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Examiners' Report
June 2016

IAL Biology WBI01 01

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Introduction

This paper tested the knowledge and understanding of the two AS topics: 'Lifestyle, health and risk' and 'Genes and health', together with elements of How Science Works. The range of questions provided plenty of opportunity for candidates to demonstrate their grasp of these AS topics. On the whole, candidates coped well with this paper, finding most of the questions straightforward to tackle; indeed, there were very few examples of questions not being attempted at all, with all questions achieving the full spread of marks.

It was pleasing to see how well many candidates could recall several areas of the specification in a good level of detail. It was also very pleasing to see very few candidates losing marks for poor quality of written communication (QWC) with many producing clear answers, set out in a logical style with key biological terms spelt correctly.

Some candidates let themselves down by not reading the questions carefully enough, or by providing a response without the detail required at this level.

Many candidates have clearly made good use of past papers and mark schemes, but it is important for candidates to understand the scientific principles covered in the specification so they can apply them to new contexts and not write a rehearsed answer to a question that has been asked in the past.

Question 1 (a) (i)

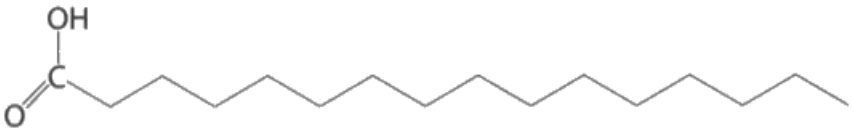
Many candidates provided a good description of the fatty acid and gained a maximum of two marks. However, some candidates struggled to provide a creditworthy description.

Simply stating that oleic acid has a double bond is not sufficient. In order to gain marking point 3 candidates needed to make it clear that they were describing the presence of a single carbon carbon double bond. To gain marking point 1 candidates needed to identify the group at the end of the fatty acid chain as a carboxylic acid or carboxyl group. Simply writing COOH was not sufficient for marking point 1.

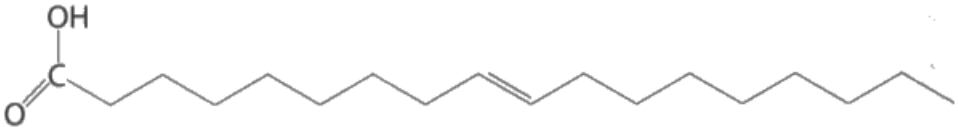
1 Triglycerides are synthesised from glycerol and fatty acids.

(a) The diagrams below show the structures of three fatty acids and their melting temperatures.

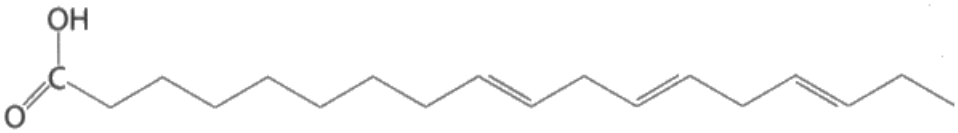
palmitic acid 63 °C



oleic acid 14 °C



linolenic acid –5 °C



(i) Using the diagrams above, describe the structure of oleic acid.

(2)

oleic acid has a long hydrocarbon chain made up of 18 carbons and a -COOH group. It has one C=C double bond which means it is unsaturated, kinked shape.

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Examiner Comments

This response gained marking point 3 for mono-unsaturated. Reference to kinks was ignored so 'one kink' by itself would not be sufficient.

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Examiner Tip

Biochemistry is important. Make sure you understand and learn the biochemistry aspects of unit 1.

(i) Using the diagrams above, describe the structure of oleic acid.

(2)

Oleic acid has chain-like structure and contains one kink. This one kink means it is mono-unsaturated.

ResultsPlus
Examiner Comments

This response gained two marks: marking point 2 for long hydrocarbon chain and marking point 3 for one carbon carbon double bond. Reference to -COOH was ignored. To gain marking point 1 candidates need to name the group as being a carboxylic acid group.

Question 1 (a) (ii)

While many good answers were seen, this question proved challenging to the majority of candidates. Many candidates recognised and described the general trend in melting temperature for the first marking point; some then went on to link this to 'kinks' in the fatty acid chain for the second marking point. However, very few went any further and linked the shape of the hydrocarbon chain to packing and the strength of intermolecular forces between the hydrocarbon chains.

A disappointing number of candidates suggested that the trend in melting temperature could be explained by the idea that carbon double bonds themselves are weaker or more easily broken.

(ii) Using the information in the diagrams, explain why these fatty acids have different melting temperatures.

(3)

Each acid has a different number of double bonds. The more double bonds the lower the melting temperature. This is because less energy is needed to break double bonds, so the melting temperature is lower.

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Examiner Comments

In this response the candidate correctly describes the trend that as the number of carbon carbon double bonds increases the melting temperature decreases and gains marking point 1. Unfortunately a correct explanation for the trend does not involve the breaking of double bonds so the reset of the response gained no additional marks.

Question 1 (b) (i)

This question proved straightforward for most candidates, although many forgot to show water as a product of the reaction.

Question 1 (b) (ii)

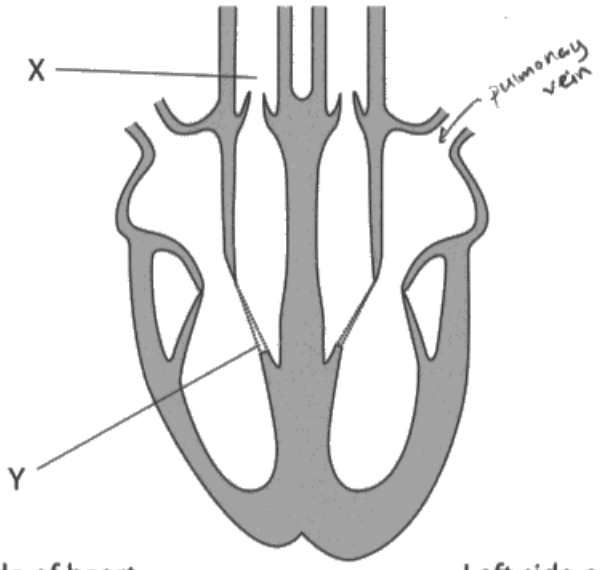
Another very straightforward question for which most candidates gained a mark.

Question 2 (a)

The majority of candidates that provided an answer gave a correct response and gained the mark. However, many candidates left this question blank.

2 The diagram below shows a section of a human heart and its blood vessels.

(a) On the diagram, draw arrows to show the flow of blood through the left side of the heart.



(1)

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Examiner Comments

This response did not gain the mark. Although the candidate has shown blood correctly entering the left atrium they have not completed the diagram to show blood leaving the left ventricle.

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Examiner Tip

Take care when asked to label or add to a diagram. Make sure you provide a complete answer.

Question 2 (c)

This question was discriminating with the full range of marks observed. Marking points one and two were most frequently observed. Many candidates also expressed the idea that the low pressure in the pulmonary circuit protects the alveoli capillary network (marking point 4). The idea of maintaining a concentration gradient (marking point 3) and high pressure in the systemic circuit delivering oxygen to body cells (marking point 5) were often not sufficiently clearly expressed to gain credit.

(c) In mammals, blood passes through the heart twice for each circulation of the body.

Suggest how this type of circulation enables mammals to carry out effective gas exchange.

(3)

A donble pnmp allows delivery and removal of raw materials aronnd the body to be more etticient than if it were by dithnsion which wonld be too slow. A double pnmp allows blood to remove oxygen and raw materials from the alveolis in gas exchange and this keeps the concentration gradien high. Some mammals have a very high metabolic rate so this "donble pnmp" is much more ettective. Blood will constantly be removing oxygen and snpplying it to vital organs qnicker and removing carbon dioxide and metabolic waste at a faster more ett ici ent way dne to the donble circulation of blood.

(Total for Question 2 = 6 marks)

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Examiner Comments

In this response the candidate gains marking point 2 for separation of oxygen rich and oxygen depleted blood, marking point 3 for the idea of maintaining a steep concentration gradient and marking point 4 for the idea that relatively low pressure in the pulmonary circuit protects the delicate structures of the lung. This response would not have gained marking point 1 as there is no mention of the systemic circuit.

(c) In mammals, blood passes through the heart twice for each circulation of the body.

Suggest how this type of circulation enables mammals to carry out effective gas exchange.

(3)

It separates oxygenated from deoxygenated blood. This makes sure only deoxygenated blood reaches the lungs. Gas exchange is therefor more efficient because there is steep O_2 gradient between the alveoli and the blood flowing through the capillaries that ensures O_2 diffuses into the deoxygenated blood. Double circulation pumps blood to the lungs at low pressure to avoid damaging the lungs.

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Examiner Comments

In this response the candidate has not focussed on the question asked and much of the answer lacks detail and clarity. Only marking point 3 was awarded, lines 3 - 6.

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Examiner Tip

Read questions carefully. This question asks what it is about the double circulation system that allows for efficient gas exchange. Many candidates answered 'why do mammals need a circulation system?' - which is a different question.

Question 3 (a) (i)

This question proved very straightforward and many candidates gained the maximum of three marks. Those candidates that did not gain full marks often failed to make a full comparison and focussed only on differences between the molecules.

Some candidates made reference to differences in 1,4 and 1,4 – 1,6 bonds gaining marking point 4 but as they made no reference to glycosidic bonds they failed to get marking point 3. A number of candidates described amylose as straight chains and amylopectin as branched and did not get marking point 5. References to β glucose and incorrect bonds e.g. peptide bonds, negated marking points 2 and 3.

3 Carbohydrates, such as starch and lactose, are important energy sources.

(a) Starch contains amylose and amylopectin.

(i) Compare the structures of amylose and amylopectin.

(3)

Amylose is ~~a~~ an unbranched molecule. It contains 1,4 glycosidic bonds only, and it coils into a spiral.

Amylopectin is a branched molecule. It contains 1,4 and 1,6 glycosidic bonds, and has a larger number of end molecules compared to amylose.

ResultsPlus
Examiner Comments

This clearly expressed response gained marking points 3, 4 and 5.

ResultsPlus
Examiner Tip

When making a comparison, the answer does not need to be in prose. A neatly laid out table can gain full marks and might help you make a complete comparison.

Question 3 (a) (ii)

Many candidates recognised that the branched structure of amylopectin was important and gained the first marking point. Very few candidates then linked this to the rapid release of glucose units. A disappointing number of candidates suggested or implied that it was the hydrolysis of the glycosidic bonds that released energy.

(ii) Explain how the structure of amylopectin affects its ability to provide energy.

(2)

Since amylopectin is branched, and also ~~was~~ contains many glucose monomers. It can be broken down quite easily to release these glucose ~~monomers~~. The glucose then provides energy.

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Examiner Comments

For this response the candidate gained marking point 1 for the idea that amylopectin is branched. The candidate then suggests that amylopectin can be more easily broken down into glucose monomers. References to ease of breaking glycosidic bonds were ignored. Marking point 2 was for the idea of more rapid release of glucose.

ResultsPlus
Examiner Tip

Take care with descriptive words, for example, easily and rapidly mean different things. You should take time to make sure you are using the appropriate term.

(ii) Explain how the structure of amylopectin affects its ability to provide energy.

(2)

amylopectin is a branched chain of glucose with 1,4 and 1,6 glycosidic bonds. It has loads of side branches that allow the enzymes that break it down reach the glycosidic bonds and release glucose (energy) quickly.

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Examiner Comments

This candidate has gained both marking points 1 and 2. The first marking point was for the idea that amylopectin is branched. The second marking point was for linking the branched structure to the speed at which glucose molecules can be released from the amylopectin.

ResultsPlus
Examiner Tip

Take care with the way you express your biological knowledge and understanding. Many candidates suggested that branching of amylopectin allows the more rapid release of energy; the implication being that it was the hydrolysis of amylopectin that releases energy, which is incorrect.

Question 3 (b)

Many candidates were able to state that lactose was a disaccharide and starch a polysaccharide (marking point 1). Less frequently candidates described lactose as being formed from glucose and galactose and starch being formed from glucose alone (marking point 2). Marking point 3 was seen infrequently.

(b) Milk contains between 2% and 8% lactose by weight.

State **one** difference between the structure of lactose and the structure of starch.

(1)

lactose is made up of galactose and glucose and starch is made up of glucose and fructose.

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Examiner Comments

This response did not gain any marks. Although the candidate has correctly identified that lactose is made from glucose and galactose they have then incorrectly suggested that starch is formed from glucose and fructose.

Question 3 (c) (i)

This question proved very straightforward and most candidates gained the mark.

Question 3 (c) (ii)

Candidates generally scored well on this question frequently gaining both marks.

Question 3 (c) (iii)

Another question that was answered well by many candidates. The majority of candidates gained the mark for either the first or second marking point. Marking point 3 was infrequently awarded. This mark was for the idea that all variables or factors have not been identified and not simply for naming an additional factor or variable that may be involved. Answers making reference to newspapers being unreliable, or milk being good for you, were ignored.

(iii) A newspaper report claimed this study proved that drinking large quantities of milk increased the risk of death.

Suggest why this claim may not be true.

(1)

correlation does not show causation. Other factors meant might be responsible such as smoking and diet / medical history.

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Examiner Comments

In this response the candidate provided an answer that could be awarded either marking point 1 or 3. Note for marking point 3 it is the idea that other factors might be responsible, and not the named examples that gains the mark.

Question 4 (b) (i)

The availability of six marking points made this a very accessible question. Although many candidates gained all four available marks the answers provided were often incomplete or contained some elements that were incorrect. For marking points 2 and 4 simple description of the change e.g. prothrombin is converted into thrombin was not sufficient for the mark. It needs to be clear that something e.g. thromboplastin was carrying out the conversion.

(b) Atherosclerosis leads to an increased risk of blood clotting.

(i) Describe the blood clotting process.

(4)

After an inflammatory response, platelets and white blood cells attach to the damaged endothelial layer. This creates an atheroma. With this hardening plaque also forms. Calcium binds to the atheroma. Blood clotting reduces blood flow in the arteries possibly leading to a heart attack.

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Examiner Comments

This is an example of a reasonably complete and well expressed response. All six marking points could be awarded.

(b) Atherosclerosis leads to an increased risk of blood clotting.

(i) Describe the blood clotting process.

(4)

Platelets release thromboplastin. Thromboplastin is an enzyme that catalyses the conversion of prothrombin to thrombin ~~with~~ in the presence of calcium ions. Thrombin is an enzyme that catalyses the conversion of fibrinogen (a plasma protein) to fibrin. Fibrin is a fibrous protein that forms a mesh at the damaged area in the ~~of~~ endothelial lining. Platelets and blood cells get caught in the fibrin mesh, forming a blood clot.

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Examiner Comments

This response does not address the question and gains no marks. The candidate appears to have seen atherosclerosis in the stem of the question and ignored the actual question in (i).

ResultsPlus
Examiner Tip

Read questions carefully. Make sure you answer the question that is asked.

Question 4 (b) (ii)

Many candidates gained both marks for two suitable treatments. Frequently seen incorrect responses included changes in lifestyle, such as low fat diet or more exercise, or the use of anti-hypertensives. The question was about treatments and not lifestyle changes that reduce the risk of coagulation. Statins were accepted not because of their lipid lowering activity but because of their anticoagulant activity.

Many candidates provided several answers on each answer line. When they did this only the first response on each answer line was marked.

(ii) Name **two** treatments that can reduce the risk of blood clots forming.

(2)

1 Antihypertensive Drugs (e.g. Diuretics, ACE inhibitors)

2 Anticoagulants (e.g. warfarin, Aspirin...)

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Examiner Comments

In this response, on line 1 antihypertensives is incorrect so the first mark cannot be awarded. On line 2 the candidate has listed anticoagulant, warfarin and aspirin. Although all three responses could gain a mark only the first response on the line is marked so the candidate gains one mark.

ResultsPlus
Examiner Tip

When you are given answer lines and are asked to provide simple pieces of information e.g. the name of a drug, a treatment or a variable, the examiner will only mark the first response on the answer line.

Question 4 (c) (i)

Candidates who interpreted the graph correctly gained both available marks. The most frequently seen incorrect responses involved candidates describing increases in systolic blood pressure with garlic.

(i) Using the information in the graph, describe the effect of eating beetroot and garlic on blood pressure.

(2)

The mean systolic blood pressure is higher when you eat garlic than when you eat beetroot. There is a 0.2kPa difference between them, the beetroot has a mean systolic blood pressure of 17.1kPa and the garlic has 17.3kPa.

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Examiner Comments

In this response the candidate has described the results without actually answering the question. To gain marks the effects of beetroot and garlic must be compared to the control.

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Examiner Tip

If you are given values for a control don't ignore them. Think about how any test conditions compare with each other and with the control.

(i) Using the information in the graph, describe the effect of eating beetroot and garlic on blood pressure.

(2)

Eating beetroot and garlic reduces blood pressure ~~Beet~~ Beetroot is more effective than garlic as it reduce blood pressure by a more significant amount, by 3.9% compared to a 2.8% decrease for garlic in blood pressure.

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Examiner Comments

In this response the candidate has gained both available marks. These could be awarded for marking points 1, 2 or 3.

Question 4 (c) (ii)

This proved to be a straightforward question that many candidates answered correctly. Marking point 1 and 2 were the most frequently seen. Marking points 3, 4 and 5 were also seen on occasion. Marking point 6 was seen very infrequently.

(ii) Suggest **two** ways in which the design of this study could be improved.

(2)

1 We a bigger sample (e.g. 200 people).

2 Include female volunteers as well.

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Examiner Comments

This was a fairly typical response that gained two marks, marking points 1 and 2.

(ii) Suggest **two** ways in which the design of this study could be improved.

(2)

1 Range bars could have been added.

2 A larger group of volunteers could have been used.

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Examiner Comments

The question asks how the study could be improved. Since the study was focussed on the effect of beetroot and garlic, suggestions of using different food supplements or of methods of data analysis (e.g. range bars or calculate mean values) were ignored. This response gained one mark for suggesting use of a larger sample size (marking point 1).

Question 5 (a) (i)

This question proved surprisingly difficult for many candidates.

Candidates were not asked what genotype meant in terms of a specific trait. Rather they were asked what the genotype of an organism is. Two alternative answers were accepted. Candidates could gain the mark for the preferred response that the genotype of an organism is the genetic constitution of an organism. However, an alternative response in terms of the alleles for a particular trait was also accepted on this occasion.

5 The genotype and phenotype of an individual can be affected by gene mutations.

(a) Explain what is meant by each of the following terms.

(i) Genotype

(1)

The genetic make up of ~~the~~ an organism.

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Examiner Comments

The question was not given in the context of a specific gene or condition. This is an example of the expected or preferred response.

5 The genotype and phenotype of an individual can be affected by gene mutations.

(a) Explain what is meant by each of the following terms.

(i) Genotype

(1)

The alleles present in a gene at a particular gene locus of ~~a~~ homologous chromosomes.

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Examiner Comments

The question is about an individual's genotype and not the genotype of a particular trait. However, on this occasion, although not the preferred response, answers in terms of a particular gene or locus were credited. This response gained the mark.

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Examiner Tip

Terms such as genotype may have slightly different meaning depending on the context in which they are used. An individual's genotype is all the genes and alleles of the individual, their 'genetic make-up'. In contrast the genotype of a particular gene or trait refers to the inherited alleles for that particular gene or trait.

Question 5 (a) (ii)

Many candidates gained the first marking point suggesting that the phenotype is all the characteristics of an organism. Some went on express the idea that phenotype is determined by genes and the environment gaining the second mark. Again, on this occasion responses were accepted in terms of the whole organism or of a particular trait.

(ii) Phenotype

(2)

The observable characteristics due to a certain genotype inherited by their parents such as hair colour or eye colour

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In this response the candidate has forgotten to mention the role of the environment in determining the phenotype. Marking point 1 was awarded but not marking point 2.

(ii) Phenotype

(2)

Phenotype is the observable features of an organisms produced by ~~both~~ ~~th~~ the influence of both environment and the genes.

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Examiner Comments

This response gained both marking point 1 and 2.

Question 5 (b) (iii)

Those candidates who answered in the context of the question generally scored well on this question.

Marking points 1 and 3 were frequently seen. Marking point 2 was seen on occasion. However, many candidates simply suggested injecting the vector into the blood or 'the appropriate tissue' and did not gain the mark. Some candidates described engineering of embryonic stem cells which would be of no benefit to the patients described in the question.

(iii) Explain how gene therapy could be used to treat individuals with LCA.

(3)

Indentify and isolate a normal gene which is not affected by LCA. Insert this normal gene into a vector (virus/lysosome). Insert the vector into the host, (bone marrow). During DNA replication, the new DNA formed would not ge be detected but normal.

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Examiner Comments

This type of question needs to be answered in the context of the question. Here the candidate has gained marking points 1 and 3. Identify and isolate the normal gene was accepted for marking point 1 and the use of an appropriate vector was accepted for marking point 3.

Question 6 (a)

This question was straightforward for most candidates. However, in order to gain marks they needed to correctly name the sugar as deoxyribose; pentose sugar was not accepted.

Question 6 (b)

Even with four marking points being available many candidates did not achieve the maximum of two marks. Many of the responses seen only addressed one aspect of the formation of a DNA molecule. Some described the formation of phosphodiester bonds without mention of DNA polymerase and gained one mark. Others made reference to the idea of hydrogen bonding or complementary base pairing but not to both so again only gained one mark. Very few complete answers were seen.

(b) Explain how mononucleotides combine to form a DNA molecule.

(2)

DNA polymerase catalyses the formation of phosphodiester bonds. Then the two strands are joined together by hydrogen bonds to form the double helix.

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Examiner Comments

The candidate gained two marks for this response: marking point 1 for the formation of phosphodiester bonds and marking point 2 for a correct reference to DNA polymerase. Although the candidate mentions hydrogen bonding, the response would not have gained marking point 4, as it is not made clear that the hydrogen bonding is between bases.

Question 6 (c) (i)

A surprising number of candidates struggled to compare DNA and RNA. Many incorrect assertions were made, e.g. hydrogen bonding is seen in DNA but not in RNA, or 'DNA carries genetic information but RNA does not'. Many comparisons did not relate to structure, e.g. 'DNA is found in the nucleus, RNA is found throughout the cell'.

However, the biggest problem was that candidates often failed to provide a complete comparison e.g. 'RNA contains uracil' or 'RNA contains uracil rather than thymine'. If candidates did not make clear reference to both DNA and RNA the marking point was not awarded.

(c) RNA is another nucleic acid.

(i) Give **two** differences between the structure of RNA and the structure of DNA.

(2)

1 RNA is single strand as DNA is double strand.

2 There is only 1 type of DNA but RNA there is mRNA, tRNA and ribosomal RNA

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Examiner Comments

The candidate has made one valid comparison between the structure of DNA and RNA and gains one mark, for marking point 2. The second comparison is about the different types of nucleic acids and is not addressing the question about differences in structure, so gains no credit.

(c) RNA is another nucleic acid.

(i) Give **two** differences between the structure of RNA and the structure of DNA.

(2)

1 RNA contains ribose sugar, DNA contains deoxyribose sugar

2 RNA is a single strand thread like structure, DNA is coiled structure consisting of 2 strands.

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Examiner Comments

In this response the candidate has made two clear and complete comparisons and gains both marks.

Question 6 (c) (ii)

This question was reasonably discriminating with a good range of marks awarded. However, a disappointing number of candidates went into far too much detail of transcription and translation. In Unit 1, candidates are only expected to know these processes in outline. Marks were lost when candidates contradicted themselves or omitted important concepts.

*(ii) Describe the roles of RNA molecules in protein synthesis.

(5)

RNA is present in both translation and transcription in protein synthesis as tRNA and mRNA respectively. First, in transcription, hydrogen bonds break between bases via the RNA helicase enzyme. Nucleotides form complementary base pairs creating and mRNA as an antisense strand of the DNA. the mRNA then leaves the nucleus via the nuclear pores. In translation, the mRNA attaches to the ribosome. tRNA transports specific ~~pro~~ amino acids to the ribosome. Each mRNA codon codes for a specific amino acid. The anticodon and codon interaction form complementary base pairs. The neighbouring amino acids then form peptide bonds, producing a polypeptide (protein).

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Examiner Comments

This response gained five marks. Marking point 1 (lines 2 to 4), marking point 2 (lines 4 and 5), marking point 4 (lines 5 and 6) and marking points 5 and 6 (lines 6 and 7). The simple statement that, 'RNA is present in both translation and transcription ...', (line 1 and 2) was not sufficient, by itself, for either marking point 1 or 7.

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Examiner Tip

Scientific vocabulary is important but it needs to be used as part of a sensible answer. Simply stating scientific terms will not gain credit.

In this question, 'mRNA is produced by transcription' or 'mRNA is translated at the ribosome' would be acceptable for marking points 1 and 7 respectively. In contrast, 'RNA is transcribed and translated' is not sufficient for either mark.

Question 7 (a)

Many candidates have a good understanding of the role of phospholipids in the formation of a cell membrane and this question was answered well by most candidates.

7 Molecules are transported through cell membranes in a number of different ways.

(a) Explain the role of phospholipids in the formation of a cell membrane.

(3)

Phospholipids have a phosphate head which is hydrophillic so attracts water and A fatty acid tail which is hydrophobic so repels water. Therefore the phosphate head stays out where water is present hiding the fatty acid tails. This forms a monolayer. Two of these monolayers forms a bilayer. The ~~The~~

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Examiner Comments

In this response, the candidate has explained how the properties of the phospholipids contribute to the formation of a cell membrane and gains all three available marks.

Question 7 (c) (i)

This question assesses candidates' ability to recognise an example of facilitated diffusion. The first mark is for suggesting facilitated diffusion and the second for a correct reference to the role of concentration gradient.

For the second mark the candidates needed to make it clear diffusion was from a region of high concentration to a region of low concentration, i.e. down a concentration gradient. Terms such as with the concentration gradient or across a concentration gradient were ignored.

(i) The transport of glucose across the cell membranes of liver cells does **not** require energy.

Using information in the diagram, suggest how glucose is taken into liver cells from the blood.

(2)

By diffusion, glucose moleecules from the region of high concentration (blood) to region of low concentration (inside the liver cells), down a concentration gradient, without energy.

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Examiner Comments

Here the candidate has correctly suggested that glucose is diffusing into the cells from a region of high concentration to a region of low glucose concentration, gaining marking point 2. However, the role of the membrane protein has been missed and the candidate does not gain marking point 1. Use of the term 'facilitated diffusion' or a description of diffusion through a membrane protein would have gained marking point 1.

ResultsPlus
Examiner Tip

Take care when describing concentration gradients. A full description is best, 'diffusion from a region of high concentration to a region of low concentration'. The use of terms such as 'along', 'across' or 'with' a concentration gradient are ambiguous and cannot be credited.

Question 7 (c) (ii)

This question asks for an explanation as to how insulin might increase the rate of uptake of glucose. The first marking point is for the suggestion that insulin lowers the concentration of glucose in the cell. The second marking point is that this results in a steeper concentration gradient. The idea that the diffusion gradient is steeper is important as it links to the idea of a faster rate of uptake. A disappointing number of candidates gave explanations in terms of enzymes lowering the activation energies of reactions.

(ii) The hormone insulin activates an enzyme that converts glucose to glycogen in liver cells.

Explain how insulin increases the rate at which glucose is taken into liver cells.

(2)

As the insulin converts glucose to glycogen, the glucose concentration in the liver cells reduce. So the concentration of glucose in the blood is more than in the liver cell. this increases the rate at which glucose is taken into liver cells.

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Examiner Comments

In this response the candidate has correctly suggested that the concentration of glucose inside the liver cell will fall, gaining marking point 1. The second mark is for suggesting that the glucose concentration gradient across the cell membrane becomes steeper. In this response the candidate simply states that the glucose concentration in the blood is higher than in the cell. As the question asks about an increased rate of uptake, this was not considered to be sufficient to gain the second mark.

(ii) The hormone insulin activates an enzyme that converts glucose to glycogen in liver cells.

Explain how insulin increases the rate at which glucose is taken into liver cells.

(2)

When glucose is converted into glycogen, the concentration of glucose in the liver cells decreases further, therefore max the concentration gradient becomes steeper, thus, more rapid uptake of glucose, according to the Fick's Law.

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Examiner Comments

This is an example of a clear explanation that gained both available marks.

Question 7 (d)

This question was answered well by the majority of candidates and all five marking points were frequently seen.

A number of candidates described in detail how a mutation could result in a change in protein structure even though this was not the focus of the question.

(d) Cystic fibrosis is caused by a mutation in the CTFR gene.

Suggest how mutations in the CTFR gene affect the movement of water through cell membranes.

(4)

~~A mutation~~ Cystic fibrosis doesn't inhibit the sodium channel therefore Na^+ ions will move into the cell. Furthermore the chloride pump doesn't move Cl^- ions out of the cell. This means that there will be a high concentration of Na^+ and Cl^- ions inside the cell therefore water will not leave the cell by osmosis. Leaving the mucus sticky

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Examiner Comments

This candidate has ignored the idea that the mutation in the CFTR gene results in a change in the primary structure of the CFTR protein, which results in a non-functional protein (marking points 1 and 2). However, they have described the rest of the story, with the chloride ions remaining in the cells (marking point 3), and water not moving out of the cell by osmosis (marking point 4 and 5).

(d) Cystic fibrosis is caused by a mutation in the CTFR gene.

Suggest how mutations in the CTFR gene affect the movement of water through cell membranes.

(4)

- Mutation in the CFTR gene will result in a faulty CFTR protein being formed due to alteration of the structure of the protein
- Mutated CFTR gene will result in the CFTR protein to not work properly.
- ~~Chloride ions~~ Chloride ions will not be able to leave the cells while Sodium ions will ~~enf~~ entey the cells
- The concentration of ions inside the cell will be greater than the concentration of ions outside the cells.
- So water will move by osmosis from the higher water potential outside the cell to lower water potential inside the cell along the concentration gradient passing through the cell membrane.

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Examiner Comments

This response gained all four available marks for marking points 2, 3, 4 and 5. Marking point 1 could not be awarded as the candidate has not mentioned a change in primary structure. Marking point 2 could be awarded for either of the first two bullet points. Marking point 4 was awarded for a description of water moving from outside the cell to inside the cell. Use of water potential is not in the specification; however, it is used correctly and thus does not negate the mark. Use of the term 'along a concentration gradient' was ignored.

Question 8 (a)

In this question candidates were asked to calculate an initial rate of reaction from a graph. Many candidates were able to calculate the rate correctly. However, relatively few were able to provide suitable units. If an answer line for a calculation does not contain units then candidates should provide any appropriate units. A solidus '/' or negative superscript 'cm^{-3}' and 'min^{-1}' were accepted in place of 'per'.

(a) Calculate the initial rate of hydrolysis for 8 units per cm^3 of pepsin.

Show your working.

$2.5 - 0.5 = 2$

(2)

$\frac{2}{4}$

0.5

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Examiner Comments

In this question the candidate has completed the calculation to get a value of 0.5 gaining the first marking point.

However, the candidate has not provided units so does not get the second marking point.

ResultsPlus
Examiner Tip

If the answer line for a calculation does not include units then you are expected to provide appropriate units.

(a) Calculate the initial rate of hydrolysis for 8 units per cm^3 of pepsin.

Show your working.

$\frac{2.5 - 0.5}{4 - 0} = \frac{2}{4} = 0.5$ mg per $100 cm^3$/ minutes

(2)

0.5 mg per $100 cm^3$/minutes

ResultsPlus
Examiner Comments

In this example the candidate has carried out the calculation correctly and has provided suitable units. A solidus '/' was accepted in place of 'per'.

Question 8 (b)

This question proved challenging for most candidates. Many recognised that as the concentration of pepsin increased so did the rate of hydrolysis and gained marking point 1. A disappointing number suggested that as pepsin concentration increased the rate of reaction decreased. Very few candidates recognised that the relationship was directly proportional, marking point 2. Some candidates did correctly calculate a second rate of reaction to compare with the rate calculated in 8(a) and thus gained marking point 3. Many candidates simply described the shape of the curves and gained no marks.

(b) Using the information in the graph, describe the effect of pepsin concentration on the initial rate of hydrolysis.

/minute

(2)

As the pepsin concentration increases the rate of hydrolysis increases. The initial rate is linear for each. The ~~rate of~~ increase in initial rate increases with increase in pepsin concentration. The initial rate for 8 units/cm³ (0.5) is twice as that for 4 units/cm³. (0.25)

ResultsPlus
Examiner Comments

In this response the candidate has clearly expressed the idea that as the concentration of pepsin increases, the rate of reaction increases gaining marking point 1. The description of the relationship being linear was not considered sufficient for marking point 2. However, the correct calculation of a second rate and its comparison with the rate calculated in 8(a) gains marking point 3.

Question 8 (c)

This was another example of a question that candidates struggled to answer. Although a number of good answers were seen many candidates reverted to incorrect explanations in terms of reduced activation energies. When candidates did attempt to provide a sensible answer, marking points 1 and 2 were often seen. However, marking point 3 was seen less frequently.

(c) Explain the effect of pepsin concentration on the initial rate of hydrolysis.

(3)

As the pepsin concentration increases there are more enzymes and more active site and thus the kinetic energy increases and so does the frequency of collisions thus the ~~initial~~ more enzyme-substrate complex is formed per minute and so initial rate of hydrolysis increases.

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Examiner Comments

In this response the candidate gains all three available marks. Marking point 1 squeezed in between lines 1 and 2, marking point 3 at the beginning of line 3 and more clearly on line 4 and marking point 2 on lines 3-4.

(c) Explain the effect of pepsin concentration on the initial rate of hydrolysis.

(3)

When concentration of pepsin increases, the number of active sites increases and more substrates are able to bind to the active sites, which increases the rate of hydrolysis.

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Examiner Comments

In this response, the candidate has gained marking points 1 and 2. The first was awarded for the clear reference to an increase in the number of active sites; the second for the description of the formation of more enzyme - substrate complexes. However, there is no indication that these increases take place over a fixed time period, i.e. the changes are not linked to rate, so marking point 3 cannot be awarded.

Question 8 (d)

Candidates who answered the question in the context of an enzyme often scored well. Those candidates that simply gave descriptions of the role of the primary structure without linking this to pepsin often only gained marks from the first three marking points. A significant number of candidates appear not to understand what the primary structure of a protein is, often confusing amino acid sequences in proteins and base sequences in polynucleotides.

(d) Suggest how the primary structure of pepsin determines its three-dimensional structure and properties.

(5)

Primary structure is the sequence of amino acid. if the amino acid is changed the structure ~~function~~ of the protein thus the function will change. Primary structures are made in to α helixs and β plates. DNA ~~was~~ twists and unwinds this to make up a globular 3 dimensional structure. which is maintained by hydrogen bonds, ionic bonds and covalent bonds

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Examiner Comments

In this response the candidate gained the maximum of five marks: marking point 1 in line 1, marking point 2 in lines 2-3, and marking point 3 in line 11. Marking point 6 was awarded in lines 13 - 14. The statement about shape of the protein in lines 12 - 13 was not sufficient for this marking point. The last three lines describe the idea of specificity, gaining marking point 7.

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Examiner Tip

Make sure you read questions carefully and provide a complete answer. This question asks you how the primary structure of pepsin (an enzyme) determines its structure and properties. The main properties of enzymes are that they catalyse specific reactions and to do this they have an active site with a particular shape. In addition most enzymes are globular and soluble, properties brought about by the distribution of hydrophobic and hydrophilic R groups.

*(d) Suggest how the primary structure of pepsin determines its three-dimensional structure and properties.

(5)

The primary structure determines the sequence of amino acids in the protein. Therefore this sequence of amino acids determine the position of the bonds being made such as hydrogen bonds to make the secondary structure foldings. The foldings of beta-pleated sheets and alpha-helices of the secondary structure depend on the position of the amino acids to form bonds. Then the position of the folded amino acids in secondary structure determines the positions and types of bonds formed in the tertiary structure. The R groups in the amino acids determines the formation of the di-sulphide bridges, ionic bonds and hydrogen bonds in the tertiary structure. These bonds determine the shape of the enzymes. As enzymes have specific active sites the bonding and folding determines the shape of the active site. The active sites are specifically shaped for each substrate molecule. to fit and form products. So the function of the enzyme depend on the bonds formed. The

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Examiner Comments

For this response the candidate was awarded two marks. Marking point 1 was given in lines 1 and 2. The comment about changing amino acids (lines 2 - 3) was not relevant and was ignored. The statement that the primary structure is folded into secondary structures (lines 4 - 5) was not awarded marking point 2. To gain marking point 2 it has to be clear that it is the primary structure that determines the folding, not just that the primary structure is folded. The statement about DNA forming a globular structure (lines 5 - 7) is incorrect so marking point 5 was not awarded. On this occasion, marking point 3 was allowed for lines 7 and 8. As the candidate had already been penalised for reference to DNA it was felt that overall there was sufficient context to allow the reference to hydrogen and ionic bonding as being sufficient for marking point 3.

Paper Summary

Many candidates have clearly made good use of past papers and mark schemes, but it is important for candidates to understand the scientific principles covered in the specification so they can apply them to new contexts and not write a rehearsed answer to a question that has been asked in the past.

Based on their performance on this paper, candidates are offered the following advice:

- Read the whole question carefully, including the introduction, to help relate your answer to the context used. You should read the question through carefully at least once and then write down your knowledge and understanding in a way that answers the question.
- Make sure you understand the biochemistry that underpins the concepts covered in this unit.
- Read questions carefully: do not assume that the question asked is the same as that which has appeared on a previous paper.
- Read your answers back carefully – do they answer the question, have you made at least as many clear points as marks are available?
- When asked to distinguish between two things make sure your answer is comparative and mentions both things being compared.
- When asked to describe a trend this is asking for the overall changes and not a detailed description of individual points on a graph or in a table.
- Include a relevant calculation whenever you are asked to describe or compare numerical data in tables or graphs.
- Don’t be afraid to include a sketch diagram or graph if it will help add clarity to your answer.
- When describing the measurement or control of variables, be specific about what is to be measured e.g. volume or mass, and avoid vague terms such as amount.
- Pay particular attention to spelling, the use of technical names and terms, and organisation of your answer in QWC labelled extended writing questions.
- Explore and assess examples of candidate responses from this report to help you understand what makes a good response to different types of questions, and exemplify the level of knowledge and understanding expected at AS level.

Grade Boundaries

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