Pearson Edexcel

# Examiners' Report
# Principal Examiner Feedback

## June 2023

Pearson Edexcel GCE
In Biology Spec B (8BN0)
Paper 01: Lifestyle, Transport,Genes and Health

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Summer 2023
Publications Code 8BN0_01_2306_ER
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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 'compare and contrast' type answers in particular showed a significant increase in the quality of comparative answers as opposed to separate paragraphs about each.

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

However, fewer students utilised the data they were provided with in some of the longer questions.

**Question 1(a)(i)**

This question required students to complete the diagram to show how a complementary pair of nucleotides would appear in a DNA molecule.

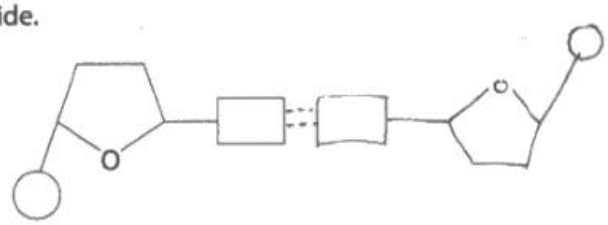
It was disappointing that there were a significant minority of students who did not answer this question.

Where students did complete the diagram, many responses showed nucleotides joined together in a vertical arrangement.

Some students did not draw an inverted nucleotide, or only drew one hydrogen bond.

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

**1** The diagram shows a DNA nucleotide.



(a) (i) Complete the diagram to show how a complementary pair of nucleotides would appear in a DNA molecule.

(2)

**Question 1(a)(ii)**

This question asked students to name two bonds formed between nucleotides in the process of DNA replication.

Nearly all students could name at least one correct bond, with the majority gaining both marks.

The most common incorrect answer was peptide bond.

**Question 1(b)**

This question asked students to give one difference in the structure of the two molecules provided in the diagram.

Most students were able to give a correct difference, however some students incorrectly stated that the DNA nucleotide contained ribose.

**Question 2(a)(i) and (ii)**

The majority of students could identify where the relevant valves were opening or closing.

**Question 2(a)(iii)**

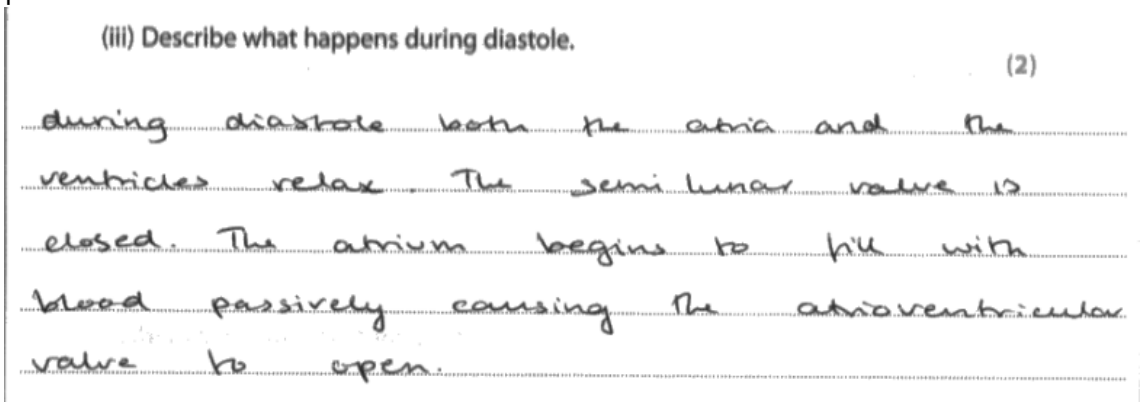
This question required students to give a description of what happens during diastole.

Marking point one was the most commonly awarded mark.

Some students thought that both the semilunar and atrioventricular valves would be closed throughout diastole, which negated the third marking point.

Some students just referred to 'chambers' of the heart, instead of naming the atria/ventricles.

This is an example of a response which covered all of the available marking points:



(iii) Describe what happens during diastole.

(2)

during diastole both the atria and the ventricles relax. The semi lunar valve is closed. The atrium begins to fill with blood passively causing the atrioventricular valve to open.

**Question 2(b)(i)**

This question asked students to calculate the diameter of the lumen along the line XY.

A small minority of students just measured the width of the line and did not calculate the diameter.

Most students were able to divide a correct measurement by the given magnification. However, fewer students took careful note of the requirement to give their answer to two significant figures.

**Question 2(b)(ii)**

This question asked candidates to state the feature of the wall of the aorta that causes a reduction in the diameter of the lumen.

It was pleasing to see that most students could give a correct answer.

**Question 3(a)**

This question asked students to state what is meant by the term biological catalyst.

Most students knew what a catalyst was and could state it reduces activation energy or speeds up a reaction to gain one mark.

However, fewer students addressed the biological aspect in sufficient detail.

**Question 3(b)(i) and (ii)**

These questions were answered correctly by most students.

**Question 3(b)(iii)**

Selecting the correct unit proved to be more challenging for students.

**Question 3(c)**

This question asked students to explain how the structure of starch makes it a good storage molecule.

Most students could give at least one correct explanation, with all three possible marking points being awarded with similar frequency.

The most common error was to link the branched structure to easier hydrolysis instead of faster hydrolysis.

**Question 3(d)**

This question required students to analyse the provided diagram and use it to deduce why the amylase enzyme could not hydrolyse the molecule.

Most students could correctly explain that this molecule was not a complementary shape to the active site of amylase and therefore an enzyme-substrate complex would not form.

Numerous responses were also seen that correctly explained that the amylase active site was specific to starch.

Some students could correctly explain that the molecule could not bind to the amylase active site, but did not give any further depth to their explanation.

**Question 4(a)(i)**

This question asked students to state what was meant by the term allele.

Most students could correctly state that it was an alternative version of a gene, although fewer students gained the second mark.

**Question 4(a)(ii)**

This question was required students to explain why offspring of the described cross had the wide bar eye shape.

It was pleasing to see that most students recognised that the offspring would be heterozygous, with numerous genetic diagrams seen in the margin.

The majority of students also explained that incomplete dominance would occur, however few students gained the third marking point.

This is an example of a response which gained all three marking points:

(ii) When a round-eyed fruit fly is crossed with a bar-eyed fruit fly, offspring are produced that have wide bar eyes.

Explain why offspring are produced with the **wide** bar eye shape.

(3)

| | B | B |
|---|---|---|
| R | RB | RB |
| R | RB | RB |

offspring are produced with wide bar eye shape because this is an example of codominance. In the Punnett Square, it shows the genotypes of the offspring. They all have RB. They have alleles that code for round eyes as well as alleles that code for bar eyes. They are both dominant alleles so they are both expressed in the phenotype so offspring have wide bar eyes.

**Question 4(b)(i)**

This question asked students to use a genetic diagram to determine the probability of two individuals who are heterozygous for the Tay-Sachs gene having a child with this condition.

Most students could use the provided alleles T and t to draw a correct genetic diagram and give the correct probability.

**Question 4(b)(ii)**

This question was answered correctly by most students.

The most common incorrect answer was chorionic villus sampling.

**Question 4(b)(iii)**

This question required students to explain why the mother may prefer PGD to amniocentesis.

Most students gained at least one mark, with both marking points being equally awarded.

This response scored full marks:

(iii) Explain why the mother may prefer this type of prenatal screening to amniocentesis.

(2)

~~Mother finds out results before amniocentesis,~~ & amniocentesis has higher risk of miscarriage than Prenatal ~~Screening~~ pre implantation genetic screening. pre implantation genetic screening provides mother with result earlier than amniocentesis, make a decision before carrying the embryo (in uterus). Can be more ethically accepted if baby is before being in the uterus

**Question 5(a)(i) and (ii)**

These questions were answered correctly by many students.
Some students confused the pulmonary arteries and veins.

**Question 5(b)(i)**

This question gave the students a diagram of a human heart. Labelled on the heart was the location of a blood clot in vessel E.
Students were asked to sketch an outline on the diagram to show the area of heart muscle that would receive a reduced blood supply.
It was disappointing that some students did not answer this question. Students should take care to ensure they don't miss out questions which do not have answer lines.
Some outlines were not credit worthy as they included areas of cardiac muscle above the blood clot.

**Question 5(b)(ii)**

This question gave the information that a blood clot had formed in a coronary artery. Students needed to explain how this blood clot could have been formed.
Most students gave extremely high-quality descriptions of how blood clots could form and gained full marks.
Where full marks were not awarded, it was often due to confusing the order of thrombin and fibrin formation, or not linking the formation of fibrin to the trapping of blood cells.
The highest-level answers also considered the involvement of calcium ions or vitamin K, for example:

(ii) Describe how this blood clot could have been formed.

(4)

~~A blockage~~ collagen fibres are exposed in the wall of the coronary artery. The enzyme thromboplastin is released, this catalyses the conversion of prothrombin to thrombin. Calcium ions and vitamin K are also required. Thrombin catalyses the conversion of soluble fibrinogen to insoluble fibrin. The fibrin forms a mesh which traps red blood cells in it leading to a blood clot.

**Question 5(c)**

This question gave students information about an investigation. One group of patients took a new platelet inhibitor drug whereas the control group were given no treatment. The students were asked to explain the results of the investigation shown in the graph.

Nearly all students gained the first marking point.

Most students explained that the reduction in heart attacks was due to fewer blood clots forming.

More detailed answers explained the link between blood clots and heart attacks.

This is an example of a response which scored all three marks:

Explain the results of this investigation.

(3)

The control group has a higher increase in the percentage of patients who had a heart attack because no treatment was given so no decrease is seen. Control is used to compare the effects the PI drug has on the PI group. Platelet inhibitors means that thromboplastin isn't released. Less prothrombin converted to thrombin so less fibrinogen is converted to fibrin so less blood clots form. Less blood clots in heart means that coronary arteries supply blood to all cardiac muscle so all can have sufficient oxygen required for respiration so no cell death means less chance of heart attack.

**(Total for Question 5 = 10 marks)**

**Question 6(a)**

This question provided students with a diagram showing the stages in the development of emphysema.

Students were asked to explain why emphysema affects the **rate** of gas exchange between the alveolus and the blood.

This question proved to be a very good differentiator.

Low level responses described the diagram or described general adaptations of an alveolus for gas exchange.

Higher level responses showed a good understanding of the effect of emphysema on the surface area and distance for diffusion and linked this to Fick's Law, for example:

(a) Explain why emphysema affects the **rate** of gas exchange between the alveolus and the blood.

(4)

It increases the surface area of the alveoli thus there is a less steep concentration gradient. Fick's law states that both the surface area and concentration gradient are directly proportional to the rate of diffusion and gas exchange but diffusion distance is inversely proportional. By decreasing the surface area (to volume ratio) less oxygen can diffusive into the blood at a slower rate. Diffusion distance also increases thus decreasing the rate of gas exchange thus less oxygen diffuse into the blood and less carbon dioxide out at a slow rate

**Question 6(b)**

Students were asked to evaluate the effects of smoking on the respiratory system, heart and pulmonary circulation.

This question expected students to analyse the given information, including the graph and the diagrams.

Most students clearly had done so, using this information in their answers, but it was clear that some students did not.

This question proved to be a very good differentiator with the full spread of marks awarded.

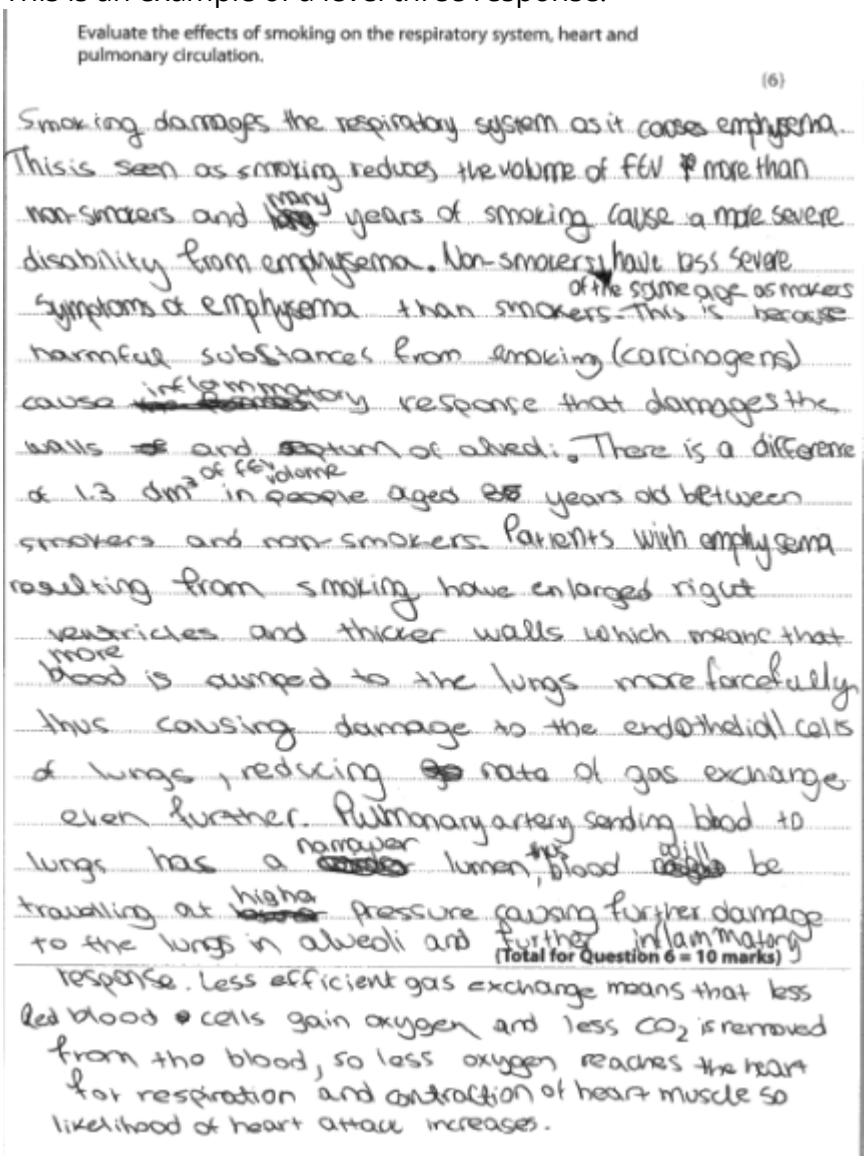
To achieve level one students needed to evaluate the effects of smoking on at least one aspect.

Most students achieved level one by discussing the effect on the respiratory system.

To achieve level two, students needed to discuss the effect on two aspects from the question, or one in depth.
Many students achieved level 2 for a detailed evaluation on the effect of smoking on the respiratory system.
Some students recognised the difference in the heart of the patient with emphysema, but incorrectly thought it was the left ventricle. Some thought the pulmonary blood vessels were bronchioles.

Where students discussed the effect of smoking on all three aspects, supported throughout with relevant evidence from the provided information and their own knowledge and understanding, they accessed level three.

This is an example of a level three response:



Evaluate the effects of smoking on the respiratory system, heart and pulmonary circulation.

(6)

Smoking damages the respiratory system as it causes emphysema. This is seen as smoking reduces the volume of FEV more than non-smokers and many years of smoking cause a more severe disability from emphysema. Non-smokers have less severe symptoms of emphysema than smokers of the same age as smokers - This is because harmful substances from smoking (carcinogens) cause inflammatory response that damages the walls and destruction of alveoli. There is a difference of 1.3 $dm^3$ of FEV volume in people aged years old between smokers and non-smokers. Patients with emphysema resulting from smoking have enlarged right ventricles and thicker walls which means that more blood is pumped to the lungs more forcefully thus causing damage to the endothelial cells of lungs, reducing rate of gas exchange even further. Pulmonary artery sending blood to lungs has a narrower lumen, this blood will be travelling at higher pressure causing further damage to the lungs in alveoli and further inflammatory response. Less efficient gas exchange means that less red blood cells gain oxygen and less $CO_2$ is removed from the blood, so less oxygen reaches the heart for respiration and contraction of heart muscle so likelihood of heart attack increases.

(Total for Question 6 = 10 marks)

**Question 7(a)(i)**

This question asked students to name two other types of molecule that would be found in a cell surface membrane.
Most students recognised that they should not name phospholipids or cholesterol.
Glycoproteins and glycolipids were the most common molecules named.

**Question 7(a)(ii)**

This question required students to analyse the provided diagram and note the differences in the structure of phospholipid A and B. They were expected to relate their knowledge and understanding of saturated and unsaturated fatty acid chains to this context in order to answer the question.

Some students describe the shapes without attempting to give an explanation.
It is important to take careful note of the command word.
Many responses correctly linked C=C to the kink in the fatty acid chain.

Students failed to gain marks when they used the terms saturated and unsaturated without linking this to C-C and C=C.

Common misconceptions in responses centred around temperature affecting the shape of the phospholipids, cholesterol affecting the shape of the fatty acid chains or mutation causing a change in the tertiary structure.

**Question 7(b)**

This question required students to compare and contrast the structures of a phospholipid and a triglyceride.
It was pleasing to see an improvement in the structure of responses. Many students gave clear statements detailing similarities and differences in structure.
Nearly all students knew that both molecules contained fatty acid chains, but there were a significant number of students who thought that a phospholipid did not contain glycerol.
The most common mark awarded was for the correct comparison of the number of fatty acid chains.
This is an example of a response which showed good exam technique and scored full marks:

(b) A phospholipid is a modified triglyceride.

Compare and contrast the structures of a phospholipid and a triglyceride.

(3)

Both phospholipids and triglycerides contain glycerol and fatty acid chains that are held together by an ester bond. However, phospholipids have a hydrophilic phosphate head whilst triglycerides do not. Also ~~phospholipid~~ phospholipids are made up of two fatty acid tails (that are hydrophobic) whilst triglycerides are ~~an~~ made of three fatty acid chains.

**Question 7(d)(i)**

This question continued the context of LDL's from the multiple choice question. Students were asked to describe the relationship shown in the graph.

Nearly all students gained the first marking point, but fewer students describe the decrease in number of deaths ≥ 190 mg 100 $cm^{-3}$ LDL concentration.

**Question 7(d)(ii)**

This question asked students to comment on the validity of a conclusion.

It was pleasing to see that the majority of students had recognised that the conclusion was not valid as this study was only carried out on males aged 25-40. Many students knew that this was not representative of the UK population.

The highest-level answers also considered that the deaths could have been caused by something other than high LDL levels/

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

(ii) The UK population in 2021 was 68 269 157.

A student concluded that 81 923 people with an LDL concentration in the blood of 130–159 mg per 100 $cm^3$ died from CVD in 2021. 1·2

Comment on the validity of this conclusion.

Use the information in the graph to support your answer.

(4)

This statement is not valid. This is because the people and were investigated were males from 25-40 years old. This does not represent the UK population where older people are more prone to death and females were not included. In addition, the 130-159 per 100 $cm^3$ bar does not fit the trend of the graph. The value of 1.2 lies close to 100-129 mg/100$cm^3$ where this value is 1.1 the value is expected to be higher, therefore repeats of the investigation would be done in order to gain more accurate results (and identify any anomalies) and with females. Finally there could have been other factors that could have caused the death and not just LDL concentration (such as exercise or smoking).

**(Total for Question 7 = 14 marks)**

**Question 8(a)(i)**

This question asked students to calculate the **largest** percentage change in mass for potato cylinders in 1.0 mol $dm^{-3}$.

Students were expected to use the given values of 2.79±0.04 and 2.01±0.16 in their calculations.

A large number of students did not read the question correctly and used the values in the table which was not credit worthy.

This is an example of a correct calculation:

(i) For test tube E the range of the initial mass was 2.79 ± 0.04 g and the range of the final mass was 2.01 ± 0.16 g.

Calculate the **largest** percentage change in mass for potato cylinders in 1.0 mol $dm^{-3}$.

(2)

Upper bound of initial mass: 2.79 + 0.04 = 2.83g

Lower bound of final mass: 2.01 − 0.16 = 1.85g

$\frac{2.83 - 1.85}{2.83} \times 100 = 34.6\%$

Answer 34.6 %

**Question 8(a)(ii)**

This question asked students to explain the change in mass for potato cylinders in test tube E.

Most students were able to give a correct explanation as to why the potato cylinders lost mass for the first marking point.

However fewer students recognised that the potato lost the most mass because it was in the highest sucrose concentration.

**Question 8(b)**

Students were asked to describe how the given investigation could be modified to determine the concentration of sucrose that does not change the mass of the potato cylinders.

Students were expected to refer back to the table of data and the information above the diagram in order to help them answer this question.

Most students were able to describe the need to use concentrations between 0.0 and 0.4, showing their correct interpretation of the data in the table.

However, there were some responses that chose to extend the range above 1.0, which was not creditworthy.

Although many students recognised that they should include repeats at each concentration, few mentioned the calculation of a mean.

There were some excellent answers which gained marking point four, for example:

(b) Describe how this investigation could be modified to determine the concentration of sucrose solution that does **not** change the mass of the potato cylinders.

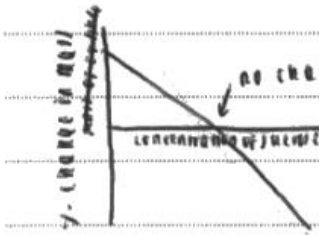
**(3)**

Include 5 concentrations between 0.0 and 0.4 mol dm$^{-3}$ and go in smaller interval. 1 of sucrose solution ~~Now~~ ~~correct these results and take repeats at each concentration~~ the to calculate average mass afterwards. The ~~mass~~ interval between what the mass stays constant - go in smaller intervals between these intervals (of concentrations) until there is a no mass change.

(b) Describe how this investigation could be modified to determine the concentration of sucrose solution that does **not** change the mass of the potato cylinders.

**(3)**

~~More concentrated~~ The ~~of~~ experiment could be repeated with more concentration intervals between 0 and 0.4 mol dm$^{-3}$ of the mean of the results are found and sucrose. Once the graph is plotted, the point at which the line crosses the X axis is where there is no change in mass. Alternatively you could repeat the experiment at




smaller intervals until there is no change in mass.

**Question 8(c)(i)**

This question gave students the diameter and height of a beetroot disc in different units.

Students were expected to convert one of the values and then use the given formula to calculate the volume of the beetroot disc to one decimal place.

Many students were able to calculate the volume of the disc correctly and give the appropriate unit to score full marks.

However, there were a significant number of students who did not convert one of the given measurements, or did not include the appropriate unit. Some incorrect unit conversions were also seen.

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

(i) Calculate the volume of a beetroot disc with a diameter of 1 cm and a height of 5 mm to **one** decimal place. 0.5cm
Include the appropriate unit.

Use the formula $V = \pi r^2 h$

(2)

$V = \pi (0.5)^2 (0.5)$

$= 0.4$ (1 d.p)

Answer $0.4 cm^3$

**Question 8(c)(ii)**

This question required students to analyse the graph to see the effect of ethanol concentration of the relative colour of the ethanol solution. Students were then asked to explain the results of the investigation.

It was disappointing that a significant minority of students did note take careful note of the command word and gave a description which was not credit worthy.

For example, this response:

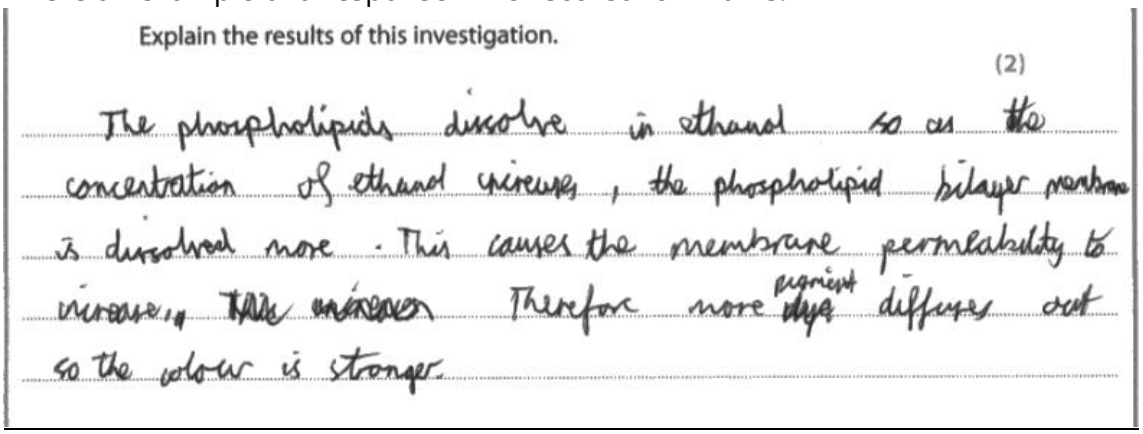
Explain the results of this investigation.

(2)

As the concentration of ethanol increases, the relative colour of the ethanol solution increases aswell. ~~The~~ The colour increases gradually at the beginning before increasing quite quickly as the concentration is increased. Before the end, the increase in concentration of ethanol causes a ~~be~~ flattening of the relative colour of ethanol solution.

Where an explanation was attempted, the most common marking point awarded was for ethanol disrupting the membrane structure in some way.

Higher quality answers then went on to explain how this caused the increase in the relative colour of the ethanol solution, for example explaining that more betalains could be able to leave the cell.
This is an example of a response which scored full marks:


Explain the results of this investigation.

(2)

The phospholipids dissolve in ethanol so as the concentration of ethanol increases, the phospholipid bilayer membrane is dissolved more. This causes the membrane permeability to increase. This increases. Therefor more pigment dye diffuses out so the colour is stronger.

**Question 8(c)(iii)**

This question required students to devise a valid investigation to compare the effects of ethanol and propanol on the permeability of beetroot membranes. This question was a very good differentiator, and few blank responses were seen.
Most students gained marking points one and three. Comparing propanol results to the graph in the previous question was not credit worthy as there were no concentration values on the graph to make a comparison with. Adding them to the same test tube was not creditworthy.
However fewer students described how an appropriate variable was controlled, or stated what should happen to the raw data.

**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 asked. 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.
- 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 answer.
- Apply your practical skill knowledge to given contexts

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