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Examiners' Report
June 2022

GCE Biology A (Salters-Nuffield) 9BN0 02

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Introduction

This paper offered candidates a wide range of opportunities to demonstrate their biological knowledge and understanding. It was most gratifying to see that candidates rose to the challenge and delivered clear, accurate and considered responses. They deserve much credit for this, as do those who taught them and helped prepare them.

Question 1 (a)(i)

Many candidates clearly had a most pleasing grasp of the cell cycle, with over half gaining both marks. Here they were asked to describe the role of the atrioventricular valves (AV) during one cycle. Whilst it was rare for candidates to mix up the AV valves with the semilunar valves, atria and ventricles were confused in a minority of cases.

This response offers a clear and targeted answer that gains both marks.

1 Blood from the lungs returns to the left side of the heart in the pulmonary vein. The pulmonary vein does not have valves.

(a) (i) Describe how the atrioventricular (AV) valves work during one cardiac cycle.

(2)

As the ventricle contracts during ventricular ~~syt~~ systole, the ~~bt~~ AV valve closes ~~opens~~ ~~and the~~ ~~blood~~ to stop the blood from flowing back into ~~a~~ the atria as it's forced out ~~of~~ and through the aorta and pulmonary veins. The ~~ass~~ AV valve opens during ~~atrial~~ systole to allow blood to be pumped through the valve from the ~~atoma~~ atrium to the ventricles.

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Examiner Comments

The first line and a half correctly deal with the closing of the AV valves which is the second marking point. Much of the remainder of this sentence then describes why the AV valves are closed during ventricular systole which is the third marking point. The second sentence then covers the first marking point for a maximum of two marks.

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Examiner Tip

As the cell cycle has various stages, consider writing your response in a stage-by-stage sequence such as atrial systole followed by ventricular systole.

This response considered the first marking point in terms of the pressure differences in the atria and ventricles affecting the AV valves.

1 Blood from the lungs returns to the left side of the heart in the pulmonary vein. The pulmonary vein does not have valves.

(a) (i) Describe how the atrioventricular (AV) valves work during one cardiac cycle.

(2)

The atrioventricular valves work by staying closed until the pressure in the atria increases higher than the ventricles, they then open and allow blood to enter the Ventricles.

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Examiner Comments

The description of the pressure differences links correctly to the AV valve behaviour so the first marking point could be awarded.

Question 1 (a)(ii)

In this item, candidates were asked to explain how the difference in pulmonary vein structure, compared to the pulmonary artery, is related to its function. Whilst a majority of candidates were able to give structural differences, a good number were also able to relate these to function.

This response clearly considers the structural difference between the pulmonary vein and pulmonary artery wall.

(ii) The structure of the pulmonary vein is different from the structure of the pulmonary artery.
Explain how this difference is related to the function of the pulmonary vein.

(2)

Pulmonary vein has valves which prevent the blood from flowing backward. the pulmonary vein has a larger lumen and less smooth muscle as it does not need to forcefully contract, unlike the pulmonary artery.

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Examiner Comments

The first sentence, like a number of candidate answers, referred to valves being present though the pulmonary vein lacks them. However, the second sentence gives two structural differences. This is the first marking point. The remainder of the second sentence was moving towards the second marking point but needed to refer to the blood flowing back to the heart.

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Examiner Tip

This answer not only gives differences, it makes it clear that it is the pulmonary vein that has a wider lumen and less smooth muscle.

Question 2 (b)(i)

This question item tested candidate knowledge of why an area in the brain would show up lighter in an fMRI scan that the surrounding tissue. Whilst a good number of students appreciated that this was due to an increased oxygenated blood supply, some were not sure whether the fMRI signals were absorbed or reflected by this blood. Having said this, the full mark range was seen, and several excellent answers offered.

This is a clear and well executed response that gains full marks.

(b) There are various types of scan that can be used to study the brain.

(i) Describe why a region of the brain might appear lighter in an image obtained by a functional magnetic resonance image (fMRI) scan.

(3)

Because it does not absorb radiowaves due to ~~bein~~ oxyhaemoglobin being present. Deoxyhaemoglobin does absorb radiowaves so appears darker on the scan. The area appears lighter due to being more active and so contains oxyhaemoglobin as there is more blood flow to this area of the brain.

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Examiner Comments

The first sentence links the fRMI signals being reflected from oxygenated blood for the third marking point. This is reaffirmed in the second sentence. The third sentence then correctly identifies that the area is lighter due to being more active and having more blood flow for the first and second marking points respectively.

This answer was awarded one mark.

(b) There are various types of scan that can be used to study the brain.

(i) Describe why a region of the brain might appear lighter in an image obtained by a functional magnetic resonance image (fMRI) scan.

(3)

- Tumours are shown as a lighter shade ~~of white~~ ~~in fMRI~~ in fMRI
- Appearing lighter may show greater blood flow to a specific area, as that part of the brain is functioning at the time
- therefore showing lighter color

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Examiner Comments

The candidate has correctly referred to an increased blood flow to the lighter area for the second marking point.

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Examiner Tip

Don't forget that all living tissues are respiring at all times, including those of the brain. Therefore, the first marking point needs to be in the context of greater aerobic respiration or more activity.

Question 2 (b)(ii)

In this question item, the candidates were required to describe why a combination of a CT and PET scan was advantageous to having either a CT or a PET scan on its own. It was most pleasing to see a number of candidates giving detailed and thorough answers.

This response considers two aspects of the scans, and gains two marks.

(ii) One scan combines positron emission tomography (PET) and computed tomography (CT). This scan can be used to show whether a person has cancer.

Describe why a combined PET and CT scan may be better for diagnosing cancer than a PET or CT scan on its own.

'frozen moment' (3)

A CT scan allows for still photos of the brain to be taken, ~~and~~ by using X-rays, the brain tumour could absorb the ~~so~~ xrays and ~~app~~ appear in photograph, but a single photo is not very accurate as the tumour can be benign. The PET scan allows for the neural activity to be investigated by injecting radiotracers, they are transported in blood to active areas of brain, so increased detected gamma rays and positrons where the tumour is could indicate increased cell division and activity, showing that the tumour is ~~replicating~~ growing and cells are dividing rapidly. PET scans also allow 3D images to be taken.

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Examiner Comments

The first sentence describes the use of X-rays in a CT scan and the second sentence refers to radiotracers for a PET scan. This enables the fourth marking point to be awarded. The penultimate line makes a suitable reference to a PET scan detecting cell division for the second marking point.

This answer offers a clear advantage for using a CT scan as part of a CT and PET scan combination for one mark.

(ii) One scan combines positron emission tomography (PET) and computed tomography (CT). This scan can be used to show whether a person has cancer.

Describe why a combined PET and CT scan may be better for diagnosing cancer than a PET or CT scan on its own.

(3)

PET scan provides a more detailed image.

CT scans ~~take~~ take less than 1 minutes so can be used to identify ~~size~~ size ~~and~~ & location of of tumour. CT scans do not provide a detailed brain image so PET scans can be used to identify and image ~~tumour~~ oxygen levels at tumour more clearly using radioactive O_2. this allows doctors to see how the tumour is affecting the brain in 1 second ~~rate~~ live images compared to a frozen picture **(Total for Question 2 = 7 marks)**

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Examiner Comments

The first sentence of the second paragraph describes how a CT scan can show the size and location of a tumour. This is the third marking point.

Question 3 (a)(ii)

This question required candidates to offer a null hypothesis in relation to an investigation considering fertility in mice. Approximately half the cohort appreciated that the hypothesis should suggest there was no link between the various treatments the female mice had and their fertility.

This answer correctly links the two variables being considered to gain the mark.

(ii) State a null hypothesis for this investigation.

(1)

There will be no difference in the number of offspring recorded, between the 3 conditions.

ResultsPlus
Examiner Comments

The reference to conditions was considered an acceptable alternative to treatments or groups.

ResultsPlus
Examiner Tip

Make sure you know how to link the dependent and independent variables in a null hypothesis.

Question 3 (a)(iii)

In this item candidates had to review graphical data relating to mouse fertility, and the full mark range was seen. Many were able to appreciate how the various treatments affected the HDL levels within the mice, and therefore, to deliver a credit worthy response.

This response focused on the first two marking points, which was common to a number of candidates.

(iii) Comment on the effect of blood plasma HDL levels on the fertility of these female mice.

(4)

Increased blood plasma HDL levels reduced the fertility of these female mice. Group P had high levels of HDL as they were genetically modified and were not given the drug to reduce HDL levels, and had a mean ~~number~~ number of offspring per month of 0.2. Whereas group Q, who had reduced HDL levels due to drug K had a mean offspring number of 6.5. This shows that lowering the blood plasma HDL levels increased fertility in these mice.

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Examiner Comments

The first sentence correctly links raised HDL levels in mice with a reduction in fertility, so the second marking point could be given. The second sentence moves towards the first marking point but for this mark to be given the candidate has to state that the group P mice produced the lowest number of offspring per mouse per month.

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Examiner Tip

Consider whether quoting values from provided data will be sufficient to gain the mark.

Question 4 (a)(i)

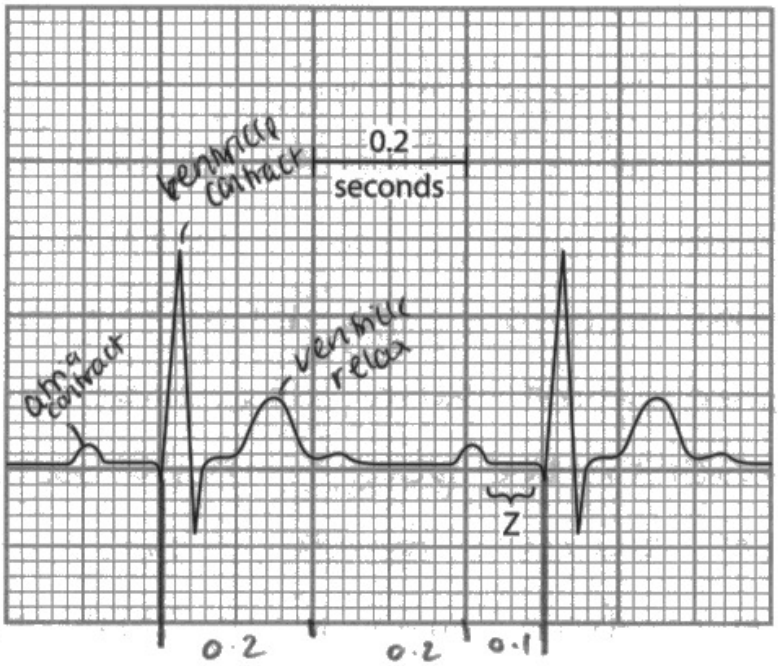
Over half of the candidates were able to show their ability to correctly interpret and analyse the data provided to show the percentage heart rate for the adult above the tachycardia threshold.

This response shows a successful calculation of the heart rate of the person for one mark.

4 A person arrived at hospital having eaten some poisonous berries.

(a) An electrocardiogram (ECG) was recorded for this person.

The diagram shows part of the ECG obtained.



heart rate too fast

(i) Tachycardia for an adult is defined as a heart rate above 100 beats per minute.

Calculate the percentage increase above 100 beats per minute for the heart rate of this person.

(2)

1 heart beat per 0.5 seconds

$\frac{60}{0.5} = 120$ bpm

$\frac{120}{100} \times 100 = 120\%$ increase

Answer 120 %

ResultsPlus
Examiner Comments

The candidate has correctly worked out the heart rate at 120 beats per minute for the first marking point.

A clearly laid out calculation that achieves the correct answer.

4 A person arrived at hospital having eaten some poisonous berries.

(a) An electrocardiogram (ECG) was recorded for this person.

The diagram shows part of the ECG obtained.



(i) Tachycardia for an adult is defined as a heart rate above 100 beats per minute.

Calculate the percentage increase above 100 beats per minute for the heart rate of this person.

(2)

∴ 2bps = 120 bpm

$\therefore \frac{120}{100} = 1.2 \therefore 120\% \therefore +20\%$

Answer 20 %

ResultsPlus
Examiner Comments

Both marks have been awarded for this answer.

Question 4 (b)

In this item, candidates had to explain how a drug that inhibited acetylcholinesterase led to a reduction in heart rate. Pleasingly, the majority of the cohort offered a credit worthy response.

An encouraging answer that gains two marks.

(b) One of the poisons in the berries can bind to acetylcholine receptors on the surface membrane of cells in the SAN. This prevents acetylcholine binding to the receptors if it is in low concentration.

This person was treated with a drug that stopped acetylcholinesterase from being released into the synaptic gap.

Explain how this drug lowered the heart rate of this person.

(3)

acetylcholine is no longer broken down by the enzyme ~~acetyl~~ acetylcholine esterase, the neurotransmitter can now bind to the post synaptic membrane and ~~initiate~~ prevent depolarisation. more acetylcholine can bind to the receptors, on the ~~st~~ SAN, as it is increasing in concentration, due to not being broken down. this will ~~as~~ o inhibit depolarisation, of the SAN, reduce frequency of impulses, reduce electrical activity, to reduce heart rate.

ResultsPlus
Examiner Comments

The candidate has clearly stated that the acetylcholine is not broken down for the first marking point. They then refer, in the first part of the second sentence, to the neurotransmitter binding to receptors on the SAN for the fourth marking point. However, the latter part of this second sentence does not gain the second marking point as the location of the neurotransmitter concentration increase was not provided.

This response appears to suggest that acetylcholinesterase is the neurotransmitter, rather than acetylcholine. This misconception was seen in a minority of cases.

(b) One of the poisons in the berries can bind to acetylcholine receptors on the surface membrane of cells in the SAN. This prevents acetylcholine binding to the receptors if it is in low concentration.

This person was treated with a drug that stopped acetylcholinesterase from being released into the synaptic gap.

Explain how this drug lowered the heart rate of this person.

(3)

It prevents neurotransmitters from being released which doesn't allow the regular Brain bodily functions to continue. This therefore lowered the heart rate and limited the amount of ~~p~~ regular processes that cannot occur.

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Examiner Comments

Unfortunately there were no marks awarded for this answer.

Question 4 (c)

Candidates had to describe how pupil size increased in the person who ingested the poisonous plant. An encouraging majority were able to supply answers that achieved at least one mark.

This candidate answer gained two marks.

(c) The poison also caused the pupils of this person to dilate.

Describe the interaction of the muscles in the eye that led to this dilation of the pupils.

(3)

The circular muscles relax and the radial muscles contract which causes dilation of the pupil. It involves the sympathetic nerve. Occurs in the iris.

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Examiner Comments

The initial reference to the behaviour of the circular and radial muscles was correct. This was, perhaps, the most commonly awarded mark. The candidate then tells us that this muscle action occurs in the iris for the second marking point. This was the least often awarded mark for this question.

This response also gained two marks.

(c) The poison also caused the pupils of this person to dilate.

Describe the interaction of the muscles in the eye that led to this dilation of the pupils.

(3)

The radial muscles began to contract ~~whti~~ whilst circular muscles relaxed causing the pupils to widen. leading to the dilation of the pupils. An antagonistic muscle pair.

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Examiner Comments

The third marking point was clearly stated in the first sentence, and then at the end, the first marking point.

ResultsPlus
Examiner Tip

Be careful with terminology as a number of candidates incorrectly referred to ciliary muscle when describing circular muscle.

Question 5 (b)(i)

In this question, candidates had to devise an investigation to study a prediction relating to breathing rate and tidal volume in people with different thoracic cavity sizes. Whilst the full mark range was seen, many delivered answers that focused on the selection of the participants. Clear descriptions of how to assess tidal volume and breathing rate from a spirometer trace were less often encountered.

This is a detailed answer that included a focus on the selection of participants.

(b) The availability of oxygen in the air is lower at high altitudes because of the lower air pressure.

Populations of humans that have lived at high altitude for many generations have adapted to these conditions.

One adaptation these people have is a larger thorax than people living at lower altitudes.

A student made the following hypothesis:

People with this adaptation will have a lower breathing rate as their tidal volume will be greater than those without the adaptation.

(i) Devise a valid investigation, using a spirometer, to test this hypothesis.

(4)

- calibrate your kymograph to ensure volume is correct
- disinfect mouthpiece and nose clip.
- purified oxygen tank
- ~~limestone to absorb CO_2~~
- limestone to absorb CO_2 produced as it's toxic and can produce carbonic acid in the blood which lowers blood pH which can lead to enzyme denaturation.
- candidates should be of same age & gender
- Take 2 candidates {one from an area of high altitude and one from an area of low/normal altitude}.
- place mouth piece in mouth
- ~~use spirometer to determine~~ and place nose clip on nose to ensure only oxygen breathed in is from O_2 tank.
- ~~use~~ use kymograph to measure ~~amount~~ volume of gas taken in and given out.
- use peak and trough to determine tidal volume and number of peaks in 1 minute to determine breaths per minute.
- Work out the cardiac outputs → tidal volume x breath rate
- Repeat this experiment for the 2nd candidate and compare the cardiac outputs, the breaths per minute and tidal volume.
- do a statistical test to compare results and determine if there is a correlation.

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Examiner Comments

Marks awarded in this response included for the references to the participants used in the investigation. The first bullet point (on the fifth line) gains the second marking point and the next bullet point (next line) can be awarded the first marking point.

The fourth bullet point from the bottom considers how to measure the tidal volume and breathing rate. In the former case, more detail is needed in relation to the peak and trough reference, but how to measure the breathing rate was credit worthy (fifth marking point). Therefore, three marks can be awarded here.

A technical discussion but one that does not really address how to test the proposed hypothesis.

(b) The availability of oxygen in the air is lower at high altitudes because of the lower air pressure.

Populations of humans that have lived at high altitude for many generations have adapted to these conditions.

One adaptation these people have is a larger thorax than people living at lower altitudes.

A student made the following hypothesis:

People with this adaptation will have a lower breathing rate as their tidal volume will be greater than those without the adaptation.

(i) Devise a valid investigation, using a spirometer, to test this hypothesis.

(4)

Soda lime should be used to absorb CO_2 to ensure only oxygen is measured.
Using a float with a pen and rotating paper, the person breathes into the float and their breathing in and out makes the float sink and rise producing a graph on the paper.

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Examiner Comments

No marks awarded.

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Examiner Tip

Always make sure that the response links to the context of the question.

This response offers the most commonly awarded mark point and gained one mark.

(b) The availability of oxygen in the air is lower at high altitudes because of the lower air pressure.

Populations of humans that have lived at high altitude for many generations have adapted to these conditions.

One adaptation these people have is a larger thorax than people living at lower altitudes.

A student made the following hypothesis:

People with this adaptation will have a lower breathing rate as their tidal volume will be greater than those without the adaptation.

(i) Devise a valid investigation, using a spirometer, to test this hypothesis.

(4)

Gather two groups of participants, one group devised of people from low altitudes and the other group being people from high altitudes. ask them to breathe into the spirometer to calculate their tidal volume and take their heart rate using a heart rate monitor and compare the results to the hypothesis.

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Examiner Comments

The first four lines nicely describe the choice of people to include in the investigation. The first marking point can, therefore, be awarded.

Question 5 (b)(ii)

This item required candidates to explain differentiation of stem cells into a specialised cell type, but in the context of bone marrow stem cells specialising into red blood cells. Many had a splendid grasp of the differentiation process but not all tailored their answer to this erythrocyte example.

This response focused on the first marking point.

(ii) Another adaptation to living at high altitude is to have more red blood cells circulating in their blood.

Explain how a bone marrow stem cell can give rise to red blood cells.

(4)

from bone marrow
Stem cells ^ are undifferenciated cells, hence they are able to
mostly
develop into a ~~mostly~~ any other cell.

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Examiner Comments

Whilst the candidate targeted the first marking point, the reference to develop was not sufficient for the first marking point to be awarded. This answer was not credit worthy.

ResultsPlus
Examiner Tip

Look to use technical language where appropriate.

A response that elicited one mark by gaining the first marking point.

(ii) Another adaptation to living at high altitude is to have more red blood cells circulating in their blood.

Explain how a bone marrow stem cell can give rise to red blood cells.

(4)

Bone marrow stem cells are pluripotent, meaning they are able to differentiate into any cell in the body, excluding the placenta or embryo cells. Bone marrow stem cells would ~~[illegible]~~ differentiate into a red blood cell and enter the blood vessels via diffusion in order to be taken to where it is needed.

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Examiner Comments

The reference to the stem cells differentiating into red blood cells is credit worthy, one mark awarded.

This is a strong and detailed account of cell differentiation, that gained four marks.

(ii) Another adaptation to living at high altitude is to have more red blood cells circulating in their blood.

Explain how a bone marrow stem cell can give rise to red blood cells.

(4)

The stem cell could be exposed to a chemical stimulus. Different genes in their DNA will be activated. RNA Polymerase will transcribe activated genes. mRNA is produced. mRNA can be translated into protein. The protein modifies the cell. The protein can determine cell structure and function. The stem cell will divide by mitosis. It will form specialised red blood cells in differentiation. Bone marrow stem cells are multipotent.

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Examiner Comments

The first sentence correctly refers to a suitable stimulus, which is the second marking point. The second sentence considers gene activation and achieves the third marking point. The third and fourth sentences suitably link the activated genes and transcription for the fourth marking point. The penultimate sentence then makes a correct reference to differentiation, the first marking point.



There is merit in working through a question like this in a logical sequence as this reduces the chance of missing out an important component.

Question 6 (a)(ii)

In this item the candidates needed to explain the movement of sodium ions and potassium ions during neurone depolarisation and repolarisation, but in the context of the ions within the cell cytoplasm. Whilst there were many excellent and thorough answers given, a sizable minority did not take note of the context.

A clear answer that gains the two most commonly awarded marks.

(ii) Explain the changes in the sodium and potassium ion concentrations in the cytoplasm of the neurone from point W to point X on the graph.

(4)

At point W voltage gated Na^+ ion channels open and Na^+ ions diffuse into the neurone cytoplasm. Once the threshold potential is reached all the Na^+ ion channels open and the neurone becomes depolarised as the inside of the neurone becomes more positive than the outside. The Na^+ ions diffuse in because they are going down their concentration gradient. Then at +40mV the voltage gated Na^+ ion channels close and the voltage gated K^+ ion channels open. So K^+ (cytoplasm) diffuses out of the neurone down it's concentration gradient and cation gradient. Because the K^+ diffuses out the neuron the neurone becomes repolarised as the inside of the neurone becomes more negative compared to outside. This happens until point X on the graph.

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Examiner Comments

Initially (first sentence) the candidate focuses on what happens from point W and accurately describes the the opening of relevant voltage gated channels and the correct directional movement of sodium ions for the first marking point. In the second sentence, there is a reference to an increased positive charge inside the cell but to gain the second marking point, sodium ions must be included.

The candidate then suitably considers the behaviour of the voltage gated potassium ion channels and the movement of the potassium ions during repolarisation for the third marking point.

Therefore, two marks awarded for this response.

Question 6 (a)(iii)

Candidates were expected to explain why hyperpolarisation occurs after repolarisation in a neurone. About half of candidates were able to identify that it was hyperpolarisation that was being considered and to correctly explain the ion movement.

This answer delivers the most commonly awarded mark point for this item.

(iii) Explain why the neurone becomes hyperpolarised after point X on the graph.

(3)

After point X there is an overshoot period where more K^+ ions diffuse out of the cell than necessary, ~~this~~ - 70 mV. This makes the inside of the neurone more negative than the resting potential of -70 mV therefore it is said to be hyperpolarised.

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Examiner Comments

The answer here gives a clear explanation as to why the neurone pd drops below that of the resting potential, to gain the first marking point.

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Examiner Tip

Always consider the mark allocation as an indication of the detail required.

This response gains one mark by considering the second most commonly awarded mark for this question item.

(iii) Explain why the neurone becomes hyperpolarised after point X on the graph.

(3)

Hyperpmansation occurs to make a refractory period, so that another action potential cannot fire straight after.

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The candidate correctly refers to a refractory period.

This item response gains the first two marking points for two marks.

(iii) Explain why the neurone becomes hyperpolarised after point X on the graph.

(3)

There is a refractory period as voltage gated ion channels take time to close, so more K^+ ions diffuse outwards than is present at resting potential. The K^+ voltage gated channel needs time to close.

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The reference to potassium ion voltage gated channels being slow to close, and therefore the ions continue to move out, is a suitable alternative approach for the first marking point.

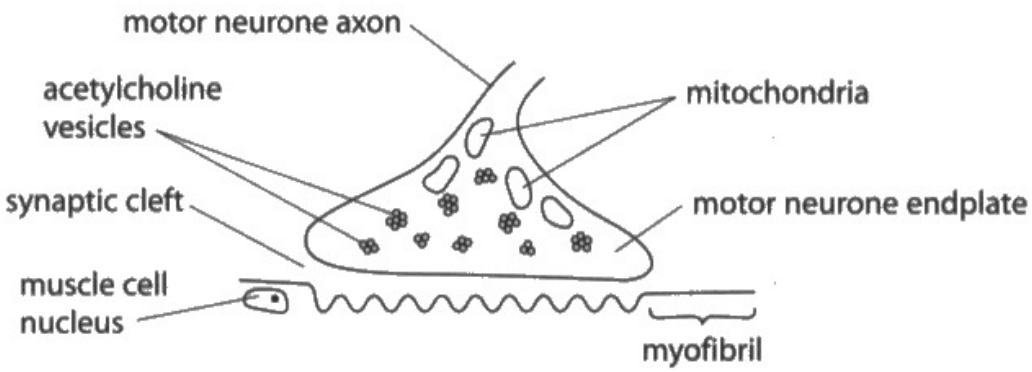
Question 6 (b)

This component considered the synapse, but in the twin contexts of a motor end plate and what happens within the synaptic cleft. Most dealt with this item well, and about half achieved both marks. However, a minority of candidates described post-synaptic membrane behaviour after the neurotransmitter had bound, which was beyond the scope of the question.

This answer gains both the marks that are available.

(b) The junction between the end of a motor neurone and a muscle myofibril is a modified synapse.

The diagram shows this neuromuscular junction.



Describe how the neurotransmitter crosses this synapse.

(2)

Neurotransmitter that is packaged in vesicles fuses with the pre-synaptic cell surface membrane

- ~~the~~ Neurotransmitter released via exocytosis. into synapses
- Neurotransmitter diffuses across synaptic cleft.

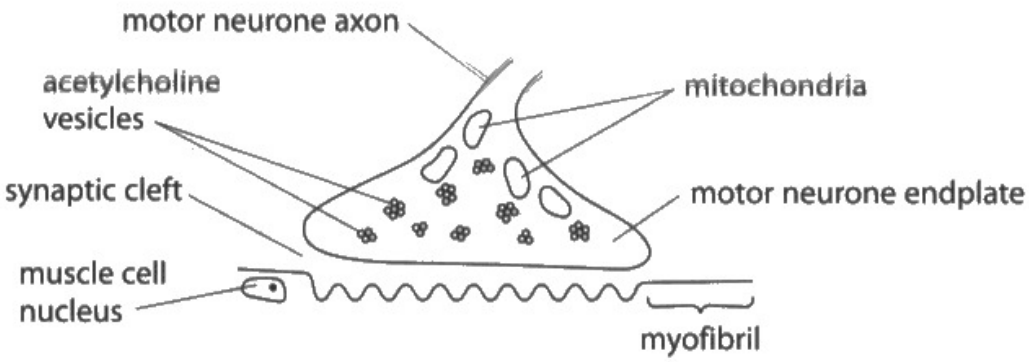
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Examiner Comments

The first two sentences make it clear that the neurotransmitter is being released from the presynaptic membrane for the first marking point. The final sentence accurately describes how this neurotransmitter moves across the synapse for the second marking point.

This response could not be awarded any marks.

(b) The junction between the end of a motor neurone and a muscle myofibril is a modified synapse.

The diagram shows this neuromuscular junction.



Describe how the neurotransmitter crosses this synapse.

(2)

Vesicles leave the ~~the~~ Synaptic knob via exocytosis. These vesicles contain the neurotransmitter. The release of these vesicles of neurotransmitter is triggered by an influx of calcium ions into the synaptic knob. They then diffuse across the Synaptic cleft and bind to ^specific receptors on the muscle cell membrane.

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Examiner Comments

The first two sentences suggest that it is the vesicles that exit the presynaptic membrane and enter the synaptic cleft. The context of the third sentence strongly implies that it is the vesicles that diffuse across the gap so the second marking point cannot be given.

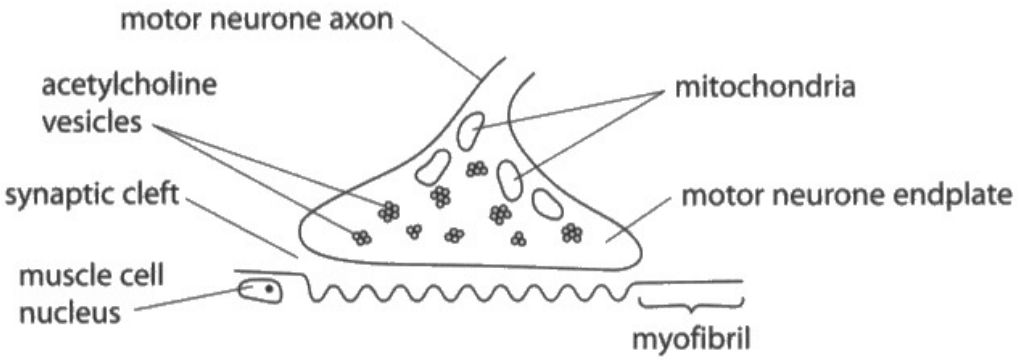
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Examiner Tip

Make sure it is clear what is being released, and from where, in questions about the synapse.

This answer targets one aspect of the description and gives a clear response for one mark.

(b) The junction between the end of a motor neurone and a muscle myofibril is a modified synapse.

The diagram shows this neuromuscular junction.



Describe how the neurotransmitter crosses this synapse.

(2)

The Neurotransmitter is diffuses across the Synaptic cleft and binds to receptor sites on the post Synaptic membrane of the muscle cell

ResultsPlus
Examiner Comments

There is a sound account of neurotransmitter movement across the synaptic gap for the second marking point.

Question 7 (a)(i)

Candidates were expected to explain why there is a rise in core body temperature when physical exercise commences. A good majority of the cohort achieved at least 50% of the marks available.

This response is typical of a number seen and can be awarded one mark.

7 Athletes compete in a range of environmental conditions.

(a) An investigation studied the effects of environmental conditions on athletes.

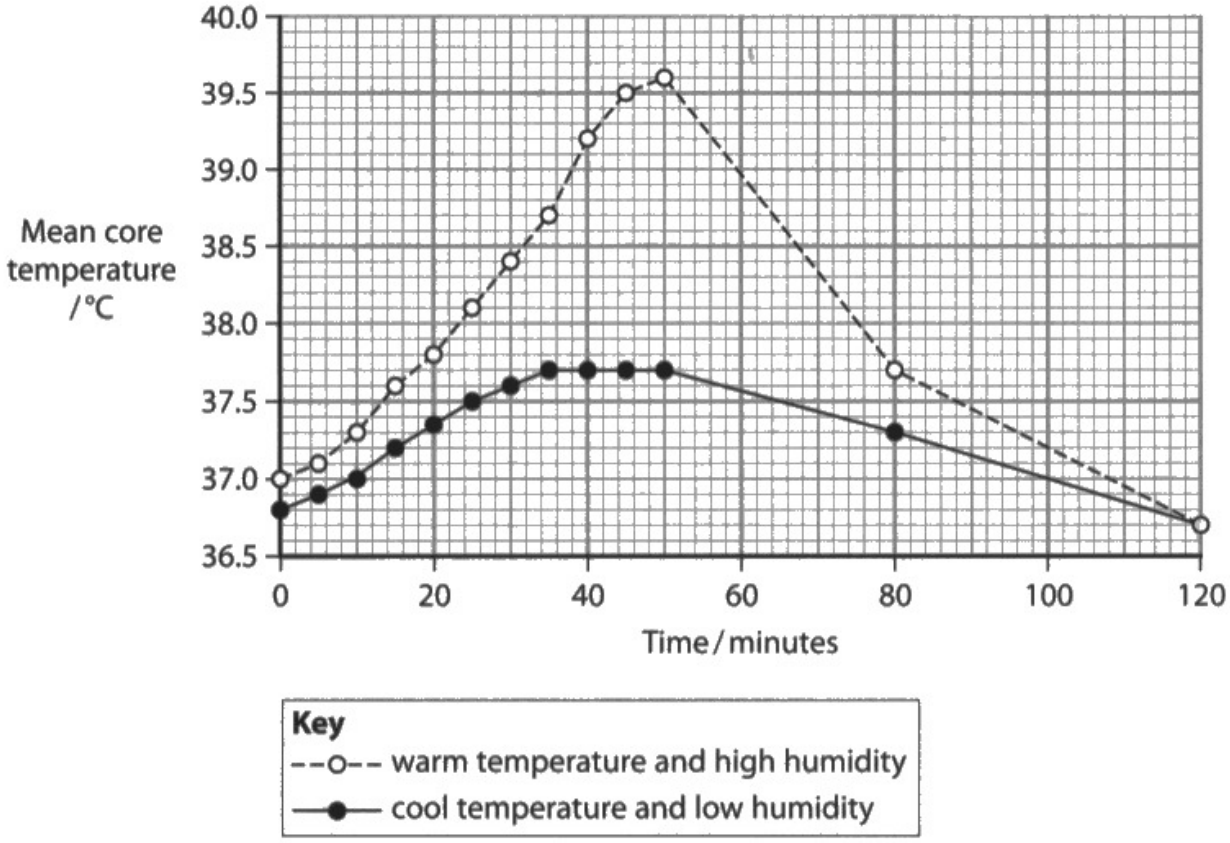
A group of nine athletes ran for 50 minutes in two sets of environmental conditions:

- warm temperature and high humidity
- cool temperature and low humidity.

All other variables were kept constant including the level of exercise.

The core temperature of each athlete was recorded during the exercise and for 70 minutes following the exercise.

The results are shown in the graph.



(i) Explain why there was a change in core temperature during the first 20 minutes of exercise.

(2)

Energy is being produced through aerobic respiration, so excess becomes heat energy / radiation.

ResultsPlus
Examiner Comments

The candidate recognises that heat energy is produced as an outcome of respiration, so can be awarded the first marking point. However, for the second marking point to be given, the candidate needed to include an increase in the respiration occurring in the muscles.

ResultsPlus
Examiner Tip

All cells within the body will be respiring at all times generating heat, so make sure you consider why the body temperature rises during exercise.

Question 7 (a)(ii)

This item required the candidature to comment on a statement that considered whether thermoregulation in exercising humans occurs in two specific situations described in the question, including a graphical representation of the results. The full mark range was seen with some very strong answers offered.

This response did not fully target the question so no marks could be awarded.

(ii) Using the results of this investigation, a student concluded that during exercise: → hypothalamus

- the human thermoregulatory system only works in cool environmental temperatures when the humidity is low.

Comment on this conclusion.

(4)

In cool (cold) temp + ~~than~~ humidity, environments the mean core body temperature increase from 0 minutes to 34.5 minutes because ~~the~~ thermoreceptors detect a decrease in temp in blood and skin, so hypothalamus send impulses to vasoconstrict to blood vessels to reduce heat loss per min surface. However, thermoregulatory system also works in hot temps and high humidity environments as it has a greater decrease of mean body temp from 50 mins compared to cool temp.

The thermoreceptors have detected high temp in blood, so hypothalamus has quickly send impulses to vasodilate blood vessels and to cause sweating to cool down.

ResultsPlus
Examiner Comments

The first sentence starts by describing an increase in body temperature for one of the two groups of athletes. Initially it considers the low temperature/low humidity situation but unfortunately the graphical data was misread.

The response then refers to a decrease in body temperature of the high temperature/high humidity group after exercise has been completed, though the question limits itself to during exercise only.

ResultsPlus
Examiner Tip

Make sure that the response limits itself to the parameters of the question, in this case, commenting on the student conclusion associated with the exercise period only.

Also look carefully when reading data off graphs.

This response achieved half of the available marks.

(ii) Using the results of this investigation, a student concluded that during exercise:

- the human thermoregulatory system only works in cool environmental temperatures when the humidity is low.

Comment on this conclusion.

(4)

The human thermoregulatory system worked better in cool temperatures with low humidity than in high temperatures with high humidity as shown by the graph. An experiment would need to be carried out to see if the thermoregulatory system works as effectively in low temperatures with high humidity or # high temperatures with low humidity.

ResultsPlus
Examiner Comments

The first paragraph suitably offers the converse of the second marking point. The candidate's second paragraph correctly deals with the idea of the limited scope of the environmental conditions the athletes were subjected to so gains the fourth marking point

Question 7 (a)(iii)

It was excellent to see that many candidates were able to interpret the body temperature data after the exercise had been completed with a good majority gaining 2 or 3 marks (out of a maximum of 3).

This response gives a clear account of the fourth marking point for one mark.

(iii) Compare and contrast the changes in core body temperature, in the two environments, after the exercise was completed.

(3)

- After the exercise has finished, core body temperature are both at 36.7°c
- At high ~~and high~~ temperature and high humidity, temperature falls faster.
- falls by 0.0414 °c min^{-1} whilst temperature at low and low humidity, temperature falls much slower, falls by 0.0143 °c min^{-1}

ResultsPlus
Examiner Comments

Whilst the first sentence correctly identifies the final temperature 70 minutes after the exercise was completed, the candidate has not stated the timeframe and implies that this is the temperature immediately after exercise has finished, so the second marking point could not be awarded.

This is a strong and thorough answer that gains all three marks.

(iii) Compare and contrast the changes in core body temperature, in the two environments, after the exercise was completed.

(3)

After exercise ended both returned to 36.7°C within 70 minutes. However, in cool low humidity conditions it was fairly gradual and declined at a constant rate where as in the warm humid conditions there was an initial sharp decline before gradually decreasing further. Both decline to 37.3 within half an hour of finishing exercise. Shows in warm humid as environments change in temperature was quicker as declined to the same temperature in the same amount of time but from a higher initial temperature

ResultsPlus
Examiner Comments

The first sentence clearly lays out the second marking. The second sentence then compares the nature of the heat loss post exercise for the two conditions which is the fourth marking point. The beginning of the third sentence states that both decline which is the first marking point. The final sentence then offers the other approach for the fourth marking point.

This is also a clear and considered answer that gained full marks.

(iii) Compare and contrast the changes in core body temperature, in the two environments, after the exercise was completed.

(3)

- After exercise was completed, the group in higher temperatures and humidity had a fast and dramatic and steep decrease in core body temperature but in the low temp + humidity, the decrease was slower and less dramatic
- After exercise, ~~Both~~ the core body temperature decreased in both groups.
- In both groups, ~~after~~ 70 minutes after exercise, core body temperature ~~re~~ was the same and had returned to the norm value of 36.7°C

ResultsPlus
Examiner Comments

The first bullet point suitably refers to the rate of decrease in core body temperature for both groups via the terms faster and slower, for the fourth marking point. The second bullet point succinctly deals with the first marking point, whilst the third bullet point can be awarded the second marking point.

ResultsPlus
Examiner Tip

Remember that to gain full marks in a compare and contrast question, both similarities (the first two marking points) and differences (the third and fourth marking points) must be given.

Question 7 (b)(i)

Candidates were required to use the data provided in the first row of the table to calculate the decrease in neutrophil concentration per kilogram of athlete body mass immediately after carrying out an exercise. Many dealt with this well, but a number failed to appreciate that the figures given were in millions.

This response offered the correct calculated figure so gained full marks.

(b) In another investigation, samples of blood were taken from athletes during exercise and after exercise.

The concentration and activity of neutrophils, a type of phagocyte, in the blood were measured.

The table shows the results.

Measurements	During exercise	Immediately after exercise
Mean concentration of neutrophils in blood / 10^6 cells cm^{-3}	3.57	3.42
Mean activity of neutrophils / a.u.	28.4	22.0

(i) The mean body mass of the athletes was 70 kg and the mean volume of blood per athlete was 5 dm^3.

Calculate how many fewer neutrophils there are in the blood per kilogram of body mass immediately after exercise.

(3)

$3.57 \times 10^6 \rightarrow 3.42 \times 10^6$
cm^3 : x : 5
∴
$3.57 \times 10^9 \rightarrow 3.42 \times 10^9$
dm^3

1.785×10^{10} (×5) 1.71×10^{10}

$\frac{7.5 \times 10^8}{70} = 1.07 \times 10^7$

1.07×10^7 kg^{-1}

ResultsPlus
Examiner Comments

Three marks awarded

This response gained the first two marking points.

(b) In another investigation, samples of blood were taken from athletes during exercise and after exercise.

The concentration and activity of neutrophils, a type of phagocyte, in the blood were measured.

The table shows the results.

Measurements	During exercise	Immediately after exercise
Mean concentration of neutrophils in blood / 10^6 cells cm^{-3}	3.57	3.42
Mean activity of neutrophils / a.u.	28.4	22.0

(i) The mean body mass of the athletes was 70 kg and the mean volume of blood per athlete was 5 dm^3.

Calculate how many fewer neutrophils there are in the blood per kilogram of body mass immediately after exercise.

(3)

$5dm^3 = 5000 cm^3$

$3.57 \times 10^{6} \times 5000 = 17850$

$3.42 \times 10^{6} \times 5000 = 17100$

$17850 - 17100 = 750$

$\frac{750}{70} = 10.7$

10.7 ..... kg^{-1}

ResultsPlus
Examiner Comments

The final value offered did not take into account the 10 to the power 6 component, so this answer gained two of the three marks available.

Question 7 (b)(ii)

Candidates were asked to use the data about neutrophils as evidence for a greater risk of infection immediately after exercise in this question item. This required the candidates to consider all of the data in the table.

This response focused on the second row of the table only, so only dealt with the change in neutrophil activity data.

(ii) State how these results support the statement that exercise increases the risk of infection.

(1)

The neutrophils were less active after exercise.

ResultsPlus
Examiner Comments

As the change in the numbers of neutrophils was not also considered in this answer, no mark could be awarded.

This answer to the question considered the decrease in neutrophil numbers only. This was the most common approach seen for those candidates who did not gain this mark.

(ii) State how these results support the statement that exercise increases the risk of infection.

(1)

This is because there are less neutrophills (white blood cells) to attack the site of infection during exercise as concentration of neutrophills in the blood drops.

ResultsPlus
Examiner Comments

As activity was not considered, this mark could not be awarded.

The candidate has tackled both changes in the neutrophils after exercise to gain the mark.

(ii) State how these results support the statement that exercise increases the risk of infection.

(1)

+ The neutrophils decreased in concentration and activity after exercise. The phagocyte is needed for phagocytosis.

ResultsPlus
Examiner Comments

The candidate has correctly stated that both neutrophil numbers and their activity level have decreased post exercise.

ResultsPlus
Examiner Tip

Make sure to consider all the possible relevant data.

Question 8 (b)(i)

Candidates were asked to name two single membrane-bound organelles in this question. A wide range of organelles were suggested.

This candidate identified two correct organelles.

(b) Eukaryotic cells contain a range of membrane-bound organelles including the Golgi apparatus and the rough endoplasmic reticulum (rER).

(i) Name two other organelles that are bound by a single membrane.

(1)

Vesicles and smooth endoplasmic reticulum

ResultsPlus
Examiner Comments

Mark awarded.

This response offered two organelles, but neither are surrounded by a single membrane.

(b) Eukaryotic cells contain a range of membrane-bound organelles including the Golgi apparatus and the rough endoplasmic reticulum (rER).

(i) Name two other organelles that are bound by a single membrane.

(1)

centrioles and ribosome

ResultsPlus
Examiner Comments

Mark could not be awarded.

Both organelles need to be correct to gain the mark.

(b) Eukaryotic cells contain a range of membrane-bound organelles including the Golgi apparatus and the rough endoplasmic reticulum (rER).

(i) Name two other organelles that are bound by a single membrane.

(1)

ribsomes and sER

ResultsPlus
Examiner Comments

Whilst smooth endoplasmic reticulum is correct, ribosomes are not, so no mark achieved.

Question 8 (b)(ii)

In this question, candidates were presented with a data table showing the percentage of membranes in pancreatic cells and liver cells that comprised rough endoplasmic reticulum and Golgi apparatus. Many were able to explain the differences in the values and over half of the candidate cohort scored at least 60% of the marks.

In this response, the candidate has tended to quote the data in the table rather than explaining the data.

(ii) The table shows the percentage of cell membranes that make up Golgi apparatus and rER in the cells from two organs.

Organ	Percentage of cell membranes (%)	
	Golgi apparatus	rER
Liver	7	35
Pancreas	10	60

Explain the differences in the percentage of membranes that comprise the two organelles in these cells.

(5)

In the Liver there is only 7% of cell membranes that are golgi apparatus compared to the 35% of the rER. In the pancreas there is only 10% ~~in the~~ golgi apparatus when there is 60% for rER. This shows that the majority of rER cell membranes is made up in the liver and pancreas, ~~which is used for liver protein~~ as it is 90% combined however the majority of golgi apparatus cell membranes is then made up outside of the liver and pancreas as only 17% is.

ResultsPlus
Examiner Comments

No marks can be awarded for this answer.

ResultsPlus
Examiner Tip

Make sure the answer matches the command word.

A thorough answer that clearly considers the data and follows it through with a detailed explanation. Full marks awarded.

(ii) The table shows the percentage of cell membranes that make up Golgi apparatus and rER in the cells from two organs.

Organ	Percentage of cell membranes (%)	
	Golgi apparatus	rER
Liver	7	35
Pancreas	10	60

Explain the differences in the percentage of membranes that comprise the two organelles in these cells.

(5)

The pancreas secretes many hormones and proteins therefore requires a higher ~~more~~ % of golgi apparatus and RER. ~~Poly~~ Polypeptide chains leave the ribosome after synthesis and move through the rER for folding into it's tertiary structure. The rER then packs the protein in a transport vesicle which leaves the rER and fuses with the golgi. The golgi further modifies the protein via the addition of a lipid or carb, and packages the modified protein into a secretory vesicle to be used in the cell, or leave via exocytosis to be used outside the cell.

The pancreas synthesises insulin which is needed in high demand to control blood glucose. The liver requires less golgi apparatus and RER as it synthesises less proteins.

ResultsPlus
Examiner Comments

In the context of the question, the first sentence makes it clear that the pancreas has more rough endoplasmic reticulum and Golgi apparatus than the liver, so gains the third and first marking points respectively. It then gives some of the roles of the rough endoplasmic reticulum for the second marking point. Subsequently it offers the modification of the protein and packaging for secretion by the Golgi apparatus for the fourth and fifth marking points.

Question 8 (c)

The candidates have been presented with some measurements relating to a single Golgi apparatus and were asked to calculate the height of the stack of cisternae. An encouraging proportion of the exam cohort were able to do so effectively.

This response displays a suitable approach to this calculation and achieves the correct answer.

(c) In one study, measurements were taken of a single Golgi apparatus.

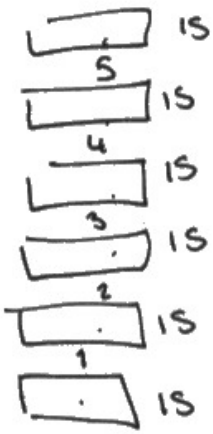
The measurements were:

- total number of cisternae = 6
- height of each cisterna = 15 nm
- distance between adjacent cisterna = 25 nm

Calculate the total height of the stack of cisternae in this Golgi apparatus.

Give your answer in micrometres.

(2)



15x6 = 90nm

5 x 25 = 125nm

215nm x 10^{-3} =

0.215 µm

0.215 µm

ResultsPlus
Examiner Comments

The candidate has worked out the height in millimetres and then correctly converted the answer to micrometres as requested. Both marks given.

ResultsPlus
Examiner Tip

The idea of using a diagram to help with an item such as this is a good one. It shows that there were six cisternae but only five gaps between them.

This response also used a diagram to aid the calculation, but only gained one mark

(c) In one study, measurements were taken of a single Golgi apparatus.

The measurements were:

- total number of cisternae = 6
- height of each cisterna = 15 nm
- distance between adjacent cisterna = 25 nm



Calculate the total height of the stack of cisternae in this Golgi apparatus.

Give your answer in micrometres.

(2)

(15 x 6) + (25 x 5)

= 215 nm

2.15 µm

ResultsPlus Examiner Comments

The candidate has successfully appreciated the cisternae stack arrangement and has calculated the total height. However, they have not converted the height into the units required.

ResultsPlus Examiner Tip

Always check the units when doing calculations.

Question 8 (d)

This part of question 8 asked the candidature to explain the effect of alcohol on the concentration of betalain in the cell. Whilst nearly half gained at least two marks, a number of candidates did not link their answer to the question context, which was to do with the pigment concentration inside the cells. Some candidates felt that betalain moved out via osmosis.

This candidate answer correctly appreciates the outcome of alcohol on beetroot cell membranes for one mark.

(d) Beetroot cells contain the pigment betalain.

When beetroot cells are placed in alcohol, the concentration of betalain in the cells changes.

Explain why alcohol affects the concentration of betalain in these cells.

(3)

Alcohol disrupts the cell membrane of beetroot cells. This causes the phospholipid bilayer to diffuse more betalain outside the cell. Because of the concentration gradient present, betalain diffuses out of the cell

ResultsPlus
Examiner Comments

The response shows that the candidate recognises that alcohol alters the nature of cell membranes but more detail, such as increased permeability and dissolving the phospholipids was required. However, they correctly identify the outcome of this disruption, so gain the second marking point.

ResultsPlus
Examiner Tip

Check the context as in this case, the question relates to betalain concentrations within the cell.

This response gives detail about the change in membrane permeability and answers within the framework of the question for two marks.

(d) Beetroot cells contain the pigment betalain.

When beetroot cells are placed in alcohol, the concentration of betalain in the cells changes.

Explain why alcohol affects the concentration of betalain in these cells.

(3)

- alcohol affects the permeability of the plasma membrane of beetroot
- alcohol denatures enzymes in the plasma membrane, creating pores & making the beetroot more permeable.
- This means the concentration of betalain in the cell decreases as more pigment leaves out & can exist the ~~p~~ phospholipid bilayer.
- alcohol affects the tertiary structure of the membrane.

ResultsPlus
Examiner Comments

Whilst the first bullet point refers to permeability, it has not stated how the permeability has changed. However, the second bullet point clarifies this so the third marking point can be awarded. The start of the third bullet point makes an appropriate reference to a decrease in betalain within the cell so gains the first marking point. However, the remainder of this bullet point does not qualify for the second marking point as there is no reference to diffusion or a description of the betalain diffusing.

Question 9 (a)(i)

Candidates were required to explain how the recessive allele can be identified when two mice with yellow coats produce some offspring that have yellow coats and some that have non-yellow coats in this question item.

This candidate answer gives a succinct and clear explanation identifying which allele is recessive for one mark.

9 The inheritance of coat colour in mice has been investigated.

Some scientists crossed mice that had yellow coats. The offspring had either yellow coats or non-yellow coats.

(a) (i) Explain how the scientists knew which allele for coat colour was recessive.

(2)

The non-yellow coats must be from recessive alleles, as if yellow coats were recessive, all of their offspring would also be yellow. Therefore, the allele for yellow coats is dominant.

ResultsPlus
Examiner Comments

The response gains the second marking point.

A clear explanation that covers both marking points.

9 The inheritance of coat colour in mice has been investigated.

Some scientists crossed mice that had yellow coats. The offspring had either yellow coats or non-yellow coats.

(a) (i) Explain how the scientists knew which allele for coat colour was recessive.

(2)

The non-yellow coat colour allele was recessive as if it was dominant the parent mice would be expressing it's phenotype. In the offspring it was present in homozygous form and as such was expressed. ~~In~~ the parent mice must be heterozygous and carries for non yellow recessive.

ResultsPlus
Examiner Comments

The first sentence of this response gives a nice explanation as to why non-yellow coat colour in mice is recessive for the second marking point. It then considers the parents and identifies them as heterozygous for the first marking point.

Question 9 (a)(ii)

Here, candidates had to recognise that there would be a 3 to 1 ratio and to then use this information to predict the expected frequency of the offspring at 1199.25 for yellow coat and 399.75 for the non-yellow coat. Well over half of the cohort correctly applied both elements of this calculation.

This response is typical of a minority who thought the ratio must be 1 to 1.

(ii) The crosses led to a total of 1599 offspring being produced.

Predict the number of yellow and non-yellow offspring produced.

(2)

Offspring with a yellow coat	Offspring with a non-yellow coat
799	800

	Y	y
y	Yy	yy
y	Yy	yy

50%

ResultsPlus
Examiner Comments

No mark can be awarded.

Question 9 (a)(iii)

In this item, candidates were presented with the actual number of yellow coated and non-yellow coated offspring, and were asked to explain why there are differences between actual numbers and the predicted values.

This answer offered the most commonly awarded marking point for this question item, for one mark.

(iii) The table shows the actual number of offspring with each coat colour.

Offspring with a yellow coat	Offspring with a non-yellow coat
1064	535

Explain why there are differences between the predicted and actual numbers of these mice.

(3)

• This could be due to random mutation in the DNA base sequence, causing a change in the appearance of the mice.

• Random fertilisation, crossing over of different alleles and independent assortment all giving rise to genetic variation.

• Different selection pressures could be experienced causing increase/decrease of different advantageous alleles.

ResultsPlus
Examiner Comments

The second bullet point identifies random fertilisation as a possible reason.

ResultsPlus
Examiner Tip

When presented with data such as this, it would be worth trying to establish the ratio, as in this case, it is quite different to the predicted ratio.

Question 9 (b)

This was the first of the two indicative content six-mark questions. Data was provided on the size of a gene and, indirectly, its mRNA transcript, and the candidates were asked to explain the differences. Many were able to deliver good descriptions of the differences between the two nucleic acids, but it was less common to see explanations for those differences. Having said this, there were a number of outstanding responses that displayed excellent candidate knowledge and understanding. Answers at all levels, and marks, were seen.

The main focus of this answer is on a comparison of the structure of the gene (on the DNA) and the mRNA produced so is a level 1 answer.

*(b) There is a gene in humans similar to the mouse coat colour gene.

This human gene comprises 74775 base pairs. The mRNA produced from this gene codes for a protein made up of 132 amino acids.

Explain the differences in the gene coding for this protein and the mRNA produced from it.

(6)

While the gene comprises of 74775 base pairs in the double stranded DNA, the mRNA will include 399 base pairs ~~as there is no~~ on its single strand as there will be 396 bases that are the codons for a complimentary anticodon ~~associated~~ carrying each amino acid, and the final 3 base, ~~but~~ is a stop codon that does not code for an amino acid.

The Gene's nucleotides will contain a deoxyribose sugar, while the mRNA's nucleotide, will contain a ribose sugar in its sugar phosphate backbone.

~~The~~ The Gene may include the bases Guanine, cytosine, adenine and thymine, but the mRNA molecule ~~as~~ contains uracil ~~bases~~ bases instead instead of thymine.

ResultsPlus
Examiner Comments

The comparison is accurate and detailed so would be worthy of both marks in this level. Two marks awarded.

This is a response that not only satisfies the criteria for level 1 but moves into level 2 as well.

*(b) There is a gene in humans similar to the mouse coat colour gene.

This human gene comprises 74 775 base pairs. The mRNA produced from this gene codes for a protein made up of 132 amino acids.

Explain the differences in the gene coding for this protein and the mRNA produced from it.

(6)

DNA MRNA

Nucleotides

- The gene is made up of DNA nucleotides whereas the mRNA strand is made from RNA nucleotides DNA has deoxyribose sugar and RNA has ribose. RNA has Uracil instead of Thymine on DNA.
- The strand of MRNA is single stranded and is shorter than the gene used to code for it this means it can leave the nucleus.
- The DNA is replicated using helicase and DNA polymerase whereas RNA is made using RNA polymerase and requires a template strand of DNA
- DNA remains in the nucleus.
- DNA is not involved in translation, RNA is

ResultsPlus
Examiner Comments

The first bullet point and the start of the second one of this response give a good comparison of the structural differences between the DNA and its mRNA product. This is a pleasing account for level 1. However, the remainder of the second bullet point refers to the mRNA's smaller size enabling it to leave the nucleus which moves this answer into level 2. Three marks were awarded.

Question 10 (a)

The candidates were expected to explain the presence of cartilage in a joint for two marks in this item. Whilst a number were able to do so, others only gave the outcome.

A short and precise answer worthy of both marks.

10 All mammals have an internal skeleton that includes bone and cartilage. Bones contain calcium ions.

(a) Explain one way in which cartilage at the ends of the bones in the knee joint reduces wear and tear.

(2)

Cartilage is a smooth surface that prevents friction at the joint as the bones glide over each other. It also provides lubrication.

ResultsPlus
Examiner Comments

This candidate has stated that the cartilage is smooth (first marking point), and therefore, reduces friction (second marking point).

This candidate response gains one mark.

10 All mammals have an internal skeleton that includes bone and cartilage. Bones contain calcium ions.

(a) Explain one way in which cartilage at the ends of the bones in the knee joint reduces wear and tear.

(2)

- they act as shock absorbers to reduce force exerted on the joint and therefore damage ~~that~~ which is wear and tear

ResultsPlus
Examiner Comments

There is a correct reference to the cartilage acting as a shock absorber for the second marking point.

Question 10 (b)(i)

Candidates were presented with four different sets of data relating to calcium ions in humans and were expected to use this to calculate the mass of calcium in the soft (non-bony) tissue. Most candidates were able to offer a credit worthy calculation.

In this response, the candidate has correctly calculated both the mass of calcium ions in the soft tissue and the mean mass of soft tissue in a human.

(b) In humans, calcium ions are important for structure as part of bone material. These ions are also involved in physiological processes in soft tissue. Soft tissue is non-bony material.

The table shows some data relating to humans.

mean mass of an adult	80 kg
mean percentage of body mass that is bone	4%
mean mass of calcium ions per adult	1000 g
mean percentage of calcium ions present in soft tissue	1%

(i) Calculate the calcium ion concentration in the soft tissue of a human.

(3)

4% × 80 = 3.2kg

80 − 3.2kg = 76.8kg (non-bony)

1% × 1000 = 10g $\frac{7680}{10}$

~~768~~ 768 ..... µg g^{-1}

ResultsPlus
Examiner Comments

The first and second marking points can be awarded, so two marks given.

Question 10 (b)(ii)

This is the second of the two indicative content six-mark questions. In this one, candidates were required to evaluate a statement considering whether calcium ions were more important for animals or plants. Many candidates appeared to have a very good appreciation of the role of this ion in humans, but some were less secure in relation to plants. Again, answers at all levels, and marks, were seen.

The candidate has considered the role of calcium ions in both plants and animals as well as delivering a conclusion and gains three marks.

*(ii) Calcium ions are also found in the tissue of plants. pectate

The calcium ion concentration in one species of plant has been measured.

It was found to be 170 $\mu g\ g^{-1}$ of plant tissue. 130 : 170

A student made the conclusion that:

Calcium ions are more important in the tissue of plants than in animals.

Evaluate this conclusion.

(6)

Plants:

- Calcium ions are used in the cell wall to form calcium pectate which glues microfibrils of cellulose together to maintain plant structural integrity, if there was no Ca^{2+} ions, the cell wall would not be as strong and the plant would weaken and die.

Animals:

- Calcium is integral to synapsing neurons as it moves vesicles of neurotransmitter out of the membrane, if no Ca^{2+} we would be in a vegetative state.
- Ca^{2+} ions are also integral to our muscles as they ~~reveal they~~ bind to the tropomyosin, revealing the myosin, if no Ca^{2+} ions then our muscles wouldn't function.
- Ca^{2+} ions are also integral to our skeletal system as, 99% of Ca^{2+} ions in the body are found there, if no Ca^{2+} ions, the skeleton would disintegrate

To conclude, it does disagree, the function, although essential, is limited in plants whereas, in animals, they couldn't perform any ~~muscle motor~~ movement or strength without them.

ResultsPlus
Examiner Comments

The level of detail offered in relation to the role of calcium ions in both plants and animals is sufficient to make this a level 2 response. However, there is no comparison of data or consideration that only one species is used, hence three marks achieved.

This is also a level 2 response but gains four marks.

*(ii) Calcium ions are also found in the tissue of plants.

The calcium ion concentration in one species of plant has been measured.

It was found to be 170 $\mu g\ g^{-1}$ of plant tissue.

A student made the conclusion that:

Calcium ions are more important in the tissue of plants than in animals.

Evaluate this conclusion.

(6)

Calcium ions is plants is important for production of calcium pectate in plants which makes up the middle lamella which acts as an adhesive by sticking adjacent plants together. While in animals Calcium ions is important for the inducing of action potentials in neurons which are important for most processes in animals such as muscle contraction of brain activity. However you cannot justify this conclusion due to there being not data of calcium ion concentration in animals meaning you cannot compare. Also the sample size is too small as only one plant has measured which you cannot use for the concentration of calcium for plants for all plant species. However a possible argument could be made that Calcium ions are more important in animals due to the number of activities and processes it is required in compared to plants

ResultsPlus
Examiner Comments

The detail given about the roles of calcium ions in plants and animals is suitable for level 2. In addition, the candidate recognises that only one species of plant has been used to supply the data on which the student made the conclusion. Therefore, four marks can be awarded.

Question 10 (c)

This final question required candidates to describe how the disaccharide lactose is formed. Many had a very good understanding of this biochemistry aspect.

This response gained one mark.

(c) Milk from humans contains both calcium ions and lactose.

Lactose is a disaccharide.

Describe how lactose is formed from two monosaccharides.

(2)

- disulphide bonds via a condensation reaction

ResultsPlus
Examiner Comments

The reference to condensation reaction is the third marking point.

Paper Summary

Based on candidate performance on this paper, candidates should:

- make sure they know the meaning of the various command words. For example, the difference between describe and explain
- consider the mark allocation given to each question item as this is a guide to the level of detail required to answer it
- make sure their answer links to the context of the question
- consider showing working in calculations
- take note of units and know how to convert between them
- make sure they carefully read any graphs if they wish to quote data in their answers
- make sure that the quality of handwriting is always sufficiently clear.

Grade boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:

https://qualifications.pearson.com/en/support/support-topics/results-certification/grade-boundaries.html

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