

Examiners' Report
Principal Examiner Feedback

Summer 2024

Pearson Edexcel AS Level GCE
In Biology A Salters Nuffield (8BN0)
Paper 01: Lifestyle, Transport, Genes and Health

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Introduction:

This paper tested the knowledge, understanding and application of material from the topics 'Lifestyle, health and risk' and 'Genes and health'.

The range of questions provided ample opportunity for students to demonstrate their grasp of these topics and apply their knowledge to novel contexts.

The questions on this paper yielded a wide range of responses and some very good answers were seen. The paper appears to have worked very well with all questions achieving the full spread of marks.

There were some straightforward questions that yielded high marks across the ability range and some more challenging questions that discriminated well. The plotting of data and compare and contrast questions showed an improvement from past exam series. However, few students utilised the data they were provided with in more extended responses.

As previously, questions that demanded recall were generally well answered, as were the majority of the calculation questions.

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Question 1(a)(ii)

This question asked students to complete the diagram to show the location of the semilunar valve in the pulmonary artery.

Most students completed the diagram correctly and were awarded the mark.

However there were a significant number of students who did not complete the diagram. Students should check carefully to ensure they complete all questions, even if there are no answer lines.

A minority of students drew a semilunar valve in the aorta or labelled the atrioventricular valve instead.

Question 1(a)(iii)

This question asked students to describe the role of this semilunar valve in the cardiac cycle.

Most students were able to describe the role in preventing the backflow of blood. However, fewer students linked this to the closing of the valve in diastole.

Many students were able to describe the opening of the valve to allow the flow of blood from the ventricle to the artery but omitted ventricular systole.

Question 1(b)

This question asked students to complete the diagram to show the relative sizes of the lumens of the aorta and vena cava.

Most students were able to show that the vena cava had a larger lumen than the aorta.

Question 2(a)

This question provided students with information regarding red, white and pink snapdragon flowers. Students were expected to analyse the given information and deduce why heterozygous snapdragon plants produce flowers with pink petals.

It was pleasing to see that most students could correctly deduce that both F^R and F^W alleles were co-dominant and were both expressed in the phenotype.

Some students however referred to dominant and recessive alleles which was incorrect.

Question 2(b)(I and ii)

This question required students to determine the probability of each petal colour in the offspring of a cross of two heterozygous parent plants.

It was pleasing to see that the majority of students could correctly complete the provided Punnet square with the given parental genotypes, give the correct probabilities and calculate the number of plants with white flowers.

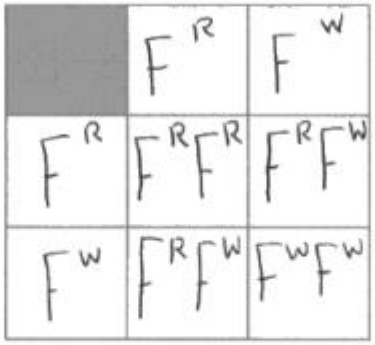
However, there were a small number of students who did not use the genotype provided.

This is an example of a response which scored full marks:

(b) (i) Two snapdragon plants with genotype F^RF^W were crossed.

Determine the probability of each petal colour in the offspring of this cross, using a genetic diagram.

(3)



Petal colour	Probability
Pink	50%
Red	25%
White	25%

(ii) There were 416 plants produced from this cross.

Predict how many of these plants will have flowers with white petals.

(1)

~~83 2 20.6 104~~ 104

Question 3(a)(ii)

This question asked students to name structure R in a DNA nucleotide and in an mRNA nucleotide.

Most students could correctly name deoxyribose and ribose.

Question 3(b)(iii)

This question asked students to describe the role of RNA in the formation of the polypeptide chain in the diagram.

It is important that students read the question carefully. A significant number of students described transcription, which was not creditworthy.

Most students could describe the mRNA leaving the nucleus and going to a ribosome. However, fewer students described the mRNA binding or attaching to the ribosome.

Marking point three was commonly awarded, although some students omitted the binding aspect.

The more detailed responses correctly described that the tRNA brought specific amino acids and that the sequence of bases on the mRNA determined the sequence of amino acids in the polypeptide chain.

A common misconception was that mRNA and tRNA would bind and then make or produce amino acids.

Question 4(a)

This question asked students to describe how oxygen and glucose can enter red blood cells.

It was clear that the majority of students knew this part of the specification well, with most gaining both marking points.

Question 4(b)

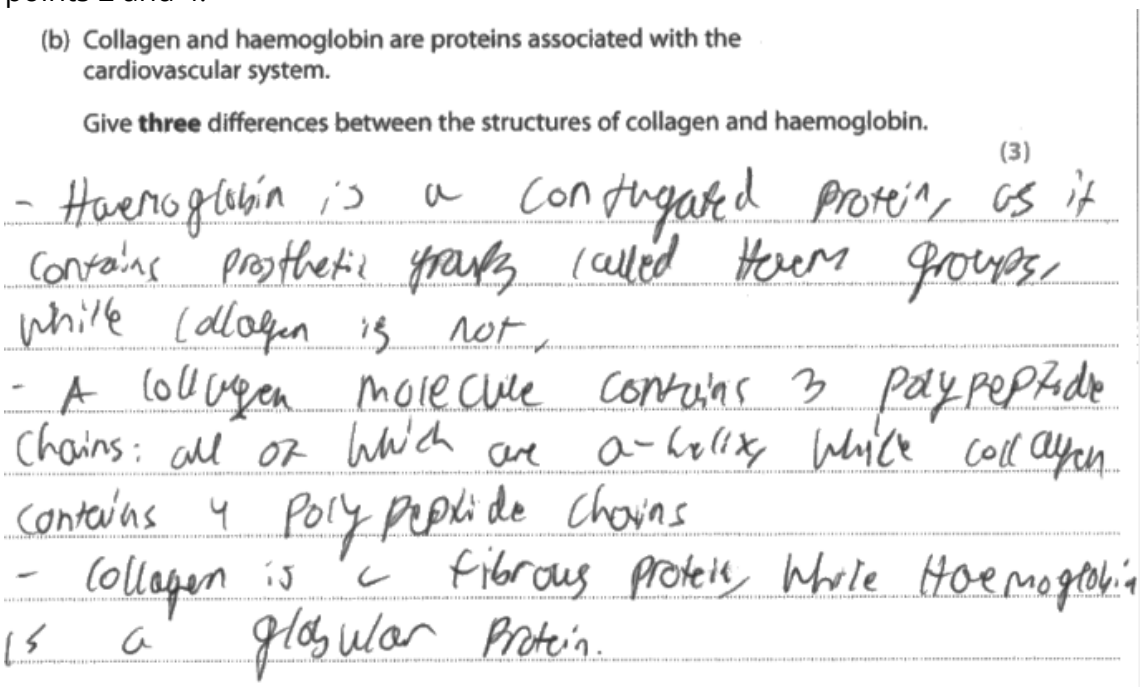
This question asked students to give three differences between the structures of collagen and haemoglobin.

Students must ensure that they read the question carefully. Some students gave similarities which were not creditworthy.

Some students described differences in properties of the two molecules, which were not creditworthy.

All of the marking points were credited during the marking period, with the most commonly awarded being marking points 1, 3 and 5.

This is an example of a response which gained full marks, including marking points 2 and 4:



(b) Collagen and haemoglobin are proteins associated with the cardiovascular system.

Give **three** differences between the structures of collagen and haemoglobin.

(3)

- Haemoglobin is a conjugated protein, as it contains prosthetic groups (called Heem groups, while collagen is not,
- A collagen molecule contains 3 polypeptide chains: all of which are α-helix, while collagen contains 4 polypeptide chains
- Collagen is a fibrous protein, while Haemoglobin is a globular Protein.

Question 4(c)(i)

This question required students to read the given information carefully and justify a stated control for the investigation.

Many students did not understand the difference between a control and a controlled variable. Numerous responses were seen justifying why a stated variable should be controlled which were not creditworthy.

Where students did give a control, they often did not appreciate that distilled water would be unsuitable as it would also cause haemolysis of the red blood cells.

Question 4(c)(ii)

This question required students to evaluate the effect of concentration of the three alcohols on the haemolysis of red blood cells.

It is important that students understand the requirements of command words and use all aspects of the given information.

Students were expected to make use of the information in the table showing the formula for each alcohol as well as the information in the graph.

Most students gained marking point 1 for a correct conclusion stating that increasing concentration of alcohol increases the percentage of red blood cells that were haemolysed.

Similarly, most students could conclude that butanol caused the most haemolysis.

It was also pleasing to see many students identifying the correlation between the size of the alcohol molecules and the percentage of red blood cells which were haemolysed. However, some students did not refer to the given information.

However, relatively few students could draw on their supporting knowledge of the core practical to give answers scoring marking points 3 or 5.

This is an example of a response which scored full marks:

(ii) Evaluate the effect of concentration of the three alcohols on the haemolysis of red blood cells.

(4)

Generally, as alcohol concentration increases, the percentage of red blood cells (RBCs) haemolysed also increases. All 3 alcohols increased the % of red blood cells haemolysed. Ethanol had the least haemolysis, whereas butanol had the greatest/most haemolysis. For both ethanol and propanol, there's a gradual (proportional) increase of 12 % (12-0) for ethanol and 22.5 (25 - 2.5) for propanol. Butanol's increase is rapid, of 90 (95 - 5). Butanol reached the highest percentage of red blood cells haemolysed at a lower concentration than propanol and ethanol. This is because butanol has more carbons and hydrogens, which causes the disruption of the phospholipid bilayer more, causing glycoproteins / proteins in the membrane to denature / dissolve, hence increasing haemolysis rate. Ethanol has the greatest concentration, yet least percentage of RBCs haemolysed. At all concentrations, percentage of red blood cells haemolysed for butanol is greater than propanol and ethanol. This show that butanol is the most effective at haemolysis whereas ethanol is the least effective.

(Total for Question 4 = 11 marks)

Question 5(a)(i)

This question required students to describe the function of DNA polymerase in producing a polynucleotide.

Most students could correctly describe the enzyme joining DNA nucleotides together via condensation reactions forming phosphodiester bonds.

However, some students thought the enzyme was involved in the hydrogen bonding between complementary bases. Some students described mRNA nucleotides being bonded which was incorrect.

Question 5(a)(ii)

Students were provided with information regarding a property of DNA polymerase and were expected to apply their knowledge to this new context.

Most students could identify that an error in DNA replication would cause a mutation and could discuss some possible benefits of correcting the change in the base sequence.

These are examples of responses which gained full marks:

(ii) Scientists have discovered a property of DNA polymerase that detects and corrects errors in DNA replication.

Discuss the possible benefits of this property of DNA polymerase.

(4)

If DNA polymerase corrects errors, then here are fewer mutations as the base sequence is not changed. Fewer mutations results in the gene being more likely to be transcribed correctly, so there is the decreased risk that the mRNA is incorrect. Therefore the tRNA is more likely to carry the correct amino acid, and the correct protein will be made. This decreases the ~~likely~~ chance of uncontrolled cell division, so less risk of cancer.

Discuss the possible benefits of this property of DNA polymerase.

(4)

- ~~Mutations~~ Changes can occur during DNA ~~polymerase~~ replication if the ~~strand~~ ~~is~~ bases are not copied correctly.
- This can cause ~~diseases~~ conditions such as cystic fibrosis, caused by ~~mutations~~ differences in DNA, coding for different proteins.
- If DNA polymerase can identify where the errors occur and change the base to the correct one, then these diseases can be prevented.
- This ~~could~~ may also reduce severity of some conditions as some are due to multiple ~~mutations when~~ mistakes when bases are copied. This may not prevent production of a protein entirely or change the ~~the~~ shape of a protein less drastically so it can still function.
- Enzymes can still have shape complementary to substrate so can still ~~can~~ catalyse reactions.

Question 5(b)

This question gave the students information and a pedigree diagram to analyse. The students were asked to explain why individuals A and B may choose PGD.
Most students gained marking point 1, for a correct analysis of the pedigree diagram.
Fewer students gained marking point 2. One reason was the use of incorrect terminology, for example gene instead of allele. Another common error was imprecision in responses. The given information stated that the faulty DNA polymerase would result in an increased risk of developing cancer, therefore answers regarding allowing the couple to 'choose an embryo without cancer' were incorrect.

Question 6(b)(i)

Students were asked to explain how to carry out a valid investigation to collect the data shown in the table.

This question expected students to analyse the given information, including the table and the diagram showing the colour of iodine in different concentrations of starch.

Most students clearly had done so, using this information in their answers, but it was clear that some students did not. Some students decided to vary the concentration of a different solution for example.

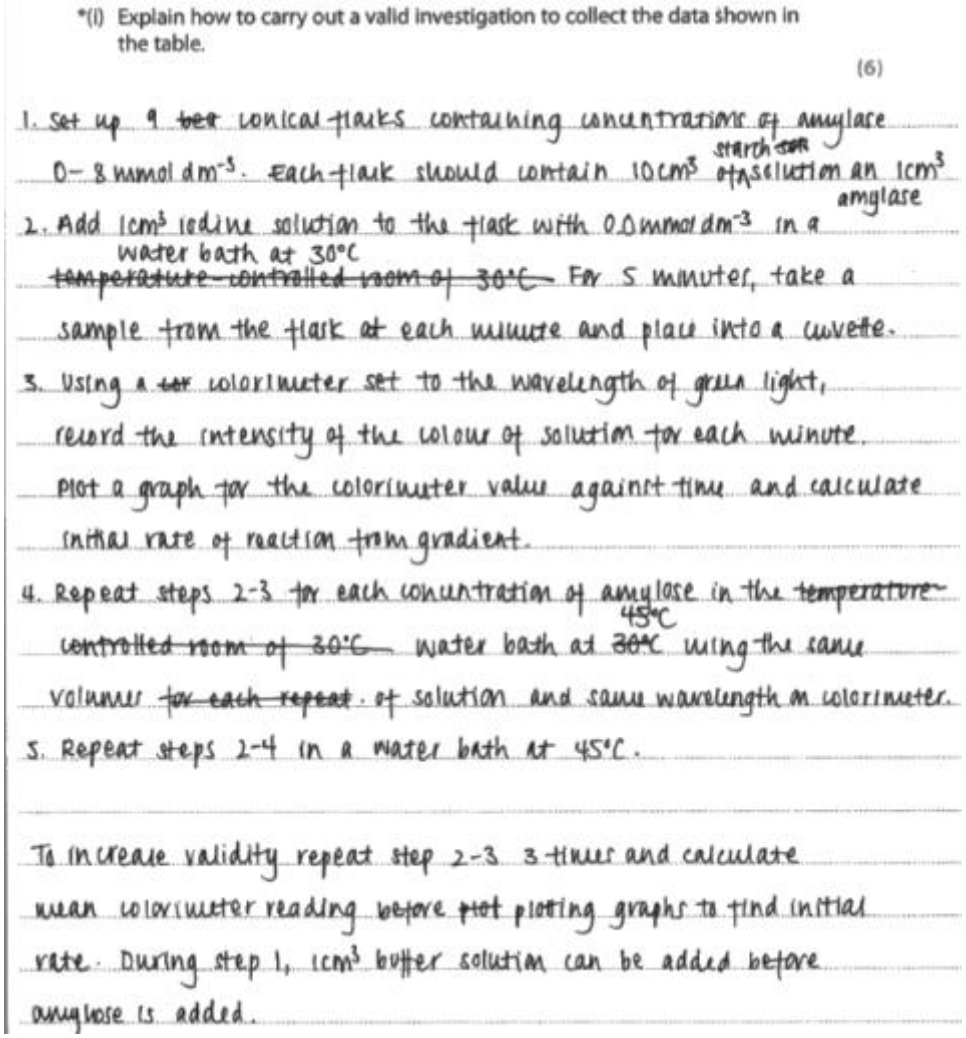
This question proved to be a very good differentiator with the full spread of marks awarded. An improvement in practical methodology was also seen from previous exam series.

To achieve level one students needed to describe a basic method using more than one enzyme concentration, starch solution and iodine solution.
It was disappointing that a small number of students were limited to the lower mark in this level as they did not use all three of the solutions required for this practical.

To achieve level two, students needed to show some linkages to the provided information and their knowledge of the related core practical.
Many students achieved level 2 for explaining how they would use the provided enzyme concentrations in the table and how they would control a stated controlled variable.
The most common variables that were controlled were volume or concentration of relevant solutions. For example, the student would describe how they would control the concentration of starch solution by using one bottle of a stated concentration.

Where students extended their answer to explain how the dependent variable would be measured and then how this data could be used to calculate the rate of reaction, they were able to access level three.

This is an example of a level three response:



*(i) Explain how to carry out a valid investigation to collect the data shown in the table.

(6)

1. Set up 9 ~~ber~~ conical flasks containing concentrations of amylase 0 – 8 nmol dm^{-3}. Each flask should contain 10 cm^3 of starch ~~con~~ solution an 1 cm^3 amylase
2. Add 1 cm^3 iodine solution to the flask with 0.0 nmol dm^{-3} in a water bath at 30°C ~~temperature-controlled room of 30°C~~ For 5 minutes, take a sample from the flask at each minute and place into a cuvette.
3. Using a ~~cor~~ colorimeter set to the wavelength of green light, record the intensity of the colour of solution for each minute. Plot a graph for the colorimeter value against time and calculate initial rate of reaction from gradient.
4. Repeat steps 2-3 for each concentration of amylose in the ~~temperature-controlled room of 30°C~~ 45°C water bath at ~~30°C~~ using the same volumes ~~for each repeat~~ of solution and same wavelength on colorimeter.
5. Repeat steps 2-4 in a water bath at 45°C.

To increase validity repeat step 2-3 3 times and calculate mean colorimeter reading before ~~plot~~ plotting graphs to find initial rate. During step 1, 1 cm^3 buffer solution can be added before amylose is added.

<u>Question 6(b)(ii)</u>

This question asked students to comment on the effects of enzyme concentration and temperature on this investigation.

Most students could correctly state that the rate of the reaction increased as concentration increased to gain marking point one.

However, it was surprising that there were a significant number of responses which incorrectly stated that the rate of reaction was higher at 45°C than 30°C due to increased kinetic energy and more successful collisions. Students are encouraged to apply their knowledge to the given context.

The higher level responses also correctly identified that there was a plateau in the rate of reaction 30°C and correctly came to the judgement that there was a limiting factor.

Question 7(a)

This question gave students a table showing BMI categories. Students were expected to use these values, and the given equation, in order to calculate the minimum and maximum height for a man with a body mass of 65kg and normal BMI.

Many students gave correct minimum and maximum heights.

However, there was a significant minority of students who wrote their answers in the wrong place, giving the minimum value next to the words 'maximum height' for example, and others gave answers which were clearly incorrect.

Students need to check their answers carefully to make sure that they are reasonable.

Question 7(b)(i)

This question required students to analyse the provided data and describe the relationship between the number of additional risk factors and the incidence of CHD.

Nearly all students could correctly analyse the data to describe the positive correlation between the number of risk factors and the incidence of CHD.

However, fewer students extended their description to include a description of the non-linear increase. Students are encouraged to look carefully at the number of marks available and tailor their descriptions accordingly.

Question 7(b)(ii)

Nearly all students could correctly state a risk factor for CHD other than obesity.

The more commonly given risk factors were smoking, high cholesterol and high blood pressure.

Imprecise references to 'bad diet', 'age' or 'alcohol', without detail were insufficient.

Question 7(c)

This question required students to plot the given data in a suitable graphical form.

It was pleasing to see that the majority of students could draw a suitable graph correctly.

The most common errors were using a scale that was less than 50% of the space provided, incorrect plotting or omission of some of the required labelling.

Question 7(d)(ii)

This question asked students to explain why balloon angioplasty could reduce the immediate risk of a person having a heart attack.

This question was a very good differentiator and the full range of marks was awarded.

Most students could explain that the lumen of the coronary artery would be widened. However some students referred to arteries unqualified which was

insufficient. Some students described the unblocking of the coronary arteries here, but were not awarded a mark as this wording was given in the diagram.
Frequent correct explanations relating to decreased blood pressure or reduced risk of a blood clot were seen. Linkages to atherosclerosis were not relevant in the context of this question.
Many students described increased oxygenated blood flow to cardiac muscle cells, gaining both marking points 2 and 4. However, some students did not analyse the diagram carefully enough as they referred to blood being able to flow, instead of an increase in blood flow.
More detailed responses linked the increased flow of oxygenated blood to aerobic respiration. Students who referred to respiration unqualified were not awarded marking point 5.

Question 8(a)(i)

This question asked students to calculate the actual width of the nematode in the image.
Students are encouraged to practise converting units correctly, as this was the most common error in this calculation.
Most students could correctly divide their measurement by the magnification.

Question 8(a)(ii)

This question asked students to explain why the nematode does not need a circulatory system.
Most students were able to correctly explain that the nematode has a large surface area to volume ratio and that diffusion could supply the needs of all of its cells.

Question 8(b)(i)

Students were asked to explain why the blood pressure in the aorta section of the graph increased and decreased.
It is important that students use appropriate relevant terminology in their explanations.
The majority of students could recognise that the blood pressure increased during ventricular systole and decreased during diastole.
There was a common misconception that the pressure increased in the aorta when the pressure in the ventricles was low (and therefore in diastole). This could be students confusing comparative pressures between the aorta and ventricles and the opening and closing of the semilunar valves. Some students also thought that the decrease in pressure in the aorta happened when the aorta was empty.

Question 8(b)(ii)

This question required students to calculate the percentage decrease in blood pressure as blood travels through the capillaries.

It is important that students ensure they are reading correct data from the graph. A significant number of students used an incorrect value for the higher blood pressure.

Similarly to previous exam series, a significant number of students used the incorrect value as the denominator in their calculation. Students are encouraged to practise the mathematical skills listed in the specification.

Some students lost a mark as they did not give their answer to two significant figures.

This is an example of a correct calculation:

(ii) Calculate the percentage decrease in blood pressure as blood travels through the capillaries.

Give your answer to two significant figures.

(2)

$\frac{14-32}{32} \times 100 = -56.25$

Answer 56 %

Question 8(c)(i)

This question gave students a diagram of the circulatory system of a squid. Students were expected to use their knowledge of a human circulatory system to identify both similarities and differences.

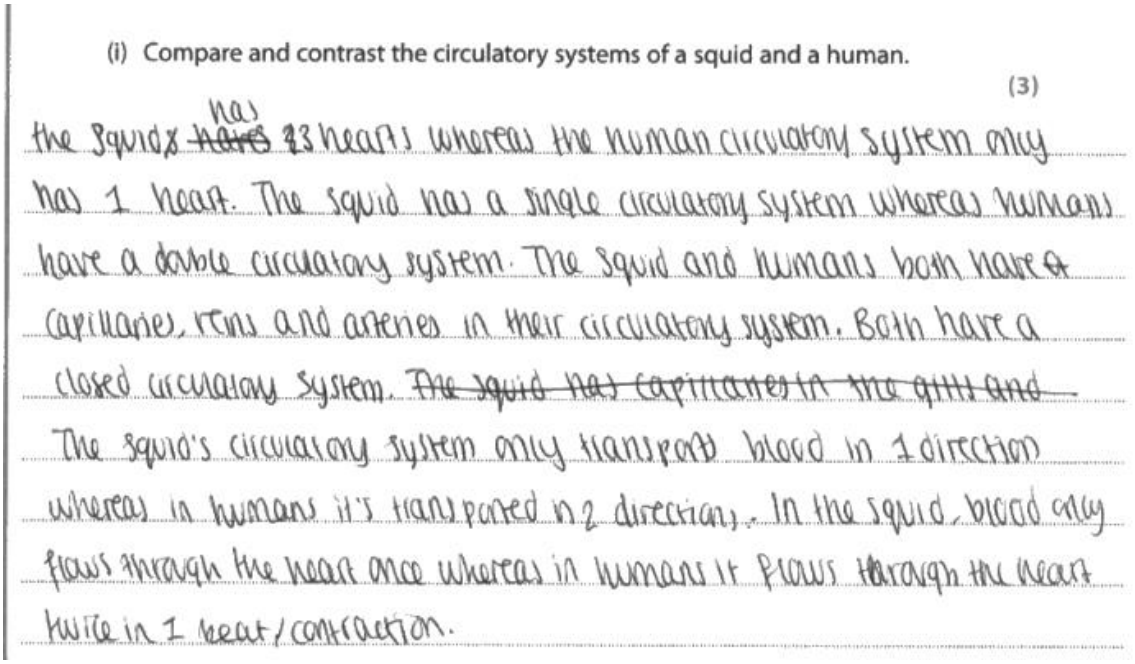
It was pleasing to see an improvement in the examination technique for this type of question.

Nearly all students made clear statements concerning similarities and differences.

The most commonly awarded marks revolved around the comparison of the number of hearts and the identification of the first similarity.

A small number of responses indicated the diagram was incorrectly interpreted as showing the squid to have a double circulatory system.

This is an example of a response which scored full marks:



(i) Compare and contrast the circulatory systems of a squid and a human.

(3)

the squid ~~has~~ has 3 hearts whereas the human circulatory system only has 1 heart. The squid has a single circulatory system whereas humans have a double circulatory system. The squid and humans both have capillaries, veins and arteries in their circulatory system. Both have a closed circulatory system. ~~The squid has capillaries in the gills and~~ The squid's circulatory system only transport blood in 1 direction whereas in humans it's transported in 2 directions. In the squid, blood only flows through the heart once whereas in humans it flows through the heart twice in 1 beat/contraction.

Question 8(c)(ii)

This question required students to apply their knowledge of the core practical. They were asked to describe two potential ethical issues which should be considered before the selection of vertebrate and invertebrate organisms in the given investigation.

Most students were awarded marking point 1.

Some students considered the aspects covered by marking point 3.

More detailed responses considered the use of a non-invasive procedure to measure the heart rate of the organisms.

Paper summary

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

- Read the whole question carefully, including the introduction, to help relate your answer to the context. You should take into account the command words as well as all of the context given. Answers which do not match the command words or do not relate to the given context will not gain high marks.
- Ensure you are familiar with the mathematical skills listed in the specification, especially unit conversion and calculating percentage change.
- When asked to compare and contrast, make sure you have included both similarities and differences in your answer.
- Ensure you use the correct technical names and terms in your answers.
- Apply your practical skill knowledge to given contexts.

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