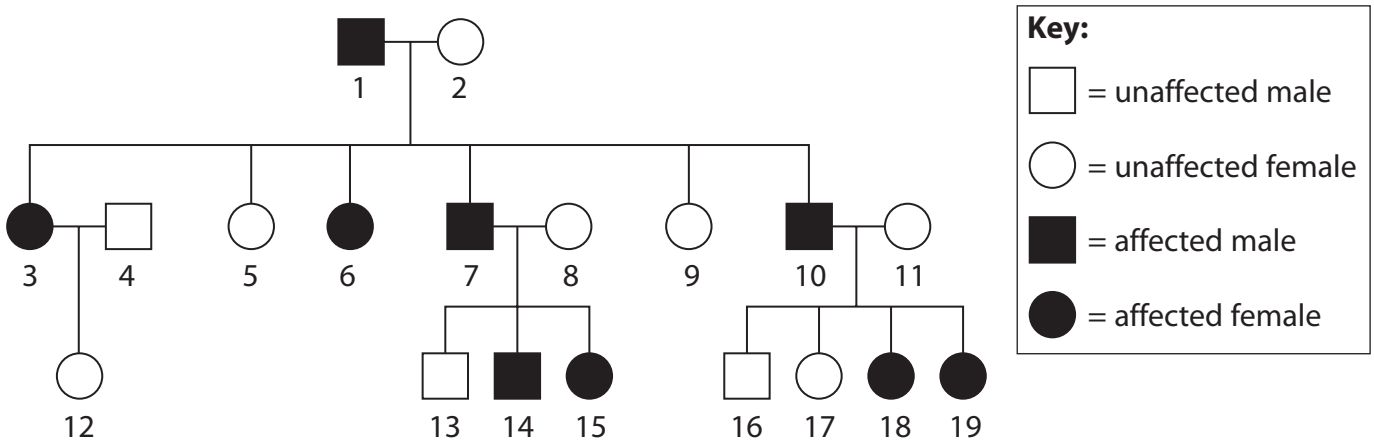
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3 Moyamoya is a **rare** disorder caused by a dominant allele. This disorder progressively damages the arteries supplying the brain.

(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)

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(Total for Question 3 = 10 marks)

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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.

(2)

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(Total for Question 4 = 10 marks)

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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)

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(Total for Question 5 = 14 marks)

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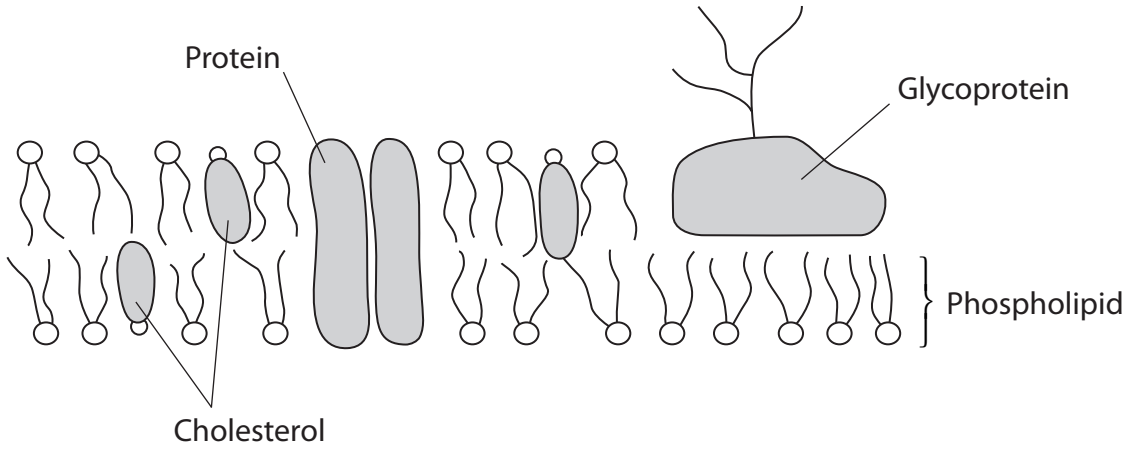
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6 The fluid mosaic model explains our current knowledge of the structure of cell membranes and the movement of molecules in and out of cells.

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

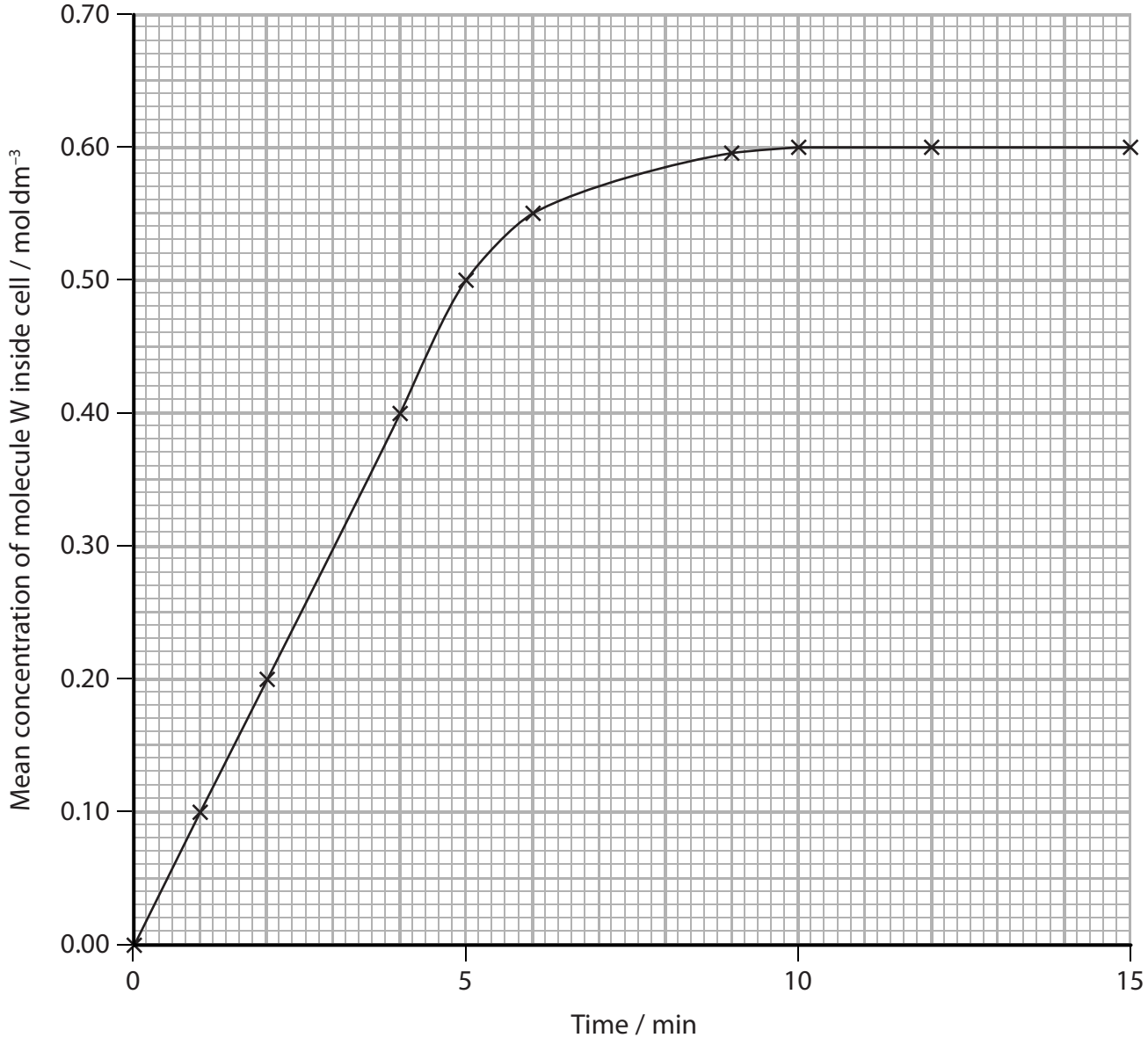
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(b) A student investigated the movement of molecules into red blood cells. He placed red blood cells into a solution of molecule W.

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.



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(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)

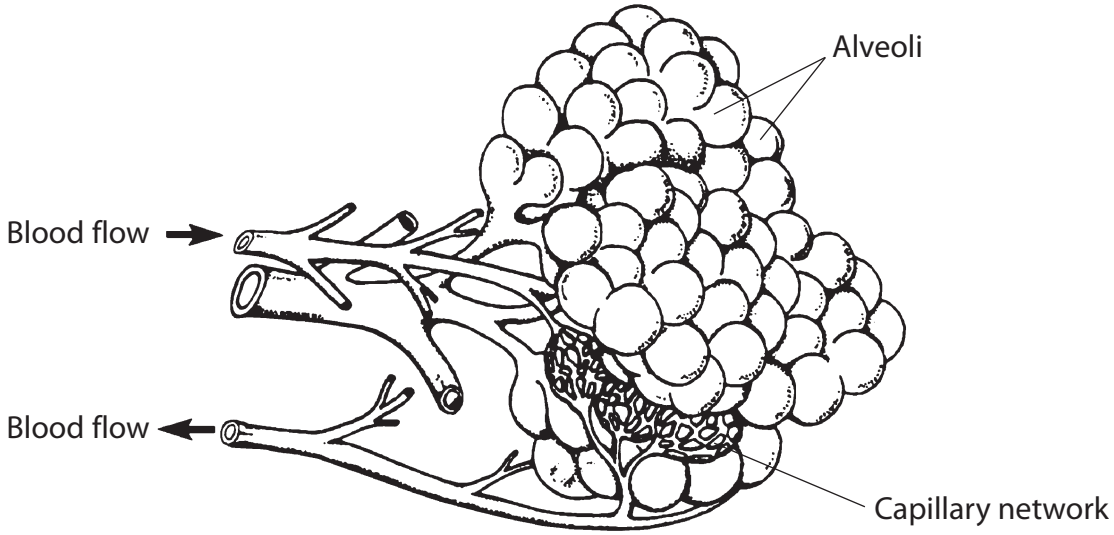
(Total for Question 6 = 11 marks)

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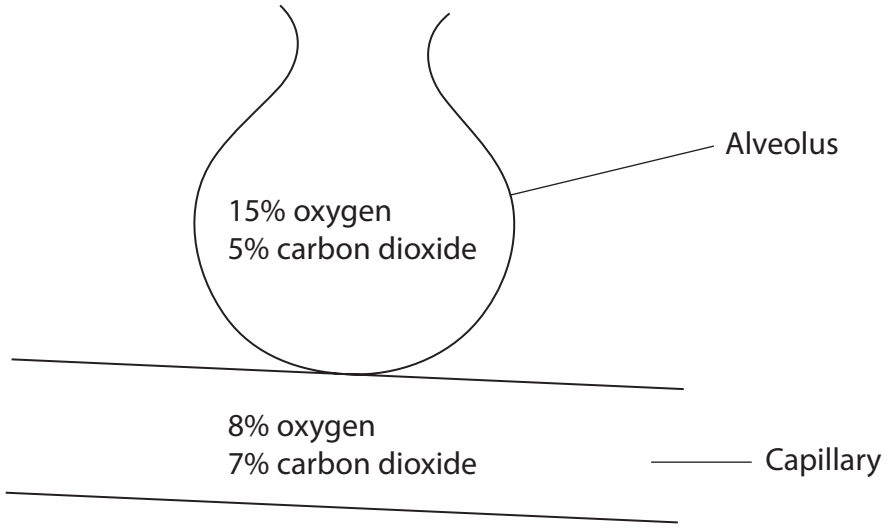
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(b) The diagram below represents the approximate concentrations of oxygen and carbon dioxide inside an alveolus and a capillary in the lungs.

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)

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(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.

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

*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)

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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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Mark Scheme (Results)

Summer 2016

Pearson Edexcel GCE
in Biology (6BI01) Paper 01
Transport, Genes and Health

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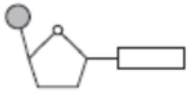
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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question Number	Answer	Additional Guidance	Mark
1(a)(i)	C 		(1)

Question Number	Answer	Additional Guidance	Mark
1(a)(ii)	B G-A-U-U-C-A-C-G-U		(1)

Question Number	Answer	Additional Guidance	Mark
1(a)(iii)	C 3 1 4 2		(1)

Question Number	Answer	Additional Guidance	Mark
1(b)(i)	8		(1)

Question Number	Answer	Additional Guidance	Mark
1(b)(ii)	6		(1)

Question Number	Answer	Additional Guidance	Mark
1(c)	1. DNA is {double stranded/ has a double helix} and RNA is {single stranded / does not have a double helix} ; 2. DNA has {thymine / T } while RNA has { uracil / U } ; 3. DNA has deoxyribose while RNA has ribose ; 4. DNA is { larger / longer } than RNA / eq ;	**1. ACCEPT** mixtures e.g. DNA double helix mRNA is single strand **IGNORE** hydrogen bonds **2.NOT** thiamine, thyamine	**(3)**

Question Number	Answer	Additional Guidance	Mark
2(a)	correct answer only gains both marks 1. 32.2 – 7.6 = 24.6 ; 2. (÷ 32.2) × 100 = 76.4 / 76. 40 ;	 **ACCEPT 7.6** ÷ 32.2 100 – 23.6 = 76.4 / 76.40	**(2)**

Question Number	Answer	Additional Guidance	Mark
2(b)	1. idea of producing liquid extract of cabbage; 2. description of titration ; 3. reference to use of DCPIP ; 4. correct colour change described ; 5. compare volumes with standard e.g. reference to use of calibration curve / eq ; 6. description of appropriate standardisation of extract e.g. mass of cabbage, volume of liquid added to cabbage ;	 2. e.g. set volume of extract and find the volume of DCPIP needed or converse 4. e.g. it goes colourless when extract added, add DCPIP until it goes blue	**(4)**

Question Number	Answer	Additional Guidance	Mark
2(c)(i)	1. cell membranes {damaged / permeable / eq} ; 2. vitamin C leaves the {cells / cabbage} (because it is water soluble) ; 3. vitamin C is destroyed by {boiling / enzyme / ascorbic acid oxidase } ;		(2)

Question Number	Answer	Additional Guidance	Mark
2(c)(ii)	the { enzyme / ascorbic acid oxidase } would have been denatured (quicker when added to the boiling water) ;	**ACCEPT** for cold water: enzyme is more active as water is heated up or vitamin C leaks out as it heats up	(1)

Question Number	Answer	Additional Guidance	Mark
2(d)	1. idea that stored sauerkraut still contains some vitamin C. 2. cabbage would {rot / decompose / eq } ;	**ACCEPT** sauerkraut does not rot	(1)

Question Number	Answer	Additional Guidance	Mark
3(a)(i)	1. idea of it being frequently inherited in the family e.g. 1, 7 and 10 all have affected offspring, 9 of the family have the disorder ; 2. individual { 1 / 3 / 7 / 10 } must be heterzygous / eq ; 3. use of the pedigree diagram to explain mark point 2 ; 4. appropriate use recessive allele argument e.g. if it were recessive then 2 would have to be {heterozygous / a carrier} ; 5. idea that it is unlikely that the unrelated parents { 8 / 11 } would also be carriers of the affected allele ;	**IGNORE** 50% are affected **1 ACCEPT** 8 of 14 descendants of 1 and 2 2 **ACCEPT** have one dominant allele	**(3)**

Question Number	Answer	Additional Guidance	Mark
3(a)(ii)	1. parents gametes displayed correctly (e.g. M, m and m ,m) ; 2. correct genotypes of offspring shown ; 3. probability matches genotypes shown e.g. 0.5 / ½ / 1 in 2 / 50% ;	**1. ACCEPT** gametes shown on a punnett square alone 3. **ACCEPT** other probabilities if match genotypes shown	**(3)**

Question Number	Answer	Additional Guidance	Mark
3(b)	Any two pairs from: 1. idea that there is a { thick wall / thick layers / thick tunica media / eq } ; 2. idea that it needs to { avoid rupture / withstand high pressure / allow expansion / eq } ; 3. collagen / elastic fibres ; 4. allow expansion / elastic recoil ; 5. muscle { layer / fibres / wall / eq } ; 6. control the flow of blood / maintain blood pressure / eq ; 7. smooth endothelial wall / eq ; 8. to reduce { friction / resistance / eq } ; 9. narrow lumen ; 10. (to maintain) high blood pressure / eq ;	**3 and 4 . ACCEPT** folded {endothelium / (inner) surface} allows expansion	**(4)**

Question Number	Answer	Additional Guidance	Mark
4(a)(i)	**B** (are R and S) ;		**(1)**

Question Number	Answer	Additional Guidance	Mark
4(a)(ii)	**C** (is P only) ;		**(1)**

Question Number	Answer	Additional Guidance	Mark
4(b)	1. glycerol plus three fatty acids as reactants ; 2. ester bond labelled ; 3. water shown ;	**2 ACCEPT** an ester bond drawn out correctly even if not labelled	**(3)**

Question Number	Answer	Additional Guidance	Mark
4(c)(i)	condensation / polymerisation ;	**ACCEPT** polymerization	**(1)**

Question Number	Answer	Additional Guidance	Mark
4(c)(ii)	glycosidic / 1,4 glycosidic ;	**ACCEPT** glycoside **ACCEPT** missing commas and commas replaced with dashes **NOT** 1,6 glycosidic **IGNORE** link or bond	**(1)**

Question Number	Answer	Additional Guidance	Mark
4(c)(iii)	Amylose is {coiled / unbranched / eq } / amylose has only 1,4 (glycosidic) bonds / eq ;	**ACCEPT** glycogen is not coiled / branched / has 1,4 and 1,6 glycosidic bonds	**(1)**

Question Number	Answer	Additional Guidance	Mark
4(c)(iv)	1. contain glucose / eq ; 2. idea that they are compact so large {numbers of glucose / amylose / glycogen } molecules can fit into a small volume ; 3. insoluble therefore {does not affect osmosis / eq } ; 4. large molecules therefore { remains in cells / too big to diffuse / eq} ;	**ACCEPT if each described separately but allow each Mp once only** 1. **ACCEPT** can be hydrolysed / broken down to release glucose 2. **ACCEPT** large amounts of energy in a small volume 3. **IGNORE** insoluble so will not dissolve	**(2)**

Question Number	Answer	Additional Guidance	Mark
5(a)	1. platelets ; 2. prothrombin ; 3. fibrin ;	**NB any sign of an arrow then item to go to review.** 1. **ACCEPT** plattelets, platellets 2. **ACCEPT** prothrombrin	**(3)**

Question Number	Answer	Additional Guidance	Mark
5(b)	1. prevents oxygen reaching the heart {muscle / cells / tissue / eq} ; 2. prevents (aerobic) respiration ; 3. (cardiac) muscle { unable to contract / dies / eq } ;	1. **ACCEPT** heart muscle ischaemic 2. **ACCEPT** reference to anaerobic respiration / lactic acid production **ACCEPT** { no / less } ATP is produced 3. **ACCEPT** produces interference in the electrical impulses across the heart / eq **ACCEPT** cells of the heart die	**(3)**

Question Number	Answer	Additional Guidance	Mark
5(c)(i)	1. description of the trend e.g. increasing ratio decreases death rate, negative correlation / eq ; 2. highest death rate in countries with lowest ratio of unsaturated to saturated fatty acids / eq ; 3. correct manipulation of figures to illustrate relationship ;	**2. ACCEPT** converse **3**. e. g. Finland and Italy 2x ratio / deaths down by 268 Finland and USA ratio up by 0.1 / deaths down by 95	**(3)**

Question Number	Answer	Additional Guidance	Mark
5(c)(ii)	1. increase the ratio of unsaturated to saturated in their diet / eq ; 2. because in countries with a low ratio of unsaturated to saturated the death rate by CVD is high / eq ; 3. replace animal fats with plant oils / reduce animal fats / increase plant oils ; 4. because {animal fats / beef / butter } have a high % of { saturated fatty / palmitic / stearic } acids / **OR** { plant oils / olive and corn oil } have a high % of {unsaturated fatty / linoleic / oleic } acids **OR** { saturated fatty / palmitic / stearic } acids raise blood cholesterol / **OR** { unsaturated fatty / linoleic / oleic } acids {reduce / do not raise } blood cholesterol (to reduce chance of death) ;	**1.ACCEPT** eat more unsaturated and less saturated 3. **ACCEPT** suitable reference to beef, butter, olive oil and corn oil	**(3)**

Question Number	Answer	Additional Guidance	Mark
5(d)	1. other { variables / uncontrolled variables / eq } affect CVD ; 2. genetic differences (between national populations) / eq ; 3. (countries have) {environmental / life style } differences / eq ; 4. idea that data does not provide a causal { link / mechanism} ;	2. **ACCEPT** gender 3. **ACCEPT** differences in levels of activity, smoking, other dietary factors e.g. salt, alcohol consumption **ACCEPT** age profiles of countries may differ	**(2)**

Question Number	Answer	Additional Guidance	Mark
6(a)(i)	**D** – passive transport		**(1)**

Question Number	Answer	Additional Guidance	Mark
6(a)(ii)	**C** - ions move down a concentration gradient		**(1)**

Question Number	Answer	Additional Guidance	Mark
6(a)(iii)	**B** - involves the production of a vacuole or vesicle		**(1)**

Question Number	Answer	Additional Guidance	Mark
6(b)(i)	1. idea that the rate of uptake {is constant for first 5 minutes / reduces after 5 minutes} ; 2. idea that { concentration of W reaches a maximum / no more uptake / stays at 0.6 mol dm^{-3} } from 10 minutes ; 3. suitable manipulation of figures e.g. rate of uptake in first 5 minutes is 0.1 $moldm^{-3}$ per minute ;	**1. ACCEPT** idea of linear increase in first 5 minutes	**(3)**

Question Number	Answer	Additional Guidance	Mark
6(b)(ii)	1. uptake {slows down / is less / stops} / eq ; 2. because of smaller {concentration / diffusion } gradient / eq ; 3. credit argument for why it is not another process e.g. not osmosis as the solute concentration rises from 0, not active transport as it will continue to rise and not reach a maximum ;	**2 ACCEPT** converse	**(2)**

Question Number	Answer	Additional Guidance	Mark
6(c)	1. idea that water has moved into the cell ; 2. by osmosis ; 3. idea of a solute concentration gradient ; 4. cell membrane ruptures / eq ;	**3. ACCEPT** water {potential / concentration} gradient	**(3)**

Question Number	Answer	Additional Guidance	Mark
7(a)(i)	Blood vessel at bottom of diagram with blood flowing away from the capillaries clearly labelled {P / pulmonary vein};		(1)

Question Number	Answer	Additional Guidance	Mark
7(a)(ii)	Any one difference described e.g. 1. capillary wall is one cell thick while vein wall is thicker / eq 2. capillary has no {collagen/ muscle} 3. capillaries do not have valves 4. smaller lumen in capillaries than veins ;	 1. **ACCEPT** capillary wall is only one cell thick **NOT** cell wall 2 **ACCEPT** converse 3 **ACCEPT** converse	(1)

Question Number	Answer	Additional Guidance	Mark
7(b)	1. O_2 diffuses more quickly than CO_2 ; 2. different concentration gradients / eq ; 3. molecules are different sizes / eq ;	 2. **ACCEPT** higher concentration gradient for O_2. **ACCEPT** gradients are 7 for oxygen and 2 for carbon dioxide	(2)

Question Number	Answer	Additional Guidance	Mark
7(c)	**(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence)** 1. idea that large surface area provided by alveoli ; 2. idea that large surface area provided by capillary network ; 3. idea that concentration gradient maintained by {ventilation of / air flow in / eq } the lungs ; 4. idea that concentration gradient maintained by {circulation / mass flow / eq } of blood ; 5. idea that diffusion pathway is small because alveoli have a thin wall ; 6. idea that diffusion pathway is small because capillaries { have a thin wall / are in contact with alveoli / are only one cell thick / eq } ; 7. idea that air is warmed because lungs are in core of body ; 8. warmer air enables faster {movement / diffusion / eq } of gases / eq ; 9. reference to { respiratory pigment / haemoglobin / red blood cells / eq } to carry oxygen ;	**QWC emphasis is on clarity of expression** 1&2. **IGNORE** large surface area to volume ratio unless in context of whole body 5.& 6. NOT cell wall	**(5)**

Question Number	Answer	Additional Guidance	Mark
8(a)(i)	1. life expectancy is likely to be lower than {Aa / heterozygote} ; 2. because of higher chance of (developing) malaria / eq ; **OR** 3. life expectancy may be {higher / same } than {aa / homozygous recessive} ; 4. because of {less / similar} severity of anaemia ;		**(2)**

Question Number	Answer	Additional Guidance	Mark
8(a)(ii)	1. idea they (heterozygotes) are less likely to have { malaria / anaemia } ; 2. idea that { *Plasmodium* / parasite / eq } unable to reproduce (and cause wider infection) **OR** lower (functional) red blood cell count / blocking of blood vessels causes {pain / cell death / eq} ;	**2 ACCEPT** parasite will die	**(2)**

Question Number	Answer	Additional Guidance	Mark
8(b)	**(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence)** 1. reference to change in primary structure ; 2. reference to different R group ; 3. leading to different named bond e.g. ionic, hydrogen, disulfide ; 4. different { folding / secondary / tertiary / 3D structure / globular } ; 5. suggested change in properties of the haemoglobin e.g. change in solubility, flexibility, affinity for oxygen / eq ;	**QWC emphasis is on logical sequence** **Maximum of 3 from Mps 1 to 4** 1. **IGNORE** sequence of amino acids 3. **ACCEPT** type or position of bonds **IGNORE** peptide 5. **ACCEPT** {less/no} oxygen will bind to haemoglobin	**(4)**

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Write your name here

Surname	Other names

Pearson Edexcel GCE

Centre Number	Candidate Number

Biology

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

Thursday 21 May 2015 – 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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P 4 5 0 6 7 A 0 1 2 4

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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 One function of DNA is to act as a template for the synthesis of messenger RNA.

(a) State what is meant by the term **template** for the synthesis of messenger RNA.

(1)

.....

.....

.....

.....

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

(i) DNA and mRNA both

(1)

☒ **A** contain ribose

☒ **B** contain thymine

☒ **C** have a double helix structure

☒ **D** have a sugar-phosphate chain

(ii) One advantage of DNA having two complementary strands is that

(1)

☒ **A** diploid cells can inherit DNA from both parents

☒ **B** hydrolysis of DNA is faster

☒ **C** semi-conservative replication is possible

☒ **D** transcription and replication can occur at the same time

(iii) Analysis of a sample of DNA found that 40% of the nucleotides contained cytosine. In the same sample of DNA the percentage of nucleotides containing adenine would be

(1)

☒ **A** 10%

☒ **B** 20%

☒ **C** 40%

☒ **D** 60%

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(c) The DNA base sequence for part of a gene is shown below.

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

Write the mRNA base sequence produced from this sequence of bases.

(2)

(d) Describe **three** differences between the processes of replication and transcription of DNA.

(3)

1 .....

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2 .....

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3 .....

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(Total for Question 1 = 9 marks)

P 4 5 0 6 7 A 0 3 2 4
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2 The photograph below shows a cleft iris, a rare condition in humans. Cleft iris may be due to the inheritance of recessive alleles.



Magnification ×1

(a) Explain the meaning of the term **recessive allele**.

(3)

P 4 5 0 6 7 A 0 4 2 4
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(b) (i) In the space below, draw a genetic diagram to show the genotypes and phenotypes of a man with cleft iris and a woman who is heterozygous for this condition, and all their possible children.

(4)

(ii) State the probability that the first child of these parents will have a cleft iris.

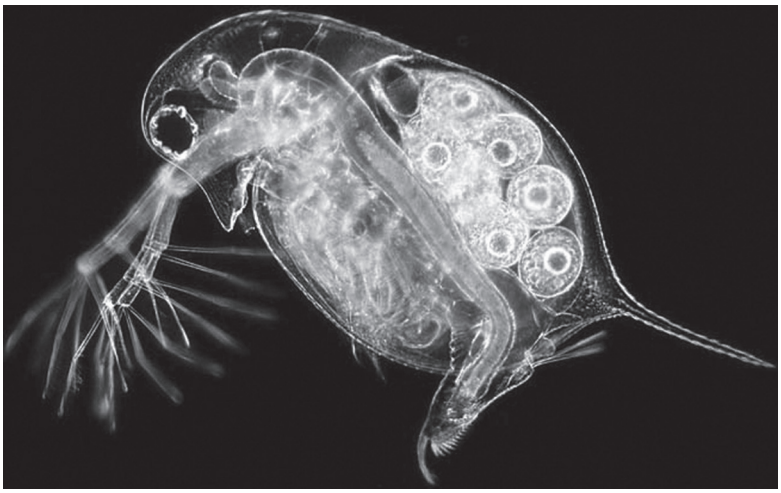
(1)

.....

(Total for Question 2 = 8 marks)

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3 The photograph below shows *Daphnia* (a water flea). *Daphnia* can be used to investigate the effect of chemicals on heart rate.



Magnification ×30

(a) (i) Give **two** reasons why *Daphnia* is a suitable organism for investigating the effect of chemicals on heart rate.

(2)

1 .....

.....

.....

.....

2 .....

.....

.....

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P 4 5 0 6 7 A 0 6 2 4
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(ii) State **two** variables that you would need to control for a valid investigation into the effect of caffeine on the heart rate of *Daphnia*.

Describe how to control each of these variables.

(4)

1. Variable .....

How to control .....

.....

.....

.....

2. Variable .....

How to control .....

.....

.....

.....

(b) Explain why many small animals, such as *Daphnia,* have a heart.

(3)

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(Total for Question 3 = 9 marks)

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4 Cystic fibrosis is an inherited condition.

(a) Read through the following passage about cystic fibrosis then write on the dotted lines the most appropriate word or words to complete the sentences.

(4)

Cystic fibrosis is a disorder caused by one of a number of gene mutations.

The symptoms of the disorder are seen only in an individual who is

..... for the recessive allele. The gene codes for

a ..... protein called CFTR. This protein is responsible for the

movement of ..... ions across the cell membranes. Cystic fibrosis

impairs the functions of the gaseous exchange, digestive and .....

systems in the body.

(b) Explain why people with cystic fibrosis can have breathing difficulties.

(4)

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(c) Cystic fibrosis can be detected using prenatal genetic testing.

(i) Describe how **one** named method of **prenatal** genetic testing can be carried out.

(3)

(ii) Explain **either** one ethical issue **or** one social issue relating to the use of prenatal genetic testing.

(2)

(Total for Question 4 = 13 marks)

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5 Over 20% of the population of the UK is classified as obese. Obesity is a significant risk factor in the development of cardiovascular disease (CVD).

(a) One way of estimating if a person is obese is to find their Body Mass Index (BMI). Body Mass Index is calculated using the formula below.

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

The table below provides the range of BMI values for different categories of people.

Category	BMI range
Very severely underweight	less than 15.0
Severely underweight	from 15.0 to 15.9
Underweight	from 16.0 to 18.4
Normal (healthy weight)	from 18.5 to 24.9
Overweight	from 25.0 to 29.9
Obese Class I (moderately obese)	from 30.0 to 34.9
Obese Class II (severely obese)	from 35.0 to 39.9
Obese Class III (very severely obese)	over 40.0

(i) Calculate the BMI of a person who has a mass of 95 kg and a height of 1.75 metres.

(1)

Answer .....

(ii) Use your calculated value and the information in the table to find the category of this person.

(1)

Category .....

P 4 5 0 6 7 A 0 1 0 2 4
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*(iii) People in this category are more likely to develop high blood pressure than people with a healthy weight.

Explain why someone who has a high blood pressure is at a significantly higher risk of developing CVD.

(4)

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(b) Suggest **one** piece of medical advice that could be given to someone who does not have high blood pressure but who is obese.

Explain why this will help to reduce their risk of developing CVD.

(3)

Medical advice: .....

.....

Why this will reduce the risk of developing CVD: .....

.....

.....

.....

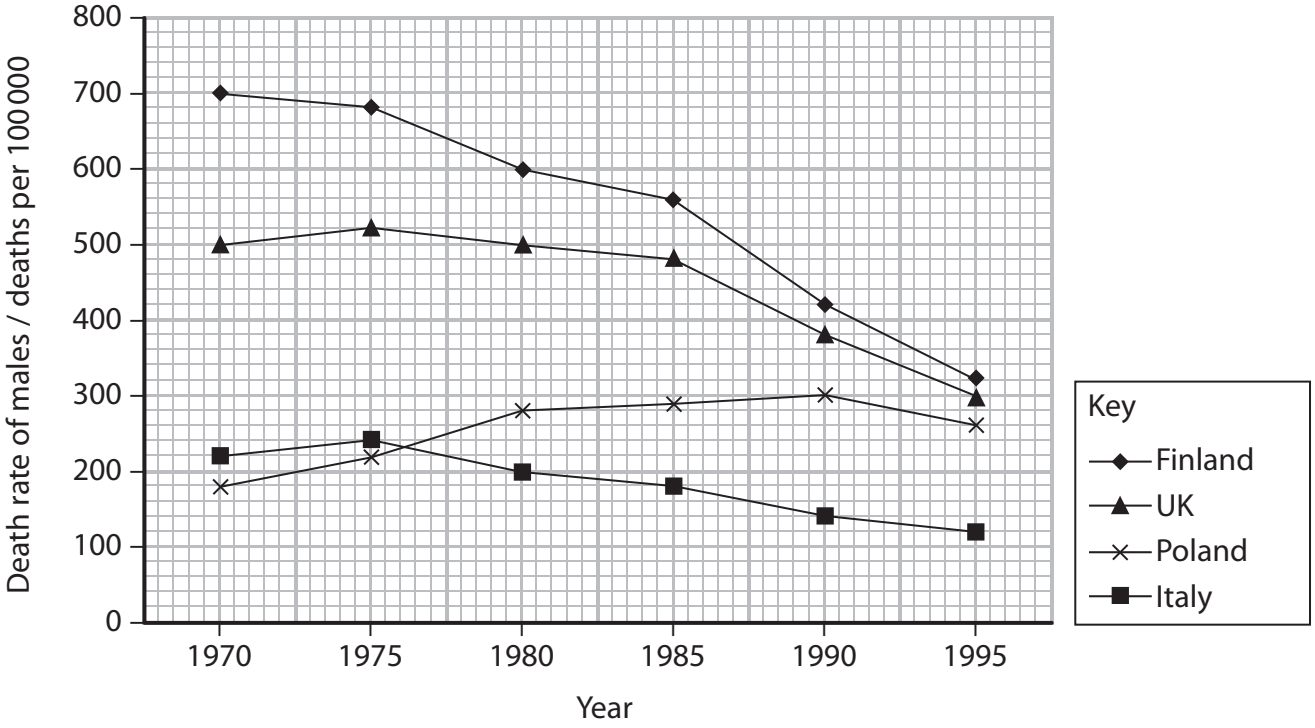
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(c) The graph below shows the death rates from CVD for men from four different European countries.



Using the information in the graph, discuss the statement that death rates from CVD are falling.

(3)

(Total for Question 5 = 12 marks)

P 4 5 0 6 7 A 0 1 3 2 4
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6 Lysozyme is an enzyme found in tears. Lysozyme can destroy some bacteria by breaking down the polysaccharide chains that form part of their cell walls.

(a) The primary structure of lysozyme is a specific sequence of 129 amino acids.

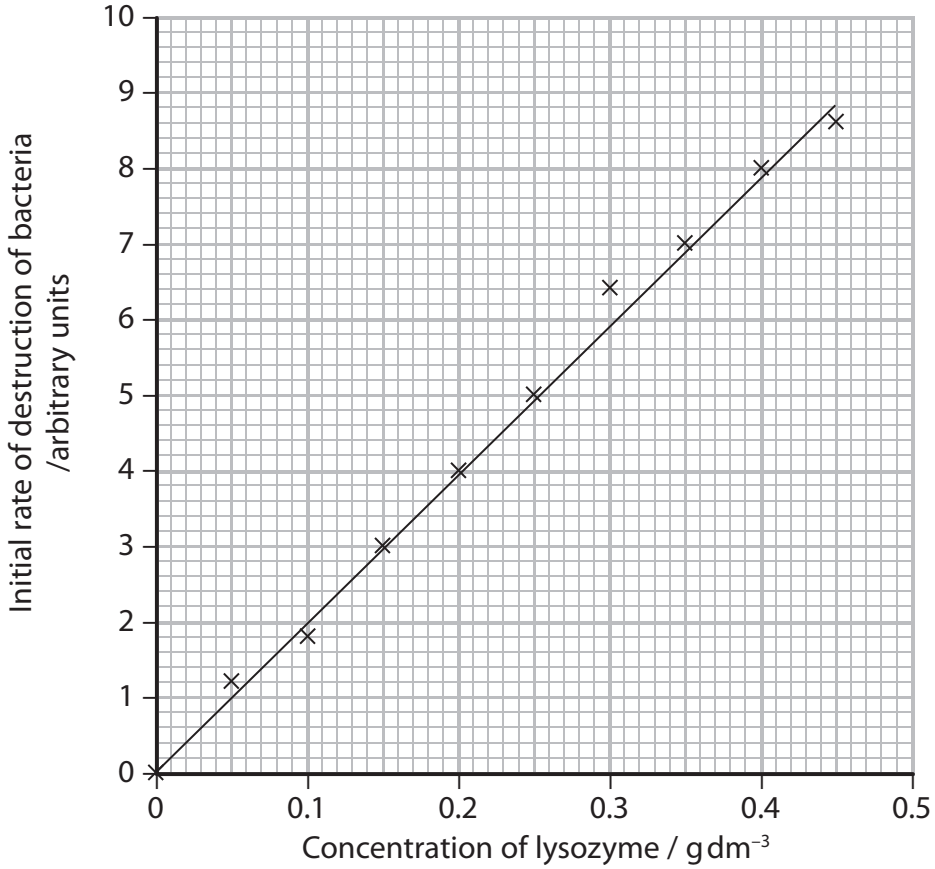
Two of the amino acids that make up the active site are in positions 35 and 52 in the primary structure.

Suggest how these two amino acids could be brought closer together to form part of the active site of this enzyme.

(3)

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(b) The graph below shows the effect of increasing the concentration of lysozyme on the initial rate of destruction of bacteria.



(i) Using the information in the graph, explain the effect of the concentration of lysozyme on the initial rate of destruction of bacteria.

(3)

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(ii) Suggest why some of the data points in the graph do not fit on a straight line.

(1)

(c) Temperature affects the activity of lysozyme.

Suggest why increasing the temperature above 45 °C causes a decrease in the activity of lysozyme.

(2)

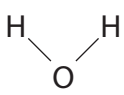
(Total for Question 6 = 9 marks)

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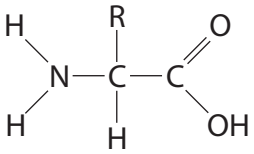
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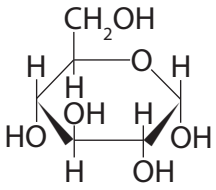
7 The diagram below shows four molecules, P, Q, R and S, found in living organisms.



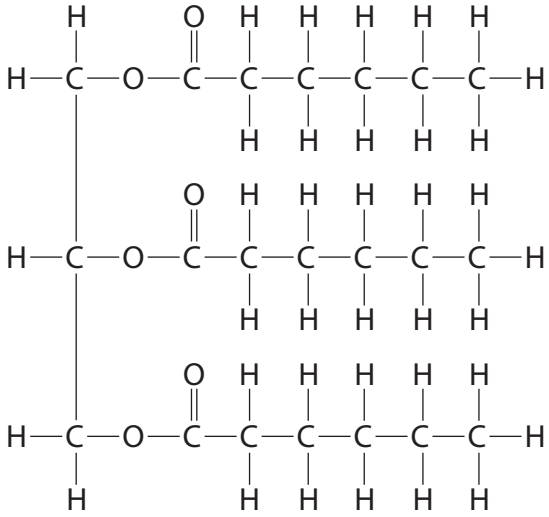
P



Q



R



S

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

(i) Two molecules of **P** can be joined together by

(1)

☒ **A** a hydrogen bond

☒ **B** a hydrophobic interaction

☒ **C** an ionic bond

☒ **D** a peptide bond

(ii) A condensation reaction between two molecules of **Q** forms

(1)

☒ **A** an ester bond

☒ **B** a glycosidic bond

☒ **C** a hydrogen bond

☒ **D** a peptide bond

P 4 5 0 6 7 A 0 1 8 2 4
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(iii) Molecule **R** is

(1)

- ☒ **A** a fatty acid
- ☒ **B** an amino acid
- ☒ **C** deoxyribose
- ☒ **D** glucose

(iv) One of the products of the hydrolysis of molecule **S** is

(1)

- ☒ **A** a triglyceride
- ☒ **B** an amino acid
- ☒ **C** glycerol
- ☒ **D** water

(b) Name **one** element found in all molecules of **Q** that would not be found in carbohydrates.

(1)

.....

(c) Draw a diagram to show the molecules produced when **two** molecules of **R** join together during a condensation reaction.

(3)

(d) Explain how the dipolar nature of water is essential for living organisms.

(2)

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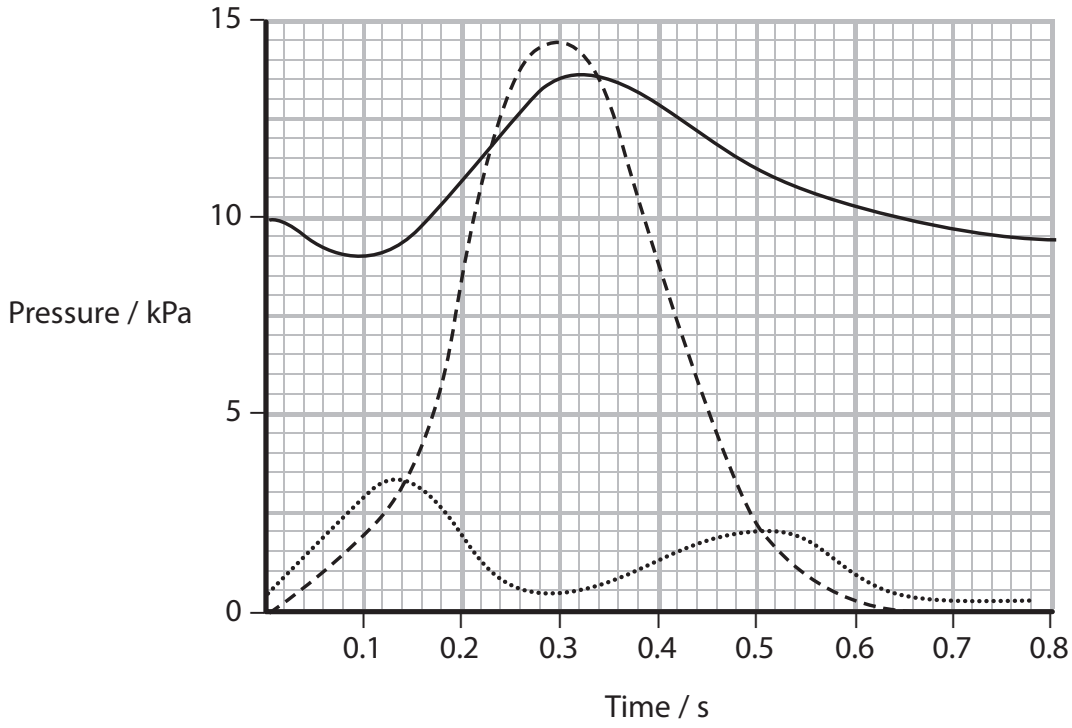
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(Total for Question 7 = 10 marks)

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8 During the cardiac cycle, muscles in the walls of the atria and ventricles contract and relax.

The graph below shows the changes in pressure that occur in the left side of the mammalian heart during one cardiac cycle.



(a) Use the graph to identify the following.

(i) The time at which the bicuspid (left atrioventricular) valve closes.

(1)

..... seconds

(ii) The pressure in the aorta when the semilunar (aortic) valve closes.

(1)

..... kPa

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(b) Using the information in the graph, describe the pressure changes that take place in the left ventricle during each stage of this cardiac cycle.

(3)

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*(c) During this cardiac cycle, the changes in pressure that occur in the left atrium and in the left ventricle are different.

Using the information in the graph and your own knowledge, explain these differences.

(5)

(Total for Question 8 = 10 marks)

TOTAL FOR PAPER = 80 MARKS

Acknowledgements

http://www.health.state.mn.us/divs/fh/mch/webcourse/vision/coloboma.cfm

http://www.microscopy-uk.org.uk/mag/indexmag.html?http://www.microscopy-uk.org.uk/mag/artmar02/fleanatomy.html

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Mark Scheme (Results)

Summer 2015

Pearson Edexcel GCE
in Biology (6BI01)
Paper 01 Transport, Genes & Health

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question Number	Answer	Additional Guidance	Mark
1(a)	idea that the (RNA) nucleotides attach to this strand OR idea of {nucleotide / base } sequence that directs the synthesis of {complementary sequence / mRNA / eq} ;	ACCEPT complementary to RNA nucelotides, codes for mRNA, {part of the DNA / antisense } strand that the mRNA is built along, NOT DNA nucleotides, plural strands	(1)

Question Number	Answer	Mark
1(b)(i)	**D** have a sugar-phosphate chain ;	(1)

Question Number	Answer	Mark
1(b)(ii)	**C** semi-conservative replication is possible ;	(1)

Question Number	Answer	Mark
1(b) (iii)	**A** 10% ;	(1)

Question Number	Answer	Additional Guidance	Mark
1(c)	U G A A A G C G G G C U 1. both uracils correct ; 2. the rest of the sequence correct ;		(2)

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>1 (d)</td><td>Any three from:

<table>
<tr><th></th><th>replication</th><th>transcription</th></tr>
<tr><td>1</td><td>uses DNA nucleotides</td><td>uses RNA nucleotides / eq ;</td></tr>
<tr><td>2</td><td>uses DNA polymerase / eq</td><td>does not use DNA polymerase / uses RNA polymerase ;</td></tr>
<tr><td>3</td><td>reference to semi-conservative</td><td>not semi-conservative / eq ;</td></tr>
<tr><td>4</td><td>(copies) both DNA strands / eq</td><td>(copies) only {one strand / template / gene / eq} ;</td></tr>
<tr><td>5</td><td>makes DNA double helix / eq</td><td>Makes single strand mRNA / eq ;</td></tr>
</table></td><td>Must be clearly comparative for the mark
IGNORE destination of the molecules

1. ACCEPT thymine / T, uracil / U comparison, deoxyribose and ribose, DNA and RNA bases
2. ACCEPT no ligase in transcription

4. ACCEPT whole DNA molecule unzipped for replication with only part for transcription
ACCEPT all {DNA / genome} copied in replication only part in transcription
5. NOT just produces DNA and mRNA
ACCEPT two {new strands of DNA / DNA molecules} compared to one mRNA (each time)
ACCEPT if clear what is being produced elsewhere in the response</td><td>(3)</td></tr>
</table>

Question Number	Answer	Additional Guidance	Mark
2(a)	1. idea that both of these alleles need to be present in order for the recessive phenotype to be expressed ; **AND any two of:** 2. different form of a gene / eq ; 3. same locus /position / eq ; 4. different base sequence / eq ;	1. ACCEPT not expressed in presence of dominant allele 2. ACCEPT type of same gene NOT just type of gene	**(3)**

Question Number	Answer	Additional Guidance	Mark
2(b) (i)	1. genotypes and phenotypes of parents ; 2. gametes clearly shown as individual alleles ; 3. offspring genotypes ; 4. phenotypes correctly matched to genotypes ;	IGNORE gender 1. & 4. ACCEPT carrier/ normal / healthy / unaffected /sufferer as a phenotype 2. NOT E.C.F. from 1. 2. & 3 can be awarded in a Punnett square 3. and 4. can be awarded as E.C.F. from 2	**(4)**

Question Number	Answer	Additional Guidance	Mark
2(b)(ii)	0.5 / ½ / 1 in 2 / 50% ;	IGNORE expressed as a ratio	**(1)**

Question Number	Answer	Additional Guidance	Mark
3 (a) (i)	1. idea that you can see the { heart / internal organs / eq} ; 2. Daphnia {are simple organisms / have less developed nervous system / can't feel pain / eq} ; 3. idea that there are fewer ethical concerns because it is an { invertebrate / eq} ; 4. idea that they are abundant / used as fish food / eq ; 5. idea that they can absorb chemicals from the surrounding solution quickly ;	1. ACCEPT they are transparent 3. NB. needs to be linked to something about the *Daphnia* and not just because it is a *Daphnia* e.g. a simple organism 4. ACCEPT easy to reproduce / easy to keep / readily available / eq; 5. ACCEPT they are small so chemicals can affect them quickly	**(2)**

Question Number	Answer	Additional Guidance	Mark
3(a)(ii)	suitable variables identified ; suitable control method ; Examples: • temperature ; heat shield ; • volume of caffeine (solution) ; (use pipette to measure) stated volume e.g. 2 cm^3 ; • { age / species / source /size / gender } of *Daphnia* ; hatched from eggs at the same time ; • pre-treatment / acclimatisation ; same time ; • reduce movement of Daphnia ; use of cotton wool strands ; • method of measuring heart rate ; count number of heartbeats in 30 seconds / eq ; • {concentration / source} of caffeine ; one caffeine tablet in 10 cm^3 of water ;	**Other variables may be given e.g. stress, oxygen, pH** **The methods shown are examples others may be seen** **IGNORE** water bath, room temperature etc **ACCEPT** keep lamp off except when needed **DO NOT ACCEPT** number of drops **ACCEPT** water bath used in acclimatisation **DO NOT ACCEPT** just stated concentration	**(4)**

Question Number	Answer	Additional Guidance	Mark
3(b)	1. reference to mass flow ; 2. name a suitable substance transported e.g. oxygen ; 3. comment on {blood pressure / fast movement of blood to cells /eq} ; 4. idea of increased concentration gradient of solutes e.g. oxygen ; 5. idea that diffusion alone would be too slow ; 6. has high metabolic rate / eq ;	1. **ACCEPT** mass transport 2. **IGNORE** oxygenated blood 3. **IGNORE** pump alone 4. **ACCEPT** improved gaseous exchange 5. **ACCEPT** surface area to volume ratio too small 6. **IGNORE** activity level	**(3)**

Question Number	Answer	Additional Guidance	Mark
4(a)	1. homozygous ; 2. channel / transport / transmembrane / intrinsic / globular ; 3. chloride / Cl^- / Cl ; 4. reproductive / eq ;	1. **ACCEPT** (a) homozygote 3. **DO NOT ACCEPT** chlorine	**(4)**

Question Number	Answer	Additional Guidance	Mark
4(b)	1. produces {thicker / stickier / more viscous / eq} mucus ; 2. blocking { trachea / bronchi / bronchioles / airway / eq} / eq ; 3. cilia are unable to move mucus out of lungs / eq ; 4. idea of reduced flow of {air / oxygen } to alveoli ; 5. idea of reduced concentration gradient for {oxygen / carbon dioxide} (in alveoli) ; 6. idea of loss of surface area / elasticity / eq ; 7. idea of reduced gaseous exchange ; 8. trapped bacteria may result in more respiratory infections / eq ;	1. ACCEPT sticky / thick in context, ACCEPT less water in mucus 2. IGNORE respiratory system ACCEPT alveoli 7. ACCEPT less O_2 diffuses into blood IGNORE larger diffusion pathway	**(4)**

Question Number	Answer	Additional Guidance	Mark
4(c) (i)	1. chorionic villus sampling / amniocentesis ; 2. idea that (fetal) {cells / DNA} are obtained from appropriate source { placenta / amniotic fluid / eq } ; 3. (cells / DNA) tested for presence of {CFTR / recessive / faulty / mutant / eq} {allele / gene } / eq ;	1. **ACCEPT** CVS **DO NOT ACCEPT** chronic 2. **ACCEPT** from embryo 3. **ACCEPT** test for cystic fibrosis allele or gene	**(3)**

Question Number	Answer	Additional Guidance	Mark
4 (c) (ii)	Any of the following paired points 1. idea that it may result in a miscarriage / choice of an abortion ; 2. {killing / eq} is {wrong / unethical / eq}; **OR** 3. idea of risk of false {positive / negative} ; 4. comment on consequence e.g. healthy fetus may be aborted / parents not prepared for child with cystic fibrosis / eq ; **OR** **5.** if cystic fibrosis or some other abnormality may be found ; 6. comment on possible problems with {future employment / insurance / what constitutes a serious condition} / eq ; **OR** 7. who has right to decide if tests should be performed / eq ; 8. {implications of medical costs / disagreements over next step} ; **OR** 9. issues relating to confidentiality of {parents / child} / eq ; 10. idea that {some other abnormality may be found / paternal DNA does not match / other family members have right to know results} ;	1. **ACCEPT** can {harm / damage / kill} the fetus 2. **ACCEPT** fetus has right to life / distress to parents / genetic discrimination / eugenics 3. **ACCEPT** it isn't 100% accurate 4. **ACCEPT** parents did not have choice of abortion	**(2)**

Question Number	Answer	Mark
5(a)(i)	31.0 / 31.02 / 31 ;	**(1)**

Question Number	Answer	Additional Guidance	Mark
5 (a) (ii)	Obese class I / moderately obese ;	ACCEPT category based on answer to (ai)	**(1)**

Question Number	Answer	Additional Guidance	Mark
5(a) (iii)	(QWC – **Spelling of technical terms must be correct** and the answer must be organised in a logical sequence) 1. idea of damage to {*endothelium* / *endothelial lining*} of {*artery / arteries}* ; 2. reference to *inflammatory* response ; 3. leading to formation of {*atheroma / plaque / atherosclerosis* } ; 4. increased risk of blood clot formation / eq ; 5. ref to {loss of elasticity of *artery* / narrowing of *lumen* / eq } ; 6. idea of (*positive feedback* causing) further increase in blood pressure ;	QWC emphasis is spelling [penalise once only] 1. ACCEPT lining of *artery* IGNORE wall NOT vein 2. ACCEPT detail e.g. foam cells, white cells move into wall , macrophages etc 4. ACCEPT *thrombus* 5. ACCEPT hardening of *artery* wall, blocking of artery	**(4)**

Question Number	Answer	Additional Guidance	Mark
5 (b)	Explanations should be linked to the medical advice. 1. reduce energy intake / increase activity / follow calorie controlled diet / eq ; 2. idea of change in balance of energy budget ; 3. lower {weight / BMI / obesity level / eq} / reduce risk of {atherosclerosis / diabetes / eq} ; OR 4. statins / sterols / reduce { cholesterol / saturated fats / eq} in diet / eq ; 5. reduce blood cholesterol levels ; 6. idea of reducing risk of atherosclerosis / eq ; OR 7. eat more fruit / vegetable / vitamins / moderate alcohol intake / eq ; 8. reference to antioxidants ; 9. they protect against free radical damage / reduce damage to cells / eq ; OR 10. anticoagulants / platelet inhibitory drugs / warfarin / aspirin / eq ; 11. prevent blood clot formation / eq ; 12. reduces risk of blocking artery / eq ;	NB: if more than one piece of medical advice given, mark the one which has the best explanation IGNORE smoking, salt intake 1. **NOT** just healthier diet ACCEPT regular exercise / lower {fat / carbohydrate } intake 2. **ACCEPT** lowers LDL / HDL ratio 3. and 6. **ACCEPT** reduces chance of atheroma / blood clot / eq 4. **ACCEPT** improve HDL/LDL ratio **IGNORE** increase HDL (unless instead of LDL) 10. **DO NOT ACCEPT** drugs to treat blood pressure e.g. beta blockers	**(3)**

Question Number	Answer	Additional Guidance	Mark
5 (c)	1. idea that death rates decrease over time for three of the countries ; and any two from 2. death rate for Poland has{ increased / eq} (overall) ; 3. limitations of the data due to number of countries / eq ; 4. limitations due to timescale of data / eq ; 5. limitations due to men only data / eq ;	1. **ACCEPT** all except Poland / eq **IGNORE** separate descriptions of data for Finland, UK and Italy 2. **IGNORE** decreased after 1990	**(3)**

Question Number	Answer	Additional Guidance	Mark
6 (a)	1. idea of formation of secondary or tertiary structure ; 2. idea of bonding between R groups ; 3. named bond e.g. ionic, disulfide, hydrogen ;	1. **ACCEPT** e.g. alpha helix, beta pleated sheet, globular structure **ACCEPT** folding (of primary structure) **IGNORE** 3D shape 2. **ACCEPT** hydrophilic R groups go to outside/ hydrophobic R groups go to inside / eq 3. **DO NOT ACCEPT** peptide	**(3)**

Question Number	Answer	Additional Guidance	Mark
6 (b) (i)	1. as the enzyme concentration increase the rate of reaction increases / eq ; 2. idea that enzyme lowers activation energy / provides alternative reaction pathway ; 3. idea that the higher concentration of enzyme means that more active sites are available ; 4. more chance of a collision between {enzyme / active site } and substrate ; 5. reference to {enzyme – substrate complex / specific interaction between enzyme active site and substrate } ; 6. idea that substrate is in excess / enzyme concentration is limiting factor ;	**ACCEPT** bacteria as substrate 1. **ACCEPT** enzyme increases rate of reaction	**(3)**

Question Number	Answer	Additional Guidance	Mark
6 (b) (ii)	there were {anomalies / sources of error / random error / measurement inconsistencies / lack of precision / lack of accuracy / eq} ;	**ACCEPT** example of random error e.g. volume **IGNORE** systematic error, outliers	**(1)**

Question Number	Answer	Additional Guidance	Mark
6 (c)	1. idea that this increased temperature changes the bonding in the enzyme ; 2. the active site is {denatured / changes shape} ; 3. the substrate no longer fits into the active site / the enzyme no longer {catalyses the reaction / lowers the activation energy / eq} ;	**IGNORE** enzyme is denatured **ACCEPT** bonds are broken 3. **ACCEPT** no enzyme substrate complex can form / eq	**(2)**

Question Number	Answer	Mark
7(a)(i)	A a hydrogen bond ;	**(1)**

Question Number	Answer	Mark
7(a)(ii)	D a peptide bond ;	**(1)**

Question Number	Answer	Mark
7(a)(iii)	D glucose ;	**(1)**

Question Number	Answer	Mark
7(a)(iv)	C glycerol ;	**(1)**

Question Number	Answer	Additional Guidance	Mark
7(b)	nitrogen ;	**IGNORE** N if it is the only response	**(1)**

Question Number	Answer	Additional Guidance	Mark
7(c)	1. glycosidic bond correctly drawn ; 2. molecule of water shown to be produced ; 3. remaining groups around disaccharide drawn correctly ;	1. **IGNORE** labelling of bond 2. **ACCEPT** water named or formula 3. **DO NOT ACCEPT** two separate glucose molecules NB: check carefully H on C5	**(3)**

Question Number	Answer	Additional Guidance	Mark
7 (d)	1. idea that water can form {hydrogen bonds / eq} ; and any one from 2. water is a solvent / {ions / polar molecules / eq } can {dissolve / be transported / eq } in water 3. reference to cohesion/adhesion 4. idea of hydrogen bonds holding water together as a liquid, so that it can move in mass flow systems 5. suitable ref. to specific heat capacity 6. idea of distribution of thermal energy around body 7. reference to high latent heat of vaporisation ;	1. **ACCEPT** water is slightly charged, description of charges on O and /or H IGNORE polar/ dipole as stated in Q stem 2. **ACCEPT** named polar molecule IGNORE non polar molecules dissolving 3. **ACCEPT** specific example e.g. surface tension on a pond 5. **ACCEPT** thermal buffer / needs a lot of energy to change the temperature / eq **IGNORE** pH buffer	**(2)**

Question Number	Answer	Mark
8(a) (i)	ACCEPT answers between 0.14 and 0.15 inclusive ;	**(1)**

Question Number	Answer	Mark
8(a) (ii)	ACCEPT answers between 13.4 and 13.6 inclusive ;	**(1)**

Question Number	Answer	Additional Guidance	Mark
8(b)	1. pressure increases from 0 to 3.3 during {atrial systole / ventricular diastole / from 0 to 0.14s / eq} ; 2. pressure increases to {14.5 / 14.4} {during ventricular systole / from 0.14s / eq}; 3. pressure decreases to 0 (during diastole) / eq ;	IGNORE units 1. ACCEPT between 3 and 3.5, to 0.12 to 0.14s 2. ACCEPT calculated increase e.g. 11.2 (range 11 to 11.5), from 0.12s 3. ACCEPT calculated decrease e.g. 14.5 (range 14 to 14.5)	**(3)**

Question Number	Answer	Additional Guidance	Mark
8 (c)	(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence) 1. {pressure changes / maximum pressures} are smaller in the atrium than the ventricle / eq ; 2. the atrium has less (cardiac) muscle than the ventricle ; 3. the atrium does not have to push the blood as far as the ventricle has to / eq ; 4. the increase in pressure happens in the atrium before the ventricle / eq ; 5. idea that atrial systole has to happen before ventricular systole in order for the ventricle to fill with blood ; 6. idea that increase in atrial pressure causes increase in {pressure / volume } in ventricles ; 7. appropriate reference to effect of atrioventricular valve (AV) (on pressure) ; 8. credit correct comparative manipulation of figures to illustrate a marking point ;	QWC emphasis on clarity of expression Marking points are for comparing what is happening in L.A. and L.V. and giving reasons for these. NOT just a description of the cardiac cycle ACCEPT converse in each statement 1. ACCEPT higher pressure in V than A in context of pumping distance ACCEPT piecing together for MPs 1, 2, 3 5. ACCEPT delay at AVN / eq 7. E.g. when pressure in the atrium exceeds pressure in the ventricle the AV valve opens preventing further significant rise in the pressure in the atrium 8. e.g. compare maximum pressures exerted	**(5)**

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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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P 4 4 4 8 6 A 0 1 2 4

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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 28% adenine is transcribed, the mRNA produced will have

(1)

☒ **A** 28% adenine

☒ **B** 28% cytosine

☒ **C** 28% thymine

☒ **D** 28% uracil

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

(2)

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

(5)

Exemplar

(Total for Question 1 = 10 marks)

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

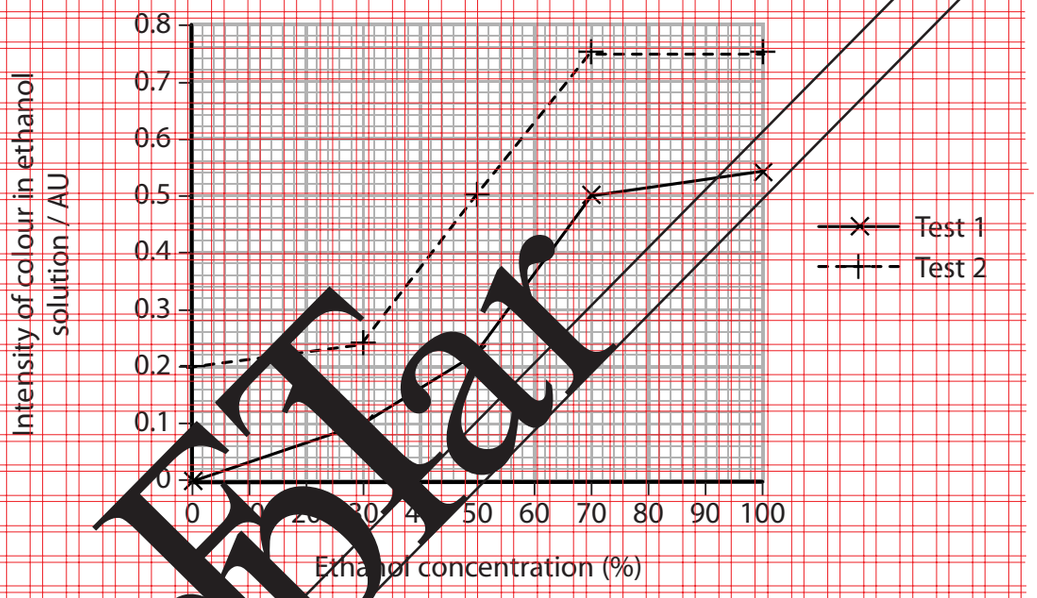
A student investigated the effect of ethanol on the permeability of beetroot cell membranes.

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)

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(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.

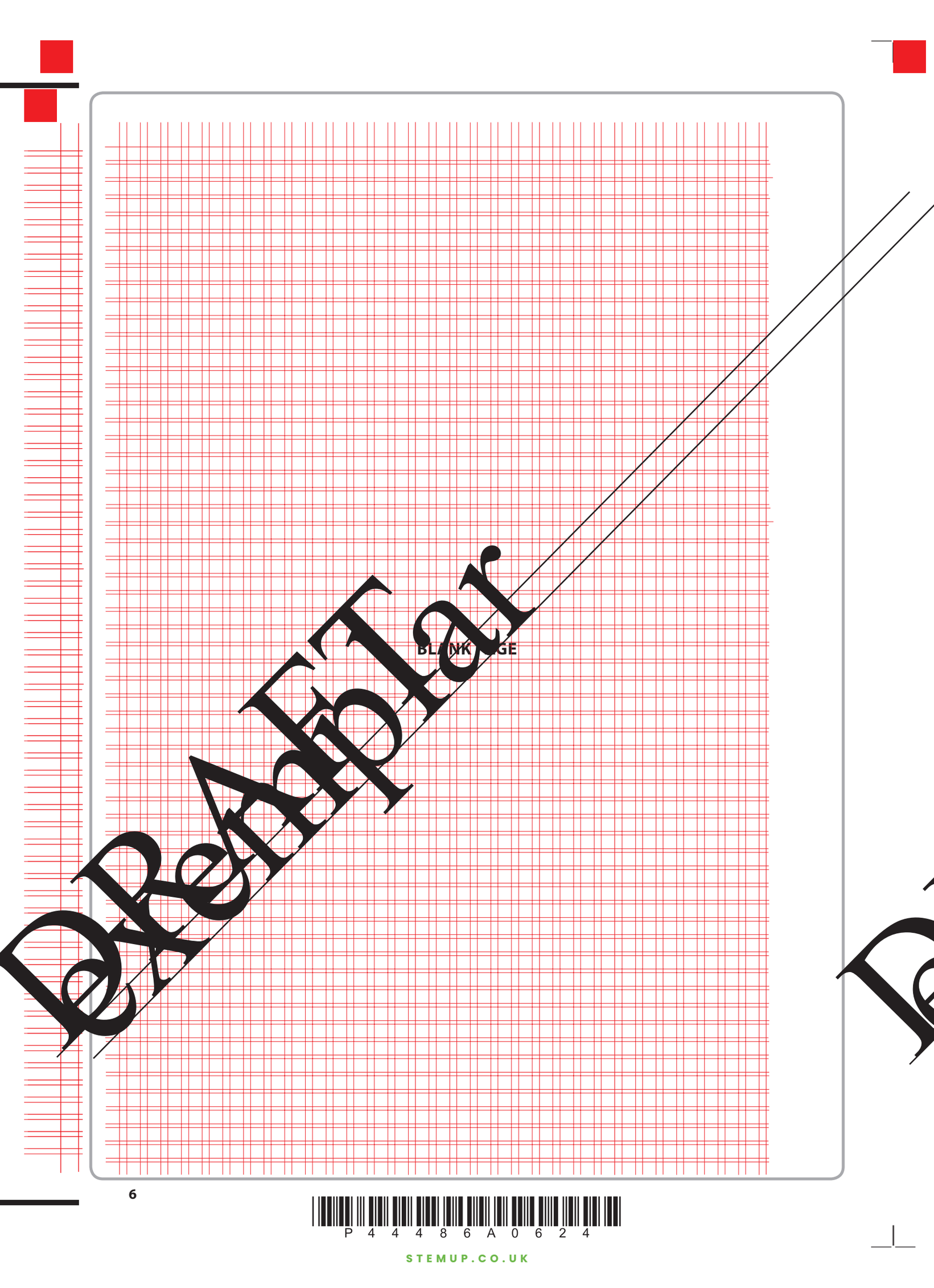
(4)

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

(2)

(Total for Question 2 = 9 marks)

Example


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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)

Example

probability .....

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(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)

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

(2)

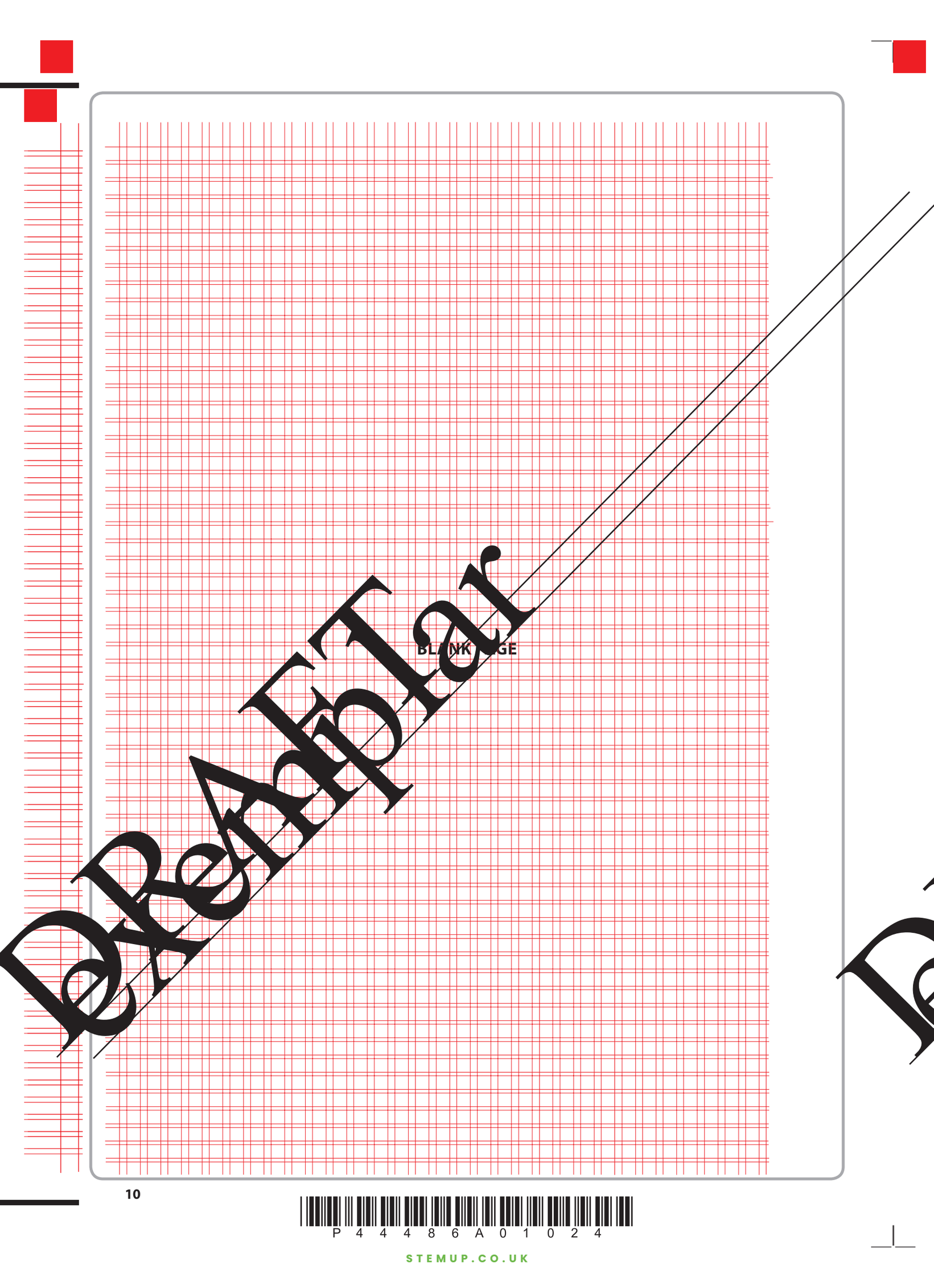
(d) There are some risks associated with somatic gene therapy.

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)

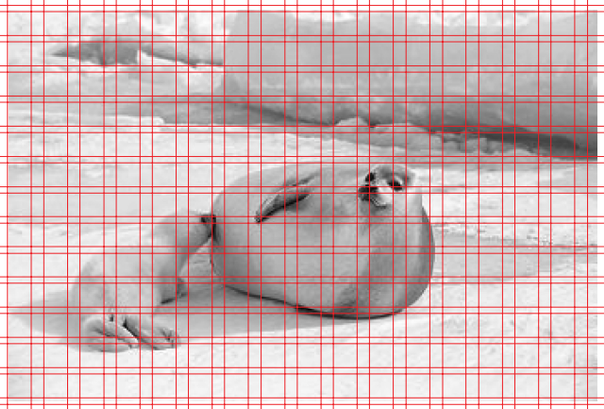
Example



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

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 .....

Exemplar

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(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
[illegible]	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

Reflar

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

(1)

.....

.....

.....

(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)

.....

.....

.....

.....

.....

.....

(Total for Question 4 = 10 marks)

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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 .....

.....

.....

2 .....

.....

.....

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

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

(2)

.....

.....

.....

.....

.....

.....

.....

PREMIER

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

(1)

.....

.....

.....

(Total for Question 5 = 10 marks)

Exemplar

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

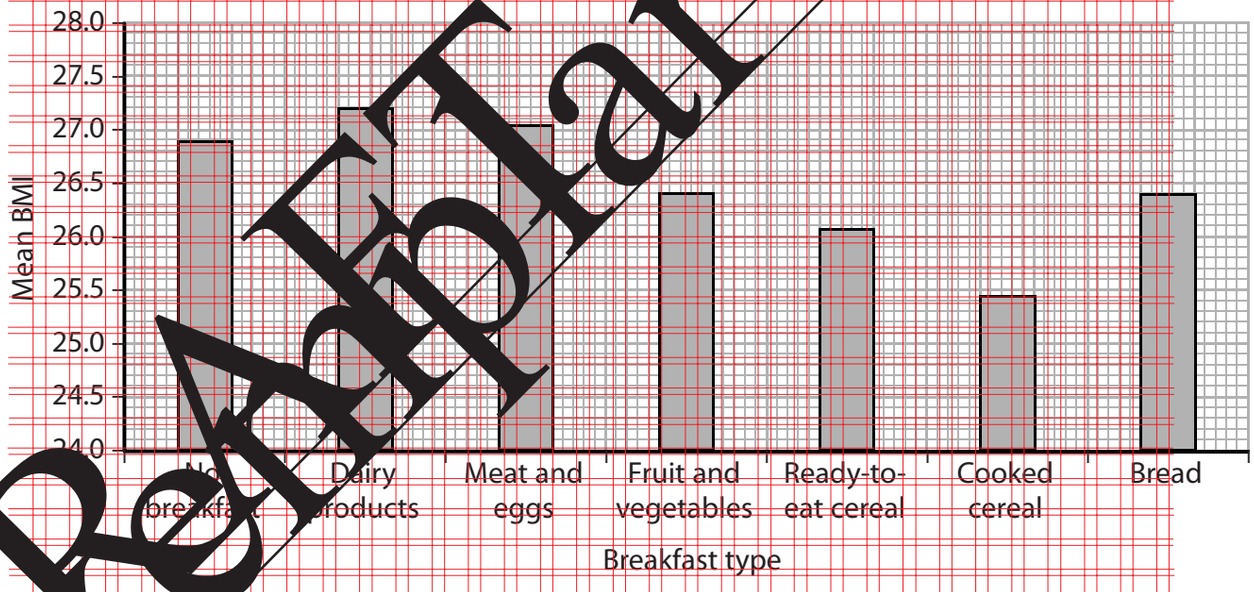
BMI is calculated using the formula below.

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

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) 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

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(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 football players

(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)

ReAplar

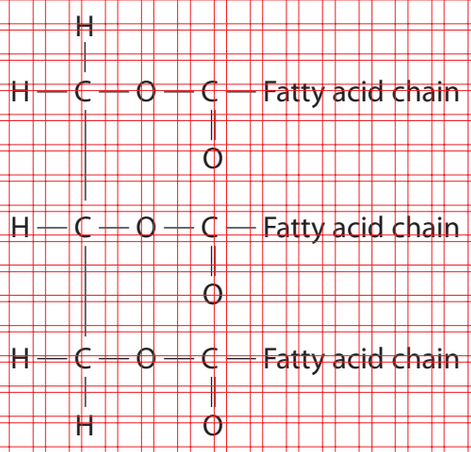
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Exemplar

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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)

PREMIER

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(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)

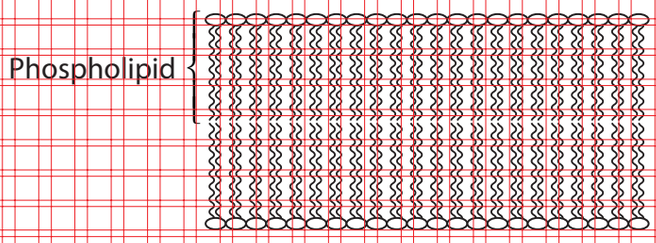
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(Total for Question 7 = 10 marks)

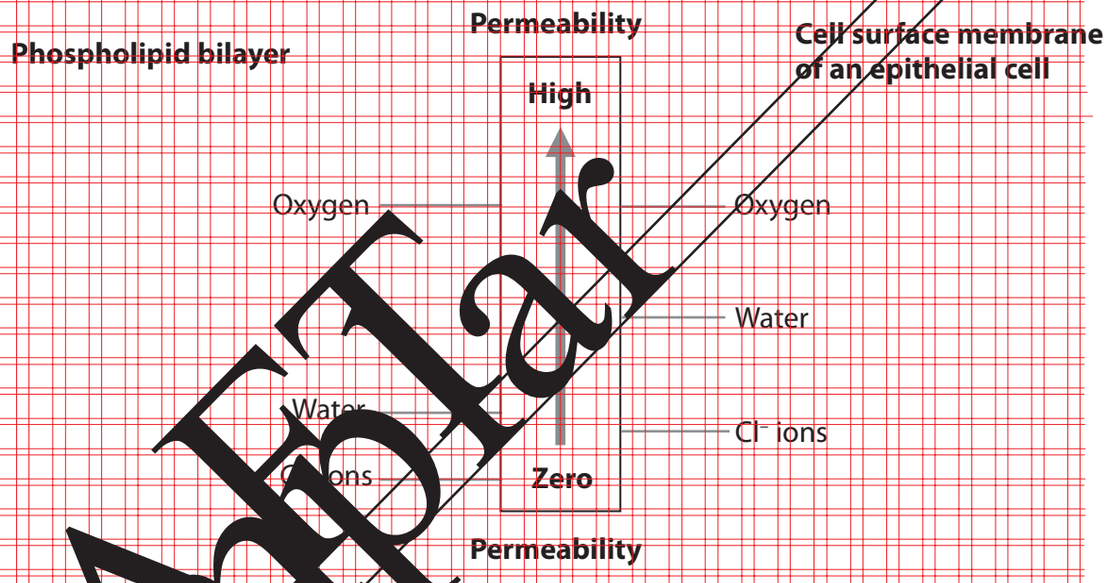
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8 Artificial membranes have a variety of medical applications.

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)

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(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.

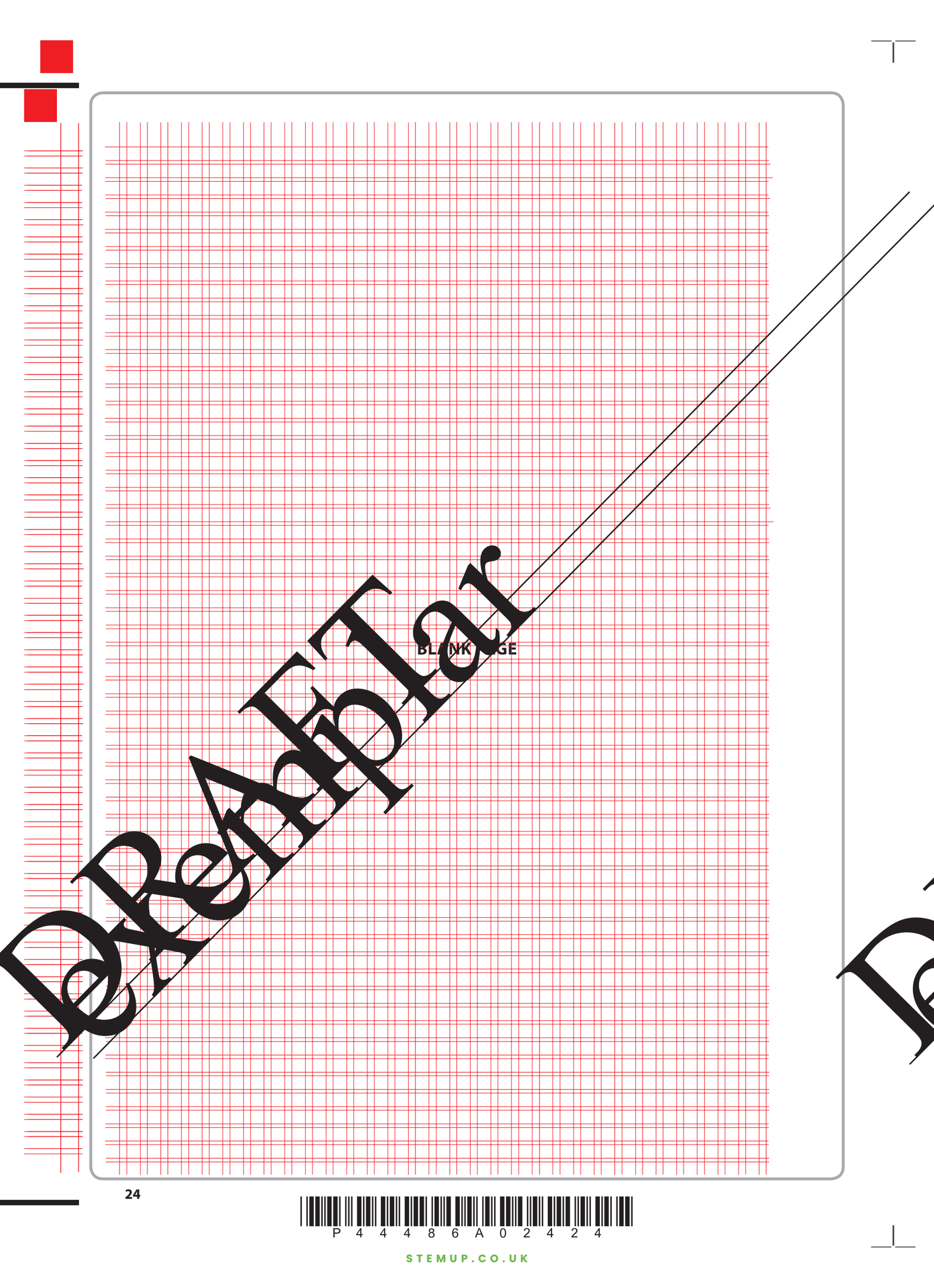
(2)

(Total for Question 8 = 7 marks)

TOTAL FOR PAPER = 80 MARKS

Exemplar

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Mark Scheme (Results)
Summer 2014

GCE Biology (6BI01)
Paper 01

Unit 1: Lifestyle, Transport, Genes and Health

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.
- Mark schemes will indicate within the table where, and which strands of QWC, are being assessed. The strands are as follows:

  i) ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear
  ii) select and use a form and style of writing appropriate to purpose and to complex subject matter
  iii) organise information clearly and coherently, using specialist vocabulary when appropriate

Using the Mark Scheme

Examiners should look for qualities to reward rather than faults to penalise. This does NOT mean giving credit for incorrect or inadequate answers, but it does mean allowing candidates to be rewarded for answers showing correct application of principles and knowledge. Examiners should therefore read carefully and consider every response: even if it is not what is expected it may be worthy of credit.

The mark scheme gives examiners:
- an idea of the types of response expected
- how individual marks are to be awarded
- the total mark for each question
- examples of responses that should NOT receive credit.

/ means that the responses are alternatives and either answer should receive full credit.
( ) means that a phrase/word is not essential for the award of the mark, but helps the examiner to get the sense of the expected answer.
Phrases/words in **bold** indicate that the meaning of the phrase or the actual word is **essential** to the answer.
ecf/TE/cq (error carried forward) means that a wrong answer given in an earlier part of a question is used correctly in answer to a later part of the same question.

Candidates must make their meaning clear to the examiner to gain the mark. Make sure that the answer makes sense. Do not give credit for correct words/phrases which are put together in a meaningless manner. Answers must be in the correct context.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:
- write legibly, with accurate use of spelling, grammar and punctuation in order to make the meaning clear
- select and use a form and style of writing appropriate to purpose and to complex subject matter
- organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities.
Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

Question Number	Answer	Mark
1(a)(i)	D phosphodiester bonds ;	(1)

Question Number	Answer	Mark
1(a)(ii)	B 200 ;	(1)

Question Number	Answer	Mark
1(a)(iii)	C 0% thymine;	(1)

Question Number	Answer	Additional Guidance	Mark
1(b)	1. contains {Ribose / 5C sugar / pentose} AND phosphate ; 2. reference to (nitrogenous) base / adenine / guanine / cytosine / uracil / eq ;	IGNORE references to bonds ACCEPT correctly labelled diagram which might use Pi 1. both components needed for the mark NOT deoxyribose, sugar with no 5C, phosphate head, P 2. NOT thymine, IGNORE A, G, C, U NOT plural bases if only referring to one mononucleotide	(2)

Question Number	Answer	Additional Guidance	Mark
1(c) *QWC	**(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence)** 1. reference to ribosome (attaches to mRNA) ; 2. idea that tRNA carries an amino acid ; 3. idea of {anticodon codon interaction / complementary base pairing } between tRNA and mRNA ; 4. formation of hydrogen bonds (between the tRNA and mRNA) ; 5. reference to peptide bond (between amino acids) ; 6. (peptide bond) formed by a condensation reaction ; 7. idea that tRNA released from {mRNA / ribosome} ; 8. idea that ribosome {attaches to / detaches from / eq} {sequence / eq} on mRNA ;	**QWC emphasis answer must be in a logical sequence** Penalise once for point out of sequence / context IGNORE descriptions of transcription ACCEPT AA for amino acid 1. ACCEPT rough endoplasmic reticulum, RER 2. NOT amino acid**s** unless tRNA plural 3. ACCEPT description of complementary base pairing 5. ACCEPT peptide link 6. ACCEPT by an enzyme 8. ACCEPT ribosome moves along mRNA, a start codon / AUG, stop codon / UAA / UAG / UGA	**(5)**

Question Number	Answer	Additional Guidance	Mark
2 (a)	1. increasing ethanol concentration increases the intensity (of colour of the solution) / eq ; 2. idea that increase in intensity is non-linear e.g. greatest increase between 30 and 70% ethanol / less increase above 70% / less increase below 30% ethanol ; 3. intensity of colour higher in test 2 than test 1 (at all ethanol concentrations) / eq ; 4. credit correct manipulation of figures e.g. 0.1 increase from 0 to 30% in test 1 ;	1. ACCEPT positive correlation IGNORE descriptions of sequences of changes 2. ACCEPT greatest increase between 50 and 70, no increase above 70 in test 2 ACCEPT comments on gradient e.g. steeper IGNORE rapid / faster / slower 4. ACCEPT subtraction from identified test IGNORE quoted figures, unidentified test	**(3)**

Question Number	Answer	Additional Guidance	Mark
2 (b)	1. idea that ethanol causes the membrane to be {disrupted / eq} ; 2. idea that this is due (phospho)lipids dissolve in ethanol ; 3. idea that (membrane) proteins denatured by ethanol ; 4. comment on the disruption of the vacuole membrane / eq ; 5. idea that {betalain / pigment} can escape from the {cell / vacuole /eq } when the membrane is disrupted ;	1. IGNORE more permeable, more fluid ACCEPT gaps in the membrane 3. ACCEPT protein changes shape NB this also gains Mp1 5. ACCEPT dye	**(4)**

Question Number	Answer	Additional Guidance	Mark
2 (c)	1. beetroot cells may have been damaged when cutting / eq ; 2. idea that beetroot pieces not rinsed before being placed in ethanol solution ; 3. idea that colorimeter was not {calibrated / zeroed / eq} (properly) ; 4. idea that test 2 is done some time after test 1 OR beetroot left in solution longer than 20 minutes in test 2 ; 5. idea that different parts of the beetroot may have different pigment concentrations ; 6. smaller volume of ethanol used in test 2 ;	2. ACCEPT blotted IGNORE dried 5. IGNORE different beetroot	**(2)**

Question Number	Answer	Additional Guidance	Mark
3 (a)	1. genotype **AND** gametes of parents shown ; 2. genotypes of possible children correctly shown ; 3. genotypes clearly matched to phenotypes of possible children ; 4. (probability =) ¼ / 25% / 1 in 4 / 0.25 ;	1. gametes can be shown on Punnett Square 3. ACCEPT carrier as phenotype 4. ACCEPT incorrect probability but based on their cross	**(4)**

Question Number	Answer	Additional Guidance	Mark
3 (b)	1. method for obtaining sample from baby described e.g. cheek swab, blood sample, heel prick, biopsy} ; 2. idea of extracting DNA (from cells) ; 3. test for presence of {normal / recessive / mutant / defective / MLD / eq} {gene / allele} ;	NOT Mp 1 and 2 if chorionic villus, amniocentesis, pre-implantation, etc 2. IGNORE testing DNA 3. ACCEPT even if method incorrect for Mp 1	**(2)**

Question Number	Answer	Additional Guidance	Mark
3 (c)(i)	1. idea of copy of {normal / functioning / eq} {gene / allele} now in cells ; 2. reference to transcription or translation of the {gene / allele} ; 3. idea that (normal) protein produced / cells function normally / eq ; 4. idea that stem cells produce more cells ;	1. NOT replaces / repairs faulty gene IGNORE dominant ACCEPT correct 4. ACCEPT mitosis, cell division	**(3)**

Question Number	Answer	Additional Guidance	Mark
3 (c) (ii)	1. idea of control (to see if the treatment made a difference) ; 2.idea that other variables controlled e.g. shared genes , environment ;	1. ACCEPT valid comparison IGNORE unqualified comparison 2. ACCEPT similar genes NOT genetically identical	**(2)**

Question Number	Answer	Additional Guidance	Mark
3 (d)	1. idea that risk from gene therapy very small ; 2. idea that consequences of the disorder more certain than risks of the therapy ; 3. idea that consequences of the disorder known while risks of the therapy are not known ; 4. idea that parents do not want their child to suffer the disorder e.g. will do anything to {treat / prevent / eq} the disorder, there is no other treatment available ; 5. idea that trial may lead to effective treatment e.g. could benefit others ;	2. ACCEPT more benefits than risks / idea that severity of the disorder makes it worth the risk 4. ACCEPT give the child a better quality of life / the best possible chance of a normal life / eq	**(2)**

Question Number	Answer	Additional Guidance	Mark
4 (a) (i)	Any **two** from: {mineral(s) / named mineral} ;; {vitamin(s) / named vitamin} ;; {carbohydrate / named soluble carbohydrate}; water ; antibodies ;	Allow two named minerals or vitamins allow salt, potassium, sodium, etc IGNORE nitrogen, NB minerals AND named mineral = 1 mark vitamins AND named vitamin = 1 mark NOT sugar, lactose, starch, fibre, glycogen IGNORE amino acids , fats, fatty acids, glycerol, cholesterol	**(2)**

Question Number	Answer	Additional Guidance	Mark
4 (a) (ii)	1. more protein AND more lipid ; 2. idea that protein is needed for making more tissue ; 3. idea that lipids are a source of energy ; 4. idea of greater energy imbalance (for seals) ; 5. idea that excess energy is needed for {weight gain / stored as fat / eq} ; 6. Credit manipulation of figures e.g. calculation of difference between human and seal milk ;	1. IGNORE simple quote of figures ACCEPT as separate comments 2. ACCEPT growth 6. e.g. 12.4%, 9.9 / 9.86x more protein, 32.7%, 9.6 / 9.61x more lipid IGNORE about 10x	**(4)**

Question Number	Answer	Additional Guidance	Mark
4 (b) (i)	it contains no double bonds (in the hydrocarbon chain) / eq **;**	ACCEPT no carbon carbon double bonds, no kinked chains NOT carbon oxygen double bonds	**(1)**

Question Number	Answer	Additional Guidance	Mark
4 (b) (ii)	<table><tr><th>Group</th><th>Total concentration of saturated fatty acids / mg per g milk</th><th>Total concentration of unsaturated fatty acids / mg per g milk</th></tr><tr><td>Vegan</td><td>325</td><td>**657**</td></tr><tr><td>Control</td><td>497</td><td>**466 ;**</td></tr></table>		**(1)**

Question Number	Answer	Additional Guidance	Mark
4 (b) (iii)	1. idea that animal products have a higher proportion of saturated fats than plant material ; 2. credit correct manipulation of figures to illustrate differences in milk content ;	1. ACCEPT converse / saturated come from {meat / dairy} / unsaturated from plants 2. e.g. 172 mg per g milk more saturated in control, 191 mg per g milk more unsaturated from vegans ACCEPT ECF for figure use from 4bii	**(2)**

Question Number	Answer	Additional Guidance	Mark
5 (a)	1. cardiac / myogenic ; 2. atrioventricular ; 3. left atrium ; 4. pulmonary artery ; 5. semilunar ;	1. IGNORE smooth 2. ACCEPT bicuspid, tricuspid, mitral IGNORE cuspid, AV 3. NOT atrium alone ACCEPT left auricle, left atria	**(5)**

Question Number	Answer	Additional Guidance	Mark
5 (b)	<table><tr><th>Arteries</th><th>Capillaries</th></tr><tr><td>1. thick wall / multiple cell layers</td><td>1. {thin / thinner / one cell thick} wall / eq ;</td></tr><tr><td>2. (lots of) collagen</td><td>2. {little / no } collagen / eq ;</td></tr><tr><td>3. (lots of) muscle</td><td>3. no muscle / eq ;</td></tr><tr><td>4. (lots of) elastic tissue</td><td>4. no elastic tissue / eq ;</td></tr><tr><td>5. no pores</td><td>5. pores present / eq ;</td></tr><tr><td>6. narrow lumen</td><td>6. narrow(er) lumen / lumen one cell wide / eq ;</td></tr></table>	Answers must be comparative for credit – i.e. 1 mark for each correct row on the table. IGNORE references to surface area, length 1. ACCEPT thinner wall NOT reference to cell wall IGNORE capillaries are one cell thick if not in clear context of 1. or 6. 3. and 4. NOT more or less 5. IGNORE porous , permeable 6. ACCEPT artery lumen wider than the capillary, artery lumen narrower in relation to diameter of vessel	**(2)**

Question Number	Answer	Additional Guidance	Mark
5 (c) (i)	1. prevent the formation of a {blood clot / thrombus / embolism / eq} / eq ; 2. idea that it reduces 'stickiness' of platelets ; 3. idea that clotting factors {not synthesised / inhibited / eq} ; 4. idea that (risk of) blood vessels becoming blocked is reduced OR idea that blood can flow normally in arteries ;	1. IGNORE 'thin the blood' ACCEPT prevents blood clotting 2. ACCEPT effectiveness of platelets reduced 3. ACCEPT named clotting factor e.g. fibrinogen, thromboplastin, prothrombin,	**(2)**

Question Number	Answer	Additional Guidance	Mark
5 (c) (ii)	(internal) bleeding / haemorrhage / stomach ulcers / eq ;	ACCEPT rashes, nausea, vomiting, hair loss, diarrhoea, irritation to stomach lining	**(1)**

Question Number	Answer	Mark
6(a) (i)	D ready-to-eat cereal have a higher BMI than those people who ate cooked cereal;	(1)

Question Number	Answer	Mark
6(a) (ii)	A every group sampled in the investigation indicates that they were overweight;	(1)

Question Number	Answer	Mark
6(a) (iii)	B kgm^{-2};	(1)

Question Number	Answer	Mark
6(a) (iv)	A a larger sample size ;	(1)

Question Number	Answer	Additional Guidance	Mark
6(b)	1.(Use subjects with) {same / similar / eq } {levels of activity / exercise / eq } ; 2.{same / similar / eq }{volume / mass / energy content } of breakfast ; 3.{same / similar / eq }{volume / mass / energy content } of other {meals / drinks} during the day ; 4. same duration of trial / eq ; 5. control of other health factors e.g. smoking , fitness, stress. 6. same starting {mass / BMI} / eq ; 7. same type of breakfast (for each participant throughout the Investigation) / eq ; 8. (body) mass measured at same time of day / eq ;	IGNORE gender, age, office workers ACCEPT control of variable for same / similar 2. IGNORE amount, quantity 5. IGNORE pregnancy	**(2)**

Question Number	Answer	Additional Guidance	Mark
6 (c)	1. those subjects who ate no breakfast had a higher mean BMI than those who ate { fruit and vegetables / ready-to-eat cereal / cooked cereal / breads / most breakfasts } ; 2. Reference to suitable calculated difference to illustrate point 1 ; 3. idea that {metabolic rate / eq} may be lower for those who skip breakfast ; 4. appropriate comment on balance between intake and energy use ;	IGNORE units 1. ACCEPT 3rd highest BMI 2. e.g. 1.5 above cooked cereal, 0.5 above fruit and veg, 0.5 above breads, 0.85 above ready-to-eat cereal 3. ACCEPT converse 4. ACCEPT may eat more during the day (due to more hunger) / eq	**(2)**

Question Number	Answer	Additional Guidance	Mark
6 (d)	1. People who eat cooked cereals have the lowest BMI of all groups / eq ; 2. credit correct manipulation of figures ; 3. idea that lower BMI helps to reduce blood pressure ; 4. idea that dietary fibre can't be digested ; 5. idea that dietary fibre helps {lower absorption of cholesterol / increase excretion of cholesterol / eq} ; 6. {lower cholesterol / eq} reduces risk of {atherosclerosis / eq } ;	IGNORE HDL/LDL references 2. e.g. 0.4 above healthy weight 6. ACCEPT converse	**(3)**

Question Number	Answer	Additional Guidance	Mark
7(a)	1. glycerol drawn correctly with three OH groups ; 2. 3 fatty acids ; 3. fatty acid(s) have COOH included at the end ;	Mp1 and 3 ACCEPT OH / HO NOT double bond to OH 2. ACCEPT 3x one fatty acid stated ACCEPT R or zig-zag chain for fatty acid chain	**(3)**

Question Number	Answer	Additional Guidance	Mark
7(b)	1. idea of energy imbalance ; 2. loss of weight / eq ; 3. reduced metabolic rate / eq ; 4. lack of protein / reduced insulation / eq ; 5. idea that they will need to eat more {carbohydrate / protein / eq} for energy balance ;	2. ACCEPT lower BMI 3. ACCEPT fatigue 4. ACCEPT muscle wastage, Malnourishment, reduced immune system	**(2)**

Question Number	Answer	Additional Guidance	Mark
7(c) *QWC	**(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence)**	**QWC emphasis clarity of expression**	
	1. idea that there is a change in the {DNA sequence / base sequence of a gene / eq } ;	1. IGNORE mRNA	
	2. change in amino acid / change in primary structure of { protein / enzyme } ;		
	3. reference to different R groups ;		
	4. leading to different {type / position / eq} bonding ;	4. ACCEPT named bond e.g. hydrogen, ionic, disulphide NOT peptide	
	5. idea of change in folding e.g. different 3D structure ;	5. ACCEPT change to tertiary structure	
	6. idea of change in {shape / properties} of the active site ;		
	7. idea of {lipid / substrate / eq} does not fit in the enzyme's active site ;	7. ACCEPT no enzyme-substrate complex made	**(5)**

Question Number	Answer	Additional Guidance	Mark
8 (a)	1. (oxygen) is a {small / non polar} (molecule) ; 2. (oxygen) is able to diffuse (through phospholipid bilayers) ; 3. cell surface membrane has a phospholipid bilayer ;	1. NOT if large or polar ACCEPT uncharged	**(2)**

Question Number	Answer	Additional Guidance	Mark
8 (b)	1. chloride ions are charged ; 2. idea that (chloride ions) are NOT able to diffuse through {a phospholipid bilayer / artificial membrane} ; 3. idea that (chloride ions) need a {carrier / channel / transport / eq } protein (to move across a membrane) ; 4. reference to {active transport / facilitated diffusion} ; 5. reference to CFTR channel protein (present in epithelial cells) ;	IGNORE chlorine 1. IGNORE chloride ions are big / polar 3. ACCEPT transmembrane	**(3)**

Question Number	Answer	Additional Guidance	Mark
8 (c)	1. the cell membrane is more permeable to water (than the artificial membrane) ; 2. idea that water can move across the phospholipid bilayer ; 3. idea that water can also move through channel proteins ;	IGNORE references to rates or concentration gradients 1. NOT artificial membrane is impermeable to water 3. ACCEPT transmembrane proteins, aquaporins	**(2)**

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Centre Number	Candidate Number

Biology

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

Tuesday 21 May 2013 – 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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P 3 9 8 8 4 A 0 1 2 4

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

(5)

The blood clotting process starts when cell fragments called ..... release molecules of ..... . These molecules are ..... which catalyse the conversion of ..... into ..... , in the presence of calcium ions. As a result, fibrinogen is converted into fibrin and blood cells are trapped to form the clot.

(b) Fibrinogen and fibrin are both proteins.

A protein consists of a chain of amino acids joined together by bonds.

(i) In the space below, draw a diagram to show the structure of an amino acid.

(3)

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(ii) Name the covalent bond that joins the amino acids into a chain.

(1)

.....

(iii) Suggest **two** differences between fibrinogen and fibrin.

(2)

1 .....

.....

.....

2 .....

.....

.....

(Total for Question 1 = 11 marks)

Example

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2 DNA is a very important molecule in living organisms as it carries the genetic code. Before a cell divides, the DNA molecule replicates so that each resulting daughter cell is genetically identical to the original parent cell.

(a) Explain the nature of the genetic code.

(2)

*(b) Describe the process of DNA replication.

(5)

(Total for Question 2 = 7 marks)

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3 Lipoprotein lipase is a biological catalyst and is involved in the hydrolysis of triglycerides.

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

(i) A catalyst

(1)

☒ **A** decreases the rate of reaction by increasing the activation energy

☒ **B** decreases the rate of reaction by reducing the activation energy

☒ **C** increases the rate of reaction by increasing the activation energy

☒ **D** increases the rate of reaction by reducing the activation energy

(ii) Hydrolysis results in bonds between glycerol and a fatty acid

(1)

☒ **A** being broken and water being formed

☒ **B** being broken and water being used

☒ **C** being formed and water being formed

☒ **D** being formed and water being used

(iii) A triglyceride is made from

(1)

☒ **A** one glycerol and one fatty acid

☒ **B** one glycerol and three fatty acids

☒ **C** three glycerols and one fatty acid

☒ **D** three glycerols and three fatty acids

(iv) A type of bond found in a triglyceride is

(1)

☒ **A** an ester bond

☒ **B** a glycosidic bond

☒ **C** a hydrogen bond

☒ **D** a phosphodiester bond

Exemplar

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(b) Some people have a mutation in the gene coding for lipoprotein lipase.

The table below shows the mean concentration of some types of lipid in the blood of people without the mutation and in the blood of people with the mutation.

Type of lipid	Mean concentration of lipid in blood / mg dm^{-3}	
	People without the mutation	People with the mutation
Triglyceride	102	93
LDL cholesterol	121	111
HDL cholesterol	48	49
Total cholesterol	186	179

It has been suggested that people with this mutation may be more at risk of developing cardiovascular disease (CVD).

(i) Give **two** reasons why the information in the table does **not** support this suggestion.

(2)

1 .....

.....

.....

2 .....

.....

.....

(ii) Name the type of drug that could be given to people with this mutation, to reduce the risk of developing CVD.

(1)

.....

(iii) State **one** health risk associated with using this type of drug.

(1)

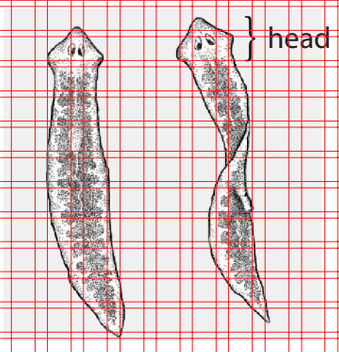
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(Total for Question 3 = 8 marks)

PreAplar

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4 Some species of flatworm are found in freshwater streams.
Flatworms obtain oxygen from the water through the surface of their bodies.
The diagram below shows the structure of flatworms.



Flatworms

Magnification ×10

(a) Using the diagram and your knowledge of gas exchange surfaces, explain how the structure of a flatworm is adapted to obtain oxygen from the water.

(2)

Pearson Edexcel

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(b) The table below shows the relationship between the temperature of water and the solubility of oxygen in water.

Temperature of water / °C	Solubility of oxygen in water / mg dm^{-3}
0	14.6
5	12.8
10	11.3
15	10.2
20	9.2
25	8.6
30	7.5
35	6.9
40	6.4

(i) Describe the relationship between the temperature of the water and the solubility of oxygen in water.

(2)

DreAmLar

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(ii) Using the information in the table and your knowledge of gas exchange and enzymes, suggest why flatworms are often found in water at a temperature of about 15 °C .

(3)

(c) Flatworms do not have a heart or a circulatory system.

Explain why many animals need a heart and a circulatory system.

(4)

(Total for Question 4 = 11 marks)

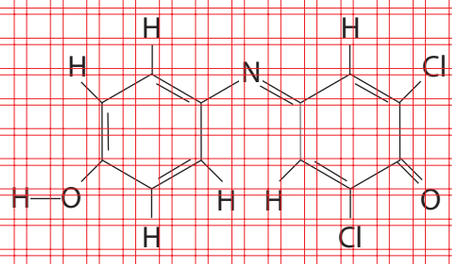
Pearson

Draft

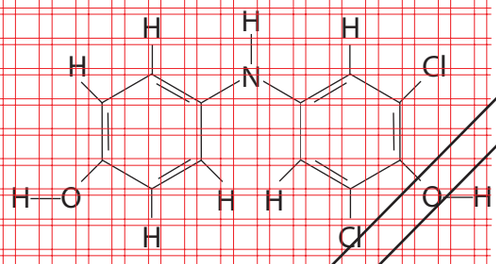
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5 The concentration of vitamin C in a solution can be determined using the chemical DCPIP.
DCPIP is blue when it is in its oxidised form and colourless when it is in its reduced form.

(a) The diagrams below show the structure of DCPIP in its oxidised form and in its reduced form.



Oxidised DCPIP



Reduced DCPIP

(i) Using the diagram, describe **two** differences between the structure of oxidised DCPIP and reduced DCPIP.

(2)

1 .....

.....

.....

.....

2 .....

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.....

(ii) Suggest why these differences occur when DCPIP is used to determine the concentration of vitamin C.

(1)

.....

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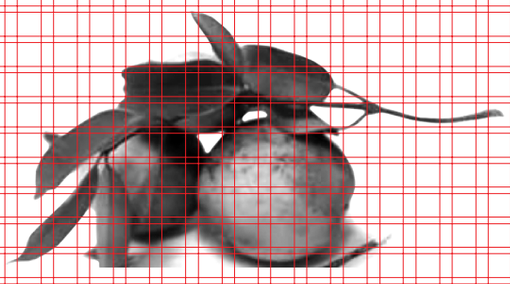
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Exemplar

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(b) Mangaba fruit is produced by a tropical plant native to Brazil.
As this fruit is a good source of protein and vitamins, it is important to study changes that take place in the fruit after picking.

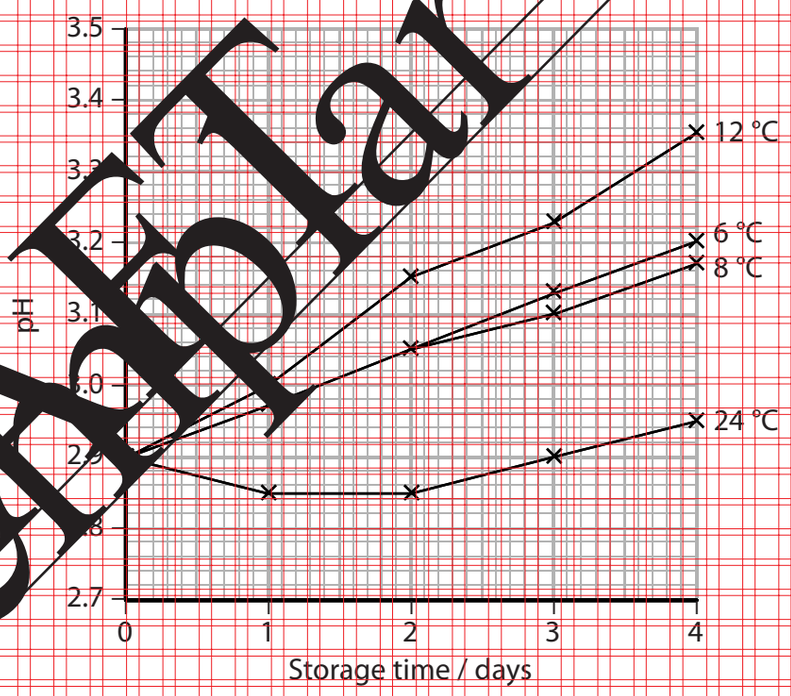
The photograph below shows mangaba fruit.



Magnification × 0.2

A study was carried out to measure the changes in pH of mangaba fruit at different storage temperatures. Mangaba fruits were picked and stored at four different temperatures for four days. Each day the pH of the fruits was measured.

The graph below shows the results of this study.



Pearson Edexcel

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(i) Using the information in the graph, describe the effects of storage temperature on the pH of mangaba fruits during this four-day storage period.

(3)

*(ii) Describe an experiment that could be carried out to compare the changes in the vitamin C content of the mangaba fruit stored at 6 °C and 8 °C.

(5)

(Total for Question 5 = 11 marks)

DxEaTpar

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6 The structure and properties of the cell membrane control which molecules can move into or out of the cell.

(a) The phospholipid bilayer plays an important role in this control of movement of molecules.

Explain why the phospholipid molecules form a bilayer.

(3)

PreMiar

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(b) The table below describes four methods by which molecules or ions can move through the cell membrane.

Description of method	Method by which molecules or ions can move through the cell membrane			
	A	B	C	D
The direction of movement is from a higher concentration to a lower concentration of the molecule	✓	✗	✓	✓
ATP required	✗	✓	✗	✗
Membrane proteins involved	✓ or ✗	✓	✓	✗
A molecule or ion transported by this method	water	sodium ions	glucose	oxygen

Identify the method of movement by placing a cross ☒ in the correct box in the table below.

(3)

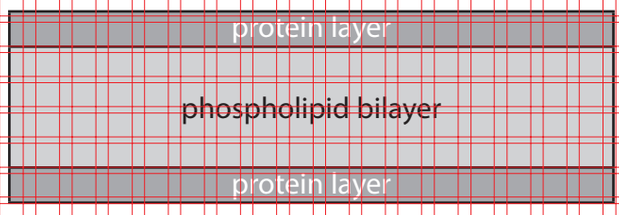
Method of movement	A	B	C	D
Active transport	☒	☒	☒	☒
Facilitated diffusion	☒	☒	☒	☒
Osmosis	☒	☒	☒	☒

Exemplar

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(c) The fluid mosaic model explains our current knowledge of the structure and properties of cell membranes. This model was developed from the Davson-Danielli model.

The diagram below shows the Davson-Danielli model of membrane structure.



(i) Use the information in the diagram to compare the Davson-Danielli model with the fluid mosaic model.

(2)

(ii) Explain why the Davson-Danielli model does not support our current knowledge of how molecules can move through the cell membrane.

(2)

(Total for Question 6 = 10 marks)

PreAPlar

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7 Cystic fibrosis is a genetic disease caused by mutations in the CFTR gene.
This disease can be classified according to the effect of the different gene mutations on the CFTR protein.

The table below shows the classification of cystic fibrosis.

Class	Effect on the CFTR protein
I	CFTR protein is not synthesised.
II	CFTR protein is mis-folded and is not found in the correct location.
III	CFTR protein is mis-folded and is found in the correct location, but does not function properly.
IV	CFTR protein has a faulty opening.
V	CFTR protein is synthesised in smaller quantities than normal.
VI	CFTR protein breaks down quickly after it is synthesised.

(a) For class I cystic fibrosis, suggest how a mutation in the CFTR gene could result in no CFTR protein being synthesised.

(2)

Exemplar

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(b) Class II cystic fibrosis results from the CFTR protein being located in the wrong place.

Describe the correct location for the CFTR protein.

(2)

(c) The mutation causing class III cystic fibrosis results in a change in the primary structure of the CFTR protein.

Explain why this would result in the CFTR protein being mis-folded.

(2)

(d) For class IV cystic fibrosis explain why a faulty opening of the CFTR protein would affect the functioning of this protein.

(2)

PREMIER

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(e) For a person with class V cystic fibrosis, describe the effect of having smaller quantities of CFTR protein.

(2)

(f) For class VI cystic fibrosis, suggest how the CFTR protein is broken down.

(2)

(Total for Question 7 = 12 marks)

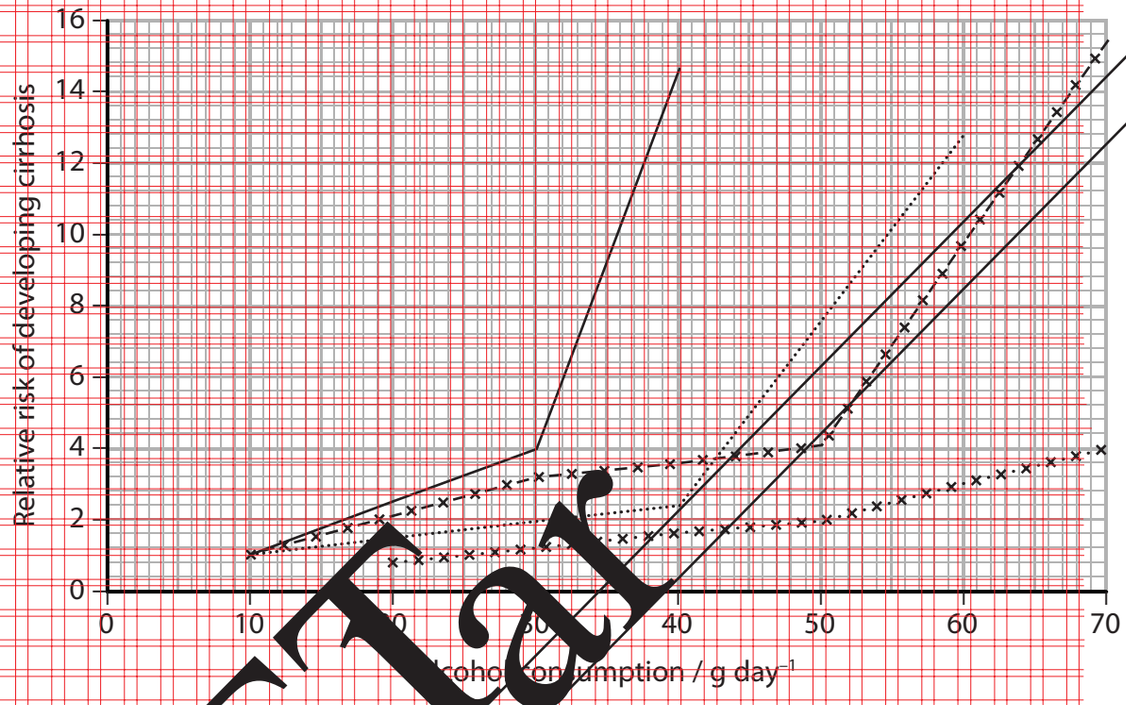
Exemplar

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8 Cirrhosis is a disease of the liver that is associated with alcohol abuse.

Two studies, study A and study B, were carried out to determine the relative risk of developing cirrhosis in relation to the mass of alcohol consumed each day by men and women.

The graph below shows the results of these two studies.



(a) The results of these studies indicate that there is a correlation between alcohol consumption and cirrhosis.

Explain how these results indicate that there is a **correlation** between alcohol consumption and cirrhosis.

(1)

Pearson Edexcel

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(b) (i) Using the information in the graph, compare the results for women in studies A and B.

(2)

(ii) Suggest **two** reasons for the difference between the results for women in these two studies.

(2)

1 .....

2 .....

Exemplar

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(c) Describe the evidence shown in the graph that suggests that the risk of developing cirrhosis depends on gender.

(2)

(d) Comment on the reliability of these results.

(2)

(e) It is possible that the men and women in these studies underestimated their alcohol consumption.

Suggest **one** reason for this.

(1)

(Total for Question 8 = 10 marks)

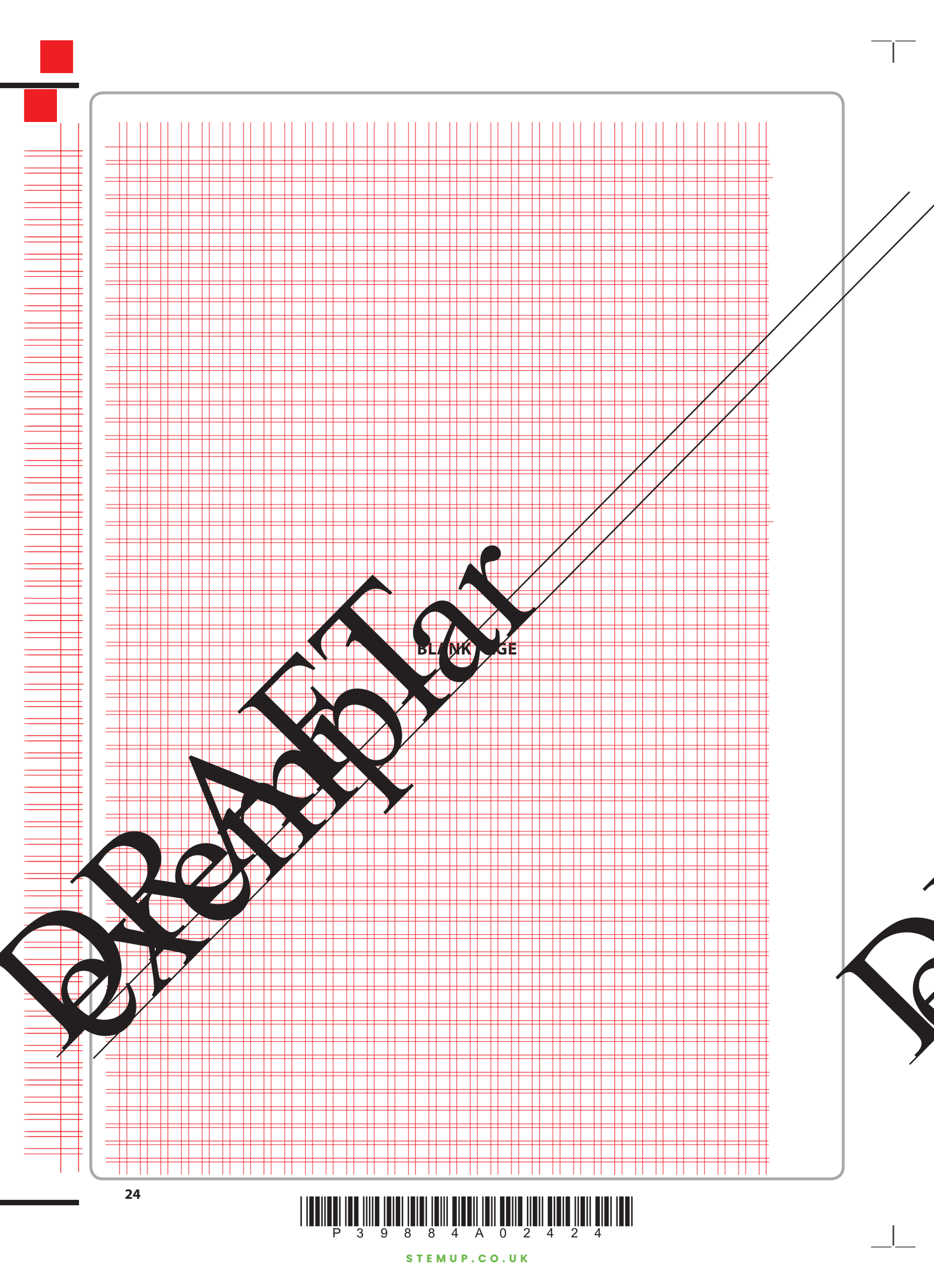
TOTAL FOR PAPER = 80 MARKS

PREMIER

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Example

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Mark Scheme (Results)

Summer 2013

GCE Biology Unit 1 (6BI01) Paper 01

Unit 1: Lifestyle, Transport, Genes and Health

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.
- Mark schemes will indicate within the table where, and which strands of QWC, are being assessed. The strands are as follows:

  i) ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear
  ii) select and use a form and style of writing appropriate to purpose and to complex subject matter
  iii) organise information clearly and coherently, using specialist vocabulary when appropriate

Using the Mark Scheme

Examiners should look for qualities to reward rather than faults to penalise. This does NOT mean giving credit for incorrect or inadequate answers, but it does mean allowing candidates to be rewarded for answers showing correct application of principles and knowledge. Examiners should therefore read carefully and consider every response: even if it is not what is expected it may be worthy of credit.

The mark scheme gives examiners:
- an idea of the types of response expected
- how individual marks are to be awarded
- the total mark for each question
- examples of responses that should NOT receive credit.

/ means that the responses are alternatives and either answer should receive full credit.
( ) means that a phrase/word is not essential for the award of the mark, but helps the examiner to get the sense of the expected answer.
Phrases/words in **bold** indicate that the meaning of the phrase or the actual word is **essential** to the answer.
ecf/TE/cq (error carried forward) means that a wrong answer given in an earlier part of a question is used correctly in answer to a later part of the same question.

Candidates must make their meaning clear to the examiner to gain the mark. Make sure that the answer makes sense. Do not give credit for correct words/phrases which are put together in a meaningless manner. Answers must be in the correct context.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:
- write legibly, with accurate use of spelling, grammar and punctuation in order to make the meaning clear
- select and use a form and style of writing appropriate to purpose and to complex subject matter
- organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities.
Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

Question Number	Answer	Additional Guidance	Mark
1(a)	1. platelets ; 2. thromboplastin ; 3. enzymes ; 4. prothrombin ; 5. thrombin ;	NB: allow phonetic spelling 1. ACCEPT thrombocytes 2. ACCEPT enzyme if not given in Mp3 3. ACCEPT thromboplastin if not given in Mp2	**(5)**

Question Number	Answer	Additional Guidance	Mark
1(b)(i)	1. central carbon with {R / H / eq} and H attached by single bonds ; 2. {NH_2 / NH_3^+ } attached to a carbon by single bond ; 3. {COOH / COO^- } attached to a carbon by single bond ;	Mp1 Must show C, H and R or a plausible R-group MP2 and 3 ACCEPT groups attached to a central C that is not shown (chemical notation) ACCEPT groups written wrong way round e.g. C-H_2N NOT incorrect bonding within groups if shown e.g. C=OH ACCEPT if correct group attached to wrong molecule e.g. glucose	**(3)**

Question Number	Answer	Additional Guidance	Mark
1(b)(ii)	peptide (bond) ;	ACCEPT peptide link NOT polypeptide or dipeptide	**(1)**

Question Number	Answer	Additional Guidance	Mark
1(b)(iii)	1. Idea that fibrinogen is globular and fibrin is fibrous ; 2. fibrinogen is soluble and fibrin is insoluble ; 3. Idea that they are different sizes ;	ACCEPT marks to be pieced together across the response. NB: answers must be comparative e.g. fibrin is fibrous fibrinogen is not 1. ACCEPT fibrinogen globular and fibrin (long) strand or chain. 3. ACCEPT fibrinogen is {smaller / larger / more amino acids} than fibrin	**(2)**

Question Number	Answer	Additional Guidance	Mark
2(a)	1. triplet code / 3 bases to each code / eq ; 2. reference to adenine, thymine, guanine and cytosine ; 3. idea that each triplet of bases codes for one amino acid ; 4. idea that the code is not overlapping ; 5. idea that code is universal ; 6. idea that code is degenerate ;	1. IGNORE codon, triple 2. ACCEPT phonetic spelling	**(2)**

Question Number	Answer	Additional Guidance	Mark
***2(b) QWC**	(QWC– Spelling of technical terms must be correct and the answer must be organised in a logical sequence) 1. reference to *semi-conservative replication* ; 2. DNA (*molecule* / strands) {unwinds / separate / eq} ; 3. *(mono)nucleotides* line up along (both) strands / eq ; 4. reference to *complementary* pairing between bases ; 5. reference to *hydrogen bonds* formed (between bases) ; 6. reference to formation of *phospho(di)ester* bonds (between adjacent *mononucleotides*) ; 7. ref. to condensation reaction; 8. name of an enzyme involved in DNA replication ;	QWC– Spelling of technical terms must be correct – penalise 1st error only – can still reach Max 5 marks if 6 points given. **If context is transcription, Max 2 marks from Mp2, 5, 6, 7, 8.** 1. ACCEPT clear description 2. ACCEPT unzipped / hydrogen bonds broken / eq 3. NOT RNA OR one strand only described IGNORE bases line up 4. ACCEPT description, NOT uracil / U 5. NOT between nucleotides in the same strand ACCEPT between (DNA) strands 8. e.g. (DNA) *polymerase*, (DNA) *helicase, ligase*	**(5)**

Question Number	Answer	Mark
3(a (i)	D ;	(1)

Question Number	Answer	Mark
3(a (ii)	B ;	(1)

Question Number	Answer	Mark
3(a)(iii)	B ;	(1)

Question Number	Answer	Mark
3(a)(iv)	A ;	(1)

Question Number	Answer	Additional Guidance	Mark
3(b)(i)	1. (total) cholesterol levels in people with mutation are not higher than people without mutation / eq ; 2. LDL (cholesterol) levels in people with mutation are not higher than people without mutation / eq ; 3. HDL (cholesterol) levels in people with mutation are not lower than people without mutation / eq ; 4. credit correct use of manipulated figures ;	1, 2, 3: ACCEPT converse, similar / little difference. Decreased/reduced is **not** equivalent to lower. 1. IGNORE same 2. IGNORE same 3. ACCEPT ref to HDL to LDL ratio higher in people with the mutation. 4. must be manipulated e.g. difference calculated and not just quoted (difference in LDL= 10, total cholesterol= 7) ACCEPT without units	**(2)**

Question Number	Answer	Additional Guidance	Mark
3(b)(ii)	(plant) statin ;	IGNORE named drug, sterol, stanin	**(1)**

Question Number	Answer	Additional Guidance	Mark
3(b)(iii)	1. muscle {inflammation / pain / eq} 2. liver {damage / failure / eq} 3. joint {aches / pains / eq} 4. nausea/ constipation / diarrhoea / indigestion / flatulence / loss of appetite / eq 5. kidney {damage /failure /eq} 6. cataracts / blurred vision 7. diabetes 8. allergies / skin inflammation / skin rash / eq 9. respiratory problems / persistent cough / nosebleeds / eq 10. headaches / dizziness / depression / insomnia / ringing in ears / fatigue / eq ;	NOT cancer or reduced vitamin absorption IGNORE affect ACCEPT problems as equivalent to damage etc 2. ACCEPT disease 4. ACCEPT vomiting 5. ACCEPT kidney disease 10. ACCEPT mood swings	**(1)**

Question Number	Answer	Additional Guidance	Mark
4(a)	1. idea of large surface area to volume ratio or that it is thin (body) ; 2. idea that this helps diffusion e.g. short diffusion distance, faster diffusion ;	1. IGNORE flat, small unqualified, thin membrane, thin skin etc NOT cell wall 2. IGNORE gas exchange NOT osmosis	**(2)**

Question Number	Answer	Additional Guidance	Mark
4(b)(i)	1. solubility of oxygen decreases as temperature increases / eq ; 2. credit correct manipulation of figures ;	1. ACCEPT converse, negative correlation 2. units not required but if given then they must be correct e.g. 8.2 mg dm^{-3} difference in solubility between 0 and 40 ^{o}C, solubility halved between 5 ^{o}C and 40 ^{o}C	**(2)**

Question Number	Answer	Additional Guidance	Mark
4(b)(ii)	1. idea that there is quite a lot of dissolved oxygen in the water at this temperature ; 2. idea of oxygen concentration gradient (between water and flatworm's cells) ; 3. idea of enzyme activity being temperature-dependent ; 4. idea that water below 15°C would be too cold for {enzymes / metabolism / eq} to work effectively ; 5. idea that it is a balance between oxygen availability and {enzyme activity / kinetic effects /eq} ;	IGNORE there is most oxygen available 1. ACCEPT sufficient O_2, not enough O_2 at higher temps. 2. Ref. to diffusion or gas exchange alone, not sufficient for the mark 3. ACCEPT e.g. 15°C is optimum for their enzymes NB: This is for linking enzymes and temperature, Mp4 is a development of Mp3 stating something specific. 4. IGNORE ref to effects above 15°C	(3)
Question Number	**Answer**	**Additional Guidance**	**Mark**

4(c)	1. heart needed to {pump / move / eq} blood (around the body) ; 2. reference to mass flow ; 3. idea that many animals have a small surface area to volume ratio ; 4. idea that a circulatory system is needed to overcome limitations of diffusion / eq ; 5. credit correctly named molecule transported (in blood) ; 6. idea that many animals have a high metabolic rate ;	4. ACCEPT idea that diffusion is not sufficient 5. oxygenated blood not enough by itself ACCEPT any appropriate molecule in the blood ACCEPT idea of thermoregulation e.g. heat	**(4)**

Question Number	Answer	Additional Guidance	Mark
5(a)(i)	1. reference to {H on the N / NH} in the reduced DCPIP ; 2. reference to more {H on the O / OH / hydroxyl} in the reduced DCPIP ; 3. more Hs in the reduced DCPIP / eq ; 4. idea of double bonds different in {number / location /eq} e.g. fewer in reduced DCPIP ; 5. idea of CN double bond not present in reduced ; 6. idea of CO double bond not present in reduced ;	IGNORE hydrogen bonds ACCEPT converse for oxidised DCPIP ACCEPT a clear statement about one implies a difference 2. e.g. two OH groups in reduced form ACCEPT alcohol groups 3. NOT more than two more Hs 4. IGNORE reduced more saturated 6. ACCEPT ref to ketone group	**(2)**

Question Number	Answer	Additional Guidance	Mark
5(a)(ii)	idea that the Hs come from the vitamin C / idea that vitamin C acts as a reducing agent ;	ACCEPT Description in terms of electrons (Vit C loses electrons/DCPIP gains electrons) ACCEPT vitamin C is oxidised ACCEPT vitamin C reduces DCPIP DCPIP is reduced alone is not enough	**(1)**

Question Number	Answer	Additional Guidance	Mark
5(b)(i)	1. pH increases during storage (over 4 days) / eq ; 2. greatest increase in pH at 12°C / smallest increase in pH at 24°C / eq ; 3. idea that pH changes are similar at 6 ^{o}C and 8 ^{o}C ; 4. reference to slight decrease in pH during first {one / two} days at 24 ^{o}C ; 5. credit correct manipulation of figures for a time period;	ACCEPT reduction in acidity for increase in pH 1. ACCEPT for all or for any one temperature 2. ACCEPT 12°C highest pH 3. ACCEPT the same up to day 2 5. Assume value is for four days unless otherwise stated, as four days specified in question stem. E.g. 12°C increased 0.45 / 12°C 0.4 higher than 24°C / only 0.03 between 6 ^{o}C and 8 ^{o}C (after 4 days)	**(3)**

Question Number	Answer	Additional Guidance	Mark
***5(b)(ii) QWC**	(QWC– Spelling of technical terms must be correct and the answer must be organised in a logical sequence) 1. idea of using juice (from stored fruits) ; 2. reference to {titration / eq} (of juice) ; 3. correct colour change described ; 4. compare volumes of {juice / DCPIP} used ; 5. use of {repeats / replicates / eq } ; 6. reference to extended storage ;	QWC points must be clear and unambiguous for awarding 1. NOT storing the juice 2. can be described or named 3. must be checked for context e.g. blue to colourless / clear / pink when titrating juice into the DCPIP, colourless to blue if DCPIP to juice. ACCEPT suitable description of use of colourimeter 4. ACCEPT in context of calibration of DCPIP against a standard concentration of vitamin C.	**(5)**

	7. reference to named controlled variable e.g. same volume DCPIP ; 8. reference to testing at regular intervals ;	6. i.e. beyond the 4 days of the original experiment	

Question Number	Answer	Additional Guidance	Mark
6(a)	1. {phosphate group / heads} are hydrophilic ; 2. Idea that heads can be attracted to water ; 3. {fatty acids / tails} are hydrophobic ; 4. Idea that tails orientate themselves away from water / eq ; 5. Idea of aqueous environment on both sides of the membrane ;	ACCEPT marks for annotated diagram, phonetic spelling OK IGNORE "water loving / hating" 1. ACCEPT polar 2. not just facing water 3. ACCEPT non polar 4. ACCEPT repel water, face away from water, away from polar environment 5. ACCEPT polar environment	**(3)**

Question Number	Answer	Mark
6(b)	B ; C ; A ;	**(3)**

Question Number	Answer	Additional Guidance	Mark
6(c)(i)	1. both have a phospholipid bilayer and protein / eq ; 2. idea that the fluid mosaic model has {proteins within the phospholipid layer / protein channels } while the	1. ACCEPT point pieced together in response 2. needs clear comparative statement re the position of the proteins in the two models, but can be expressed in a	

	Davison – Danielli model has protein layer on the outside of the membrane only ; 3. reference to other components present in fluid mosaic model e.g. glycolipid, glycoprotein, cholesterol ;	number of ways.	**(2)**

Question Number	Answer	Additional Guidance	Mark
6(c)(ii)	1. idea that molecules would not be able to diffuse through the (two) protein layers / eq ; 2. idea of no {channels / carriers / protein } for {facilitated diffusion / active transport / osmosis} ; 3. comment on fluidity of membrane / limits fusion of vesicles /eq ;	1. ACCEPT osmosis in context of water passing through protein layer 2. ACCEPT pumps for active transport 3. ACCEPT endo/exocytosis	**(2)**

Question Number	Answer	Additional Guidance	Mark
7(a)	1. mutation changes the sequence of bases / eq ; 2. reference to stop code / idea of {insertion / deletion / eq} changes all triplets / frame shift / eq ; 3. {transcription / translation} does not occur / mRNA too short / protein too short / a different protein is made / eq ;	1. ACCEPT correct sequence of bases not there 2. IGNORE changes one triplet / codon ACCEPT no start codon, no ribosome binding site 3. IGNORE change of an amino acid ACCEPT wrong protein made, different sequence of amino acids	**(2)**

Question Number	Answer	Additional Guidance	Mark
7(b)	1. in the (cell surface) membrane ; 2. of mucus-producing cells / eq ;	1. ACCEPT in phospholipid bilayer, apical membrane NOT on, attached, basal membrane 2. ACCEPT {epithelial/endothelial / lining} cells of appropriate named organ or system e.g. cells lining respiratory, digestive, reproductive	**(2)**

Question Number	Answer	Additional Guidance	Mark
7(c)	1. (change in) {number / type / sequence / eq} of {amino acids / R groups} ; 2. So the {bonding / named bond } will be different / eq ;	2. ACCEPT hydrogen, disulfide bridges, van der Waal forces, ionic NOT peptide, glycosidic, ester bond, etc IGNORE references to shape including active sites	**(2)**

Question Number	Answer	Additional Guidance	Mark
7(d)	1. CFTR is a channel protein / eq ; 2. idea that {fewer / no} chloride ions will be able to {enter / bind to / pass through / eq} the CFTR protein ; 3. idea that fewer chloride ions will leave the cell ;	NOT chlorine penalise once 1. NOT carrier 2. ACCEPT CFTR has a specific shape for chloride ions ACCEPT other ions can pass through	**(2)**

Question Number	Answer	Additional Guidance	Mark
7(e)	1. less {chloride ions / water} in mucus / eq ; 2. idea that mucus is different e.g. thicker, stickier ; 3. in the {respiratory system / lungs / digestive system / pancreas / reproductive system / oviducts / fallopian tubes / cervix / sperm duct / vas deferens / eq } ; 4. credit correct reference to a consequence of thicker mucus ;	E.g. less ventilation, enzyme release, absorption of nutrients, more chest infections, reduced fertility, etc	**(2)**
Question Number	**Answer**	**Additional Guidance**	**Mark**
7(f)	1. by {enzymes / proteases} ; 2. by hydrolysis / eq ; 3. of peptide bonds ;		**(2)**

Question Number	Answer	Additional Guidance	Mark
8(a)	Idea that the {increase / change} in relative risk of developing cirrhosis is {reflected / accompanied / eq} by the {increase / change} in alcohol consumption ;	ACCEPT 'the higher the consumption, the higher the risk' and similar IGNORE causation comments, it is positive	**(1)**

Question Number	Answer	Additional Guidance	Mark
8(b)(i)	1. both show an increase in risk with an increase in alcohol consumption / eq ; 2. idea that the risk increases markedly at 30 g day^{-1} in study A but at 40 g day^{-1} in study B ; 3. study A found the risk was higher than study B / eq ; 4. credit use of comparative manipulated figures ;	ACCEPT mps to be pieced together IGNORE faster ACCEPT steeper 3. ACCEPT for specified value of alcohol consumption or risk 4. E.g. for 30g alcohol per day study A women have a relative risk 2 higher than study B women If units given they must be correct	**(2)**

Question Number	Answer	Additional Guidance	Mark
8(b)(ii)	Any **two** from differences in: age / diet / medication / other drug abuse / nationality / ethnicity / genetics / body mass /activity levels / other medical conditions / study method / sample size / {over / under / eq} estimation of consumption of alcohol / pattern of drinking (e.g. binge compared to regular/type of drink) ;;	ACCEPT two correct answers in first section IGNORE environmental factors, lifestyle, occupation, pregnancy, ACCEPT smoking, weight, BMI, countries, regions, areas, metabolism, liver size	**(2)**

Question Number	Answer	Additional Guidance	Mark
8(c)	1. Each study found women to have a greater risk than men / eq ; 2. idea that the risk increases markedly at 50 g day-1 for men but at {30 /40 / both} g day-1 for women ; 3. idea that gradient of increased risk smaller for men than women (in both studies) ; 4. credit correct use of figures e.g. above 42-44 g day^{-1} men are at a lower risk / eq ;		**(2)**

Question Number	Answer	Additional Guidance	Mark
8(d)	1. the results of both studies are (fairly) similar suggesting that the results are reliable / eq ; 2. comments on the numbers of people in the studies / eq ; 3. comment on lack of error bars / eq ; 4. idea that the results do not reliably show at what level risk increases significantly ;	1. ACCEPT results show same pattern e.g. men lower than women in both studies 2. E.g. we don't know the sample size. IGNORE number of studies 3. ACCEPT no information about the range of results in each study	**(2)**

Question Number	Answer	Additional Guidance	Mark
8(e)	misreporting the amount of alcohol they had consumed / {did not know /guessed} the alcohol content of their drinks / used average values for alcohol content of drinks / {lost track of / could not remember } how much they drank / eq ;		**(1)**

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Edexcel GCE

Biology

Advanced Subsidiary

Unit 1: Lifestyle, Transport, Genes and Health

Wednesday 9 January 2013 – 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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1/1/1/1/

P 3 9 8 7 8 A 0 1 2 4

PEARSON

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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 Read through the following passage on the cardiac cycle, then write on the dotted lines the most appropriate word or words to complete the passage.

The cardiac cycle consists of three stages: atrial systole, ventricular systole and

..... .

During atrial systole, the ..... contract and the

..... are relaxed. The ..... valves are open.

During ventricular systole, the ..... open as oxygenated blood is

forced out of the heart through the aorta to the body and through the pulmonary

..... to the lungs.

(Total for Question 1 = 6 marks)

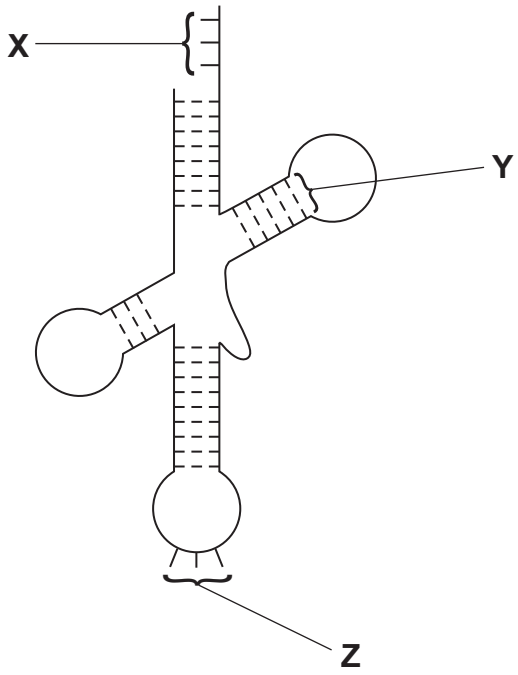
P 3 9 8 7 8 A 0 2 2 4
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2 Messenger RNA (mRNA) and transfer RNA (tRNA) are important nucleic acids involved in the process of protein synthesis.

(a) Describe how a molecule of mRNA is made during transcription.

(4)

(b) The diagram below represents a tRNA molecule.



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

(i) Part **X** binds to

(1)

☒ **A** an amino acid for transcription

☒ **B** an amino acid for translation

☒ **C** mRNA for transcription

☒ **D** mRNA for translation

(ii) Part **Y** is a

(1)

☒ **A** glycosidic bond

☒ **B** hydrogen bond

☒ **C** peptide bond

☒ **D** phosphodiester bond

P 3 9 8 7 8 A 0 4 2 4
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(iii) Part **Z** binds to

(1)

- ☒ **A** an amino acid during transcription
- ☒ **B** an amino acid during translation
- ☒ **C** mRNA during transcription
- ☒ **D** mRNA during translation

(c) Using the information shown in the diagram, describe **two** ways in which the structure of a tRNA molecule differs from the structure of a mRNA molecule.

(2)

1 .....

.....

.....

.....

2 .....

.....

.....

.....

(Total for Question 2 = 9 marks)

3 Molecules are transported across the cell membrane in a number of different ways.

(a) Describe the structure of a cell membrane.

(3)

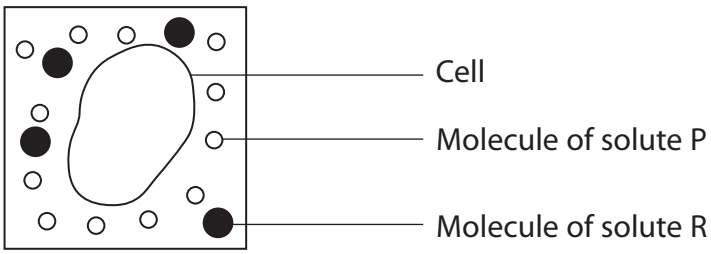
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Question 3 continues on page 8

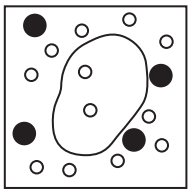
(b) Cells were placed in a solution containing two different solutes, solute P and solute R.

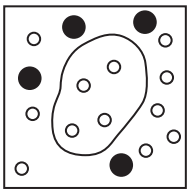
The diagram below represents the concentration of the two solutes outside one of the cells, when this cell was placed in the solution.

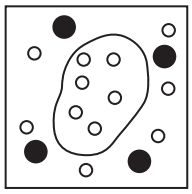


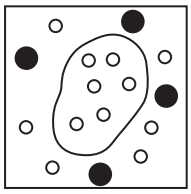
The cells were left in the solution for 50 minutes.

The diagrams below represent the concentrations of the two solutes, inside and outside the cell after 10, 20, 30 and 40 minutes in the solution.


After 10 minutes


After 20 minutes


After 30 minutes


After 40 minutes

(i) Using the information in the diagrams, describe the changes that have taken place in the concentrations of solute P and solute R, in the 40 minute period.

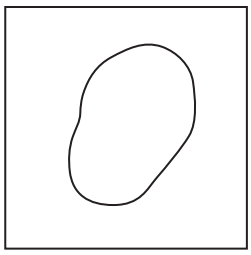
Suggest an explanation for these changes.

(5)

P 3 9 8 7 8 A 0 8 2 4
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(ii) Complete the diagram below, to show the concentration of solute P and solute R inside and outside the cell, after 50 minutes.

(1)



(Total for Question 3 = 9 marks)

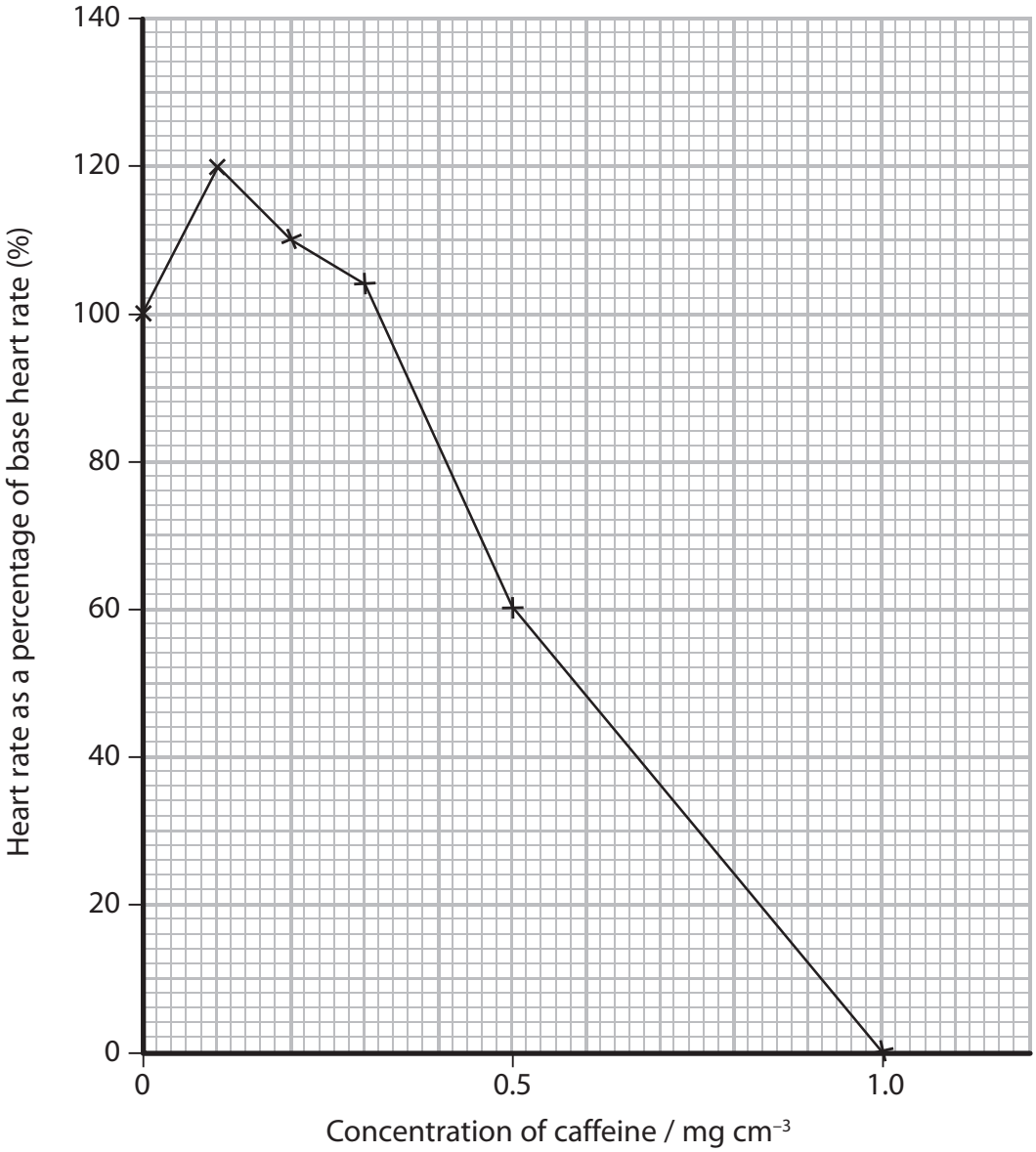
4 An investigation was carried out to study the effect of caffeine on the heart rate of a chicken embryo.

The heart from a chicken embryo was removed and placed in a glucose solution. The heart rate was determined and recorded as the base heart rate.

The experiment was repeated using glucose solutions containing five different concentrations of caffeine.

The heart rate was determined and recorded as a percentage of the base heart rate for each solution.

The graph below shows the results of this investigation.



P 3 9 8 7 8 A 0 1 0 2 4
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(a) (i) Suggest why glucose was included in the solutions.

(2)

(ii) Suggest how the caffeine solutions were prepared to obtain valid results.

(1)

(iii) State how these results could be made more reliable.

(1)

(iv) Using the information in the graph, describe the effect of caffeine on the heart rate of the chicken embryo.

(3)

(b) (i) Describe how this investigation could be carried out using *Daphnia* instead of chicken embryos.

(4)

(ii) Suggest **one** ethical issue in the use of chicken embryos in this investigation.

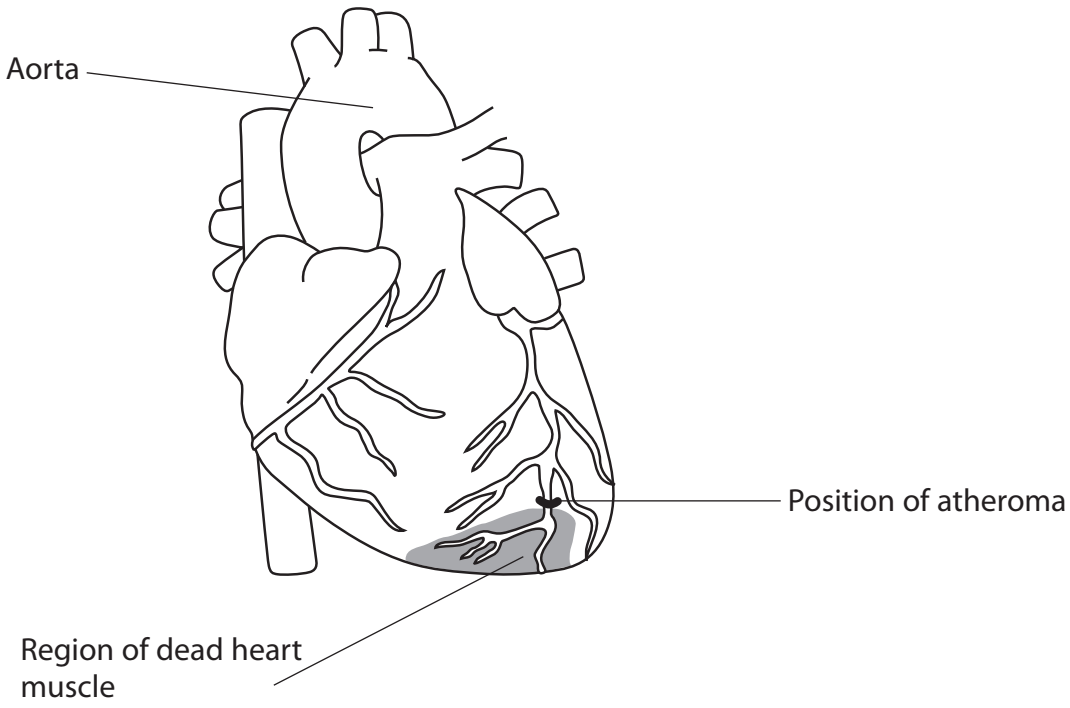
(1)

(Total for Question 4 = 12 marks)

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5 Atherosclerosis is responsible for many deaths that result from cardiovascular disease (CVD).

The diagram below shows an external view of a human heart.
The position of an atheroma (plaque) is shown and a region of dead heart muscle is shaded.



(a) (i) Explain how the structure of the aorta relates to its function.

(3)

P 3 9 8 7 8 A 0 1 3 2 4
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(ii) Describe **two** differences between the structure of a capillary and the structure of a vein.

(2)

1 .....

.....

.....

2 .....

.....

.....

(b) (i) Suggest how the location of the atheroma results in the position and size of this region of dead heart muscle.

(3)

.....

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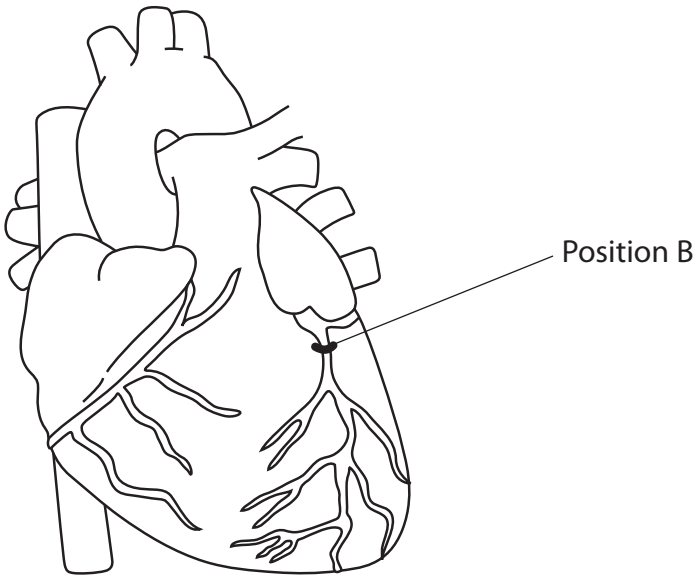
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(ii) On the diagram below, shade an area to show the position and size of dead heart muscle, if the atheroma occurred at position B.

(2)



(Total for Question 5 = 10 marks)

6 Enzymes act as biological catalysts.

Amylase is an enzyme present in saliva that catalyses the hydrolysis of starch into maltose.

*(a) Describe the structure of starch.

(5)

(b) Explain the meaning of the following terms.

(i) Catalyst

(2)

P 3 9 8 7 8 A 0 1 6 2 4
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(ii) Hydrolysis

(2)

(c) Bread contains a high proportion of starch. If bread is chewed for a long period of time it begins to taste sweet.

Suggest why bread tastes sweet after chewing for a long period of time.

(1)

(Total for Question 6 = 10 marks)

P 3 9 8 7 8 A 0 0 7 2 4
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7 There is evidence for a causal relationship between blood cholesterol levels and cardiovascular disease (CVD).

(a) Explain the meaning of the term **causal relationship**.

(1)

(b) Lipoproteins are composed of phospholipids, cholesterol and proteins.

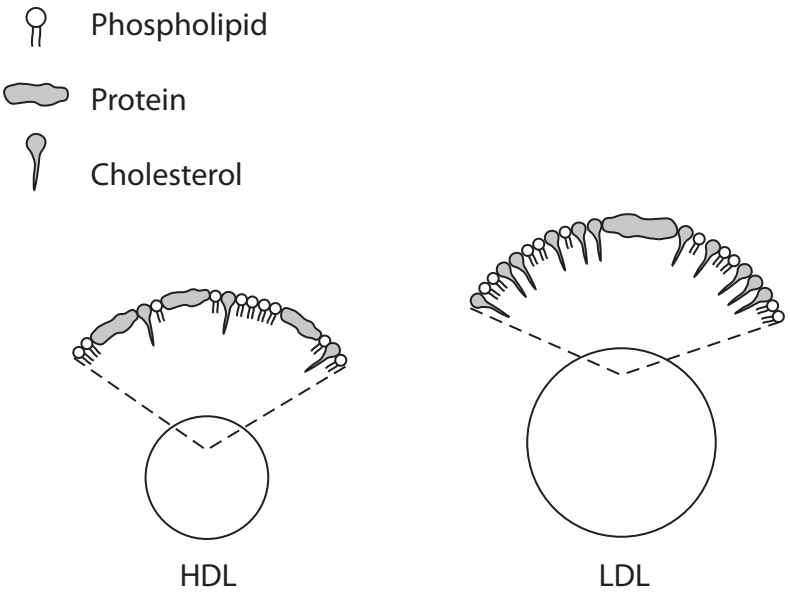
(i) Proteins are made up of amino acids.

Describe how amino acids join together to form the three-dimensional structure of a protein.

(4)

P 3 9 8 7 8 A 0 1 8 2 4
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(ii) The diagrams below show part of the structure of the surface of high-density lipoprotein (HDL) and low-density lipoprotein (LDL).



Using the information in the diagram, describe the differences between the structure of HDL and the structure of LDL.

(2)

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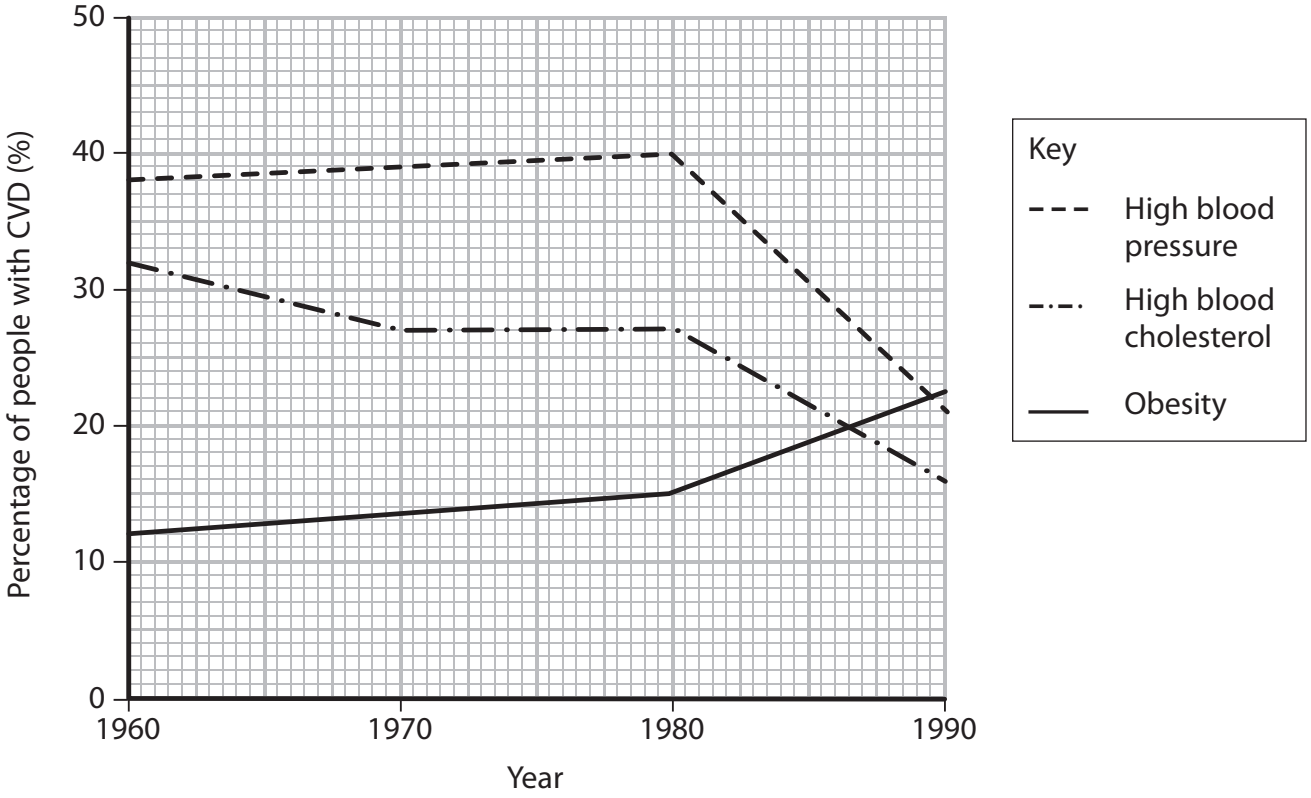
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(c) Obesity and high blood pressure are also factors that increase the risk of CVD.

The graph below shows the percentage of people with CVD who have high blood pressure or have high blood cholesterol or are obese for the period 1960 to 1990.



(i) Using the information in the graph, describe the overall changes that have occurred in these risk factors during this period.

(3)

P 3 9 8 7 8 A 0 0 2 0 2 4
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(ii) Suggest **two** reasons for the overall change in high blood cholesterol as a risk factor.

(2)

1 .....

.....

.....

2 .....

.....

.....

(iii) State **two** factors, other than obesity, high blood pressure and high blood cholesterol, that increase the risk of CVD.

(1)

1 .....

2 .....

(Total for Question 7 = 13 marks)

P 3 9 8 7 8 A 0 1 2 4
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8 Cystic fibrosis and albinism are examples of recessive genetic disorders.

Tay-Sachs disease is another example of a recessive genetic disorder.

(a) Explain the meaning of the term **recessive genetic disorder**.

(2)

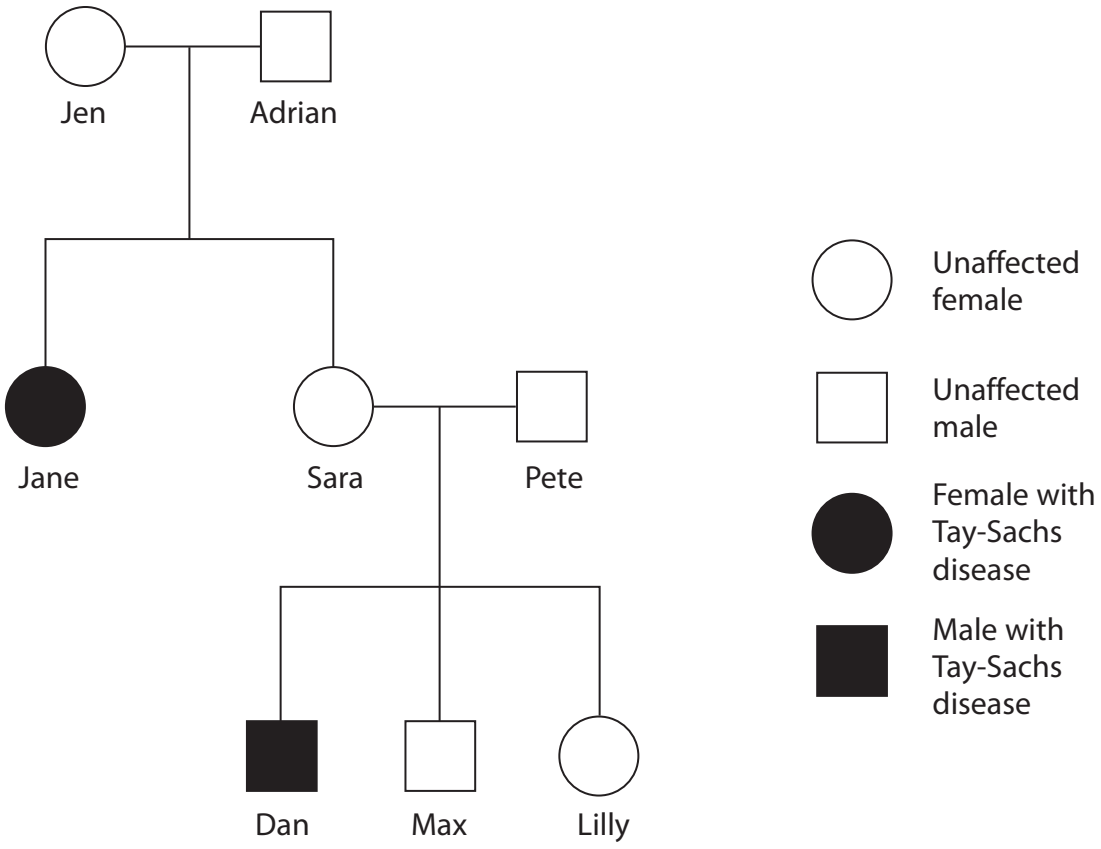
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(b) The genetic pedigree diagram below shows the inheritance of Tay-Sachs disease in one family.



P 3 9 8 7 8 A 0 2 2 4
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For each of the statements below, put a cross (☒) in the box that correctly completes the statement.

(i) The female who definitely has a homozygous genotype is

(1)

☒ **A** Jane

☒ **B** Jen

☒ **C** Lilly

☒ **D** Sara

(ii) The female whose genotype cannot be identified from the diagram is

(1)

☒ **A** Jane

☒ **B** Jen

☒ **C** Lilly

☒ **D** Sara

(iii) A male who definitely has a heterozygous genotype is

(1)

☒ **A** Adrian

☒ **B** Dan

☒ **C** Max

☒ **D** none of them

(iv) A male who definitely is homozygous dominant is

(1)

☒ **A** Adrian

☒ **B** Dan

☒ **C** Max

☒ **D** none of them

*(c) Tay-Sachs disease is caused by a gene mutation that results in the build up of lipid in the brain. It is hoped that gene therapy will be able to treat this disease in the future.

Sheep can also suffer from Tay-Sachs disease. Investigations have found that gene therapy increases the life span of these animals.

Suggest how these gene therapy investigations could have been carried out.

(5)

(Total for Question 8 = 11 marks)

TOTAL FOR PAPER = 80 MARKS

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Mark Scheme (Results)

January 2013

GCE Biology (6BI01) Paper 01
Lifestyle, Transport, Genes and Health

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GENERAL INFORMATION

The following symbols are used in the mark schemes for all questions:

Symbol	Meaning of symbol
; semi colon	Indicates the end of a marking point
Eq	Indicates that credit should be given for other correct alternatives to a word or statement, as discussed in the Standardisation meeting
/ oblique	Words or phrases separated by an oblique are alternatives to each other
{} curly brackets	Indicate the beginning and end of a list of alternatives (separated by obliques) where necessary to avoid confusion
() round brackets	Words inside round brackets are to aid understanding of the marking point but are not required to award the point
[] square brackets	Words inside square brackets are instructions or guidance for examiners
[CE] or [TE]	Consecutive error / transferred error

Crossed out work

If a candidate has crossed out an answer and written new text, the crossed out work can be ignored. If the candidate has crossed out work but written no new text, the crossed out work for that question or part question should be marked, as far as it is possible to do so.

Spelling and clarity

In general, an error made in an early part of a question is penalised when it occurs but not subsequently. The candidate is penalised once only and can gain credit in later parts of the question by correct reasoning from the earlier incorrect answer.

No marks are awarded specifically for quality of language in the written papers, except for the essays in the synoptic paper. Use of English is however taken into account as follows:

- the spelling of technical terms must be sufficiently correct for the answer to be unambiguous
  e.g. for amylase, 'ammalase' is acceptable whereas 'amylose' is not
  e.g. for glycogen, 'glicojen' is acceptable whereas 'glucagen' is not
  e.g. for ileum, 'illeum' is acceptable whereas 'ilium' is not
  e.g. for mitosis, 'mytosis' is acceptable whereas 'meitosis' is not

- candidates must make their meaning clear to the examiner to gain the mark.

- a correct statement that is contradicted by an incorrect statement in the same part of an answer gains no mark – irrelevant material should be ignored

Question Number	Answer	Additional guidance	Mark
1	1. diastole ; 2. atrium / atria ; 3. ventricles ; 4. atrioventricular / bicuspid / tricuspid ; 5. semilunar (valves) ; 6. artery ;	1. ALLOW ventricular diastole or atrial AND ventricular diastole (together) NOT atrial diastole by itself 4. ALLOW AV , mitral 5. ALLOW aortic valves	**(6)**

Question Number	Answer	Additional guidance	Mark
2(a)	1. idea that DNA (molecule){ unwinds / unzips / uncoils / eq} (DNA) strands separate ; 2. (RNA mono) nucleotides {line up against / attach to} {one strand / template / antisense strand / eq} / eq ; 3. ref to complementary base pairing (between DNA and mononucleotides) ; 4. ref to formation of phosphodiester bonds ; 5. ref to condensation reaction ; 6. correct name of enzyme involved ; 7. idea that mRNA detaches from the DNA;	1. ALLOW description e.g. breaking of hydrogen bonds 2. NOT DNA strand**s,** DNA nucleotides 3. ALLOW description of complementary base pairing 6. (DNA) helicase, RNA polymerase, DNA ligase NOT DNA polymerase, polymerase 7. NOT leaves nucleus alone / eq	**(4)**

Question Number	Answer	Mark
2(b)(i)	B ;	**(1)**

Question Number	Answer	Mark
2(b)(ii)	B ;	**(1)**

Question Number	Answer	Mark
2(b)(iii)	D ;	**(1)**

Question Number	Answer	Additional guidance	Mark
2(c)	1. tRNA is folded (and mRNA is {straight / unfolded}) / eq ; 2. tRNA has hydrogen bonds (holding the structure together) (but the mRNA does not / eq) ; 3. tRNA is a fixed {size / length} (but mRNA {is not / length depends on size of gene}) / eq ; 4. tRNA has an anticodon (but mRNA has codons) ; 5. tRNA has an amino acid binding site ;	1. IGNORE double stranded / branched ALLOW tRNA clover shaped / looped 2. ALLOW tRNA has complementary base pairing / double stranded sections NOT (all) double stranded 4. NOT is an anticodon	**(2)**

Question Number	Answer	Additional guidance	Mark
3(a)	1. phospholipid (bilayer) ; 2. credit details of phospholipid bilayer ; 3. proteins ; 4. credit details of proteins ; 5. reference to other named membrane components ;	ALLOW a clearly labelled diagram 2. e.g orientation because of hydrophobic and/or hydrophilic regions eg phospholipids are fluid 4. e.g. description of channel/carrier protein structure or position. (Intrinsic, extrinsic or transmembrane) 5.e.g. glycolipid, cholesterol, glycoprotein, carbohydrate chain, glycocalyx	**(3)**

Question Number	Answer	Additional guidance	Mark
3(b)(i)	**Solute P:** 1. (up to 30 minutes) the {concentration / number} of molecules of P increases inside the cell / eq ; 2. ref to {diffusion / facilitated diffusion}(of molecules of P into the cell) ; 3. down the concentration gradient (of P) / eq ; 4. {between 30 and 40 minutes / after 30 minutes } the {concentration / number} of molecules (of P) inside the cell stays the same / eq ; 5. concentration (of P) inside cell equals concentration outside cell / reaches equilibrium / eq ; **Solute R:** 6. solute R does not enter cell / eq ; 7. membrane is impermeable to R ;	IGNORE amount **max 4 marks for solute P** 2. NOT osmosis 3. ALLOW high to low concentration NOT high to low concentration gradient 4. ALLOW no net movement	**(5)**

Question Number	Answer	Additional guidance	Mark
3(b)(ii)	six white circles inside and outside the cell and 4 black circles outside cell ;		**(1)**

Question Number	Answer	Additional guidance	Mark
4(a) (i)	1. glucose provides respiratory substrate / eq ; 2. to provide {energy / eq} for heart (muscle) {contraction / eq} ; 3. reference to osmotic effect ;	1. ALLOW needed / used for respiration 3. Can be expressed in a variety of ways eg solution is isotonic.	**(2)**

Question Number	Answer	Additional guidance	Mark
4(a) (ii)	{glucose / pH } at same { concentration / volume / value / eq } ;	IGNORE references to caffeine and temperature etc. IGNORE amount	**(1)**

Question Number	Answer	Additional guidance	Mark
4(a) (iii)	reference to replication procedure ;	ALLOW repeats, use more than one heart NOT repeat with different concentrations	**(1)**

Question Number	Answer	Additional guidance	Mark
4(a)(iv)	1. the heart rate decreases (with increasing caffeine concentrations) above 0.1 (mg cm^{-3}) / concentrations of a caffeine above {0.30 - 0.34 (mg cm^{-3})} the heart rate {decreases / is lower than base rate} / eq ; 2. up to a concentration of {0.30-0.34 (mg cm^{-3})} caffeine there is an increase in heart rate (above base rate) / eq ; 3. 0.1 (mg cm^{-3}) caffeine causes the fastest heart rate / eq ; 4. credit correct manipulation of figures ;	4. e.g. 20% increase with 0.1 (mg cm^{-3})	**(3)**

Question Number	Answer	Additional guidance	Mark
4(b)(i)	1. details of method to limit movement of *Daphnia* ; 2. reference to determining base heart rate (in absence of caffeine) ; 3. reference to use of range of caffeine concentrations ; 4. acclimatisation of *Daphnia* (in each solution) / eq ; 5. details of method to determine heart rate; 6. repeats / replicates ; 7. Named control variable e.g. {source / size / age / type / eq} of Daphnia, temperature, pH ;	1. e.g. use of cotton wool IGNORE cavity slide 2. ALLOW measure heart rate in 0% caffeine NOT distilled water 5. eg dots on paper in a set time / use video camera IGNORE just counting	**(4)**

Question Number	Answer	Additional guidance	Mark
4(b)(ii)	chicken (embryo) {is a vertebrate / feels pain / will die / cannot give consent/ eq } ;		**(1)**

Question Number	Answer	Additional guidance	Mark
5(a)(i)	1. Idea that there is a {thick wall / lots of collagen / thick layers / thick tunica media / eq} ; 2. Idea that it needs {to avoid rupture / to withstand high pressure / eq} ; 3. {elastic / muscular / eq} {layer / fibres / wall/ eq} ; 4. Control the flow of blood / maintain blood pressure / elastic recoil / eq ; 5. smooth endothelial wall / eq ; 6. to reduce {friction / resistance / eq} ; 7. semi lunar valve present ; 8. to prevent backflow (during diastole) ; 9. large lumen ; 10. idea of accommodating large volumes of blood / eq ; 11. branches ; 12. to supply blood to different parts of the body (including coronary arteries) / eq ;	Max 2 marks for structural features only. Functions need to be in correct context 1. ALLOW idea of folded wall 2. IGNORE damage alone ALLOW stretch to accommodate more blood 4. ALLOW to squeeze blood along 5. ALLOW smooth lining 7. IGNORE no valves ALLOW aortic valve 9. IGNORE narrow lumen	**(3)**

Question Number	Answer	Additional guidance	Mark
5(a)(ii)	1. capillary walls are one cell thick / eq ; 2. no {elastic tissue / collagen / muscle / multiple layers / eq } in the capillary (walls) ; 3. no valves in capillaries ; 4. capillaries have a very narrow lumen / eq ; 5. capillaries are porous / have pores;	ALLOW converse statements ALLOW statements that only mention capillary or vein – but do not credit same mark point twice 1. and 4. IGNORE capillaries are one cell thick alone	**(2)**

Question Number	Answer	Additional guidance	Mark
5(b)(i)	1. idea that the area of dead heart muscle will be {downstream of the atheroma / in region normally supplied by the blocked artery / eq} ; 2. idea that each artery supplies (cells) with {oxygen / glucose / oxygenated blood } ; 3. idea that {cells / muscle / tissue / eq} (supplied by the blocked vessel) will die due to lack of {energy / respiration} ; 4. idea that if the atheroma is located {near the end of an artery / in a small artery } then the area of dead muscle will be small ;	4. ALLOW converse	**(3)**

Question Number	Answer	Additional guidance	Mark
5(b)(ii)	1. shaded area should not extend above position B ; 2. shaded area should be around all the vessels on the right side of the diagram but not overlap with those on the left ;		**(2)**

Question Number	Answer	Comments	Mark
6(a)	(QWC– Spelling of technical terms must be correct and the answer must be organised in a logical sequence) 1. (α) *glucose* ; 2. *glycosidic* {bonds / links} ; 3. *amylose* and *amylopectin* ; 4. *amylose* has 1- 4 (*glycosidic)* {bonds / links} **AND** *amylopectin* has 1- 4 and 1- 6 (glycosidic) bonds / eq ; 5. *amylose* is {spiralled / coiled} ; 6. *amylopectin* is branched / eq ; 7. compact *molecule* / eq ;	QWC spelling of words in italics should be correct. Penalise just once – ALLOW max score of 5 if 6 mpts met but one lost due to spelling mistake.	**(5)**

Question Number	Answer	Additional guidance	Mark
6(b)(i)	1. speeds up the rate of reaction / eq ; 2. without being {changed/used up / eq} ; 3. lowers activation energy / provides an alternative reaction pathway / eq ; 4. does not change {products / position of equilibrium / eq } / eq ;		**(2)**

Question Number	Answer	Additional guidance	Mark
6(b)(ii)	1. breaks the (glycosidic) bonds / eq ; 2. reference to use of water ;	1. IGNORE hydrogen bonds 2. NOT makes water / eq	**(2)**

Question Number	Answer	Additional guidance	Mark
6 (c)	idea that { maltose / disaccharide / glucose / monosaccharide} {is produced / tastes sweet} ;	ALLOW dextrins / sugar NOT any other named sugar eg sucrose	**(1)**

Question Number	Answer	Additional guidance	Mark
7(a)	Idea that (a change in) one variable (directly) results in the change of another variable ;	ALLOW causes, affects, etc and clear examples Eg increase in blood cholesterol causes an increase in the risk of CVD IGNORE correlation, link, relationship, trend, etc alone	**(1)**

Question Number	Answer	Additional guidance	Mark
7(b)(i)	1. reference to peptide bonds (joining amino acids); 2. between amino group (of one amino acid) and carboxyl group (of another) / eq ; 3. the sequence of amino acids is the primary structure of the protein / eq ; 4. reference to folding (of primary structure) held together by bonds / eq ; 5. {disulfide bridges / eq} / {hydrogen / H} bonds / ionic bonds / Van der Waals forces ; 6. between the R groups / eq ;	2. ALLOW from a labelled diagram ALLOW NH_2 and COOH 4. ALLOW ref to alpha helix or beta pleated sheet	**(4)**

Question Number	Answer	Additional guidance	Mark
7 (b)(ii)	1. HDL is smaller ; 2. HDL contains more protein / eq ; 3. HDL contains less cholesterol / eq ;	**ALLOW** converse for LDL	**(2)**

Question Number	Answer	Additional guidance	Mark
7(c)(i)	1. (risk due to) high blood pressure has fallen overall / eq ; 2. (risk due to) high blood cholesterol has fallen overall / eq ; 3. (risk due to) obesity has risen overall / eq ; 4. obesity was the lowest risk factor but is now the highest / eq ; 5. credit use of manipulated figures ;	Answers should cover total time period and not just 1980-1990 5. only credit overall change figures e.g. 17% drop for high blood pressure 16% drop for high blood cholesterol 10.5% increase in obesity	**(3)**

Question Number	Answer	Additional guidance	Mark
7(c)(ii)	1. people more aware of the risks / eq ; 2. people consuming foods with lower {cholesterol levels / saturated fats / eq} / eq ; 3. people consuming foods with more fibre in them / eq ; 4. use of statins / eq ; 5. more screening / eq ; 6. more exercise / eq ;	1. ALLOW more aware of healthy diets 4. Use of sterols/named example 5. ALLOW self testing	**(2)**

Question Number	Answer	Additional guidance	Mark
7(c)(iii)	Any **two** from: (being) male increase in age lack of exercise / inactivity smoking genetics high alcohol consumption high salt diet high saturated fat intake stress diabetes ;	IGNORE fat, LDL or cholesterol consumption	**(1)**

Question Number	Answer	Additional guidance	Mark
8(a)	1. (the disorder results from a) defect in genes / eq ; 2. both (defective) alleles need to be present / homozygous / not expressed in the presence of a dominant allele / eq ;	1. ALLOW faulty allele	**(2)**

Question Number	Answer	Mark
8(b)(i)	A ;	**(1)**

Question Number	Answer	Mark
8(b)(ii)	C ;	**(1)**

Question Number	Answer	Mark
8(b)(iii)	A ;	**(1)**

Question Number	Answer	Mark
8(b)(iv)	D ;	**(1)**

Question Number	Answer	Additional guidance	Mark
8(c)QWC	(QWC– Spelling of technical terms must be correct and the answer must be organised in a logical sequence) 1. {isolation / identification / eq} of normal gene / eq ; 2. {inserted / eq} into vector / stem cells / eq ; 3. vector named as {liposome / virus} ; 4. injection of {vector / modified stem cells} into {blood / brain / target cells / eq} / eq ; 5. ref to use of control injection ; 6. further detail of control injection e.g. use empty liposome / virus without gene inserted ; 7. progression of disease monitored / eq ; 8. life spans recorded / eq ; 9. reference to appropriate comparison with control eg untreated sheep ; 10. idea that treatment needs to be repeated; 11. idea of replication of investigation;	**QWC** penalise once if mark point is not in a logical position	**(5)**

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Edexcel GCE

Biology

Advanced Subsidiary

Unit 1: Lifestyle, Transport, Genes and Health

Monday 14 May 2012 – Morning
Time: 1 hour 30 minutes

Paper Reference
6BI01/01

You must have:
Ruler

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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1/1/1/1/C1

P 3 9 5 0 9 A 0 1 2 4

PEARSON

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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 Nucleic acids, DNA and RNA, are very important molecules in living organisms. Messenger RNA (mRNA) and transfer RNA (tRNA) are involved in the synthesis of proteins.

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

(a) DNA and RNA are polynucleotides composed of mononucleotides joined by

(1)

☒ **A** catabolic reactions

☒ **B** condensation reactions

☒ **C** hydrolysis reactions

☒ **D** redox reactions

(b) The mononucleotides of RNA consist of a phosphate joined to the sugar

(1)

☒ **A** deoxyribose

☒ **B** dextrose

☒ **C** ribose

☒ **D** ribulose

(c) The mononucleotides in mRNA are joined together by

(1)

☒ **A** disulphide bridges

☒ **B** glycosidic bonds

☒ **C** hydrogen bonds

☒ **D** phosphodiester bonds

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(d) The bases in RNA are

(1)

- ☒ **A** adenine, cytosine, guanine and thymine
- ☒ **B** adenine, cytosine, guanine and uracil
- ☒ **C** adenine, guanine, thymine and uracil
- ☒ **D** cytosine, guanine, thymine and uracil

(e) DNA is a double stranded molecule twisted into

(1)

- ☒ **A** a beta-pleated sheet
- ☒ **B** a double helix
- ☒ **C** a triple helix
- ☒ **D** an alpha helix

(f) The two DNA strands are held together by

(1)

- ☒ **A** disulphide bridges
- ☒ **B** glycosidic links
- ☒ **C** hydrogen bonds
- ☒ **D** phosphodiester bonds

(g) Describe the role of each of the following in protein synthesis.

(4)

mRNA .....

.....

.....

.....

.....

tRNA .....

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.....

.....

.....

(Total for Question 1 = 10 marks)

P 3 9 5 5 9 A 0 1 2 4 4
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2 Carbohydrates are important components of our diets.

(a) Distinguish between the structures of each of the following pairs of carbohydrate molecules.

(i) Monosaccharides and disaccharides

(2)

(ii) Amylose and amylopectin

(2)

(b) Explain why a diet consisting of a high proportion of carbohydrates could lead to obesity.

(2)

(Total for Question 2 = 6 marks)

3 Many animals, such as mammals, have a heart and circulation. This helps them to meet their requirements by overcoming the limitations of diffusion.

*(a) Describe the structure of the mammalian heart.

(5)

P 3 9 5 7 9 A 0 6 2 4
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(b) Giraffes are very tall mammals found roaming the plains of Africa.
Two giraffes are shown in the photograph below.



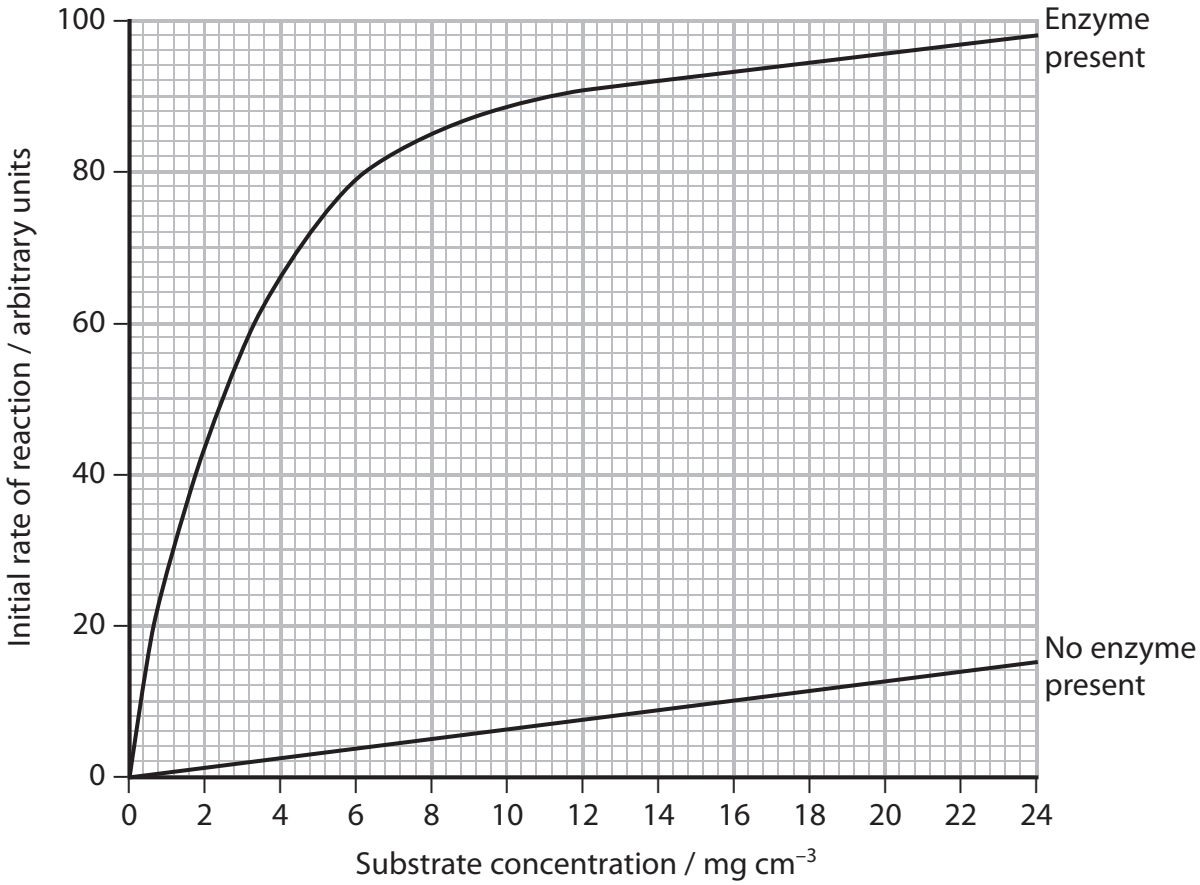
Using the information in the photograph and your own knowledge, explain the importance of the heart and circulation to the giraffe.

(4)

(Total for Question 3 = 9 marks)

4 Enzymes are biological catalysts. They are involved in many chemical reactions in the body, including the digestion of lipids.

(a) The graph below shows the effect of an enzyme on the initial rate of reaction at different concentrations of the substrate.



Describe the effects that the enzyme had on this reaction.

(2)

.....

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P 3 9 5 7 9 A 0 8 2 4
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(b) Lipases are enzymes that are involved in the breakdown of lipids, such as triglycerides.

(i) Name the bond broken by lipases.

(1)

.....

(ii) Name **two** products formed from the breakdown of triglycerides by lipases.

(2)

1 .....

2 .....

(iii) Suggest what effect the breakdown of triglycerides could have on the pH of a reaction mixture.

(1)

.....

.....

*(c) The action of lipase can be investigated using a triglyceride as the substrate.

Describe an experiment, using lipase and a triglyceride, that could be carried out to collect data to plot a graph similar to the one shown in part (a).

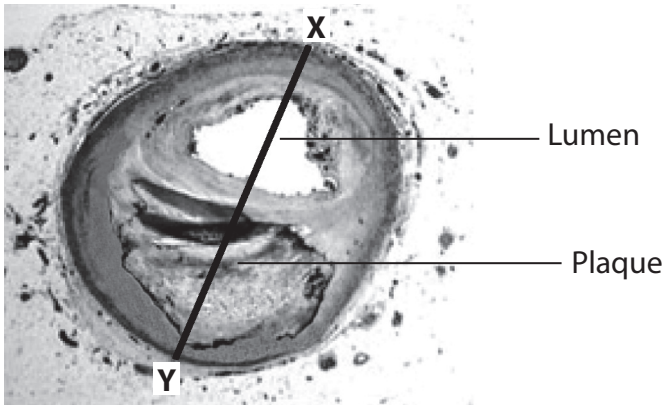
(5)

(Total for Question 4 = 11 marks)

P 3 9 5 1 0 9 A 0 0 1 0 2 4
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5 Cardiovascular disease (CVD) is responsible for many deaths. One cause of CVD is atherosclerosis.

The photograph below shows a section through an artery with a plaque (atheroma) from a patient with CVD.



(a) Calculate the increase in the thickness of the artery wall where the plaque is located. Take your measurements along the line labelled **X** and **Y**.
Show your working.

(3)

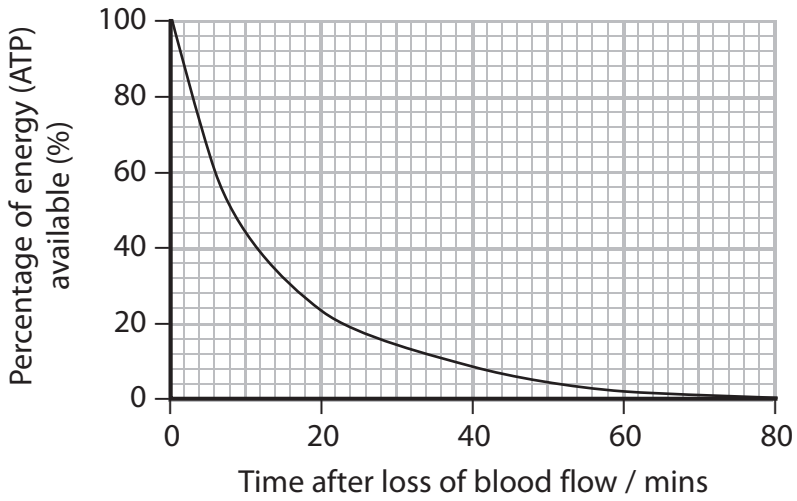
Answer .....

P 3 9 5 1 9 A 0 0 1 2 4
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(b) The plaque often increases in size and can block the artery. If the artery supplying blood to the heart becomes blocked, blood no longer flows to the heart muscle cells. Shortly after the loss of blood flow, heart muscle cells stop contracting and start to die.

In the heart muscle cells, energy (ATP) is made available from respiration.

The graph below shows how the energy (ATP) available to heart muscle cells changes with time, after the loss of blood flow.



(i) Using the information in the graph, describe how the energy (ATP) available to the heart muscle cells changes with time after the loss of blood flow.

(2)

P 3 9 5 1 0 9 A 0 0 1 2 2 4
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(ii) Suggest why there are changes to the available energy (ATP) in the heart muscle cells following the loss of blood flow.

(2)

(iii) About 8 minutes after the loss of blood flow, the heart muscle cells no longer contract. After about 20 minutes, the heart muscle cells begin to die.

Using the information in the graph and your own knowledge, suggest explanations for the timings of these two events.

(3)

(iv) If blood flow is restored within 30 minutes, most heart muscle cells will eventually recover. Suggest an explanation for this recovery.

(2)

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(Total for Question 5 = 12 marks)

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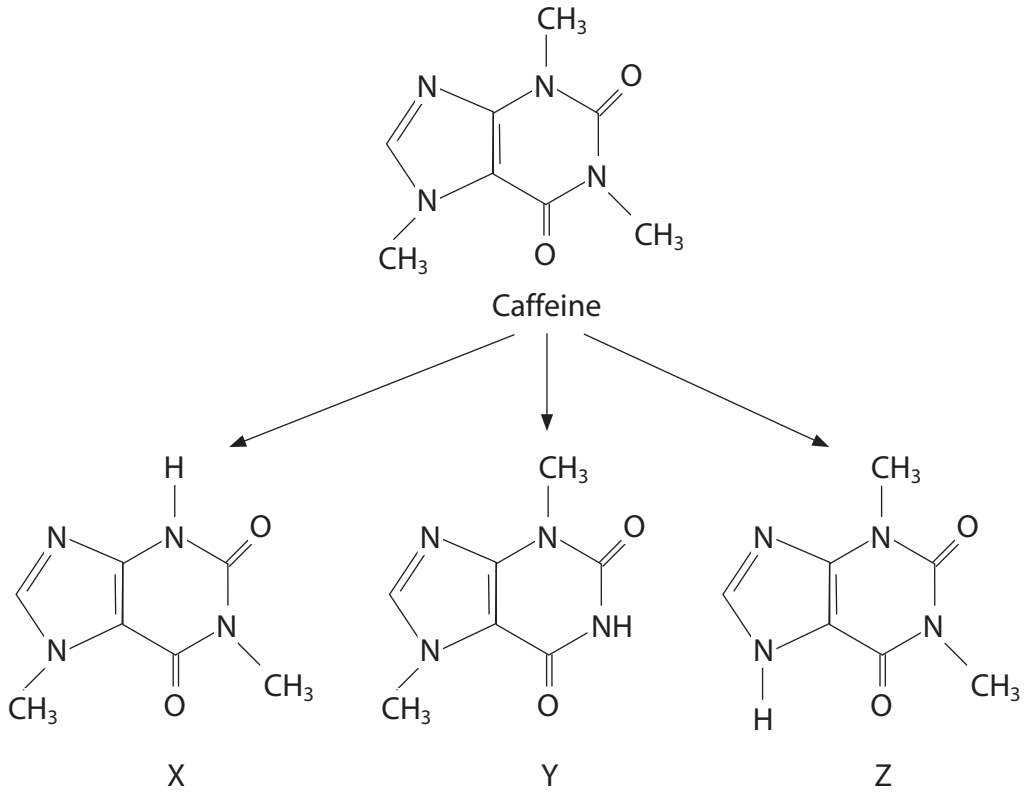
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P 3 9 5 2 4 STOMP.CO.UK

6 Caffeine is a drug frequently consumed in a number of drinks such as coffee, cola, hot chocolate and tea.

Caffeine is broken down in the liver by a group of enzymes called cytochrome P450 oxidase.

(a) The diagram below shows the structure of caffeine and its three breakdown products, X, Y and Z.



(i) Using the information in the diagram, give **two** reasons why caffeine is **not** an amino acid.

(2)

1 .....

.....

2 .....

.....

P 3 9 5 1 0 9 A 0 0 1 6 2 4
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(ii) Using the information in the diagram, state **two** differences between the breakdown products.

(2)

1 .....

.....

2 .....

.....

(iii) Using the information in the diagram and your own knowledge of enzyme action, suggest why cytochrome P450 oxidase consists of more than one type of enzyme.

(3)

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P 3 9 5 7 9 A 0 0 7 2 4
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(b) A student decided to investigate the concentration of caffeine in four drinks: coffee, cola, hot chocolate and tea.

The student's results are shown in the table below.

Drink	Volume of drink	Caffeine content / mg
coffee	200 cm^3	135
cola	1 can	80
hot chocolate	200 cm^3	10
tea	1 cup	50

The student made two conclusions from these results.

Conclusion 1 "Different drinks have different concentrations of caffeine."

Conclusion 2 "Coffee has the highest concentration of caffeine."

Comment on the validity of these conclusions. Give reasons for your answer.

(3)

Conclusion 1 .....

.....

.....

.....

Conclusion 2 .....

.....

.....

.....

(Total for Question 6 = 10 marks)

P 3 9 5 8 9 A 0 0 U K 8 2 4
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7 A large number of doctors routinely prescribe drugs to treat patients who are over 80 and have high blood pressure.

(a) (i) Give the name of the type of drug that is used to treat high blood pressure.

(1)

.....

(ii) Explain why many patients, who are over 80 and have high blood pressure, are routinely prescribed with these drugs.

(2)

.....

.....

.....

.....

P 3 9 5 1 9 A 0 0 1 1 9 2 4
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(b) A study was carried out to investigate the benefit of treating patients who are over 80 and have high blood pressure.

Patients were randomly put into one of two groups, A and B. Each group contained 2000 patients.

Patients in group A were given two tablets each containing a different drug.

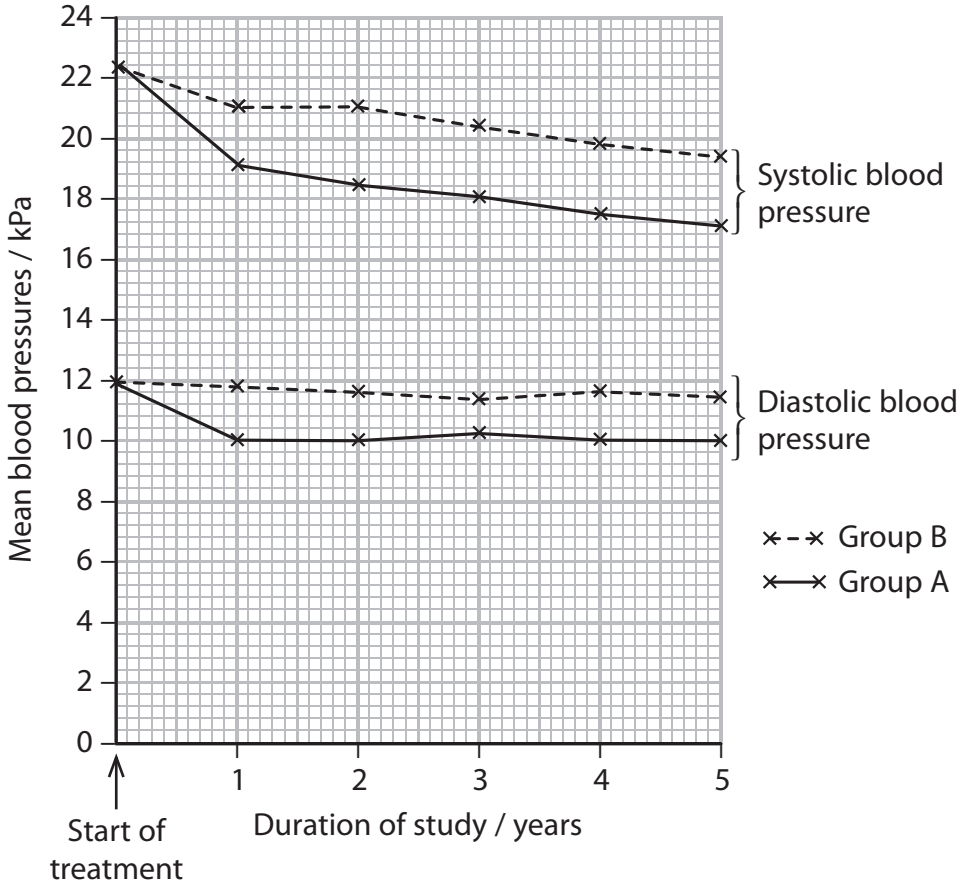
Patients in group B were given two tablets neither of which contained a drug.

The systolic and the diastolic pressure of each patient was measured. The systolic pressure is the maximum pressure when the heart contracts and the diastolic pressure is the minimum pressure when the heart relaxes.

The blood pressure of all patients was recorded over a period of five years.

The mean pressures were then calculated.

The graph below shows the results of this study.



P 3 9 5 1 9 A 0 1 2 0 2 4
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(i) Explain why the patients in group B were given two tablets that had no drugs in them.

(2)

(ii) Using the information in the graph, describe the results of this study.

(3)

(iii) Suggest why both the systolic and diastolic blood pressures were recorded in this study.

(1)

(iv) Suggest what else could have been recorded in this study to provide more evidence of other benefits of treating these patients with the drugs.

(1)

(Total for Question 7 = 10 marks)

P 3 9 5 1 9 A 0 1 2 4
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8 Cystic fibrosis and albinism are examples of recessive genetic disorders.
Krabbe disease is another example of a recessive genetic disorder.
Krabbe disease is caused by mutations in the GALC gene, resulting in a deficiency of an enzyme called galactocerebrosidase.

(a) Explain the meaning of each of the following terms.

(i) Mutation

(2)

(ii) Recessive

(1)

(b) Suggest how a mutation in the GALC gene could result in a change in the enzyme galactocerebrosidase.

(3)

P 3 9 5 1 9 A 0 1 2 2 2 4
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(c) Two parents are both carriers of the recessive allele for Krabbe disease.

In the space below, draw a genetic diagram to show the possible genotypes and phenotypes of their children.

Use the genetic diagram to find the probability of these parents having a child with Krabbe disease.

(5)

Probability .....

(d) State how these parents could determine whether or not their unborn child has Krabbe disease.

(1)

.....

.....

(Total for Question 8 = 12 marks)

TOTAL FOR PAPER = 80 MARKS

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P 3 9 5 1 0 9 A 0 0 2 4 2 4
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Mark Scheme (Results)

Summer 2012

GCE Biology (6BI01) Paper 01
Lifestyle, Transport, Genes and Health

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- Write legibly, with accurate use of spelling, grammar and punctuation in order to make the meaning clear
- Select and use a form and style of writing appropriate to purpose and to complex subject matter
- Organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities.
Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

GENERAL INFORMATION

The following symbols are used in the mark schemes for all questions:

Symbol	Meaning of symbol
; semi colon	Indicates the end of a marking point
Eq	Indicates that credit should be given for other correct alternatives to a word or statement, as discussed in the Standardisation meeting
/ oblique	Words or phrases separated by an oblique are alternatives to each other
{ } curly brackets	Indicate the beginning and end of a list of alternatives (separated by obliques) where necessary to avoid confusion
() round brackets	Words inside round brackets are to aid understanding of the marking point but are not required to award the point
[] square brackets	Words inside square brackets are instructions or guidance for examiners
[CE] or [TE]	Consecutive error / transferred error

Crossed out work

If a candidate has crossed out an answer and written new text, the crossed out work can be ignored. If the candidate has crossed out work but written no new text, the crossed out work for that question or part question should be marked, as far as it is possible to do so.

Spelling and clarity

In general, an error made in an early part of a question is penalised when it occurs but not subsequently. The candidate is penalised once only and can gain credit in later parts of the question by correct reasoning from the earlier incorrect answer.

No marks are awarded specifically for quality of language in the written papers, except for the essays in the synoptic paper. Use of English is however taken into account as follows:

- the spelling of technical terms must be sufficiently correct for the answer to be unambiguous
  e.g. for amylase, ‘ammalase’ is acceptable whereas ‘amylose’ is not
  e.g. for glycogen, ‘glicojen’ is acceptable whereas ‘glucagen’ is not
  e.g. for ileum, ‘illeum’ is acceptable whereas ‘ilium’ is not
  e.g. for mitosis, ‘mytosis’ is acceptable whereas ‘meitosis’ is not

- candidates must make their meaning clear to the examiner to gain the mark.

- a correct statement that is contradicted by an incorrect statement in the same part of an answer gains no mark – irrelevant material should be ignored

Question Number	Answer	Mark
1(a)	B ;	**(1)**

Question Number	Answer	Mark
1(b)	C ;	**(1)**

Question Number	Answer	Mark
1(c)	D ;	**(1)**

Question Number	Answer	Mark
1(d)	B ;	**(1)**

Question Number	Answer	Mark
1(e)	B ;	**(1)**

Question Number	Answer	Mark
1(f)	C ;	**(1)**

Question Number	Answer	Mark
1(g)	**mRNA** 1. idea of mRNA being a copy of the { antisense DNA strand / template DNA strand / coding DNA strand / gene / allele / part of DNA / eq } ; 2. idea that mRNA {made up of codons / codes for specific amino acids / code for amino acid sequence / eq} ; 3. idea of mRNA being taken {into the cytoplasm / to the ribosomes / out of the nucleus / eq} ; 4. used in translation ; 5. binds to ribosome ; **tRNA** 6. (tRNA) {attaches to / transports / eq } (specific) amino acid / eq ; 7. idea that tRNA binds to mRNA / reference to anticodon codon interaction ; 8. idea that two tRNA bring amino acids together (for peptide bonds to be formed) ;	**(4)**

Question Number	Answer	Mark
2(a)(i)	1. idea that a monosaccharide consists of one {sugar / named sugar / eq} (unit) whereas a disaccharide consists of two (sugar units) ; 2. idea that disaccharide has a glycosidic bond (whereas monosaccharide does not) ; 3. general formula for a monosaccharide is $C_nH_{2n}O_n$ whereas formula for disaccharide is $C_nH_{2n-2}O_{n-1}$ / eq ;	**(2)**

Question Number	Answer	Mark
2(a)(ii)	1. amylose is {straight chained / unbranched / eq} whereas amylopectin is branched ; 2. amylose {coiled / eq} (whereas amylopectin is not) / eq ; 3. amylose has 1-4 (glycosidic) bonds whereas amylopectin has 1-4 and 1-6 (glycosidic) bonds ;	**(2)**

Question Number	Answer	Mark
2(b)	1. idea of carbohydrates providing a source of energy ; 2. if the {energy / carbohydrate / eq} input is greater than the {energy output / carbohydrate use / eq} (weight will be gained) / eq ; 3. idea of excess carbohydrate converted to fat ;	**(2)**

Question Number	Answer	Mark
***3(a)QWC**	**Take into account quality of written communication when awarding the following points.** 1. idea that there are four chambers ; 2. correct reference to relative position of *atria* and *ventricles* ; 3. idea of left and right sides separate / *septum* ; 4. reference to muscular nature of walls ; 5. reference to *cardiac* muscle ; 6. idea of relative thickness of *ventricle* (walls) ; 7. correct reference to position of {*atrioventricular valves* / eq} ; 8. correct reference to position of *semilunar valves* ; 9. reference to position of {*tendons / tendinous cords / papillary muscles* / eq} ; 10. correct reference to position of {*aorta / pulmonary artery}* ; 11. correct reference to position of {*vena cava / pulmonary vein}* ; 12. correct reference to *coronary arteries* ; 13. reference to {*SAN / Sino Atrial Node / pacemaker/ AVN /Atrioventricular Node / Purkinje fibres /Purkyne fibres / Bundle of His/eq } ;*	**(5)**

Question Number	Answer	Mark
3(b)	1. idea that the heart has to pump blood a long way around the body of the giraffe ; 2. (therefore) blood needs to be (pumped) at high pressure / eq; 3. blood vessels are needed to contain the blood / reference to closed circulation / eq ; 4. idea of double circulatory system ; 5. capillaries needed to ensure that all parts of giraffe are close to blood supply/ eq ; 6. idea of need for a circulation to {provide oxygen / remove carbon dioxide / other correct named substance} ; 7. idea of {oxygen / glucose} needed as {high metabolic rate / high rate of respiration / eq} ; 8. idea of diffusion not meeting the requirements of the giraffe ; 9. reference to low surface area to volume ratio ; 10. idea that circulatory system helps regulation of body temperature ;	**(4)**

Question Number	Answer	Mark
4(a)	1. reference to enzyme increasing the rate of reaction (higher than the rate if no enzyme present) ; 2. idea that the rate of reaction with the enzyme present is non-linear ; 3. Idea that increase in (initial) rate of reaction is same with or without enzyme present above (substrate concentration) of {10 / 12} ; 4. credit correct manipulation of figures (in relation to the effect of the enzyme) ;	**(2)**

Question Number	Answer	Mark
4(b)(i)	ester ;	**(1)**

Question Number	Answer	Mark
4(b)(ii)	Any **two** from: 1. fatty acid (s) / carboxylic acid(s) 2. glycerol / propan1,2,3 triol 3. monoglyceride 4. diglyceride ;;	**(2)**

Question Number	Answer	Mark
4(b)(iii)	(pH) would {fall / drop / get lower / decrease / eq} ;	**(1)**

Question Number	Answer	Mark
***4(c) QWC**	**Take into account quality of written communication when awarding the following points.** 1. reference to use of a range of substrate (triglyceride) concentrations ; 2. idea of mixing (enzyme and substrate) ; 3. identification of a suitable dependent variable e.g. pH ; 4. description of how to measure the dependent variable e.g. use of pH indicator ; 5. reference to measuring time ; 6. description of how to calculate (initial) rate of reaction ; 7. idea of repeating experiment without the enzyme ; 8. idea of control of enzyme (lipase) concentration ; 9. reference to one other named controlled variable (e.g. temperature, type of triglyceride, volume of solutions) ; 10. reference to {replicates / repeats} (using the same triglyceride concentration) ;	**(5)**

Question Number	Answer	Mark
5(a)	1. correct measurements of wall without plaque = {8 +/- 1} (mm) ; 2. correct measurements of wall with plaque = {25 +/- 2} (mm); 3. correct calculation ;	**(3)**

Question Number	Answer	Mark
5(b)(i)	1. reference to decrease in (energy /ATP) (with time) ; 2. idea that the drop in the fall of (energy /ATP) gets less with time ; 3. credit correct manipulation of figures ;	**(2)**

Question Number	Answer	Mark
5(b)(ii)	1. idea of {less / no /eq } oxygen (available) ; 2. idea of {less / no / eq} {respiratory substrate / glucose / eq} ; 3. {less / no/ eq} (cellular/ aerobic) respiration / eq ;	**(2)**

Question Number	Answer	Mark
5(b)(iii)	1. idea that at 8 minutes insufficient {energy / ATP} is available for contraction ; 2. idea that after 20 minutes the {energy / ATP} levels are too low to sustain cell survival ; 3. credit correct value for {energy / ATP} availability read from graph e.g. 50-52 % at 8 min / 22-24% at 20 min ; 4. credit one other named use of {energy / ATP} e.g. active transport ; 5. idea that lactic acid {inhibits contraction / inhibits enzymes / eq} ;	**(3)**

Question Number	Answer	Mark
5(b)(iv)	1. idea that (restored blood flow) provides (muscle /cells) with oxygen / removes lactic acid / eq ; 2. (aerobic) respiration {rate increases / restarts / eq} ;	**(2)**

Question Number	Answer	Mark
6(a)(i)	1. no {amino / amine / NH_2 / NH_3^+ } group ; 2. no {carboxyl / carboxylic acid / COOH / COO^- } group ; 3. no {central / alpha} carbon (atom) / eq ; 4. no {R / residual} group(s) ; 5. ring structures present (amino acids only have them in some R groups) / eq ;	**(2)**

Question Number	Answer	Mark
6(a)(ii)	1. idea that position of CH_3 different ; 2. idea that position of {H / NH/ N-H} different ; 3. reference to being isomerically different ;	**(2)**

Question Number	Answer	Mark
6(a)(iii)	1. idea of specificity of {active site/enzyme} ; 2. idea that the products are different {shapes / structures} ; 3. idea that P450 consists of (at least) three {enzymes / active sites} ; 4. idea that products could be interconverted ;	**(3)**

Question Number	Answer	Mark
6(b)	**Conclusion 1:** 1. idea that the first conclusion is {valid for some of the data / not valid (for all data) / misleading /eq} ; 2. coffee and hot chocolate do have different concentrations **OR** only 4 drinks tested / concentration not measured / volumes not controlled / eq ; **Conclusion 2:** 3. idea that the second conclusion is not valid ; 4. no indication of the volumes of tea and cola / volume not controlled / impossible to calculate concentration of caffeine in all four drinks (using information given) / eq ;	**(3)**

Question Number	Answer	Mark
7(a)(i)	antihypertensives / antihypertensive drug / beta blockers / diuretics / ACE inhibitors / calcium ion channel blockers / vasodilators / eq ;	**(1)**

Question Number	Answer	Mark
7(a)(ii)	1. high blood pressure {can cause / increases risk of} {CVD / correctly named complication / description / eq} / eq ; 2. idea that older people are (more) at risk of {CVD/ eq} ;	**(2)**

Question Number	Answer	Mark
7(b)(i)	1. reference to (group B) as {control / comparison / check validity / eq} ; 2. both groups given two tablets / reference to placebo / eq ;	**(2)**

Question Number	Answer	Mark
7(b)(ii)	1. systolic blood pressure decreased in both groups / eq ; 2. systolic blood pressure decreased more {in the treated group / by the drug / group A} than the {control / placebo / group B / eq} / eq ; 3. diastolic blood pressure decreased {in the treated group / by the drug / group A} / eq ; 4. diastolic blood pressure {unchanged / decreased slightly} {in the control group / by the placebo /group B} / eq ; 5. systolic blood pressure was affected more than the diastolic blood pressure; 6. greatest decrease in first year / eq ; 7. credit correct manipulation of data (e.g. Systolic dropped 3 kPa in group B, systolic dropped 5.4 kPa in group A, 2.4 more than group B, diastolic dropped 0.6 kPa in group B, diastolic dropped 2 kPa in group A, 1.4 more than group B) ;	**(3)**

Question Number	Answer	Mark
7(b)(iii)	to see if the drugs affected both types of blood pressure / eq ;	**(1)**

Question Number	Answer	Mark
7(b)(iv)	{incidence / numbers} of {deaths / heart attacks / strokes / any other correctly named condition } ;	**(1)**

Question Number	Answer	Mark
8(a)(i)	1. reference to alteration in DNA ; 2. change in {base (sequence) / quantity of DNA} / eq ;	**(2)**

Question Number	Answer	Mark
8(a)(ii)	idea that both of these alleles need to be present in order for the recessive phenotype to be expressed ;	**(1)**

Question Number	Answer	Mark
8(b)	1. idea of a gene being a sequence of bases that code for the sequence of amino acids in the {protein / polypeptide chain /enzyme / galactocerebrosidase} ; 2. (gene) mutation will alter {DNA triplet / DNA code / codon / eq} / eq ; 3. this may result in a different {amino acid / stop codon / amino acid sequence / primary structure / eq} / eq ; 4. idea that this may change the {shape / eq} of {protein / enzyme} ; 5. therefore causing {no synthesis / incomplete / eq} of {enzyme / galactocerebrosidase} / change of active site / eq ;	**(3)**

Question Number	Answer	Mark
8(c)	1. genotype of parents shown ; 2. alleles in the gametes shown ; 3. possible genotypes of children shown ; 4. corresponding phenotypes shown ; 5. (probability =) ¼ / 25% / 1 in 4 / 0.25 ;	**(5)**

Question Number	Answer	Mark
8(d)	amniocentesis / chorionic villus sampling / CVS / eq ;	**(1)**

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Edexcel GCE

Biology

Advanced Subsidiary

Unit 1: Lifestyle, Transport, Genes and Health

Wednesday 11 January 2012 – 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 Proteins, such as enzymes, are important molecules found in all living organisms.

(a) Read through the following passage on the primary structure of proteins, then write on the dotted lines the most appropriate word or words to complete the passage.

(5)

Proteins are made of monomers called ..... . These monomers are joined together by ..... bonds, formed during ..... reactions.

Each monomer of a protein consists of a central carbon atom attached to a hydrogen atom, an R group, an ..... group and a ..... group. The sequence of monomers determines the primary structure of the protein.

(b) (i) Describe the three-dimensional (tertiary) structure of an enzyme.

(3)

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(ii) Explain how the primary structure of an enzyme determines its three-dimensional (tertiary) structure and its properties.

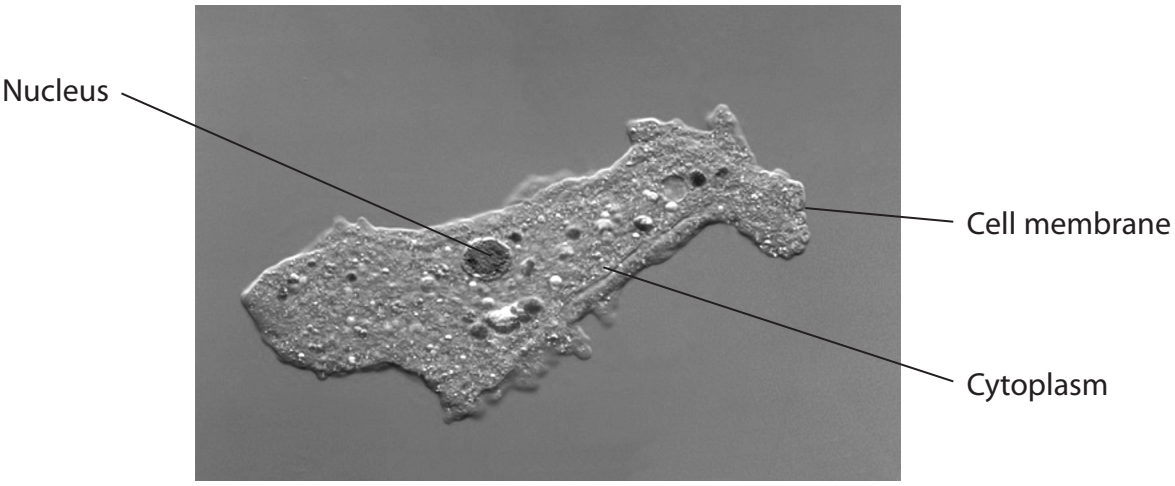
(3)

(Total for Question 1 = 11 marks)

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2 An amoeba is a single-celled organism that lives in water. Gas exchange in an amoeba occurs between the water and the cytoplasm.

The photograph below shows an amoeba, as seen using a microscope.



Magnification x800

Dr Jeremy Burgess / Science Photo Library

*(a) Using the information shown in the photograph and your own knowledge, suggest how gas exchange occurs in an amoeba.

(4)

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(b) Suggest how oxygen passes from the cell membrane into the centre of an amoeba.

(2)

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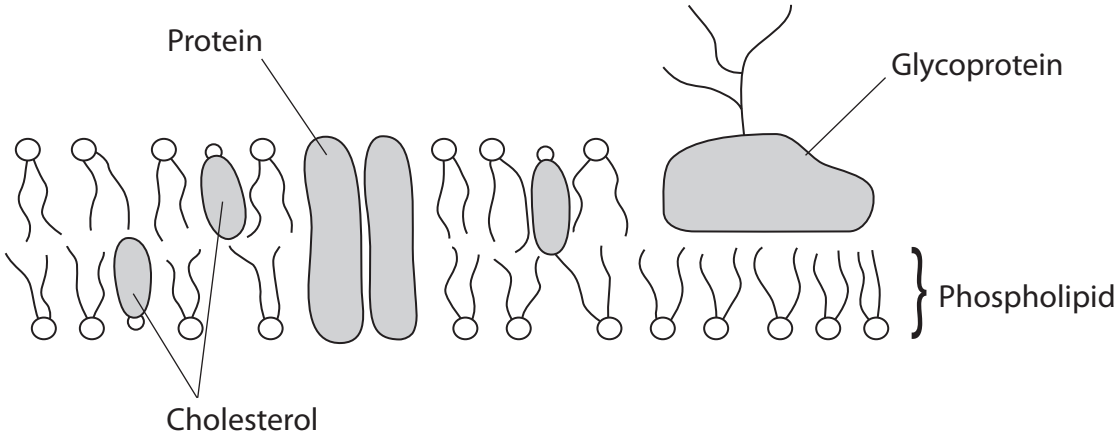
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(Total for Question 2 = 6 marks)

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3 One function of the cell membrane is to control which molecules can enter or leave the cell.

The diagram below represents the structure of the cell membrane.



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

(i) The phospholipids form a bilayer because

(1)

☒ **A** the hydrophobic heads dissolve in the aqueous (water) environment

☒ **B** the hydrophobic heads move away from the aqueous environment

☒ **C** the hydrophobic tails dissolve in the aqueous environment

☒ **D** the hydrophobic tails move away from the aqueous environment

(ii) The protein, labelled in the diagram, could be involved in

(1)

☒ **A** endocytosis

☒ **B** exocytosis

☒ **C** facilitated diffusion

☒ **D** phagocytosis

(iii) The fluidity of the membrane is determined by the proportion of

(1)

☒ **A** cholesterol

☒ **B** glycoprotein

☒ **C** phospholipid

☒ **D** protein

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(b) A student carried out an experiment to investigate the effect of temperature on the permeability of beetroot membranes. Beetroots are root vegetables that appear red because the vacuoles in their cells contain a water-soluble red pigment. This pigment cannot pass through membranes.

Six cubes of beetroot were cut. One piece of beetroot was placed into a tube containing 10 cm^3 of water and left for 20 minutes at 5 °C. After the 20 minutes, each piece of beetroot was removed from the tubes and the colour of the fluid recorded.

The procedure was repeated at five other temperatures.

The results of this experiment are shown in the table below.

Temperature / °C	Colour of fluid
5	pale pink
22	pale pink
42	pale pink
64	pink
87	dark pink
93	red

Using the information in the table, describe the effect that temperature has on the permeability of the membranes of the beetroot cells.

(2)

.....

.....

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(c) A second student carried out a very similar experiment, using three samples of beetroot at each temperature. She used a colorimeter to determine the intensity of the colour of the fluid produced.

The results of her experiment are shown in the table below.

Temperature / °C	Intensity of colour of fluid / arbitrary units		
	Sample 1	Sample 2	Sample 3
5	0.0	0.0	0.0
22	10.1	9.8	11.1
42	26.3	29.9	31.0
64	80.1	77.0	76.9
87	93.9	95.0	96.0
93	100.0	100.0	100.0

(i) State **two** variables that both of these students must keep the same if their results are to be compared.

(2)

1 .....

.....

2 .....

.....

(ii) Give **two** reasons why the results obtained by the second student are more reliable than those of the first student.

(2)

1 .....

.....

2 .....

.....

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(iii) In the first student's experiment at 5 °C, the fluid was pale pink but the fluid in the second student's experiment was colourless.

Suggest an explanation for this difference.

(2)

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(iv) Each of the students used their own results to describe the effect of temperature on the permeability of the membranes of the beetroot cells.

Suggest **one** way in which these two descriptions might differ.

(1)

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(Total for Question 3 = 12 marks)

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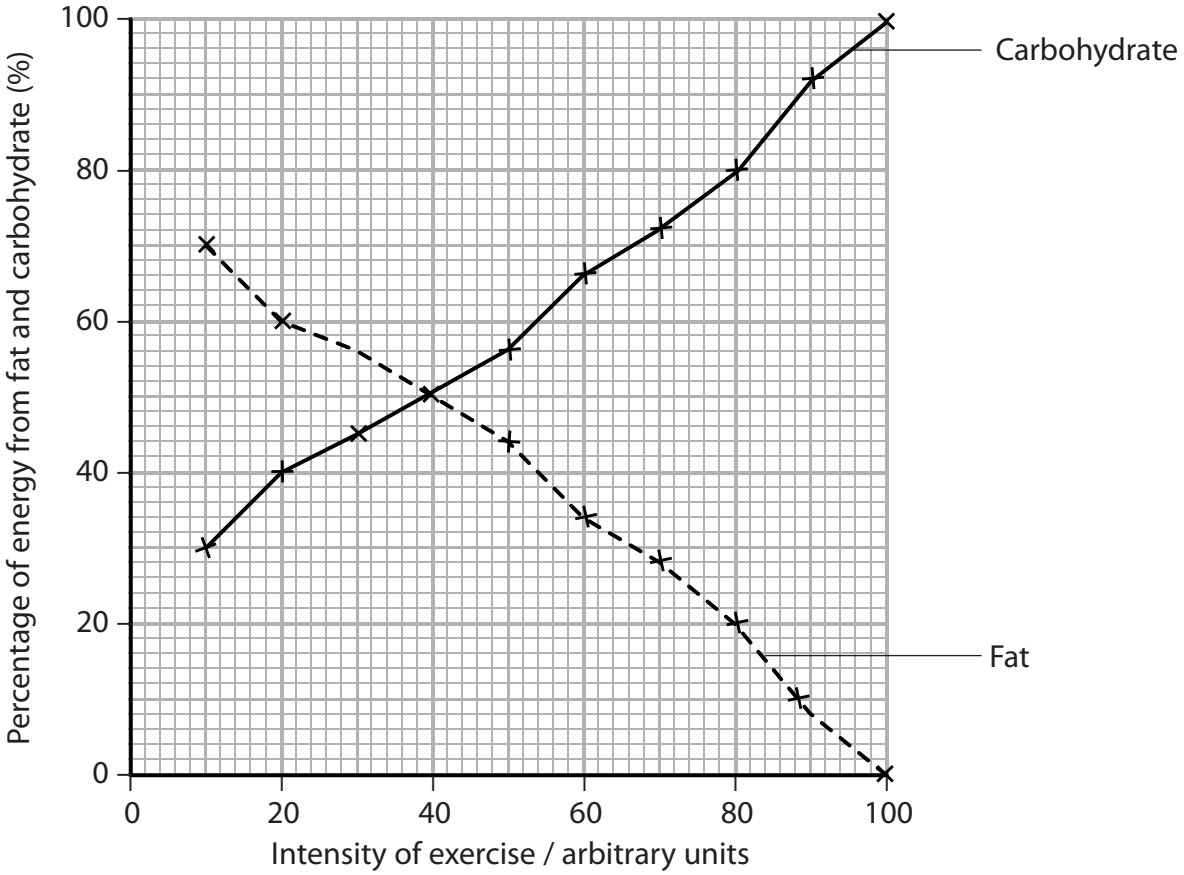
4 Fats and carbohydrates such as glycogen are important energy storage molecules. These are broken down during exercise.

(a) Describe the structure of glycogen and explain why it is a suitable molecule for storing energy.

(4)

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(b) The graph below shows how the percentage of energy obtained from fat and carbohydrate varies according to the intensity of exercise being carried out.



(i) Using the information in the graph, describe how the source of energy used depends on the intensity of exercise.

(3)

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(ii) A carbohydrate-loading diet is used by athletes in preparation for some athletic events. This diet involves increasing carbohydrate intake and decreasing activity, several days before the event.

Carbohydrate-loading is not a suitable method of preparation for all athletic events.

Using the information in the graph and your knowledge of glycogen, explain what type of athletic event could be prepared for using a carbohydrate-loading diet.

(3)

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(Total for Question 4 = 10 marks)

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5 Genetic screening can be used to determine if an embryo has a genetic disorder, such as cystic fibrosis.

(a) The table below refers to the methods used in preimplantation genetic diagnosis and prenatal genetic screening.
If the statement is correct, place a tick (✓) in the appropriate box and if the statement is incorrect, place a cross (✗) in the appropriate box.

(2)

Method of screening	Statement	
	Screening performed during pregnancy	**Cells removed from the embryo**
Preimplantation genetic diagnosis		
Prenatal genetic screening		

(b) (i) Name **one** method of prenatal genetic screening.

(1)

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(ii) Discuss either **one** ethical issue or **one** social issue relating to the use of this method of prenatal genetic screening.

(2)

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(c) Gene therapy has the potential to treat some genetic disorders.

(i) Explain why gene therapy has the potential to treat some genetic disorders.

(2)

(ii) Suggest how patients with cystic fibrosis could be treated using gene therapy.

(3)

(Total for Question 5 = 10 marks)

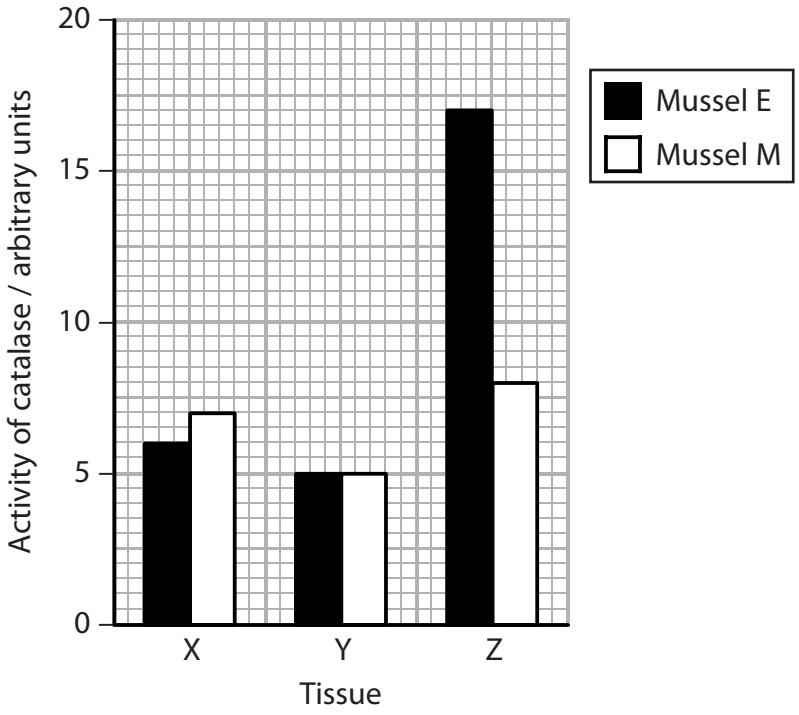
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6 Catalase is an enzyme present in many tissues of most living organisms. Its role is to break hydrogen peroxide down into oxygen and water. Hydrogen peroxide is produced by cells and is very harmful if it is not broken down.

(a) A study compared the activity of catalase in the tissues of freshwater mussels. Mussels from two different rivers: mussel E from the river Eo and mussel M from the river Masma were studied.

The catalase activity was measured in three tissues, X, Y and Z, taken from each type of mussel.

The graph below shows the results of this study.



(i) Use the information in the graph to state the conclusions that can be made about the activity of catalase in the tissues of mussel E.

(3)

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(ii) Using the information in the graph, compare the activity of catalase in mussel E and mussel M.

(2)

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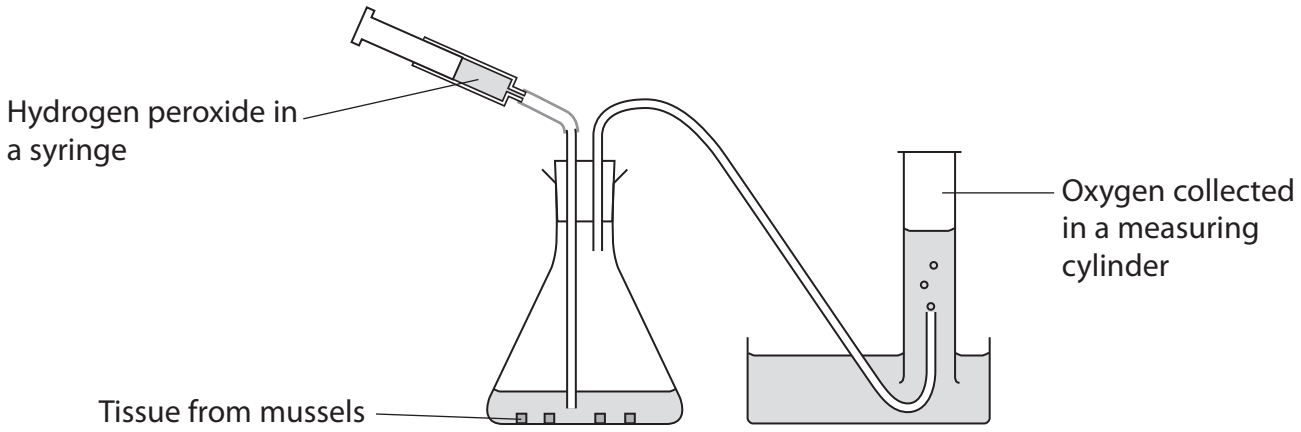
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(b) Catalase activity in tissue from mussels can be studied using the apparatus shown below.

Tissue from mussels is placed in the flask and hydrogen peroxide is added using the syringe. The oxygen produced from the breakdown of hydrogen peroxide is collected in the measuring cylinder.



Describe how this apparatus could be used to compare the catalase activity in two different types of mussel.

(4)

(Total for Question 6 = 9 marks)

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7 Cardiovascular disease (CVD) is responsible for many deaths.

*(a) One cause of CVD is atherosclerosis. Describe how atherosclerosis develops.

(4)

(b) A number of factors have been identified that increase the risk of CVD. One of these factors is genetic.

The genotype of some individuals causes them to be more at risk of developing CVD. One gene that influences this risk is the *KIF6* gene. Carriers of the 719 Arg allele of this gene are more at risk of CVD.

(i) Explain the meaning of the term **genotype**.

(1)

(ii) Explain the meaning of the term **allele**.

(1)

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(c) Give **two** factors, other than genetic factors, that increase the risk of developing CVD.

(1)

1 .....

2 .....

(d) Trials have shown that plant statin therapy is more effective in 719 Arg carriers than in non-carriers of this allele.

Describe the risks of using plant statins to treat CVD.

(2)

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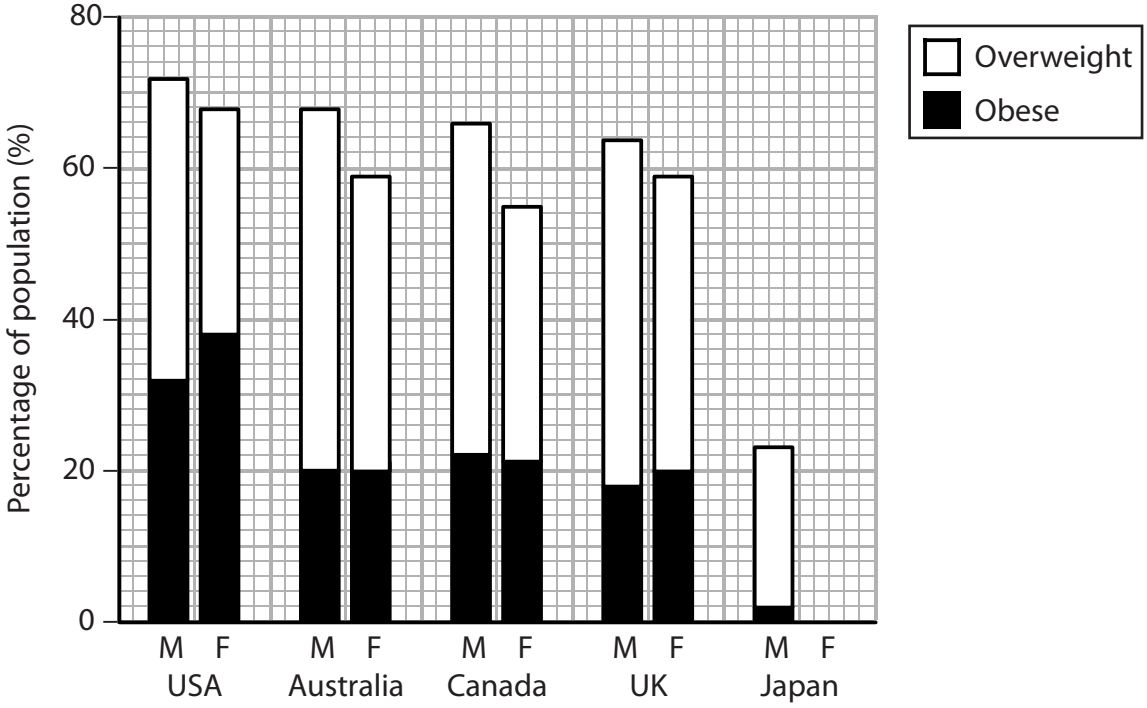
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(Total for Question 7 = 9 marks)

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8 Obesity is a significant problem in western countries and an increasing problem in some other parts of the world.

The graph below shows the percentage of the male population (M) and the female population (F) who are either overweight or obese in five different countries.



(a) The graph above shows that in Japan 2% of the male population are obese and 23% are overweight.

In the female population of Japan, 2% are obese and 16% are overweight.
Add this information to the graph above.

(3)

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

(i) The graph shows that

(1)

☒ **A** a higher percentage of males are overweight than females

☒ **B** a higher percentage of females are overweight than males

☒ **C** there is no correlation between being overweight and gender

☒ **D** an equal percentage of males and females are overweight

P 3 9 5 3 3 A 0 2 0 2 4
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(ii) The country with the highest percentage of males who are obese is

(1)

☒ **A** Australia

☒ **B** Canada

☒ **C** Japan

☒ **D** USA

(iii) The country with the same percentage of females as the UK who are overweight is

(1)

☒ **A** Australia

☒ **B** Canada

☒ **C** Japan

☒ **D** USA

(iv) In the USA, the ratio of overweight males to females is

(1)

☒ **A** 4 : 3

☒ **B** 17 : 18

☒ **C** 18 : 17

☒ **D** 24 : 23

(c) Explain why it would be incorrect to conclude that, in Japan, the same number of males as females are obese.

(2)

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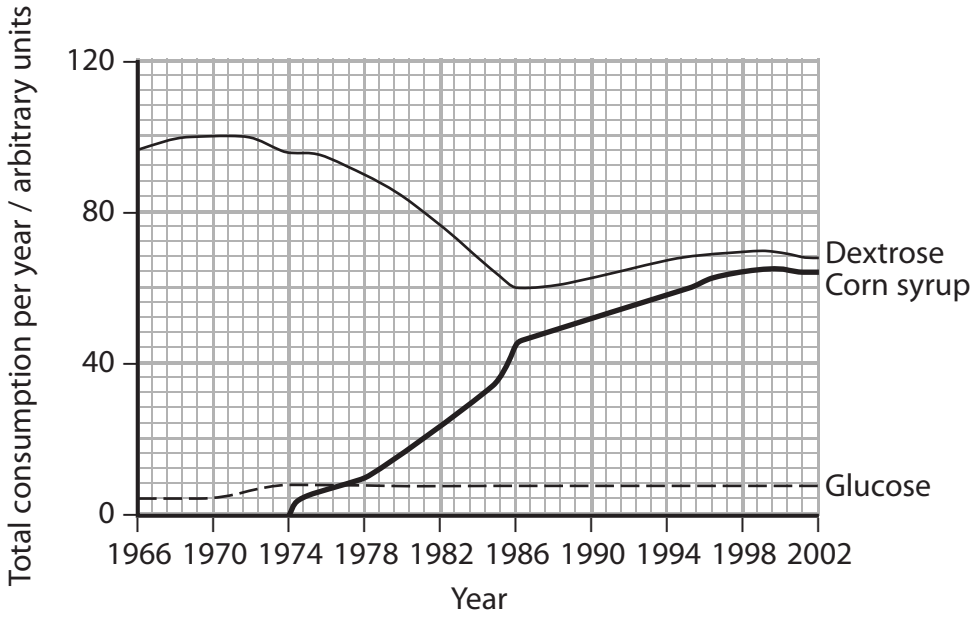
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(d) The graph below shows the consumption of three types of sweetener in the USA, from 1966 to 2002.



From 1976, the number of obese people in the USA started to increase rapidly. It was suggested that there was a correlation between the consumption of corn syrup and obesity.

(i) Explain the meaning of the term **correlation**.

(1)

.....

.....

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(ii) Using the information in part (d), describe the evidence that suggests there is a correlation between the consumption of corn syrup and obesity.

(3)

(Total for Question 8 = 13 marks)

TOTAL FOR PAPER = 80 MARKS

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GENERAL INFORMATION

The following symbols are used in the mark schemes for all questions:

Symbol	Meaning of symbol
; semi colon	Indicates the end of a marking point
Eq	Indicates that credit should be given for other correct alternatives to a word or statement, as discussed in the Standardisation meeting
/ oblique	Words or phrases separated by an oblique are alternatives to each other
{} curly brackets	Indicate the beginning and end of a list of alternatives (separated by obliques) where necessary to avoid confusion
() round brackets	Words inside round brackets are to aid understanding of the marking point but are not required to award the point
[] square brackets	Words inside square brackets are instructions or guidance for examiners
[CE] or [TE]	Consecutive error / transferred error

Crossed out work

If a candidate has crossed out an answer and written new text, the crossed out work can be ignored. If the candidate has crossed out work but written no new text, the crossed out work for that question or part question should be marked, as far as it is possible to do so.

Spelling and clarity

In general, an error made in an early part of a question is penalised when it occurs but not subsequently. The candidate is penalised once only and can gain credit in later parts of the question by correct reasoning from the earlier incorrect answer.

No marks are awarded specifically for quality of language in the written papers, except for the essays in the synoptic paper. Use of English is however taken into account as follows:

- the spelling of technical terms must be sufficiently correct for the answer to be unambiguous
  e.g. for amylase, 'ammalase' is acceptable whereas 'amylose' is not
  e.g. for glycogen, 'glicojen' is acceptable whereas 'glucagen' is not
  e.g. for ileum, 'illeum' is acceptable whereas 'ilium' is not
  e.g. for mitosis, 'mytosis' is acceptable whereas 'meitosis' is not

- candidates must make their meaning clear to the examiner to gain the mark.

- a correct statement that is contradicted by an incorrect statement in the same part of an answer gains no mark – irrelevant material should be ignored

Question Number	Answer	Mark
1(a)	1. amino acids ; 2. peptide ; 3. condensation / polymerisation ; 4. amino / amine / NH_3^+ / NH_2 ; 5. carboxyl / carboxylic (acid) / COO^- / COOH ; [Accept answers for 4 and 5 the opposite way round]	**(5)**

Question Number	Answer	Mark
1(b)(i)	ALLOW Mps in context of clearly labelled diagram 1. globular / eq ; 2. reference to active site ; 3. reference to specific shape of active site ; 4. reference to {bonds /named bond / interaction / eq} between R groups ; 5. credit correctly named {bond/interaction} e.g. disulphide bond, hydrogen bonds, hydrophobic interactions (between R groups) ;	**(3)**

Question Number	Answer	Mark
1(b)(ii)	1. (primary structure) {position / sequence / order /eq} of the {amino acids / R groups} / eq ; 2. idea that this determines the {positioning / type} of the {bonds / folding / eq} ; 3. determining the {shape / properties} of the active site / eq ; 4. idea of interaction of active sites and substrates e.g. enzyme substrate complex forms ; 5. idea of {polar / hydrophilic} on the outside of enzymes / {non polar / hydrophobic} on the inside / eq ; 6. reference to solubility ;	**(3)**

Question Number	Answer	Mark
***2 (a)QWC**	(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence) 1. *(gas exchange)* occurs through the {*cell membrane* / *phospholipid bilayer*} ; 2. idea that the *membrane* is thin ; 3. *oxygen* enters cell (from water) / eq ; 4. *carbon dioxide* leaves cell (into water) / eq ; 5. {O_2 / *oxygen* / CO_2 / *carbon dioxide*} are {small / *non-polar*} (*molecules)* ; 6. reference to *diffusion* ; 7. {reference to / description} (suitable) *concentration gradient* ; 8. reference to *large surface area (to volume ratio)* ;	**(4)**

Question Number	Answer	Mark
2 (b)	1. reference to diffusion (in the cytoplasm) ; 2. through the cytoplasm / description of part of cytoplasm / eq ; 3. down a concentration gradient (in the cytoplasm) / eq ;	**(2)**

Question Number	Answer	Mark
3 (a)(i)	D ;	**(1)**

Question Number	Answer	Mark
3 (a)(ii)	C ;	**(1)**

Question Number	Answer	Mark
3 (a)(iii)	A ;	**(1)**

Question Number	Answer	Mark
3(b)	1. an increase in temperature increases the permeability / eq ; 2. idea of change in {colour / permeability} related to {42 °C / 64 °C} OR no change up to 42 °C ;	**(2)**

Question Number	Answer	Mark
3(c)(i)	Any **two** from: 1. reference to pre-treatment e.g. rinsing method ; 2. {size / mass / surface area / volume / shape} of beetroot ; 3. beetroot storage conditions / eq ; 4. {same / type / species / eq} beetroot ; 5. {age of beetroot / storage time} ; 6. (incubation) time / eq ; 7. {volume / concentration / eq} of {water / solution}(added to beetroot) ; 8. pH ;	**(2)**

Question Number	Answer	Mark
3(c)(ii)	1. reference to repeats / replicates / eq ; 2. idea that (colorimeter / readings) are {objective / quantitative / not qualitative / more accurate / provide numbers / more precise / measured not judged / eq} ;	**(2)**

Question Number	Answer	Mark
3(c)(iii)	1. (pink colour due to) {pigment / dye /betalain / eq} ; 2. idea that this is released when {cells / vacuoles/ membranes} are damaged ; 3. and had not been washed off / eq ; ACCEPT converse argument when clear	**(2)**

Question Number	Answer	Mark
3(c)(iv)	idea that the second experiment shows that the permeability increases between {5 / 22} ^{o}C and 42 ^{o}C / in first experiment 5 ^{o}C has an effect / eq **OR** idea that the second experiment's results are quantified ;	**(1)**

Question Number	Answer	Mark
4 (a)	Any 3 of the following: 1. consists of (α) glucose ; 2. (joined by 1,4 / 1,6) glycosidic bonds ; 3. branched structure / eq ; 4. idea of compact structure ; Any 3 of the following: 5. idea that it is {easily / rapidly / eq} hydrolysed ; 6. (leading to) more {glucose / eq} in a smaller space (in a cell)/ eq ; 7. idea of low solubility ; 8. it does not diffuse out of cells /eq ; 9. it has no osmotic effect / eq ;	**(4)**

Question Number	Answer	Mark
4 (b)(i)	1. increasing intensity {increases carbohydrate use / decreases fat use / eq} / eq ; 2. {low intensity exercise / intensity below {39 / 40} au} uses more energy derived from fats / eq ; OR {high intensity exercise / intensity above {39 / 40} au} uses more energy derived from carbohydrates / eq ; 3. at {39 / 40} au both sources of energy used equally / eq ; 4. credit correct manipulation of figures to compare energy usage ;	**(3)**

Question Number	Answer	Mark
4(b)(ii)	1. idea that this diet is suitable for {a high intensity / eq} event ; 2. credit suitable example of athletic event e.g. any endurance or power event ; 3. reference to more carbohydrate being used (than fat) above {39 / 40} a.u. / eq ; 4. reference to carbohydrate being stored as glycogen ; 5. idea of {maximum / more / lots of} glycogen (stored) ; 6. idea that breakdown of glycogen provides energy (for the event) ;	**(3)**

Question Number	Answer	Mark
5(a)	<table><tr><td>x</td><td>✓</td></tr><tr><td>✓</td><td>x</td></tr></table> ;; [Any two correct for one mark]	**(2)**

Question Number	Answer	Mark
5(b)(i)	amniocentesis / chorionic villus sampling / CVS ;	**(1)**

Question Number	Answer	Mark
5(b)(ii)	1. idea of right to life ; 2. abortion is murder / ref to risk of miscarriage / eq ; **Or:** 3. false positive / negative / eq ; 4. consequences of false result e.g. abortion of (healthy) fetus ; **Or:** 5. who has right to decide if tests should be performed / eq ; 6. {implications of medical costs / discrepancies over next step} / parents {have a right to know / can prepare / eq} ; **Or:** 7. issues relating to confidentiality of {parents / child} / eq ; 8. idea that {some other abnormality may be found / paternal DNA does NOT match / other family members have right to know results} ; **Or:** 9. if abnormality found / eq ; 10. consequence of abnormality found e.g. abortion, comment on possible problems with {future employment / insurance / what constitutes a serious condition} / eq ; **Or:** 11. damage to fetus / risk of miscarriage ; 12. loss of fetus / risk to mother / eq ; **Or:** 13. ref. to stress to parents /eq ; 14. consequences of stress e.g. increased risk of miscarriage ;	**(2)**

Question Number	Answer	Mark
5(c)(i)	1. reference to faulty {alleles / genes / DNA / eq} ; 2. idea that gene therapy uses {normal / functioning / healthy} {alleles / genes / eq} ; 3. so the normal {protein / gene product / RNA / eq } is produced (by the cells) / eq ;	**(2)**

Question Number	Answer	Mark
5(c)(ii)	1. reference to using {alleles / genes / eq} coding for the CFTR {protein / channel} ; 2. reference to introducing the {alleles / genes / eq} into the cells ; 3. of the {lungs / pancreas / reproductive tracts / eq} ; 4. that produce mucus / eq ; 5. using a {vector / named vector} ; 6. credit suitable delivery mechanism e.g. nebuliser, injection ; 7. idea that treatment needs to be repeated (due to cell replacement) ;	**(3)**

Question Number	Answer	Mark
6 (a)(i)	1. different tissues have different activities of catalase / eq ; 2. Z has highest (activity) / eq ; 3. Y has the lowest (activity) / X and Y have very similar levels / eq ; 4. credit correct manipulation of figures e.g. Z has 12 more than Y / Z has 11 more than X ;	**(3)**

Question Number	Answer	Mark
6(a)(ii)	1. idea activity in mussel E is not higher than M in all tissues ; 2. mussel E has lower (activity) in tissue X / eq OR (activity) is the same in tissue Y / eq OR mussel E has higher (activity) in tissue Z / eq ; 3. mussel E has more (overall activity)/ eq ; 4. credit correct comparative manipulation of figures ; 5. Idea that both mussels have tissues with same order of activity e.g. Y X Z ;	**(2)**

Question Number	Answer	Mark
6(b)	1. reference to measuring volume of oxygen ; 2. suitable reference to time e.g. oxygen produced in unit time, time taken to produce same volume of oxygen ; 3. idea of measuring the initial rate of reaction ; 4. reference to controlled variable in relation to the mussel e.g. age, part of mussel, mass, surface area ; 5. reference to a controlled variable in relation to the experiment e.g. volume of hydrogen peroxide, temperature, concentration, pH ; 6. suitable reference to repeats ;	**(4)**

Question Number	Answer	Mark
*** 7(a) QWC**	(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence) 1. {damage / eq} to {endothelial cells/ epithelial cells / lining / eq} of artery ; 2. ref to inflammatory response ; 3. ref to migration of white blood cells into area / eq ; 4. build up of cholesterol /eq ; 5. reference to formation of atheroma / plaque ; 6. reference to {calcium salts / fibrous tissue} ; 7. ref to {loss of elasticity (of artery) / narrowing of lumen} / eq ; 8. idea that this process is self–perpetuating ;	**(4)**

Question Number	Answer	Mark
7(b)(i)	{the alleles / eq} present (in an organism) / eq ;	**(1)**

Question Number	Answer	Mark
7(b)(ii)	a (different) form of one gene / eq ;	**(1)**

Question Number	Answer	Mark
7(c)	Any **two** from: More saturated fat / more cholesterol / more salt /obesity / more alcohol / more age / male / post-menopausal women / high blood pressure / smoking / diabetes / less activity / stress ;	**(1)**

Question Number	Answer	Mark
7(d)	1. muscle {inflammation / pain / eq} ; 2. liver {damage / failure/ eq} ; 3. joint {aches / pains/ eq} ; 4. nausea/constipation/diarrhoea ; 5. kidney {damage / failure / eq} ; 6. cataracts ; 7. diabetes ; 8. allergies / skin inflammation / skin rash / eq ; 9. respiratory problems / persistent cough / eq ; 10. headaches / dizziness / depression ;	**(2)**

Question Number	Answer	Mark
8(a)	1. a bar showing 2% ; 2. a bar showing 16% ; 3. the obesity (dark) and overweight (light) portion identified / eq ;	**(3)**

Question Number	Answer	Mark
8(b)(i)	A ;	**(1)**

Question Number	Answer	Mark
8(b)(ii)	D ;	**(1)**

Question Number	Answer	Mark
8(b)(iii)	A ;	**(1)**

Question Number	Answer	Mark
8(b)(iv)	Either C or A This is because the bar chart presented, detailing overweight and obesity percentage of population by gender in different countries, can be interpreted as either: **C** - obesity as a subset of being overweight (following through the information in the question stem for 8(a)) **OR** **A -** overweight and obese as discrete categories (If candidates only refer to the bar chart and ignore the information in the stem of question 8(a)).	**(1)**

Question Number	Answer	Mark
8(c)	1. graph shows percentages ; 2. population size is not known e.g. sample size not known / the actual number of males and females who are obese will depend on the population size of each gender / eq ; 3. there may be a different number of males to females / eq ;	**(2)**

Question Number	Answer	Mark
8(d)(i)	(relationship between two variables is such that) a change in one of the variables is reflected by a change in the other variable / eq ;	**(1)**

Question Number	Answer	Mark
8(d)(ii)	1. the (consumption of) corn syrup goes up / eq ; 2. (this is) before the increase in obesity / eq ; 3. reference to the (consumption of) dextrose falling with time e.g. during the 1970s ; 4. reference to the consumption of glucose staying fairly constant ;	**(3)**

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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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.

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(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 ..... %

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(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 .....

.....

.....

.....

.....

(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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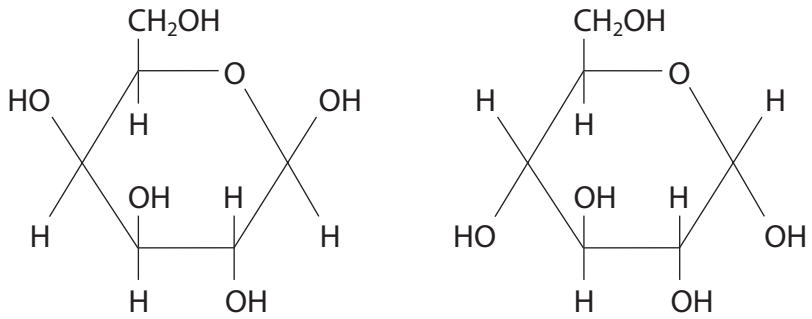
(Total for Question 1 = 12 marks)

P 3 8 STEMUP.CO.UK 4 2 8

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)

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

(1)

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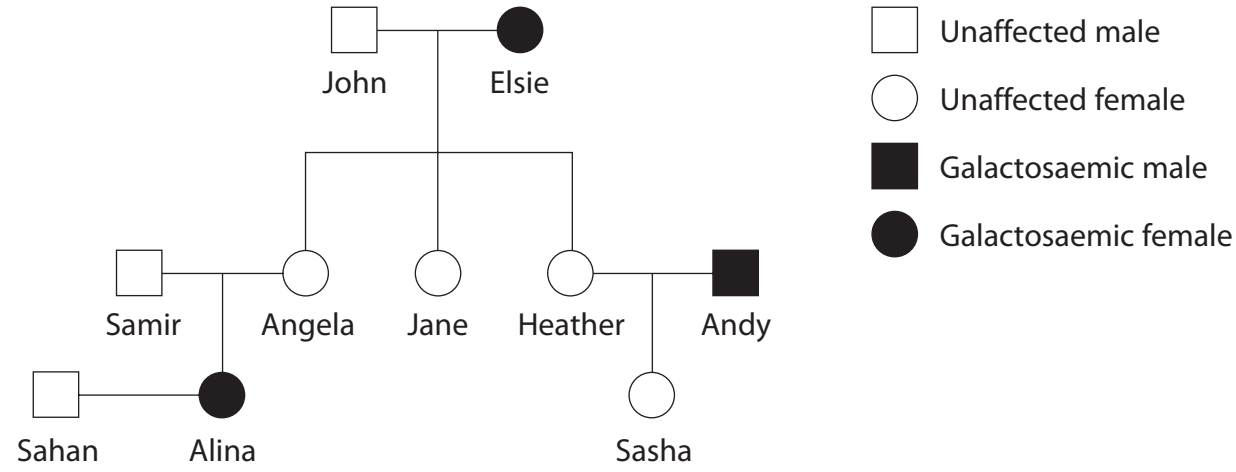
(iii) Name the bond that joins the galactose and glucose molecules together.

(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

P 3 8 1 7 0 A 0 7 2 8
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(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)

.....

.....

(Total for Question 2 = 13 marks)

P 3 8 8 2 8 STEMUP.CO.UK

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)

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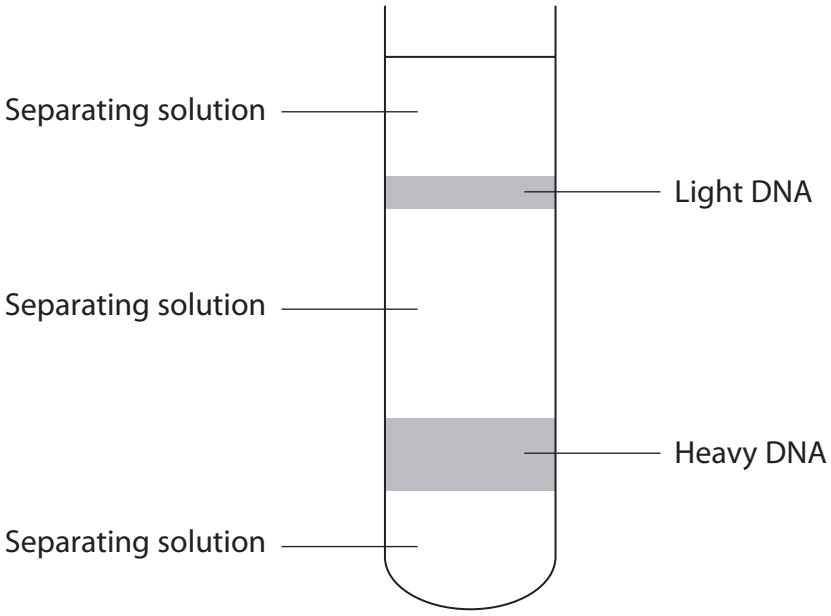
4 In the late 1950s, Meselson and Stahl performed some important experiments. These experiments provided evidence to support the idea that new DNA was synthesised by semi-conservative replication.

(a) Name an enzyme involved in DNA replication.

(1)

.....

(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.

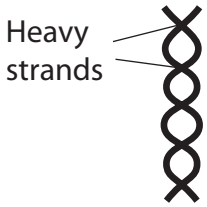
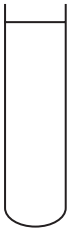
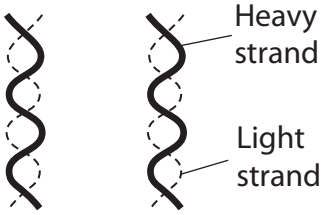
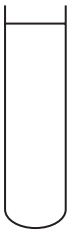


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The table below summarises the three stages of Meselson and Stahl's experiment and their results.

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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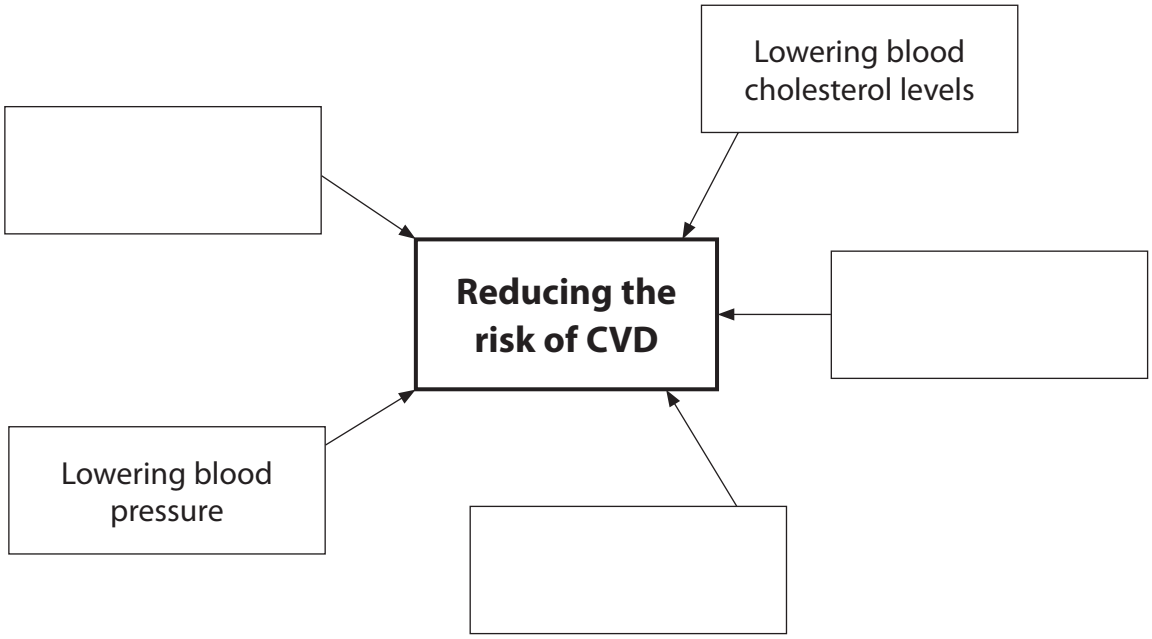
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P 3 8 1 7 0 4 2 8
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5 The risk of developing cardiovascular disease (CVD) can be reduced in several ways. Lowering blood cholesterol levels and lowering blood pressure are two ways of reducing CVD.

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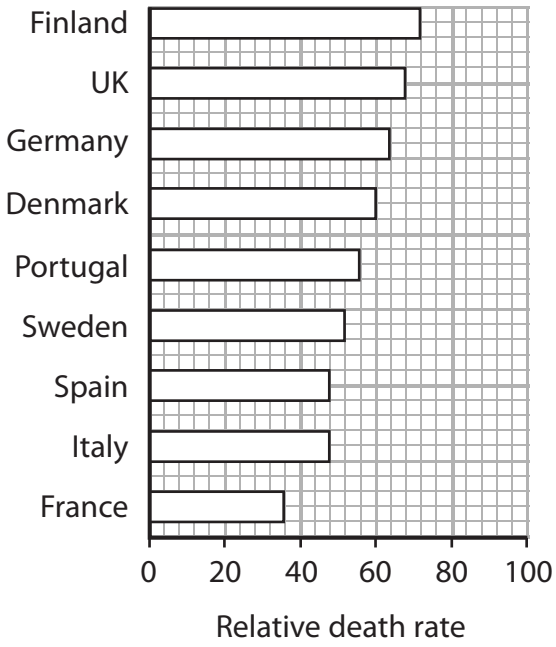
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(b) Risk calculators can be used to estimate the probability that a person will develop CVD. Many of these calculators start by asking for the age and gender of the person using them. Explain why information about age and gender is important in estimating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

(2)

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

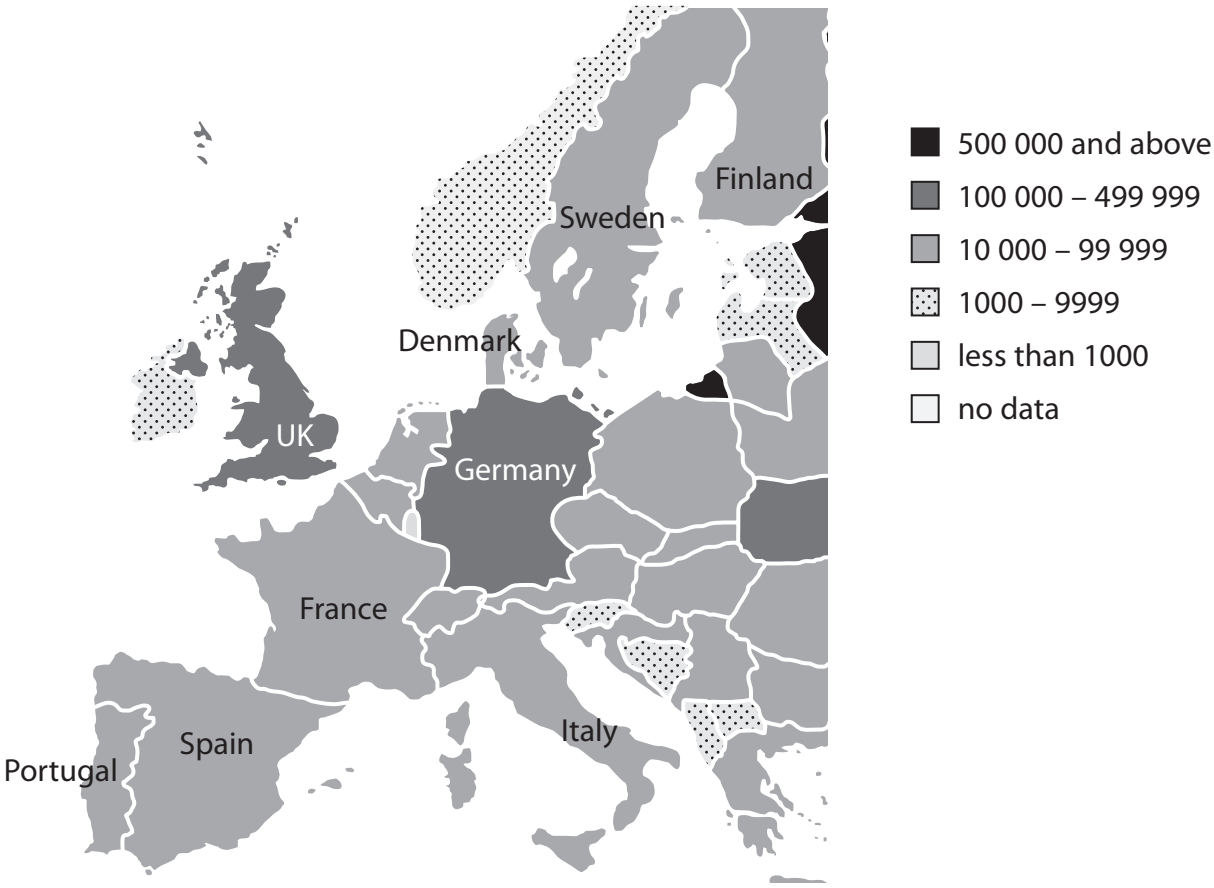


(i) Compare the relative death rates from CVD in Finland, Denmark and Sweden.

(3)

P 3 8 1 7 0 A 0 1 6 2 8
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(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 .....

.....

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(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)

P 3 8 1 7 0 A 0 0 1 8 2 8
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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)

P 3 8 1 7 0 A 0 1 9 2 8
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(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.



P 3 8 1 7 0 A 0 2 0 2 8
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(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

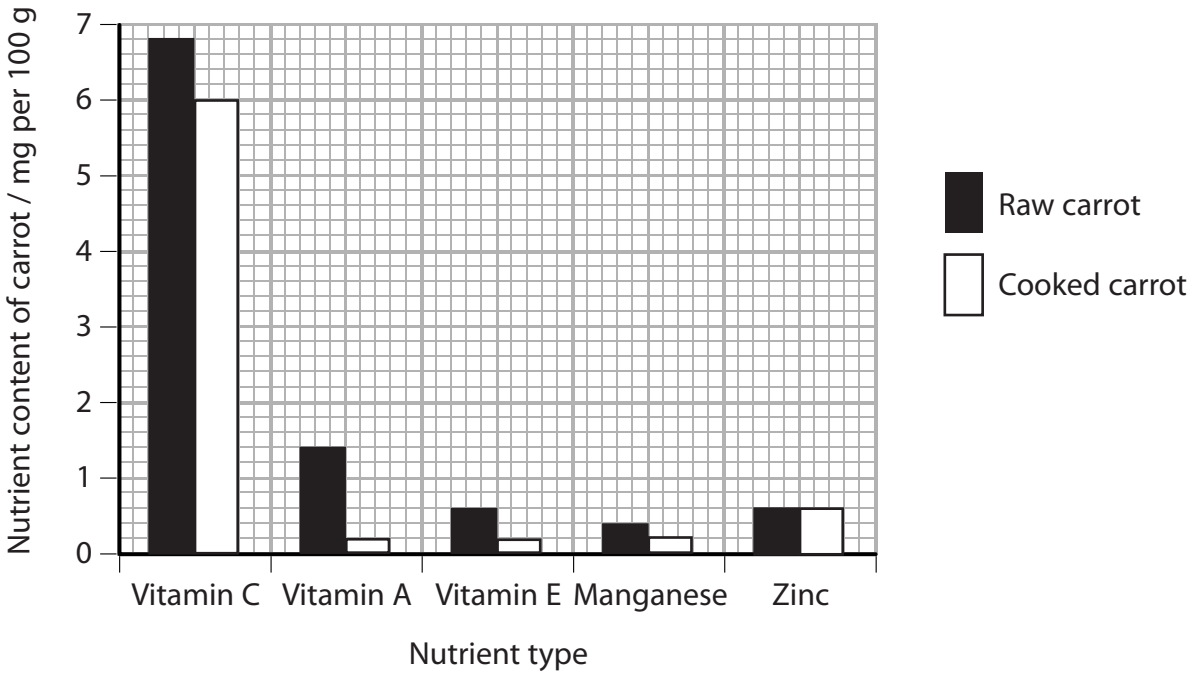
☒ **D** UGA

(Total for Question 6 = 9 marks)

P 3 8 1 7 0 A 0 2 1 2 8
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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)

P 3 8 1 7 0 A 0 0 2 2 2 8
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*(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)

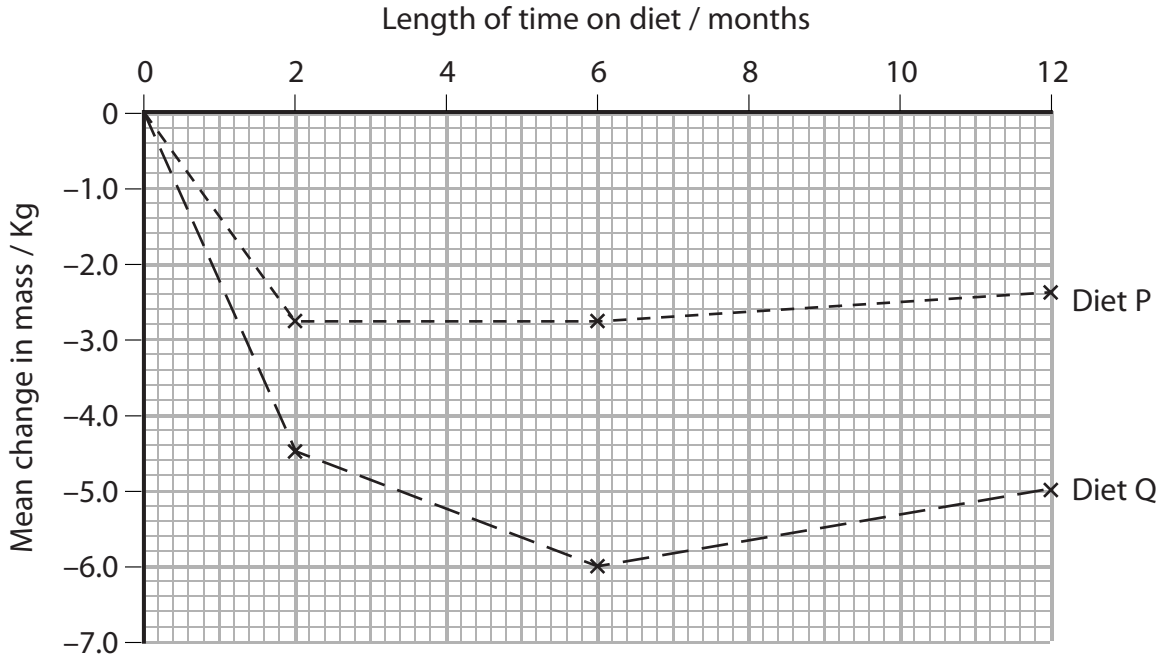
P 3 8 1 7 0 A 0 2 3 2 8
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8 Many different diets are available for people who want to lose weight. There is a lot of confusion over the merits of each one.

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)

P 3 8 1 7 0 2 4 2 8
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(ii) Suggest why there was an increase in the mean mass of the volunteers on both diets between 6 months and 12 months.

(1)

.....

.....

(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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Mark Scheme (Results)

June 2011

GCE Biology (6BI01) Paper 01
Lifestyle, Transport, Genes and Health

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If you have any subject specific questions about the content of this Mark Scheme that require the help of a subject specialist, you may find our **Ask The Expert** email service helpful.

Ask The Expert can be accessed online at the following link:
http://www.edexcel.com/Aboutus/contact-us/

Alternatively, you can contact our GCE Science Advisor directly by sending an email to ScienceSubjectAdvisor@EdexcelExperts.co.uk.
You can also telephone 0844 576 0037 to speak to a member of our subject advisor team.

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Quality of Written Communication

- Questions which involve the writing of continuous prose will expect candidates to:
- write legibly, with accurate use of spelling, grammar and punctuation in order to make the meaning clear
- select and use a form and style of writing appropriate to purpose and to complex subject matter
- organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities.
Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

GENERAL INFORMATION

The following symbols are used in the mark schemes for all questions:

Symbol	Meaning of symbol
; semi colon	Indicates the end of a marking point
Eq	Indicates that credit should be given for other correct alternatives to a word or statement, as discussed in the Standardisation meeting
/ oblique	Words or phrases separated by an oblique are alternatives to each other
{} curly brackets	Indicate the beginning and end of a list of alternatives (separated by obliques) where necessary to avoid confusion
() round brackets	Words inside round brackets are to aid understanding of the marking point but are not required to award the point
[] square brackets	Words inside square brackets are instructions or guidance for examiners
[CE] or [TE]	Consecutive error / transferred error

Crossed out work

If a candidate has crossed out an answer and written new text, the crossed out work can be ignored. If the candidate has crossed out work but written no new text, the crossed out work for that question or part question should be marked, as far as it is possible to do so.

Spelling and clarity

In general, an error made in an early part of a question is penalised when it occurs but not subsequently. The candidate is penalised once only and can gain credit in later parts of the question by correct reasoning from the earlier incorrect answer.

No marks are awarded specifically for quality of language in the written papers, except for the essays in the synoptic paper. Use of English is however taken into account as follows:

- the spelling of technical terms must be sufficiently correct for the answer to be unambiguous
  e.g. for amylase, 'ammalase' is acceptable whereas 'amylose' is not
  e.g. for glycogen, 'glicojen' is acceptable whereas 'glucagen' is not
  e.g. for ileum, 'illeum' is acceptable whereas 'ilium' is not
  e.g. for mitosis, 'mytosis' is acceptable whereas 'meitosis' is not

- candidates must make their meaning clear to the examiner to gain the mark.

- a correct statement that is contradicted by an incorrect statement in the same part of an answer gains no mark – irrelevant material should be ignored

Question Number	Answer	Mark
1(a)	1. protein / glycoprotein ; 2. facilitated diffusion ; 3. active transport / eq ; 4. ATP / adenosine triphosphate ;	**(4)**

Question Number	Answer	Mark
1(b)(i)	1. 77-70 / 7; 2. correct division by 77 (multiplied by 100) to give correct answer, e.g. 9.1 / 9.09 / 9.0 / 9 [CE applies] Correct answer = 2 marks	**(2)**

Question Number	Answer	Mark
1(b)(ii)	1. idea that not all of the {juice / sugar} washed off / idea that the strawberries were not dried after rinsing properly / idea that some water reabsorbed (during washing) ; 2. loss of mass of strawberries not as high as it should have been / eq ; 3. (%) value too small / eq ; OR 1. idea that strawberry {tissue / juice} lost because {washing too vigorous / tissue stuck to towel when drying / squeezing strawberries / juice absorbed from strawberries} / water lost through evaporation / eq ; 2. loss of mass of strawberries higher than it should have been / eq ; 3. (%) value too high / eq ;	**(3)**

Question Number	Answer	Mark
1(b)(iii)	1. correct reference to <u>water</u> gradient (between sugar and strawberries) ; 2. reference to osmosis (of water from inside of strawberry to outside) ; 3. idea that water is found in {cytoplasm / vacuoles} (of strawberry) ; 4. reference to water as a solvent (for the sugar) ; 5. reference to (di)polar nature of water / eq ;	**(3)**

Question Number	Answer	Mark
2(a)(i)	1. both hexose molecules in disaccharide correctly drawn ; 2. indication that water is formed ; 3. glycosidic bond correctly drawn ;	**(3)**

Question Number	Answer	Mark
2(a)(ii)	condensation / polymerisation ;	**(1)**

Question Number	Answer	Mark
2(a)(iii)	(1, 4) glycosidic (bond / link) ;	**(1)**

Question Number	Answer	Mark
2(b)(i)	A ;	**(1)**

Question Number	Answer	Mark
2(b)(ii)	B ;	**(1)**

Question Number	Answer	Mark
2(b)(iii)	B ;	**(1)**

Question Number	Answer	Mark
2(c)(i)	1. genotypes of parents correctly shown ; 2. alleles present in gametes correctly shown ; 3. possible genotypes of offspring correctly shown ; 4. probability stated as {0.5 / 50% /1 in 2 / ½ / 50:50} ;	**(4)**

Question Number	Answer	Mark
2(c)(ii)	The same (as the probability is for the first child) ;	**(1)**

Question Number	Answer	Mark
***3(a)** QWC	(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence) 1. reference to CFTR {gene / channel} not functioning properly ; 2. reference to {thicker / stickier / eq } *mucus* ; 3. (*mucus*) blocks *(pancreatic)* {duct(s) / eq } ; 4. in the *pancreas* ; 5. idea that *enzymes* cannot {be secreted into / reach} small *intestine* ; 6. idea of reduced *digestion* of {food / named food} ; 7. reference to reduced *absorption* / eq ; 8. idea of {*malnutrition* / *weight* loss} ; 9. idea of {self-*digestion* of *(pancreatic)* cells / problems controlling blood sugar levels / *cysts* / *fibroids*} ;	**(4)**

Question Number	Answer	Mark
3(b)	1. reference to {IVF / description of preimplantation} ; 2. {embryo / eq} DNA analysed / eq ; 3. presence of CFTR {gene mutation / faulty allele / eq} tested for / eq ;	**(3)**

Question Number	Answer	Mark
3(c)	Any of the following paired points 1. who has right to decide if tests should be performed / eq ; 2. {implications of medical costs / disagreements over next step / embryo has rights} ; **OR** 3. issues relating to confidentiality of {parents / child} / eq ; 4. idea that {some other abnormality may be found / paternal DNA does not match / other family members have right to know results} ; **OR** 5. idea some other abnormality may be found / false negative ; 6. comment on possible problems with e.g. future employment / insurance / what constitutes a serious condition / eq ; **OR** 7. idea that embryo could be {damaged / destroyed / discarded / eq} / false positive ; 8. embryo {is a potential life / has rights} /destroying embryo is {wrong / unethical / murder / eq} ;	**(2)**

Question Number	Answer	Mark
4(a)	(DNA) { polymerase / helicase / ligase} ;	**(1)**

Question Number	Answer	Mark
4(b)	**Stage 1** 1. only one bond drawn in lower half of tube ; **Stage 2** 2. one only bond drawn (higher than the one drawn in stage 1) ; **Stage 3** Diagram 3. {1 / 2} molecules shown with one light and one heavy strand ; 4. {1 / 2} molecules shown with two light strands; Test tube 5. 2 bands shown in roughly correct position (middle to upper half of test tube) ; 6. bands should be of (roughly) equal width ; [consequential error from stage 2 should apply for both marking points 5 and 6]	**(6)**

Question Number	Answer	Mark
5(a)(i)	Any **three** from: 1. decrease in smoking / not smoking / eq ; 2. reference to {increase / regular / eq} exercise ; 3. improvements to diet qualified, e.g. reduce salt, reduce saturated fat, increase fibre ; 4. maintaining appropriate weight / eq ; 5. {moderate / reduced} alcohol consumption / eq ; 6. reducing stress / eq ; 7. use of medication e.g. statins, antihypertensives, warfarin ;	**(3)**

Question Number	Answer	Mark
5(a)(ii)	1. (less) cholesterol (in blood) to build up on artery (wall) / eq ; 2. less likely to develop atherosclerosis / eq ; 3. credit correct reference to subsequent consequence of atherosclerosis e.g. narrowing of arteries, ischaemia, decrease in flow of blood (to heart) ;	**(2)**

Question Number	Answer	Mark
5(b)	1. age effect qualified e.g. older increases risk, {arteries {become less elastic / more easily damaged / blood pressure increases} with (increase in) age ; 2. gender effect qualified e.g. {women less likely to develop CVD than men / oestrogen offers some protection to women against CVD } (pre menopause) / eq ;	**(2)**

Question Number	Answer	Mark
5(c)(i)	1. Finland has the highest death rate / eq ; 2. Sweden has the lowest death rate /eq ; 3. credit correct manipulation of figures to compare one of these countries to one other country ;	**(3)**

Question Number	Answer	Mark
5(c)(ii)	1. Finland {highest on graph / not highest on map} Germany and UK have the highest on the map / eq ; 2. idea that a number (3 or more) of countries are the same on the map ; 3. France does not have the lowest number of deaths / eq ; 4. Credit any other correct comparison ; 5. {map shows number of deaths and graph shows relative death rate / map gives the results grouped together but graph shows individual values / map does not allow for population size} ;	**(2)**

Question Number	Answer	Mark
5(c)(iii)	Any **one** from: 1. the data on the map is shown in groups / eq; 2. the data might come from a different year / different time / no information given on the year / eq ; 3. different groups of people were surveyed / eq ; 4. idea that bar graph shows number of deaths relative to population / the map does not take into account the population of the country ;	**(1)**

Question Number	Answer	Mark
6(a)	1. presence of amine group /eq ; 2. presence of carboxyl group / eq ; 3. reference to R group ; 4. reference to central carbon atom ; [award marks on correctly drawn diagram]	**(2)**

Question Number	Answer	Mark
6(b)	1. correct reference to transcription ; 2. DNA {unwinds / strands separate / eq} ; 3. (RNA) (mono)nucleotides {line up against / attach / eq} to one (DNA) { strand / template / eq} ; 4. reference to <u>complementary</u> base pairing (between DNA and (mono)nucleotides) ; 5. reference to {(mono)nucleotides joining together / formation of phosphodiester bonds} ; 6. correct reference to condensation reaction ; 7. correct reference to named enzymes involved / eq ; 8. mRNA detaches (from DNA) / eq ;	**(4)**

Question Number	Answer	Mark
6(c)(i)	**DISCOUNTED QUESTION / DO NOT MARK**	**(0)**

Question Number	Answer	Mark
6(c)(ii)	B ;	**(1)**

Question Number	Answer	Mark
6(c)(iii)	D ;	**(1)**

Question Number	Answer	Mark
7 (a)	1. cooking decreases all the vitamins / eq ; 2. reference to only zinc does not change / eq ; 3. biggest decrease is in Vitamin A ; 4. credit manipulation of figures with units (if appropriate) to compare raw and cooked ;	**(3)**

Question Number	Answer	Mark
***7(b) QWC**	(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence) 1. idea that some carrots need to be boiled in water and some cooked in microwave ; 2. reference to control of appropriate variable; 3. reference to {juice / cooking water} being used ; 4. reference to DCPIP ; 5. {reference to titration / description of titration} (of juice) ; 6. colour change of DCPIP e.g. from blue to {colourless / pink} as juice added / until stays blue as DCPIP added ; 7. reference to {comparison of volumes of DCPIP added to each / use of calibration curve / calculation of vitamin C concentration against known vitamin C solution} ; 8. reference to repeats ;	**(5)**

Question Number	Answer	Mark
8(a) (i)	1. group on diet Q loses more mass (overall in the 6 months) / eq ; 2. both groups lost mass in the first { 2 / 6 } months ; 3. the group on diet Q {lost the most mass / lost mass the fastest} in the first 2 months ; 4. between 2 and 6 months there was {no more loss of mass / slight increase in mass} in the group on diet P AND those on diet Q lost more mass / eq ; 5. credit correct manipulation of figures to compare mass loss between two of the groups ;	**(3)**

Question Number	Answer	Mark
8 (a) (ii)	not following the diet {anymore / so strictly} / not doing so much exercise /eq ;	**(1)**

Question Number	Answer	Mark
8(a)(iii)	Any **two** from: 1. gender / eq ; 2. age / eq ; 3. extent to which individuals were over-weight / eq ; 4. occupation / eq ; 5. alcohol intake / eq ; 6. standardised exercise programme / amount of exercise taken eq ; 7. health / disability / stress / eq ; 8. timing of meals / eq ; 9. time of weighing / eq ;	**(2)**

Question Number	Answer	Mark
8(b)	1. idea that exercise uses energy ; 2. the {longer / more intense} the exercise, the more {energy used / weight loss} / eq ; 3. idea of {mass / weight} loss depends on energy input lower than energy output ; 4. idea that exercise increases metabolism / muscles use more energy than fat ;	**(3)**

Write your name here

Surname	Other names

Centre Number | Candidate Number

Edexcel GCE

Biology

Advanced Subsidiary

Unit 1: Lifestyle, Transport, Genes and Health

Tuesday 25 May 2010 – 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 on these questions with your spelling, punctuation and grammar, as well as the clarity of expression.*
- 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 The questions below refer to some important biological molecules.
Place a cross (☒) in the most appropriate box that describes the structure or role of these biological molecules.

(a) Disaccharides can be split by

(1)

☒ **A** hydrolysis of glycosidic bonds

☒ **B** condensation of glycosidic bonds

☒ **C** hydrolysis of ester bonds

☒ **D** condensation of ester bonds

(b) Amylose is an example of a

(1)

☒ **A** monosaccharide

☒ **B** disaccharide

☒ **C** polysaccharide

☒ **D** trisaccharide

(c) The role of starch is to

(1)

☒ **A** be a source of energy to plants

☒ **B** store energy in all living organisms

☒ **C** store energy in plants

☒ **D** store energy in animals

(d) Proteins are polymers of amino acids joined by peptide bonds formed between the

(1)

☒ **A** R groups

☒ **B** R group and the amino group

☒ **C** R group and the carboxyl group

☒ **D** carboxyl group and the amino group

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(e) The three-dimensional structure of a protein is held together by

(1)

☒ **A** peptide, hydrogen and ionic bonds

☒ **B** hydrogen, ester and ionic bonds

☒ **C** disulphide bridges and ester bonds

☒ **D** disulphide bridges, hydrogen and ionic bonds

(f) DNA consists of mononucleotides joined together by bonds between

(1)

☒ **A** two pentose sugars

☒ **B** one ribose sugar and one phosphate group

☒ **C** one deoxyribose sugar and one phosphate group

☒ **D** two phosphate groups

(g) Water is described as a dipolar molecule because it has a

(1)

☒ **A** positively charged hydrogen end and a negatively charged oxygen end

☒ **B** positively charged hydrogen end and a positively charged oxygen end

☒ **C** negatively charged hydrogen end and a negatively charged oxygen end

☒ **D** negatively charged hydrogen end and a positively charged oxygen end

(Total for Question 1 = 7 marks)

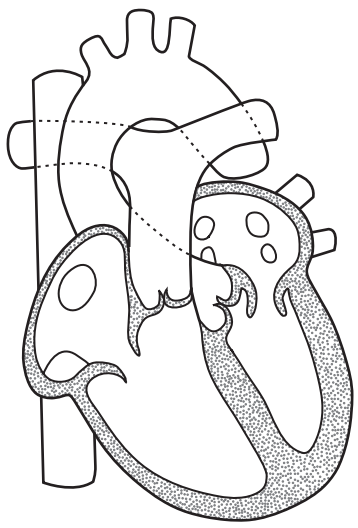
2 (a) Read through the following passage about the heart and its major blood vessels, then write on the dotted lines the most appropriate word or words to complete the passage.

(5)

The mammalian heart consists of four chambers, two upper chambers called ..... and two lower chambers called ventricles.

The ..... carries oxygenated blood away from the ..... ventricle to the cells of the body and the pulmonary ..... carries deoxygenated blood to the lungs. The ..... returns deoxygenated blood back to the heart from the body.

(b) The diagram below shows the structure of the heart.



Suggest which stage of the cardiac cycle is shown in the diagram and give a reason for your answer.

(2)

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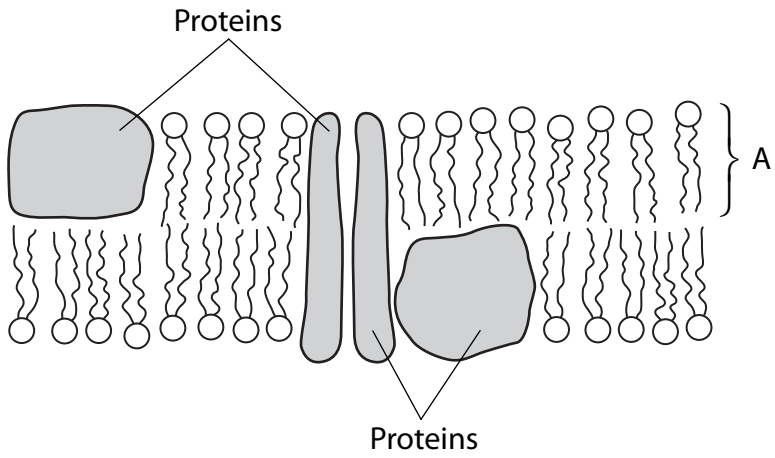
(Total for Question 2 = 7 marks)

N 3 5 8 5 0 A 0 4 2 0

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3 The fluid mosaic model describes the structure and properties of cell membranes.

(a) The diagram below shows the structure of a cell membrane based on this model.



(i) Name the molecule labelled A and describe its structure.

(3)

Name .....

Structure .....

.....

.....

.....

.....

.....

N 3 5 8 5 0 A 0 5 2 0

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(ii) Explain how the properties of molecule A contribute to the structure of the cell membrane.

(3)

(b) Some proteins in the cell membrane are involved in active transport and facilitated diffusion. Describe the role of proteins in these cell transport mechanisms.

(3)

Active transport

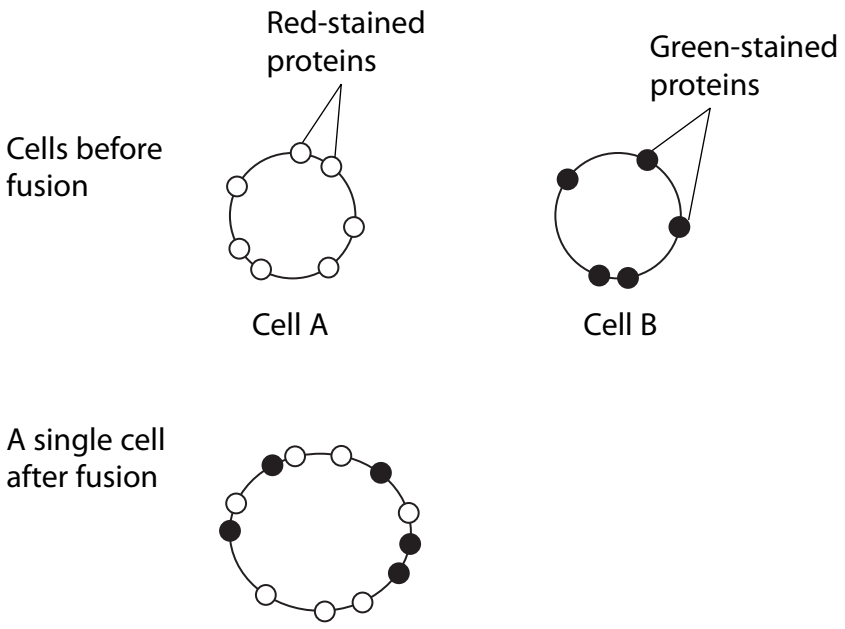
Facilitated diffusion

N 3 5 8 5 0 A 0 6 2 0

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(c) In an investigation into the properties of the cell membrane, the proteins in the membranes of two cells, A and B, were stained using different dyes. The proteins of one cell were stained green and the proteins of the other cell were stained red. The cells were then fused (merged together) to form a single cell.

The diagram below shows the distribution of the proteins in the cell membranes before and after fusion.



(i) Describe the distribution of the proteins in this single cell after fusion.

(2)

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(ii) Describe how the results of this investigation can be explained by the fluid mosaic model.

(2)

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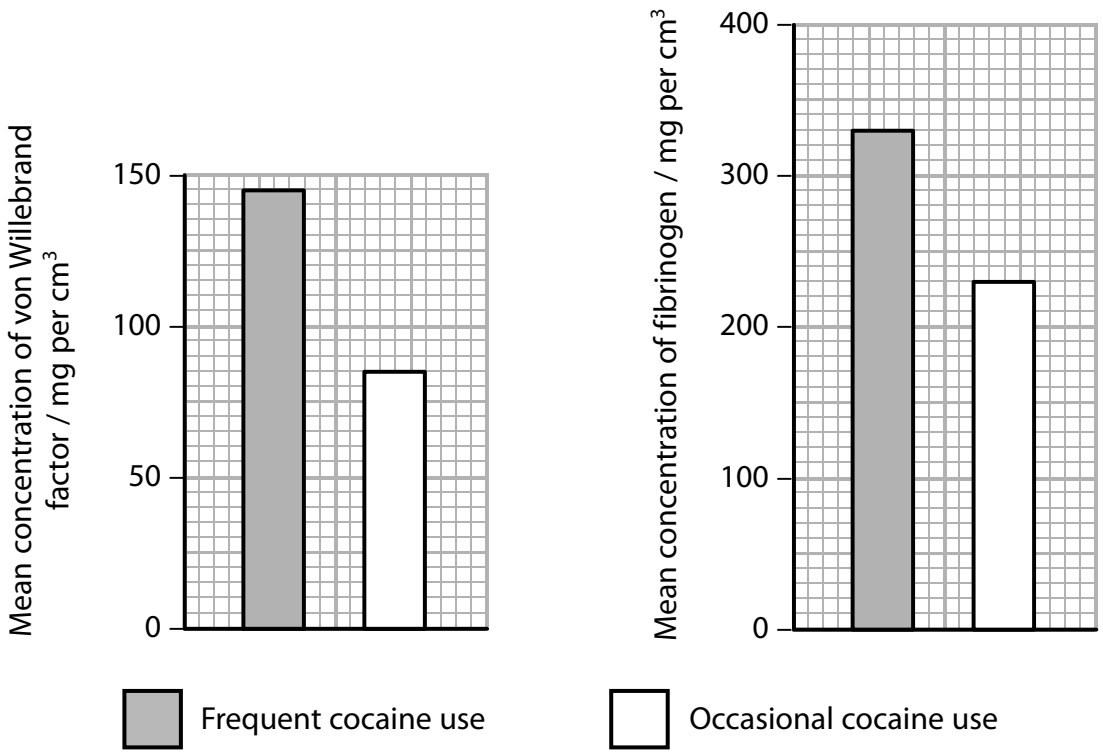
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(Total for Question 3 = 13 marks)

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4 Cocaine use increases the risk of a heart attack.
Cocaine also affects the levels of a number of blood components, including von Willebrand factor and fibrinogen. These two components are involved in blood clotting.

(a) The normal range for von Willebrand factor is 50 to 150 mg per cm^3 and for fibrinogen is 150 to 300 mg per cm^3.
The graphs below show the effects of frequent and occasional cocaine use on the mean concentration of von Willebrand factor and fibrinogen in the blood.



(i) Describe the effects of frequent and occasional cocaine use on the mean concentrations of von Willebrand factor and fibrinogen in the blood.

(3)

.....

.....

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N 3 5 8 5 0 A 0 8 2 0

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(ii) Using the information given, explain why conclusions cannot be made about the effect of occasional cocaine use on the concentrations of these blood components.

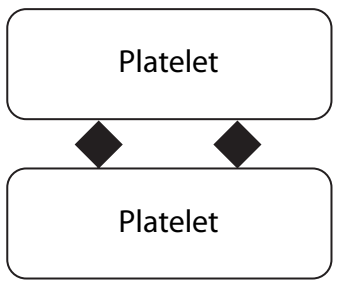
(1)

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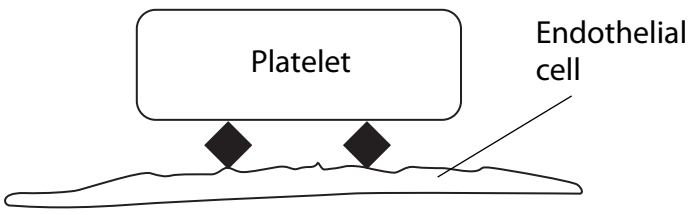
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*(b) The diagram below shows two functions of von Willebrand factor.



Platelets stick together



Platelets stick to endothelial cells lining blood vessels

von Willebrand factor

Using the information in this diagram and your own knowledge of the blood clotting process, suggest why frequent cocaine use could increase the risk of a blood clot forming.

(4)

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(c) It has been suggested that there is a correlation between the change in the concentrations of fibrinogen in the blood and the increased risk of heart disease due to cocaine use. Explain why this suggestion is valid.

(2)

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(Total for Question 4 = 10 marks)

N 3 5 8 5 0 A 0 1 0 2 0

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5 Cystic fibrosis is a genetic disease that can affect many body systems, including the respiratory system.

*(a) Explain how a gene mutation causes a build up of mucus in the respiratory system of a person with cystic fibrosis.

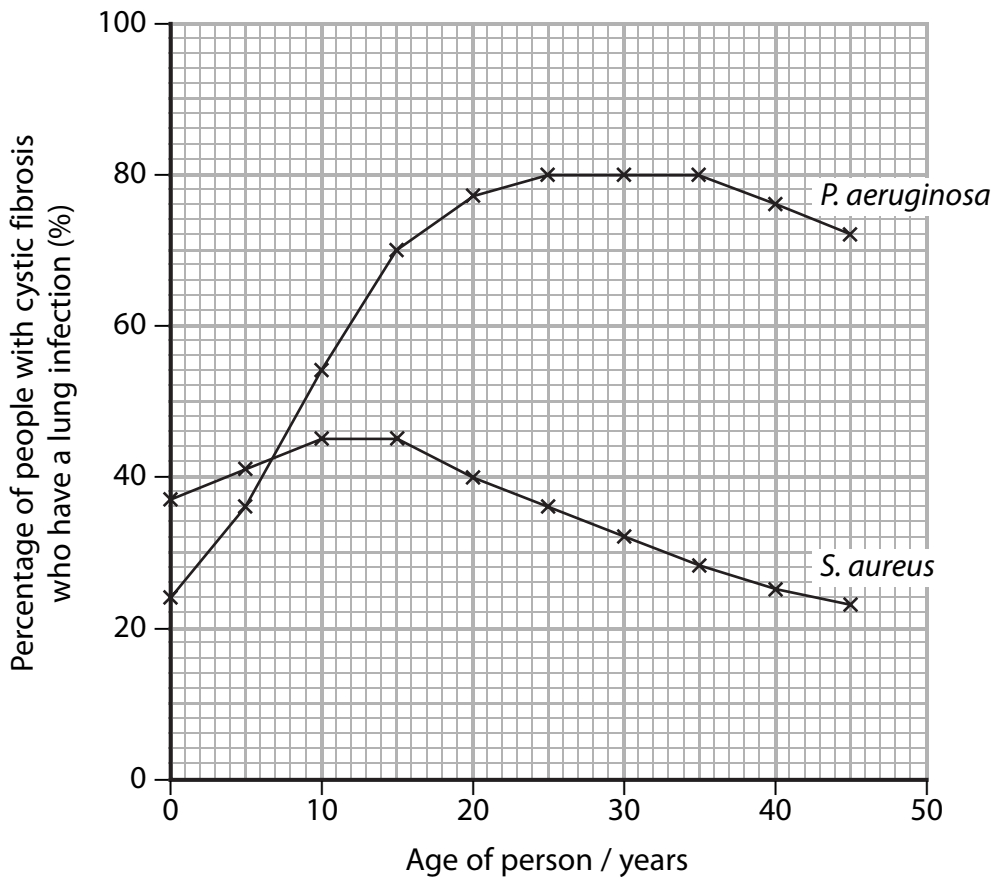
(5)

N 3 5 8 5 0 A 0 1 1 2 0

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(b) Lung infections can be caused by bacteria such as *P. aeruginosa* and *S. aureus*. People with cystic fibrosis may develop these lung infections.

The graph below shows the relationship between the percentage of people with cystic fibrosis who have a lung infection and the age of the person.



(i) Suggest why people with cystic fibrosis are more likely to suffer from these lung infections than people without cystic fibrosis.

(2)

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N 3 5 8 5 0 A 0 1 2 2 0

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(ii) Using the information in the graph, describe the relationship between the age of a person and the incidence of a lung infection due to *P. aeruginosa*.

(3)

(iii) Using the information in the graph, give **two** differences between the percentages of people with infections due to *P. aeruginosa* and infections due to *S. aureus*.

(2)

1

2

(Total for Question 5 = 12 marks)

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6 Enzymes are biological catalysts that change the activation energy of chemical reactions.

(a) Explain the meaning of the terms **biological catalyst** and **activation energy**.

(4)

Biological catalyst .....

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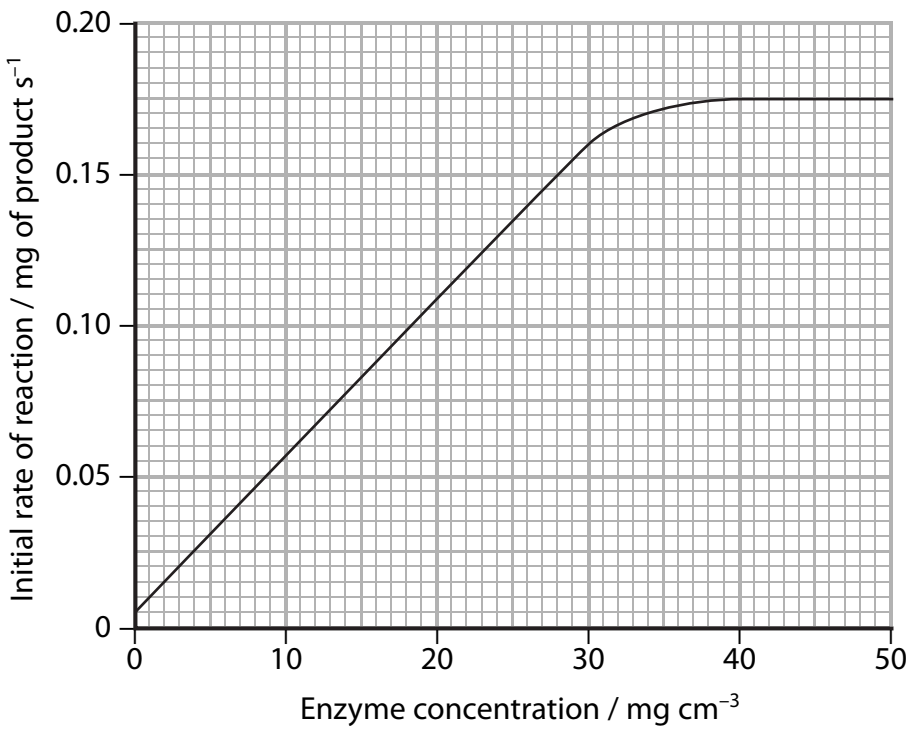
Activation energy .....

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(b) The graph below shows the results of an investigation into the effect of enzyme concentration on the initial rate of this reaction.



N 3 5 8 5 0 A 0 1 4 2 0

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Explain why it is necessary to measure the **initial rate** of reaction when investigating the effect of enzyme concentration on the rate of reaction.

(2)

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(c) In this investigation, the substrate concentration was a factor that was kept constant.
Suggest **two** other factors that should be kept constant. For each factor, state how it can be kept constant.

(4)

Factor 1 .....

How the factor can be kept constant .....

.....

.....

Factor 2 .....

How the factor can be kept constant .....

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(Total for Question 6 = 10 marks)

7 Plant statins are used in the treatment of cardiovascular disease (CVD). Some fungi can produce chemicals that can be used as statins. One example is a chemical referred to as drug S.

One study into the effect of drug S on the health of people taking it involved 20 000 people and ran for a period of 5 years. One group of people was given drug S and the other group was given a placebo. Each group had 10 000 people in it.

The table below shows some of the findings from this study.

Event	Percentage of people (%)	
	Taking drug S	Taking the placebo
Death	12.9	14.7
CVD	8.7	11.8
Stroke	4.3	5.7

(a) (i) Name **two** factors that increase the risk of CVD.

(1)

1 .....

2 .....

(ii) Suggest why it was necessary to have so many people involved in this study.

(2)

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(b) Suggest what the placebo could be in this study.

(1)

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(c) Suggest why this study had to run for a number of years.

(1)

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N 3 5 8 5 0 A 0 1 6 2 0

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(d) Using the data in the table, what is the evidence that drug S is safe for people to take?

(2)

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(e) (i) Calculate how many more people given the placebo had CVD compared with those given drug S.

(3)

Answer .....

(ii) Explain why drug S could be a potential statin.

(1)

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(Total for Question 7 = 11 marks)

8 Some types of cancer lead to the production of tumours (a group of rapidly-dividing cancer cells).

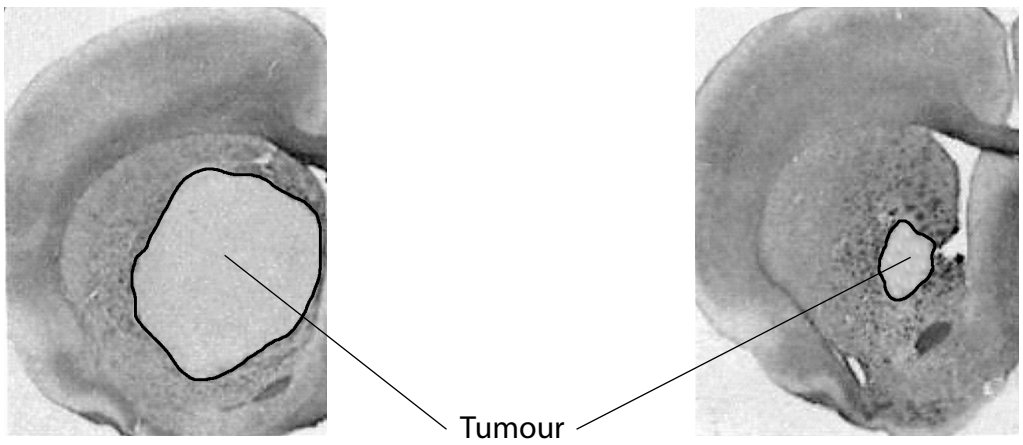
Gene therapy has the potential to cure a number of human diseases, including cancer. At present, research into gene therapy relies on animal models of diseases.

(a) In one investigation, brain tumours were induced in two groups of rats.
One group of rats was given gene therapy and the other group of rats acted as a control.

The photographs below show the appearance of a tumour in the brain of a control rat and in a rat given gene therapy.
Both photographs have the same magnification.

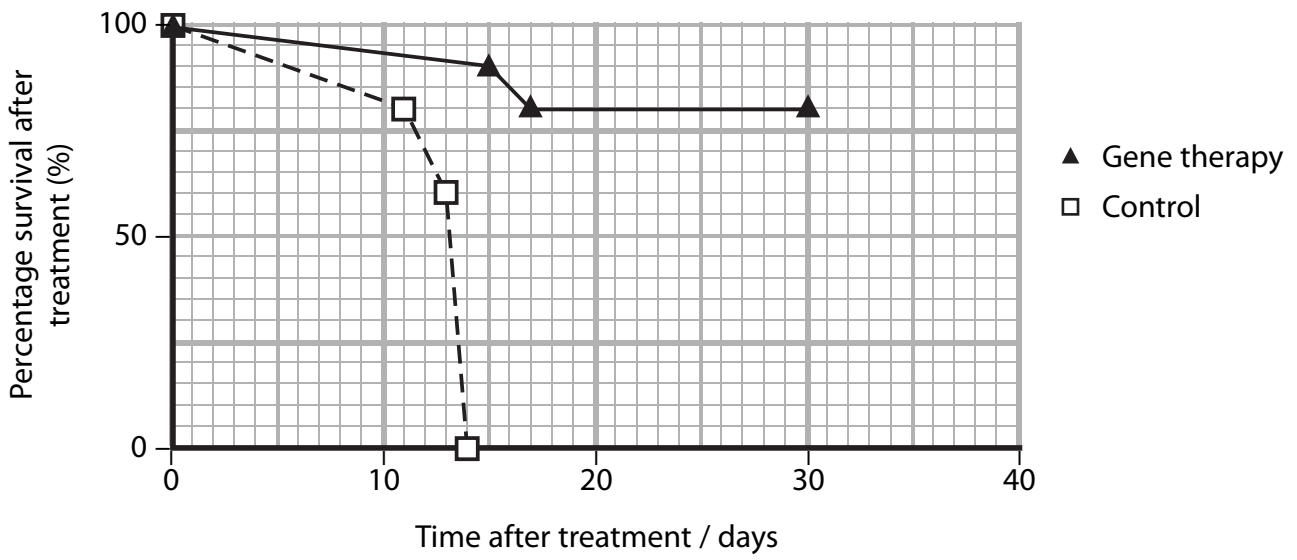
Brain of control rat

Brain of rat receiving gene therapy



Magnification ×10

The graph below shows the percentage survival after treatment of the rats in the two groups.



N 3 5 8 5 0 A 0 1 8 2 0

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Using the information shown in the photographs and in the graph, describe the effects of gene therapy on these rats.

(3)

(b) Cancer can cause a lot of pain. Pain can be reduced by a chemical called endorphin that is made by cells in the brain and spinal cord. Endorphin reduces the activity of neurones that carry impulses from pain receptors.

Gene therapy has been used in rats to increase the tolerance to pain. Viruses, containing a gene coding for endorphin, were developed. These viruses were injected into the spinal cords of a group of rats. The level of tolerance to pain was tested in these rats and in the rats in a control group.

(i) Describe the role of the viruses in this investigation.

(2)

(ii) Suggest why the injection was made into the spinal cord.

(1)

QUESTION 8 CONTINUES ON THE NEXT PAGE

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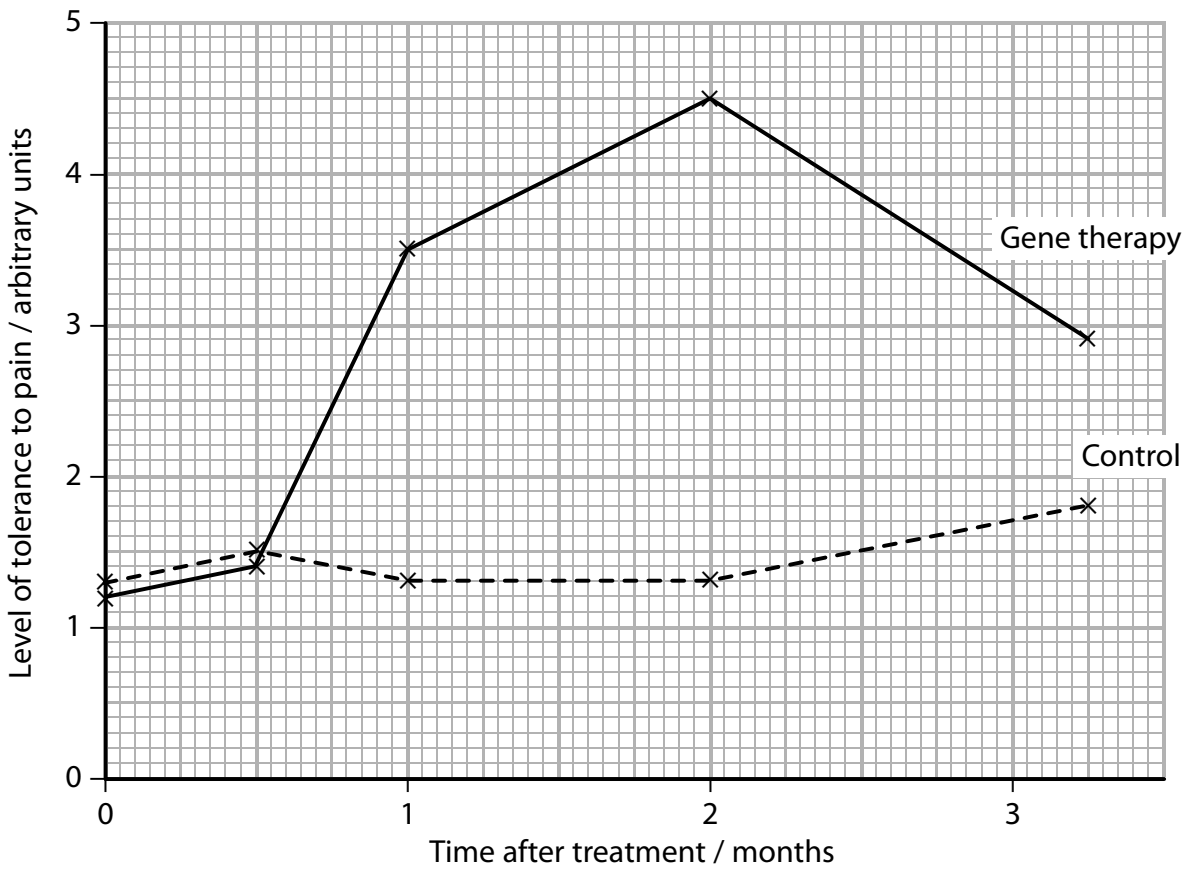
(iii) Suggest why a gene coding for an endorphin was used in this investigation.

(1)

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(iv) The results of this investigation are shown in the graph below.



Using the information in the graph, compare the levels of tolerance to pain in the rats given gene therapy with the control group.

(3)

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(Total for Question 8 = 10 marks)

TOTAL FOR PAPER = 80 MARKS

N 3 5 8 5 0 A 0 2 0 2 0

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Summer 2010

GCE

GCE Biology (6BI01/01)

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Summer 2010

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- write legibly, with accurate use of spelling, grammar and punctuation in order to make the meaning clear
- select and use a form and style of writing appropriate to purpose and to complex subject matter
- organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities.
Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

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GENERAL INFORMATION

The following symbols are used in the mark schemes for all questions:

Symbol	Meaning of symbol
; semi colon	Indicates the end of a marking point
eq	Indicates that credit should be given for other correct alternatives to a word or statement, as discussed in the Standardisation meeting
/ oblique	Words or phrases separated by an oblique are alternatives to each other
{} curly brackets	Indicate the beginning and end of a list of alternatives (separated by obliques) where necessary to avoid confusion
() round brackets	Words inside round brackets are to aid understanding of the marking point but are not required to award the point
[] square brackets	Words inside square brackets are instructions or guidance for examiners
[CE] or [TE]	Consecutive error / transferred error

Crossed out work

If a candidate has crossed out an answer and written new text, the crossed out work can be ignored. If the candidate has crossed out work but written no new text, the crossed out work for that question or part question should be marked, as far as it is possible to do so.

Spelling and clarity

In general, an error made in an early part of a question is penalised when it occurs but not subsequently. The candidate is penalised once only and can gain credit in later parts of the question by correct reasoning from the earlier incorrect answer.

No marks are awarded specifically for quality of language in the written papers, except for the essays in the synoptic paper. Use of English is however taken into account as follows:

- the spelling of technical terms must be sufficiently correct for the answer to be unambiguous
  e.g. for amylase, 'ammalase' is acceptable whereas 'amylose' is not
  e.g. for glycogen, 'glicojen' is acceptable whereas 'glucagen' is not
  e.g. for ileum, 'illeum' is acceptable whereas 'ilium' is not
  e.g. for mitosis, 'mytosis' is acceptable whereas 'meitosis' is not

- candidates must make their meaning clear to the examiner to gain the mark.

- a correct statement that is contradicted by an incorrect statement in the same part of an answer gains no mark – irrelevant material should be ignored

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Question Number	Answer	Mark
1(a)	A ;	**(1)**

Question Number	Answer	Mark
1(b)	C ;	**(1)**

Question Number	Answer	Mark
1(c)	C ;	**(1)**

Question Number	Answer	Mark
1(d)	D ;	**(1)**

Question Number	Answer	Mark
1(e)	D ;	**(1)**

Question Number	Answer	Mark
1(f)	C ;	**(1)**

Question Number	Answer	Mark
1(g)	A ;	**(1)**

Question Number	Answer	Mark
2(a)	1. atria / atrium; 2. aorta ; 3. left ; 4. artery ; 5. vena cava ;	**(5)**

Question Number	Answer	Mark
2 (b)	1. diastole / atrial systole ; 2. the {atrioventricular / bicuspid / tricuspid} valves are open / semi-lunar valves are closed ;	**(2)**

Question Number	Answer	Mark
3(a)(i)	1. phospholipids ; 2. phosphate (head) ; 3. (two) fatty acid (tails) ; 4. reference to location of glycerol ; 5. correct reference to ester bonds ;	**max (3)**

Question Number	Answer	Mark
3(a)(ii)	1. reference to {hydrophilic / polar / charged} part ; 2. reference to {hydrophobic / non polar / uncharged} part ; 3. reference to orientation of molecule in relation to water; 4. idea that aqueous environment is {on two sides / cytoplasm and {environment / tissue fluid / eq}} ;	**max (3)**

Question Number	Answer	Mark
3(b)	**Active transport:** 1. idea that molecule {binds / fits into} {protein / carriers} ; 2. idea that {protein / carrier} changes shape ; 3. (molecules move) against a concentration gradient / eq ; 4. reference to use of {ATP / energy} ; [Submax 2 marks] **Facilitated diffusion:** 5. reference to proteins as {channels / gates / pores / carriers} ; 6. idea that {channels can open or close / carriers change shape} ; 7. for {large / polar / charged} molecules (to pass through membrane) ; 8. (molecules move) down a concentration gradient / eq ; [Submax 2 marks]	**max (3)**

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Question Number	Answer	Mark
3(c)(i)	1. idea that both types of protein in fused cell in correct context ; 2. idea that the proteins are {intermingled / mixed / eq} ; 3. same original number of protein / eq ;	**max (2)**

Question Number	Answer	Mark
3(c)(ii)	1. idea that {phospholipids / molecule A} allow {fluidity / movement/ eq} ; 2. idea that {fluidity / movement / eq} allow membranes to fuse; 3. idea that {fluidity / movement / eq} allows protein to {move / intermingle / eq} ;	**max (2)**

Question Number	Answer	Mark
4(a)(i)	1. idea that frequent cocaine use results in {higher / an increase in / eq } levels in both blood components (compared to occasional use) ; 2. correct manipulation of figures to approximate the increase in levels of one of the blood components ; 3. frequent use increases fibrinogen beyond normal range / eq ; 4. idea that the levels of both the blood components are within the range for normal levels in occasional users ;	**max (3)**

Question Number	Answer	Mark
4(a)(ii)	**Any one of the following ideas** 1. the levels are given as a {range / not one level / blood components within normal level range} 2. no indication of data analysis e.g. spread of data, statistics 3. no indication of number in {samples / study / eq} 4. no indication of other variables / named variable / eq ;	**max (1)**

Question Number	Answer	Mark
4(b)	(QWC – Spelling of technical terms *(shown in italics)* must be correct and the answer must be organised in a logical sequence) 1. idea that *von Willebrand* factor results in *platelets* sticking to {the endothelium /each other} ; 2. reference to release of *thromboplastin* (from *platelets*) ; 3. (as a result) the blood clotting process is triggered / eq ; 4. credit one correct detail of clotting process ; 5. reference to more *fibrinogen* resulting in the clot {being larger / growing faster } ; 6. reference to *von Willebrand* factor making the *platelets* stickier ; 7. as a result of {*platelet* stickiness /platelets sticking together} the {clot grows faster / blood flow is decreased / eq} ; 8. If the blood is flowing slower then there is an increased chance of blood clotting / eq ;	**max (4)**

Question Number	Answer	Mark
4(c)	1. idea that a correlation is {a relationship between two factors / when one factor changes another factor changes} ; 2. fibrinogen increases with (cocaine) use / eq ; 3. heart attacks increase with cocaine use / eq ; 4. idea that increased fibrinogen levels have not been shown to result in the increase in heart disease ;	**max (2)**

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Question Number	Answer	Mark
***5(a) QWC**	(QWC – Spelling of technical terms *(shown in italics)* must be correct and the answer must be organised in a logical sequence) 1. reference to CFTR {protein / channel} eq ; 2. reference to a different {amino acid / sequence of amino acids / eq} (on defective CFTR protein) ; 3. reference to change in protein ; 4. reference to role of protein in transporting chloride ions ; 5. reference to (chloride) ions not {moving out of cells / going into mucus} ; 6. reference to sodium ions moving in ; 7. water does not move out (of cells) / water moves in (to cells) /eq ; 8. by osmosis / eq ; 9. mucus (on cell surface) {is not diluted / becomes thicker / becomes stickier} / eq ; 10. (thickened mucus) cannot be moved by {cilia / coughing} ;	**max (5)**

Question Number	Answer	Mark
5(b)(i)	1. idea that mucus {traps / eq} {bacteria / pathogens} ; 2. idea that {bacteria / mucus containing the bacteria} cannot be removed (by cilia); 3. idea that mucus provides conditions for bacteria to {live / grow / develop / eq} ; 4. reference to antibodies not being effective ; 5. reference to trauma caused by coughing ; 6. idea that resident {phagocytes / macrophages} cannot destroy bacteria ;	**max (2)**

Question Number	Answer	Mark
5(b)(ii)	1. {increase / eq} with age ; 2. (increases) {from 0 to 25 / up to 25} ; 3. {constant /eq} 25 to 35 ; 4. {decreases / eq} 35 to 45 ; 5. credit correct manipulation of figures ;	**max (3)**

Question Number	Answer	Mark
5(b)(iii)	1. Overall increase in P and decrease in S ; 2. At 0 more S than P / between 0 and 7 years S is greater than P ; 3. After 7 years P is greater than S ; 4. S starts to decrease at year 15 but P {decreases at 35 years / continues to increase} ; 5. Maximum P is greater than maximum S ; 6. S {stays constant / is at its highest} between 10 and 15 years but P {stays constant / is at its highest} between 25 and 35 years ;	**max (2)**

Question Number	Answer	Mark
6(a)	1. reference to {enzymes / biological catalysts} reducing activation energy / eq ; **Biological catalyst** 2. produced by {organisms /cells}; 3. speeds up (rate of) {reactions / processes} / eq ; **Activation energy** 4. energy needed for a reaction to occur / eq ; 5. By causing bonds to {break / weaken / form} / by increasing the number of collisions / eq ;	**max (4)**

Question Number	Answer	Mark
6(b)	1. idea that there should be enough substrate molecules to saturate the enzyme ; 2. (to ensure that) substrate is not a limiting factor/ eq ; 3. {fastest / highest} rate / decreases after initial rate / eq ; 4. as reaction proceeds substrate concentration decreases / eq ; 5. as substrate gets used up {by enzyme / in reaction / eq } ; 6. substrate concentration should be constant (in each test) / eq ;	**max (2)**

Question Number	Answer	Mark
6(c)	**Any two pairs** pH ; buffer ; temperature ; water bath ; not room temperature time of reaction ; stopwatch ; volume of {enzyme / substrate} ; not amount measuring cylinder / pipette ; type of enzyme ; same batch of enzyme ;	**(4)**

Question Number	Answer	Mark
7(a)(i)	Any **two** from: genetic, diet qualified, increasing age, male, high blood pressure, smoking, {inactivity / lack of exercise / eq} ;	**(1)**

Question Number	Answer	Mark
7(a)(ii)	1. idea that it makes the {results / data / study} {representative / reliable} ; 2. idea that there are {many potential risk factors / large variation between individuals}; 3. idea that side effects more likely to show up ;	**max (2)**

Question Number	Answer	Mark
7(b)	same treatment method as for drug S e.g. solvent used for drug S / saline / water / sugar tablet / empty capsule / eq ;	**(1)**

Question Number	Answer	Mark
7(c)	idea that {CVD is not an immediate disease / side effects may take time to become apparent / need to see if drug works over a long time} ;	**(1)**

Question Number	Answer	Mark
7(d)	1. the number of {deaths / all events / eq} is {similar to / no higher than / less than} placebo group ; 2. Credit correct manipulation of figures ;	**(2)**

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Question Number	Answer	Mark
7(e)(i)	1. correct values selected (8.7 and 11.8) ; 2. correct subtraction (11.8 – 8.7 = 3.1); 3. correct multiplication by 10 000 ÷ 100 ; [Consequential errors apply]	**(3)**

Question Number	Answer	Mark
7(e)(ii)	it has been shown to reduce {CVD / stroke} / eq ;	**(1)**

Question Number	Answer	Mark
8(a)	1. tumour has {decreased in size / grown less / eq} ; 2. decrease in size quantified ; 3. rats survive longer / eq ; 4. idea that {more rats survive / higher survival rate / lower death rate} ; 5. 80% ;	**max (3)**

Question Number	Answer	Mark
8(b)(i)	1. reference to (virus acting as a) vector ; 2. idea that virus is used to get the {gene / DNA} into the cells ;	**(2)**

Question Number	Answer	Mark
8(b)(ii)	reference to {neurones in spinal cord / endorphins being made in spinal cord / spinal cord connects to brain / eq} ;	**(1)**

Question Number	Answer	Mark
8(b)(iii)	idea that endorphins have pain-reducing properties / more {endorphins / endorphins secreting cells} produced ;	**(1)**

Question Number	Answer	Mark
8(b)(iv)	1. {little change / eq} in control but treated rats {rise and fall / eq} ; 2. in first {2 weeks / ½ month} level of tolerance is {(almost) the same in both groups slightly higher in control group} / eq ; 3. after the first 2 weeks the level of tolerance is higher in the rats given gene therapy / eq ; 4. between 2 weeks and 2 months there is an increase in tolerance in rats given gene therapy but control group {remains the same / drops (slightly)} / eq ; 5. ref to decrease in tolerance in group given gene therapy {in last month / after two months} and (slight) increase in control group ; 6. credit correct comparative manipulation of figures ;	**max (3)**

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